# Feeling Scents: Enhancing Sensory Experience Through Multi-Modal Design

By

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# Abstract

While traditional design and communication practices often prioritize visual elements, this research investigates how integrating scent, touch, sound, visual, and spatial interactions can create more immersive and meaningful experiences. "Feeling Scents" examines the impact of multi-sensory design in perfume advertising, exploring how engaging multiple senses can foster a deeper connection between the audience and the product.

Using a Research through Design (RtD) methodology, this study involved the development of an interactive installation designed to engage multiple senses. Participants interacted with different materials, scents, and sensory triggers, enabling an in-depth exploration of how multi-sensory engagement influenced perception, memory, and emotional response.

This research highlights the potential for interactive, multi-sensory advertisements to create memorable, emotionally resonant experiences, fostering deeper engagement in both commercial and artistic contexts.

Keywords: Multi-Sensory Design, Immersive Experience, Interactive Design, Advertising, Spatial Interaction, Consumer-Brand Relationship

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Oscar Wilde

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## 1. Introduction

Multisensory design is a design approach that utilizes the combination of different senses to create a richer and more holistic experience for users. This type of design seeks to establish deeper and more meaningful interactions between humans and their environment by simultaneously engaging the senses of sight, hearing, smell, and touch. Sight provides spatial awareness, contrast, and aesthetic appeal, enabling users to process information quickly. Hearing offers a temporal dimension, guiding users through rhythm, tone, and directionality, often reinforcing visual cues or evoking emotions independently. Touch introduces materiality and physical interaction, offering texture, temperature, and haptic feedback that deepen engagement. Smell, closely linked to memory and emotion, enhances immersion by triggering associations and affective responses. Incorporating sensory elements such as sound, images, scent, and texture, allows the designer to create a multi-dimensional, rich, memorable, and impactful experience for participants. For example, pairing sound with tactile feedback can make digital interactions more intuitive, while integrating scent with color and texture can amplify emotional and atmospheric effects. Understanding how these sensory modalities interact allows designers to craft experiences that are not only visually appealing but also deeply engaging and emotionally resonant.

Experts tell us that our relationship with the world is essentially affective, which means that all our interactions imply and involve emotions, whether interactions are with the social or the material world (Desmet, 2009). Frankel et al. highlights that, "Most of us have emotional reactions to the products we use every day; we love some, we hate some, and we prefer some over others. In fact, it is the design of product features that enhances those emotional experiences." (Frankel et al., 2023) The use of sensory elements in brand launch events aims to create a deep and emotional connection between participants and the hosting brand. These strong sensory and emotional experiences the likelihood that participants will recommend the brand to others and promote it through word-of-mouth.

Engaging with products, environments, and services naturally involves rich multisensory experiences, rather than being broken down into individual senses like sight, smell, touch, or hearing. Effective design creates seamless, immersive interactions that help users reach their goals by fostering focus, optimizing attention, and maintaining a sense of flow (Frankel et al., 2023).

Feeling Scents explores the role of multisensory design in creating more engaging and emotionally resonant interactive experiences. By integrating sensory elements, smell, vision, hearing and touch, this study aims to examine how multisensory engagement influences memory recall, user perception, and emotional response to product. Given that scent has a direct neurological connection to memory and emotion, and tactile experiences significantly impact user satisfaction and perception, this research investigates how these sensory combining with vision and hearing dimensions can be leveraged to enhance interactivity and create a stronger brand-user connection.

The findings will contribute to a broader understanding of how multisensory design principles can be applied to advertising strategies, offering insights into how sensory-driven engagement can transform traditional advertising into more immersive and memorable experiences. By focusing on multisensory interaction, this research aims to bridge the gap between users, product and design, proposing new ways to optimize user experience and engagement through sensory-rich advertising.

### 1.1. Motivation

As a graphic designer, my journey has been defined by a commitment to creating compelling visual narratives that resonate with diverse audiences. Over the years, I have cultivated a comprehensive skill set encompassing branding, print design, digital media, and user interface design. This diverse experience has enabled me to approach each project with a holistic perspective, ensuring that design solutions are not only aesthetically pleasing but also strategically aligned with users' objectives.

In recent years, I have become increasingly intrigued by the potential of multisensory design, particularly in the fields of design and advertising. This interest has driven me to explore how integrating multiple sensory modalities can enhance emotional engagement, strengthen brand communication, and elevate user experience. By applying multisensory design principles, I aim to create experiences that not only capture attention but also foster deeper emotional connections with audiences. This approach aligns with contemporary trends in sensory branding, which emphasize the strategic use of sensory cues to shape consumer perception and behavior.

I am particularly inspired by the potential of multisensory design to create inclusive and engaging experiences that resonate on multiple levels, ultimately enhancing the effectiveness of design and advertising initiatives.

## 1.2. Research Questions

Building upon the exploration of multisensory design's impact on user engagement and emotional response, it is essential to delve deeper into how such designs can effectively engage individuals and enhance emotions through their interaction with installations. This leads us to the central research question:

How can multisensory design effectively engage people and enhance emotions through their interaction with the installation?

To build upon the central research question, it is crucial to examine the specific ways in which different sensory elements contribute to user engagement and emotional response. The following

secondary questions aim to break down the complexities of multisensory integration in design, particularly within advertising spaces, and explore how iterative design processes can refine these experiences. These inquiries will help uncover strategies for creating more cohesive and immersive environments through the interplay of sensory modalities.

- How can designers effectively integrate vision, auditory, tactile, and olfactory elements into advertising spaces traditionally dominated by visual aesthetics?
- How can feedback from multisensory evaluations inform iterative design processes to better meet user needs?
- In what ways can designers leverage the interplay between different sensory modalities to create cohesive and immersive environments?

# 2. Literature and Contextual Review

### 2.1. Contextual Review

Traditional design practices often prioritize visual elements, potentially overlooking the holistic nature of human perception. This project aims to craft experiences that resonate on multiple sensory levels by incorporating auditory, tactile, and olfactory elements, fostering deeper connections between individuals and their environments. Such multisensory experiences have broad applications across various fields, serving as an art form that enriches the human soul. Consequently, they are pertinent to disciplines such as psychology, art, advertising, and beyond.

In recent years, some artists and designers have begun to explore the field of multisensory design, advocating for a holistic approach that engages all human senses. For instance, in product design, Stefano Giovannoni's "Mary Biscuit" container for Alessi exemplifies this concept. This plastic biscuit box not only visually resembles a biscuit but also emits a delicate aroma, engaging both sight and smell to enhance the user experience.

Similarly, in advertising, brands have created immersive experiences that appeal to multiple senses. For example, Glade's boutique that "sells feelings" integrates scent to evoke emotions, demonstrating the power of olfactory elements in marketing.



Figure 1: Because Experience, courtesy of The Marketing Society. Glade's Pop-Up Boutique in New York City, designed to "sell feelings." The boutique featured multiple scented rooms, each inspired by a different Glade fragrance, aiming to evoke specific emotions through scent and demonstrating the power of olfactory elements in experiential marketing. Used by permission, and credit Because Experience via The Marketing Society

We can also look for inspiration in the realm of immersive art, where installations leverage multiple senses to create powerful and memorable experiences, the "Rain Room" by Random International exemplifies this approach. This immersive installation allows visitors to walk through a simulated downpour without getting wet, engaging sight, sound, and touch to create a captivating sensory experience.

Additionally, Julianne Swartz's installations often incorporate sound, light, and tactile elements to engage multiple senses, fostering deeper connections between individuals and their environments.



Figure 2: Julianne Swartz, How Deep is Your, 2012-2014, Photo by Stewart Clements, Swartz creates immersive installations that combine sound, light, and tactile elements to engage multiple senses. Her work often synthesizes these elements into ephemeral, participatory experiences. Used by Permission.

Finally, Google's "Little Signals" is an experimental project developed by Google's Seed Studio in collaboration with Map Project Office, exploring subtle and non-intrusive ways for technology to communicate with users. Instead of relying on traditional screen-based notifications, Little Signals employs six unique objects that use sensory interactions such as movement, sound, air, shadow, and touch to convey information in a more ambient and intuitive manner. For example, one device releases gentle puffs of air to nudge nearby objects, while another projects shadows that shift based on updates. This project aligns closely with multisensory design, as it demonstrates how engaging multiple senses, rather than just vision or sound alone, can create a more natural, harmonious interaction between humans and technology. By integrating sensory cues like touch and environmental changes, Little Signals illustrates how digital interactions can be made more immersive and emotionally engaging. The concept resonates with the principles of multisensory advertising and product design, as it suggests new ways to capture attention and enhance user experiences through subtle yet effective sensory triggers.

In summary, multisensory design has proven to be a powerful tool across various disciplines, from product design and advertising to immersive art and technological innovation. These examples highlight the growing recognition of the importance of engaging multiple senses to create deeper emotional connections and enhance user experiences. By drawing inspiration from these fields,

this research aims to further explore how multisensory design principles can be strategically applied to advertising, fostering more meaningful and impactful brand interactions.

## 2.2. Interactive Advertising

Interactive advertising has been defined in various ways. As Giombi et al. suggest, "The academic definition of interactive advertising has evolved and varied at least in part as possibilities for ad design and placement have shifted, meaning interactive advertising can be defined differently depending on the context." (Giombi et al, 2022) Unlike traditional advertising, which delivers a message for passive viewing, interactive advertising fosters a dynamic experience, allowing users to engage with the content and influence their interaction with the advertisement.

Tetiana and Aleksieienko note that interactive advertising offers numerous benefits, enhancing engagement and communication between advertisers and consumers. It allows for direct and realtime interaction, creating a dynamic relationship that increases user interest and participation. Additionally, it enables personalized advertising tailored to individual preferences, which can boost brand loyalty and customer satisfaction. Interactive ads also provide measurable results, helping advertisers analyze consumer behavior and refine their strategies for better outcomes (Tetiana and Aleksieienko, 2024).

However, others have questioned the effectiveness of common forms of interactive advertising. A study by Giombi et al. conducted a systematic scoping review of research related to interactive advertising to examine its impact on consumer engagement, recall, and understanding of product information. The results indicate that consumers engage with interactive advertising, but the evidence on whether interactive features improve engagement and understanding is mixed. Some studies conducted by Giombi et al. show a positive link between engagement level and higher recall, while others report the opposite. Comparisons between interactive and traditional advertising have also yielded varied results.

The mixed findings regarding the effectiveness of interactive advertising underscore the need for further investigation into how such advertisements influence consumer engagement and comprehension. Although the present research is more from a designer's perspective than an advertising perspective, it focuses on multi-sensory design methods and the enhancement or modulation of various emotions that a person gets from interacting with a scent-centric product, such as a specific perfume, This is particularly relevant for this research, as it suggests that the success of interactive design may depend on various factors, including design elements, target audience characteristics, and the context in which the advertisement is presented. Understanding these nuances can inform the development of more effective interactive design strategies that truly resonate with consumers.

Thus, these findings highlight the complexity of interactive advertising's impact and the importance of considering various factors when designing and evaluating such advertisements. In this research, it would be beneficial to explore these factors in depth to develop a more comprehensive understanding of how interactive design can be optimized for better consumer engagement and comprehension.

## 2.3. Multisensory Design

Marketing communications typically focus on consumers' visual and auditory senses, but their decision-making process is also influenced by other sensory stimuli. As Rimukute et al believe marketers understand that relying solely on visual and auditory effects may not be sufficient to capture consumers' attention. Incorporating other senses such as touch, taste, and smell can enhance the persuasiveness of marketing efforts. An approach that considers all five senses is referred to as sensory or experiential marketing (Rimkute et al., 2009).

Multisensory design plays a crucial role in consumer decision-making, with significant research in the field. Rimkute et al. reviewed existing literature, noting that vision has been the most studied sense, influencing brand design, packaging, colors, and lighting. Auditory cues, such as music, affect mood, product perception, and shopping behavior. Touch remains the least explored in sensory marketing, while olfactory research primarily focuses on in-store sampling and bias in perception. The application of olfactory cues in sensory marketing is an under-researched area in comparison to vision and hearing, but more widely researched than taste and touch (Rimkute, Moraes and Ferreira, 2016).

This infographic from Rimkute et al statements to visually present these insights, highlighting the varying levels of research attention given to different senses in consumer behavior.



Figure 3: Quantitative chart of research in the field of sensory design, Figure by author.

In multisensory design, visual elements play a crucial role in shaping user experience, guiding attention, and evoking emotions. Colors, brightness, contrast, and movement all influence perception and brand communication in advertising. However, vision alone does not fully immerse users, by integrating scent, touch, and sound, designers can create more engaging and memorable interactions that go beyond visual aesthetics, deepening emotional and sensory engagement with a product or experience. The expression "seeing is believing" is not enough; it is actually "seeing is believing, but feeling's the truth". Since ancient Greece, sight and hearing have been regarded as the most important senses in Western thought. Greek philosophers believed these "distant senses" provided objective information while minimizing risk, unlike touch, taste, and smell, which required close contact. Among these, smell was considered the least informative due to its strong connection to emotions and subjective experiences (Frankel et al. 2023).

Additionally, recent findings indicate that coordinated multisensory stimulation can have a greater impact on memory recall and the retention of experiences compared to single-sensory stimulation. This highlights the growing importance of understanding and applying multisensory approaches in product design and marketing strategies. Touch plays a crucial role in shaping affective responses to products, often providing a more reliable and enjoyable sensory experience than vision or sound (Field, 1998; Spence, 2002). According to multisensory integration principles, the brain prioritizes the most accurate sensory input, making touch a dominant factor in how pleasant a product feels. While visual aspects of product design have been extensively refined, tactile attributes have received less attention, leaving room for innovation in this area. Enhancing the tactile experience of a product or its packaging could significantly improve consumer perception and emotional response (Spence & Gallace, 2011).

Human perception of the surrounding environment plays a fundamental role in shaping behaviors, emotions, and decision-making. Sheldon and Arens (1932) emphasize the critical role of touch, asserting that the hand's favorable judgment can unconsciously drive consumer approval and subsequent purchases, even for the most visually appealing products: "After the eye, the hand is the first sensor to pass on acceptance, and if the hand's judgment is unfavorable, the most attractive object will not gain the popularity it deserves. On the other hand, merchandise designed to be pleasing to the hand wins an approval that may never register in the mind, but which will determine additional purchases." (Sheldon & Arens, 1932) Decades later, Gómez-Suárez and Yagüe (2021) expand on this notion by situating sensory engagement within the broader framework of experiential marketing. Consumer experiences are multifaceted, involving sensory, emotional, cognitive, behavioral, and social dimensions to create a more personalized connection with the audience. According to Gómez-Suárez and Yagüe (2021), these experiences can be categorized five strategic modules: sensory (sense), emotional (feel), cognitive (think), into behavioral/lifestyle (act), and social identity (social) (Gómez-Suárez and Yagüe, 2021). Together, these perspectives underscore how physical and emotional involvement can transform mundane transactions into meaningful and memorable experiences. These studies suggest that emphasizing multisensory experiences may play a crucial role in fostering consumer appreciation and loyalty.

While empirical research is still evolving in this area, theoretical frameworks highlight the importance of sensory engagement in shaping consumer preferences.

Touch is the first sense to develop in infants and can convey meanings and emotions that are not easily communicated through formal language. This feature has made the use of touch in marketing more appealing. In recent years, the use of images and labels to evoke the sense of touch in advertising campaigns has become common. For instance, Unilever uses images of people touching soft materials to promote the fabric softener 'Surf', and 'Cadbury' employs visuals to evoke the tactile experience of its products. Technological advancements have made packaging prototyping faster and more affordable, allowing companies to enhance their products with tactile experiences to attract consumers. For example, the packaging of 'Daily Defence' shampoo uses soft resin to provide a pleasant tactile sensation. Similarly, innovations in consumer electronics, such as the design of the Apple iPod, focus on creating a unique tactile experience, helping to distinguish the product from competitors (Spence and Gallace, 2011).

Certain product categories may benefit more from changes in tactile sensations created by their containers or packaging than others. For example, you might wonder why perfume bottles (now considered a luxury item) are predominantly made of glass. This is not only because glass is better for preserving delicate essences and that most people will have had many experiences with scents held in glass but also because of the feeling it evokes when held. In fact, handling a beautifully crafted glass bottle gives the consumer a sense of luxury that other materials, like plastic (even if cheaper to produce), cannot provide (Frost, 2006).

Studies by Spence and Gallace indicate that packaging and visual-tactile design can have a significant impact on the overall customer experience, even when consumers claim that their decisions are primarily based on specific sensory factors. Therefore, to better understand consumer behavior, relying solely on their claims is insufficient, and more scientific and controlled methods are necessary to evaluate their actual experiences. Ultimately, the study suggests that designing packaging with tactile elements aligned with the product's characteristics can enhance the customer experience and lead to more positive evaluations of the product. For example, designing a beverage bottle that reinforces the sensation of a peach flavor.

An emotional reaction to a scent can occurs before cognitive processes begin. However, research by Morrin and Ratneshwar (2000, 2003) showed that the mood and arousal levels of participants did not differ significantly in scented and unscented environments, suggesting no clear relationship between scent and emotions. It should be noted that these findings were primarily derived from self-reported data, which may have limitations since the effects could be too subtle for consumers to notice. In an experiment conducted by Mitchell et al. (1995), participants reported a more positive mood simply by believing that a pleasant scent was present in the room. While these findings indicate the possibility of a connection between scent and emotions, accurately assessing this relationship remains a complex task. Research shows that pleasant ambient scents in service environments could be one way scent can be used to influence consumer behaviour (Rimkute, Moraes and Ferreira, 2016).

The human sense of smell has a unique ability to connect with emotions due to its direct access to the brain's limbic system, which governs emotions, behavior, and long-term memory. A single scent can transport a person to a past moment, remind them of a loved one, or create an entirely new emotional experience. As a result, the perfume industry thrives on crafting scents that appeal not just to the nose, but to the heart and mind. Research has shown that smells can evoke specific and vivid memories that might not be as intensely experienced through other senses. The human sense of smell is remarkably precise, capable of detecting at least one trillion distinct scents, making it one of the most discerning senses (Jasper and Wagner, 2018). In comparison, vision and hearing provide significantly less sensory detail, with the human eye distinguishing several million colors and the ear perceiving fewer than half a million tonnes (Frankel et al., 2023). For example, the scent of coffee can bring back a memory of sitting in a café with friends. This phenomenon is due to the direct pathway of the olfactory sense to the brain's memory and emotion centers. The sense of smell plays a crucial role in memory recall and evoking emotions. When we smell an odor, its molecules are detected by olfactory receptors in the nose, which then send signals to the olfactory bulb in the brain. These signals are subsequently transmitted to the amygdala and hippocampus, which are responsible for processing emotions and memory, respectively. This direct connection between the sense of smell and the centers for memory and emotions explains why odors can vividly revive powerful memories and emotions within us (Okray and Jacob, 2021). However, in an increasingly multisensory design landscape, the question arises: can the emotional impact of scent be extended or replicated through other sensory stimuli?

Smell plays a crucial role in shaping individuals' experiences by creating strong cultural and personal associations. According to research from Frankel et al., people recall scents far more effectively than visual, auditory, or tactile stimuli. While scent is closely tied to memory, individuals still rely on other senses for context. Fragrances also influence emotions and enhance brand recognition, making them valuable tools for businesses aiming to improve product appeal and consumer loyalty (Frankel et al., 2023).

Understanding how emotions are triggered through smell can inform multisensory design strategies that combine smell with other senses like touch, sight, and sound. This is especially important in creating immersive experiences, such as interactive advertising, exhibitions, or digital interfaces. By analyzing smell, we can explore ways to replicate or complement these emotional responses through visual design elements, soundscapes, and tactile experiences (Frankel et al., 2023).

On the other hand, sound profoundly influences emotions and perceptions. In an increasingly noisy world, sound art and sound marketing have become essential for creating memorable experiences. By engaging the senses, these tools are widely used by companies and artists to forge deeper connections with their audiences (Resonance Sound Design, 2024).

Designers and marketers aim to shape consumer emotions by leveraging past experiences, allowing positive memories to enhance new auditory interactions (Lindstrom, 2005). For example, familiar music in stores can subconsciously encourage customers to stay longer. When sensory experiences evoke emotional connections, consumers are more likely to develop a lasting affinity for a brand (Frankel et al., 2023).

Multisensory design extends beyond the mere integration of multiple senses; it fundamentally shapes how individuals perceive and interact with their environment. By engaging sight, sound, touch, and scent in a cohesive manner, designers create immersive experiences that resonate on an emotional and cognitive level. These experiences, in turn, influence consumer perception, memory retention, and emotional responses, forming the foundation for deeper brand connections and user engagement. As research suggests, perception is not a passive process but an active interpretation of sensory stimuli, shaped by past experiences, cultural influences, and expectations. Understanding these factors allows designers to craft experiences that not only captivate but also foster meaningful interactions, demonstrating the power of multisensory engagement in shaping user behavior and decision-making.

### 2.4. Experience and Perception

Perception is how our brain makes sense of the world around us using information from our senses. It involves noticing things, paying attention, interpreting what they mean, and remembering them. Our experiences are shaped by both personal factors like memories, emotions, and expectations, and external influences, such as culture, surroundings, and how things are designed or presented to us.

Gómez-Suárez and Yagüe have explained how environmental cues such as music, lighting, and scent influence individuals' internal states and external reactions.

The perception of experience plays a fundamental role in the design of products, services, and advertisements. Designers and marketers, by gaining a deep understanding of perceptual processes and influencing factors, can create experiences that align with users' needs and expectations. Despite its importance in design and advertising, challenges such as individual differences, temporal changes, and environmental complexities exist. To enhance experience perception in design and advertising, strategies like user-centered research, empathy-driven design, testing and evaluation, and cultural context consideration can be employed. Perception of experience results from a complex interaction between senses, past experiences, expectations, and cultural contexts. By understanding these processes and factors, designers and marketers can create experiences that resonate with users' needs, strengthen emotional connections with the brand, and address individual differences and temporal changes effectively (Gómez-Suárez, Yagüe, 2021).

Pleasant scents can influence perceptions and attitudes. for example, 'Studies have shown pleasant ambient scent can enhance consumer experience in several ways, encouraging them to spend more time in stores, and to pay more for products (Spangenberg et al. 1996, Rimkute, Moraes and Ferreira, 2016).

Research by Schifferstein and Desmet (2007) showed that when the sense of touch was blocked, participants felt a greater sense of detachment from the products, whereas this detachment was less pronounced when vision was blocked. These findings suggest that familiarity with products heavily relies on their tactile features. However, a limitation of this research is that using thick gloves not only impaired the sense of touch but also affected the functionality of the products. Therefore, it has been suggested that future studies should examine the impact of touch independently from product functionality. Additionally, considering the various exploratory methods people use to evaluate the tactile properties of objects, investigating the effects of wearing oven mitts on these behaviors could be an interesting avenue for further research.

Age, gender, individual differences, and even prior exposure to stimuli, whether consciously or subconsciously, can influence sensory experiences and perceptions. "In fact, some papers have confirmed the relationship between the stimulation from the physical environment and consumers' emotional status. With this theoretical assumption in mind, we can delineate two main sub-dimensions of what we call a multi-sensory emotional experience: the sensorial experience and the affective experience. The former represents external stimuli relating to the senses, while the latter reflects individuals' internal reactions" (Gómez-Suárez and Yagüe, 2021).

Consumer awareness of the presence of scent and its potential influence can be a crucial moderating variable when determining relevant consumer response. The perception of odours is different from perception of other environmental cues, since scent can be processed without consumer awareness (Davies et al., 2003). The sense of smell is exceptional because it can trigger an automatic response to stimuli before the consumer is aware of what is causing it (Hirsch, 1995). Scents which operate below the level of perception are referred to as covert or subliminal scents (Bradford and Desrochers, 2009), and their effectiveness is supported by several experimental findings (Rimkute, Moraes and Ferreira, 2016).

While studies like the article by Gentile, Spiller, and Noci (2007) have evaluated the primary sensory aspects associated with different products, evidence suggests that consumer perception is far more complex than what is explicitly stated in their opinions. For example, the taste of Pringles may be linked to the specific sound produced when biting into them, or the appeal of Harley-Davidson might stem from its unique exhaust sound. Similarly, the success of products like Snapple and iPod may be attributed more to auditory or tactile sensations than to simple visual or functional characteristics. In fact, individuals' experiences with a product are not limited to the sense of touch but result from a combination of sensations derived from smell, sound, sight, and touch. The findings emphasize the importance of multisensory integration, where a consumer's

overall perception of a product is shaped by the harmony and interaction of multiple senses (Spence and Gallace, 2011).

Ultimately, according to the hypothesis of Gómez-Suárez and Yagüe, a brand's multisensory experience has a direct impact on brand recommendations or word-of-mouth (WOM). "Environments that enable experiences are more likely to create a strong WOM, as consumers gather more memorable and distinguished impressions to share. When these experiences are emotionally impactful, consumers are more likely to spread WOM. In fact, when consumers seek feedback from other customers about hedonic consumer products, they expect to find affective and sensory experiences, which serve to intensify the WOM. WOM recommendations appear to be one of the main methods of measuring the effectiveness of experiential marketing at a theoretical level." (Gómez-Suárez and Yagüe, 2021)

To conclude, the research reviewed highlights the significant role of multisensory design in shaping consumer perceptions, emotions, and behaviors. By integrating sensory elements such as touch, scent, sound, and visual cues, brands and designers can create more immersive and emotionally engaging experiences. The ability of multisensory stimuli to influence subconscious responses and enhance memory recall underscores its potential in advertising, product design, and experiential marketing. As consumers increasingly seek engaging and memorable interactions, leveraging multisensory strategies can foster deeper brand connections, enhance word-of-mouth recommendations, and ultimately influence purchasing decisions. Moving forward, further research is needed to explore how different sensory combinations optimize engagement and emotional impact across diverse consumer demographics and contexts.

# 3. Research Methods and Methodologies

### 3.1. Research Methodology

Research through Design (RtD) is a way of exploring and understanding complex and futurefocused design problems by using the process of designing itself. This method helps gain unique insights that might not come from traditional research (Frayling, 1993). This approach recognizes and values the knowledge gained through professional practice, making it especially useful in fields where designers and researchers continue to work actively (Godin, and Zahedi, 2014).

Basballe and Halskov (2012) outline three key phases in a Research through Design (RtD) project, which occur in sequence.

**Coupling** is the initial phase where research and design are brought together. At this stage, the project's foundational structure and constraints are established to align both research and design objectives (Basballe and Halskov, 2012, 65).

In this project, the initial step involves engaging the senses through an art installation and establishing the connection between multisensory design and advertising effectiveness, specifically investigating how integrating scent, touch, sound, and visual elements in an interactive installation influences user engagement. At this stage, key research questions are defined, such as: How can multisensory design effectively engage people and enhance emotions through their interaction with the installation? Additionally, project constraints, such as material selection, space requirements, and technical feasibility (e.g., pressure sensors, softwares, scent diffusers), are outlined. This structured foundation ensures that both the artistic installation and research analysis align cohesively.

**Interweaving** follows, during which research and design interact and influence each other. This phase involves shaping project processes, selecting methods, and defining evaluation criteria (Basballe and Halskov, 2012).

In this project, this phase involves constructing and testing the multisensory installation, embedding sensor-based interactions and olfactory elements that engage participants on multiple sensory levels. The effectiveness of different material textures, scents, and audiovisual elements is assessed through pilot studies. Participants interact with the installation, and qualitative feedback (interviews) and quantitative responses (Likert-scale surveys) were collected to evaluate emotional impact, recall, and brand association. The installation was refined based on user engagement insights, ensuring an optimized sensory experience that aligns with advertising objectives.

**Decoupling** occurs later in the project when the focus shifts toward either research or design. For instance, during the production stage, emphasis is placed on the design process, whereas in the final evaluation and analysis phase, research takes precedence (Basballe and Halskov, 2012).

In this project, two distinct paths emerged:

1. Design Focus: The final version of the interactive installation was produced, with refined sensor technology, material choices, and spatial layout to maximize audience engagement.

2. Research Focus: The collected data was analyzed to assess whether multi-sensory advertising enhances consumer recall, emotional response, and product perception. Statistical methods, such as t-tests, were applied to quantitative data, while thematic analysis was used to interpret participant interviews.

This project employs prototyping to generate new knowledge. As Enby describes, "The iterative process is simply a series of steps that you repeat, tweaking and improving your product with each cycle. In practical terms, think of it as practice to make your product perfect." (Eby, 2019)

This project explores multisensory design and alternative interfaces, incorporating tactile materials, sensors, and speculative interaction models. RtD is particularly valuable in this context because it supports an iterative and flexible process, where insights emerge through experimentation rather than following a rigid, linear framework.

Additionally, RtD bridges the gap between theory and practice, making it well-suited for the goal of challenging traditional design systems. Since this project is focusing on how to create design environments that prioritize art, play and experimentation over commercial constraints, RtD enables to test speculative and artistic ideas while keeping them grounded in real-world interaction. By continuously refining prototypes and gathering feedback, this project tried developing a structured understanding of user engagement and sensory experience.

### 3.2. Research Methods

The research methods utilized in this project include design and prototyping, user testing, data collection, and data analysis. This study will develop and analyze two prototypes, each designed to investigate different aspects of sensory engagement in advertising, beginning with an exploratory phase that involves a review of literature, case studies, and existing research on multisensory design, interaction design, and advertising. This phase informs the development of early design concepts and helps refine the research question: How can multisensory design effectively engage people and enhance emotions through their interaction with the installation? Once foundational insights are gathered, the project moves into material and technology exploration, where different sensory modalities, including touch, sound, smell, and interactive digital displays, are tested for their effectiveness in enhancing user experience. The selection of materials and technologies is driven by their potential to increase immersion and emotional connection in advertising contexts.

Following material exploration, the prototype development phase involves the creation of interactive design experiences that engage multiple senses. These prototypes are built using a combination of physical computing (such as Arduino and sensors), digital interfaces, and tactile materials, ensuring a diverse set of interaction possibilities. The prototype incorporating user feedback to enhance its functionality and effectiveness. The user testing phase plays a crucial role in this methodology, allowing for direct observation of participant interactions and the collection of qualitative data on engagement, emotional response, and sensory perception. By analyzing how users react to different multisensory elements, this research it examines the strengths and weaknesses of the design and the emotions of the audience that contribute to a more immersive and memorable advertising experience. In fact, the first prototype will serve as a foundational exploration, testing initial assumptions about how sensory interactions affect engagement and memory retention. Based on the findings from this phase, a second prototype will be developed to refine and expand upon these insights. While the research does not involve extensive iterative cycles, the second prototype will incorporate feedback from the first, ensuring that the study captures a range of user experiences and reactions. To document and analyze the research process, detailed design documentation will be maintained, including sketches, material studies, process photographs, and written reflections. Additionally, user testing sessions will be conducted to gather qualitative insights on how participants interact with and respond to the prototypes. Observations, participant feedback, and thematic analysis will be used to evaluate the effectiveness of multisensory elements in enhancing engagement.

The findings from this research will contribute to the broader discourse on interactive and multisensory design, offering a structured approach to incorporating tactile, visual, hearing, and olfactory elements into advertising experiences. By adopting an RtD methodology with a focus on two distinct prototypes, this study provides a practical and tangible exploration of how sensory-driven design can transform user interaction and emotional connection in advertising.

This research involves human participants for user testing and data collection. All activities involving human participants has been conducted following approval from the Research Ethics Board.

# 4. Prototyping

This research explores how integrating other senses, such as sight, touch, and sound, can amplify or mimic the emotional effects triggered by smell. For example, visual elements like color, texture, or imagery might be used to create a mental association with a specific fragrance. Warm colors, flowing shapes, or shimmering visuals could evoke the warmth and sensuality of a particular scent, reinforcing the emotional response. Tactile elements, such as the texture of packaging or a product's physical interaction, can also play a role in creating an emotional narrative around the scent, allowing the consumer to feel connected through a multi-layered experience.

## 4.1. Prototype 1: Exploratory Prototype

Prototype 1 specifically centered around a woody scent, chosen for its association with warmth and nostalgia, often linked to the fall season. By employing materials and interactive elements that align with this theme, the project sought to create a cohesive and emotionally resonant experience. Beyond the practical application in fragrance design, this experiment also served to better understand how overlapping sensory inputs can amplify emotional reactions.

In this prototype, I hoped to explore not only the technical challenges of integrating sensory design but also the emotional impact of such efforts, laying the foundation for future iterations that push the boundaries of traditional scent-based experiences.

### 4.1.1. Making

The initial prototype designed to amplify emotional resonance through the integration of tactile, visual, and auditory elements. Wood was chosen as the primary material to evoke a tactile experience that complements the natural and warm characteristics of the woody fragrance. A wooden box was meticulously crafted, its surface divided into sections featuring various types and shades of wood. These woods, selected for their orange and red tones, were chosen to create an autumnal theme, reflecting the seasonal associations of woody perfumes, often linked to fall.



Figure 4: Woody Installation, Figure by author.

To enhance interactivity, a button was embedded within the installation. Pressing the button PUSH engages touch and starts the material that engages other senses.

In addition, since auditory stimuli can be designed to align with certain fragrance profiles, for instance soft, rhythmic sounds might evoke a sense of calmness, much like a lavender-based scent, while more upbeat or vibrant music could correspond with more citrus or floral fragrances, I used a soft autumn melody to help the audience connect more deeply with the product. Additionally, I incorporated visuals of falling autumn leaves to strengthen this connection further.

So, by using Adobe After Effects, I created visuals of falling autumn leaves and projected onto the wooden frame, accompanied by descriptive information about the scent. These visuals were synchronized with ambient autumn-themed music to enrich the experience, forming a cohesive narrative that engages multiple senses.



Figure 5: Falling Autumn Leaves, Figure by author.

The audience interacts with the installation by pressing the button, placed at the center of the piece. This tactile action initiates the display of visuals and music, immersing users in an environment that connects them emotionally to the fragrance. By overlaying the sensory elements of sight, sound, and touch, the prototype demonstrates how these inputs can overlap to create a holistic emotional experience.



Figure 6: Interactive Installation, Figure by author.

Technically, projection mapping was utilized to align the visuals with the wooden frame, ensuring precision and immersion. This was achieved using Touch Designer software and an Arduino microcontroller. The button mechanism was constructed using conductive sheets, which were covered with fabric for a polished finish. These sheets were wired to the Arduino, allowing integration of the interactive components with the visual and auditory displays.

In designing this prototype, careful consideration was given to how visual, tactile and auditory elements interact to create a cohesive sensory experience. The scent of wood was incarnated through the visual representation of autumnal colors and textures, ensuring that users not only smelled but also saw and felt the warmth associated with the fragrance. The auditory component, a soft autumn melody, was selected to complement both the scent and visuals, reinforcing the mood of nostalgia and comfort. By synchronizing projection mapping with hearing and touch interaction, the installation ensured that no single sensory element dominated the experience; instead, they worked in harmony to enhance emotional engagement.



Figure 7: Projection Mapping, Figure by author.

The process of making this prototype is included:

**Tactile Design:** Creating a wooden interface to enhance the audience's sensory engagement. Wooden interface was created from cutting different types of wood by Band Saw, Disk Sander, laser cut, also using different warm colors to different pieces and making a frame.

Interactive Mechanism: Adding a button linked to conductive and Arduino and, allowing users to trigger autumnal imagery and music.

Visual and Audio Integration: Using projection mapping and Touch Designer to display falling leaves and play seasonal music.

While the making phase involved creativity and technical experimentation, it also posted significant challenges, particularly with software and hardware integration.

### 4.1.2. Challenges

A key challenge in designing for multisensory interplay was ensuring that sensory inputs complemented rather than overwhelmed each other. For instance, the visuals of falling leaves were intentionally paced to align with the rhythm of the background melody, allowing a natural flow between sight and sound. Similarly, the button-activated interaction was designed to engage touch, vision, and hearing simultaneously, reinforcing a feeling of control and immersion. The placement of sensory triggers within the installation was also carefully planned so that users would engage with one sense while being subtly guided toward others, ensuring a layered and interconnected experience rather than discrete interactions with each sense.

One of the major issues I encountered was software instability in Touch Designer. The program often failed to save my progress correctly, leading to repeated efforts to recreate the work. This bug significantly impacted my workflow, particularly during the final presentation. A potential solution in the future would involve testing alternative, more stable tools for projection mapping or creating backup files more frequently.

Another challenge was maintaining a cohesive design language across prototypes for different scents. Balancing unique sensory experiences while ensuring thematic consistency required careful planning. In future iterations, I planned to establish a more unified visual and material palette early in the process.

### 4.1.3. Feedback and Insights

This installation was showcased in a demo exhibition, where audience feedback provided valuable insights into the diverse emotional responses to scents. While some participants associated the woody scent with nostalgia and warmth, others found it less appealing, underscoring the subjective nature of sensory design. Cultural and individual differences played a significant role in shaping perceptions of the prototype, highlighting the deeply personal nature of multisensory experiences. This feedback reaffirmed the importance of iterative testing and user-centered design in developing effective scent-based interactions.

The following table summarizes the key feedback and insights gathered from the demo exhibition, highlighting the strengths, weaknesses, and areas for improvement in the installation.

Weaknesses	<ul> <li>The installation had to be displayed in a dedicated and quiet space with appropriate lighting to help the audience maintain focus and be fully immersed.</li> <li>In the installation presented, the music could not have much of an impact on the audience due to excessive noise in the space.</li> <li>The space was too bright for the projector, preventing the audience from focusing properly.</li> </ul>	
Strengths	<ul> <li>Successfully created an engaging and immersive prototype that integrated multiple sensory elements.</li> <li>Highlighted the potential of multisensory design to evoke strong emotional responses.</li> <li>Received positive feedback on the aesthetics and concept of the installation.</li> </ul>	
Areas for Improvement	<ul> <li>Greater technical reliability in the interactive mechanism is needed to avoid interruptions during presentations.</li> <li>Explore more robust and scalable tools for future iterations.</li> <li>Broaden user testing to include diverse cultural and demographic groups for more inclusive design.</li> </ul>	

 Table 1: Summary of Feedback and Insights from the Demo Exhibition, Highlighting Strengths, Weaknesses, and Areas for

 Improvement in the Installation.

### 4.1.4. Next Step

Looking ahead, I aimed to refine the current prototype by developing a cohesive series of prototypes representing different scents while maintaining thematic integrity.

Future iterations of this project are continue refining the balance between sensory modalities to create a more immersive and emotionally engaging experience. Based on user feedback, refinements focused on fine-tuning how sensory cues align and reinforce each other, such as adjusting the timing and intensity of sound and scent diffusion to maximize their emotional impact.

This project broadened my understanding of the complexities of multisensory design and its potential applications in the fragrance industry and beyond.

Generally, the first prototype demonstrated the power of multisensory design to create emotionally engaging experiences. While the project encountered challenges, it also provided valuable learning opportunities, highlighting the importance of technical preparation, user feedback, and iterative design. This experience has strengthened my ability to combine creativity with practicality, and I applied these skills in the next endeavors.

## 4.2. Prototype 2: Refining the Multisensory Experience

### 4.2.1. Idea Development, Challenges and Design Iterations

The second prototype was developed to establish a cohesive design language, ensuring integration of sensory elements while maintaining a distinct identity. This phase aimed to refine how users interact with scents through sound, imagery, and touch, aligning with the project's objective of enhancing engagement through sensory synchronicity.

Key Design Considerations:

- Strengthening the relationship between scent and other sensory inputs to create an immersive experience.
- Addressing spatial constraints that impacted user interaction in the first prototype.
- Introducing a more centralized and accessible interaction model for improved engagement.



Figure 8: The initial sketches developed to guide the design process and explore how different sensory elements could be effectively integrate and design language for integration and identity. Figure by author.

Despite improvements in conceptual development, the second prototype revealed limitations in terms of equipment and spatial constraints. The distance between sensory elements, such as scent diffusers, visual displays, and interactive surfaces, affected accessibility and user experience, making it difficult for participants to transition smoothly between different sensory inputs.

Key Challenges Identified:

- Limited accessibility due to the spatial distribution of elements.
- Fragmented sensory engagement where users struggled to perceive the connections between different sensory stimuli.
- Technical constraints in integrating responsive elements (such as pressure sensors and scent diffusion).



Figure 9: A design approach, focusing on a more immersive layout that enhances user accessibility, Figure by author.

To address these challenges, the installation was redesigned with a table as the primary interactive surface, replacing the previous wall-mounted elements. This adjustment allowed participants to experience all sensory elements simultaneously, fostering a more immersive and intuitive interaction. The walls were repurposed to enclose the space, reducing distractions and amplifying the multisensory impact of each scent-based experience. This modification ensured a structured, yet fluid engagement, where users could interact with the fragrance displays in a natural and exploratory manner.



Figure 10: Using a table as an interactive surface with 3 different sets for 3 different scents, Figure by author.

The redesigned setup introduced three distinct interactive stations, each dedicated to a specific scent-based experience. By incorporating a round table as a focal interaction point, users could engage with the fragrances through customized material selections, lighting effects, and accompanying soundscapes, enhancing their perceived connection to each scent. This refined approach improved the overall spatial composition, allowing users to explore the relationship between scent and other sensory cues in a more intuitive and controlled manner.

Furthermore, pressure-sensitive and interactions surfaces were considered for future iterations to refine user engagement and allow for a more dynamic response. These refinements align with the project's goal of bridging sensory perception and advertising strategies, emphasizing how multisensory design can deepen user experiences and influence brand perception.



Figure 11: using a round table as an interactive surface with 3 different sets for 3 different scents, Figure by author.

#### 4.2.2. Making

In this prototype due to restrictions on using perfume and diffused scents in the testing and exhibition space, scented candles were selected as an alternative. Candles provided a controlled method of releasing fragrance while also offering a tactile element for interaction. Three distinct scents were chosen: Woody, Rose, and Ocean. These fragrances were selected based on their diverse sensory profiles, each evoking different emotional and cognitive responses.



Figure 12: Three different candles with three different materials, Figure by author.

Woody Scent - associated with strength and nature

Rose Scent – evoking floral delicacy and romance

Ocean Scent - reflecting freshness and openness

To reinforce the experience beyond scent, this prototype incorporated visuals, textures, and soundscapes, creating an immersive sensory environment. The design aimed to establish a cohesive sensory identity, ensuring that each fragrance was complemented by a corresponding tactile, auditory, and visual representation.

#### 4.2.2.1. Multisensory Integration

Each candle was wrapped in textured materials to reinforce the scent experience through touch:

Woody Scent  $\rightarrow$  Wrapped in hemp cords, representing natural roughness and resilience.

Rose Scent  $\rightarrow$  Covered in soft, delicate fabric, symbolizing gentleness and femininity.

Ocean Scent  $\rightarrow$  Embedded with seashells, evoking the sea and coastal landscapes.



Figure 13: Initial setup, Figure by author.

In addition to tactile enhancements, related visuals were selected and edited using Adobe After Effects and Premiere. The woody scent was represented through imagery of forests, burning wood, and strong tree trunks. The floral scent was brought to life with footage of blooming rose gardens, while the ocean scent was portrayed through videos of the seashore and crashing waves.

A collage-style video was also created for the woody scent, incorporating symbolic imagery such as wood and leaves to represent nature, eagle and tiger wings to convey power, and a man's face to reflect masculinity. This video and symbols were made based on the woody scent's concept.



Figure 14: A collage created as a symbol of woody scent, Figure by author.

Wood and leaves  $\rightarrow$  Symbolizing nature

Eagle and tiger wings  $\rightarrow$  Representing power and masculinity

A man's face  $\rightarrow$  Reflecting the boldness of the fragrance



Figure 15: The collage video was playing on a table in the middle of the room, Figure by author.

Soundscapes played a crucial role in reinforcing the experience. Instead of using background music, the installation incorporated natural ambient sounds corresponding to each fragrance. The Woody scent was accompanied by the sounds of rustling leaves, wood burning and forest sound effects, the Rose Scent was nightingales, and birdsong, while the ocean scent was paired with recordings of crashing waves and seagulls. This immersive approach aimed to help users form deeper emotional connections with the scents by engaging multiple senses simultaneously.

#### 4.2.2.2. Interactive Technology and Setup

The installation employed sensor-based interactions, where user engagement with the candles triggered real-time responses in both the visual and auditory components. The interaction system was developed using Arduino and Firmata code, allowing pressure sensors embedded in bellow of each candle to send signals to TouchDesigner, which controlled the projection of corresponding images and soundscapes.



Figure 16: Pressure Sensors and Arduino Circuit, Figure by author.

To create an immersive environment, four projectors were used. Three were positioned to cover the walls with visual projections, while one was directed at a central table, displaying the scentspecific collage video. The projectors were mounted using AutoPoles to ensure stability and precise alignment.

The installation required additional hardware for projection and sensor integration, including HDMI cables, USB-C adapters, spigots, clamps, magic arms, and power strips. The setup was calibrated using KantanMapper, ensuring that each visual projection corresponded seamlessly to user interactions.

### 4.2.3. Challenges and Refinements

A key challenge encountered in this prototype was the limitation of the exhibition room size in relation to the projectors' throw distance. The projectors' wideness was limited and difficult to control, as the only way to adjust projection coverage was by modifying their distance from the

wall. This made it difficult to cover the entire wall while maintaining consistent resolution and image quality across all projectors. Achieving uniform brightness and clarity required precise adjustments to positioning and focus.

Another challenge was ensuring proper calibration and synchronization of projections. Since multiple projectors had to work together, it was necessary to align them perfectly to create a seamless visual environment. The challenge was further complicated by variations in projection distance, which affected image size and resolution.

Additionally, the spatial layout of the installation had to be reworked. Initially, interactions were designed for a wall-based platform, but it became evident that a table-based setup would provide better accessibility and a more centralized experience for users. By shifting the primary interaction point to a table, the installation achieved greater spatial coherence and a stronger sense of immersion.

### 4.2.4. User Testing

The user testing phase was designed to evaluate how multisensory design enhances engagement and emotional response within the installation. A total of 18 participants took part in the study, experiencing the interactive installation while providing insights through pre-experience and postexperience questionnaires as well as open-ended discussions. This evaluation sought to determine how integrating scent, touch, sound, and visuals influences user interaction and perception.

### 4.2.4.1. Pre-Experience

Participants were recruited through screening questionnaires to ensure eligibility, particularly confirming that they had no allergies to fragrances and were interested in interactive or sensorydriven experiences. The testing sessions were conducted in a controlled environment, where participants engaged with three scented candles (woody, rose, and ocean) embedded with pressure sensors, triggering corresponding visual and auditory elements.

Before engaging with the multisensory installation, participants completed a Pre-Experience Questionnaire to assess their familiarity with multisensory design, their expectations for engagement, and their anticipated emotional responses. The data collected provides insight into their initial perceptions and how they envisioned the experience would impact them.

Analysis of the responses revealed a range of familiarity with multisensory design. While some participants had prior exposure to interactive installations incorporating multiple senses, others were relatively new to the concept. The majority of participants rated their familiarity as moderate, suggesting that while they understood the basic idea, they had limited direct experience with similar installations.

Participants were asked to rate their expectations regarding how engaging and emotionally impactful they anticipated the installation to be. The results indicated that most participants expected a highly engaging experience, with a significant portion anticipating strong emotional responses. Some expressed curiosity about how the senses would interact, while others questioned whether the combination of sensory elements would feel neutral.

In addition to numerical ratings, participants provided qualitative feedback on their expectations. The key themes identified were:

**Expectations of Engagement:** Participants expected the installation to be immersive and interactive.

**Curiosity about Multisensory Interaction:** Many were interested in how different sensory modalities would interact, particularly in the context of an advertising experience.

**Excitement about Innovation:** Several participants viewed the installation as an innovative approach to sensory engagement.

**Hopes for Emotional Connection:** A significant number of participants expressed a desire for the experience to evoke strong emotions rather than just providing visual or auditory stimulation.

Overall, participants entered the experience with high expectations for engagement but varying levels of familiarity with multisensory design and some were enthusiastic about the innovative aspects of the installation. These initial expectations set the foundation for evaluating how participants' actual experiences aligned with their predictions in the Post-Experience Questionnaire.

#### 4.2.4.2. Post-Experience

After filling the pre- experience form participants was invited to start the experience. The average time each person spend in the experience was about 5 minutes. After engaging with the multisensory installation, participants answered some post-experience questions to evaluate their level of engagement, emotional impact, and memorability of the experience. The data provides insight into how the actual experience compared to participants' pre-experience expectations.

Participants rated their engagement, emotional response, and memorability on a Likert scale from 1 to 5. The key findings are as follows:

- Engagement: The average engagement rating was 4.1, indicating that most participants found the experience immersive and engaging.
- Emotional Impact: The emotional response averaged 3.9, suggesting a strong but slightly varied reaction among participants.
- Memorability: Participants rated the experience as highly memorable, with an average score of 4.05.

The majority of participants rated engagement and memorability highly, suggesting that the integration of sensory elements played a key role in creating an immersive experience. None of the participants found any of the elements overwhelming or underwhelming and believed that there was an acceptable and sufficient balance between the senses.

By comparing pre-experience expectations with post-experience ratings, the findings indicate that the installation largely met expectations regarding engagement and memorability. However, emotional impact was slightly lower than anticipated for some participants. Some participants expected a stronger connection between specific sensory elements, which was not always fully realized.

A few participants felt that the materials did not effectively evoke the corresponding scents, while one participant instinctively attempted to touch the projected tree trunk image on the wall, expecting a tactile experience similar to the actual texture of wood through the wall's surface texture.



Figure 17: One of the participants tried to touch the wall texture to feel the woody texture, Figure by author.

Moreover, there is a growing interest in understanding how emotional responses to scents differ across cultures, genders, and individual experiences. A notable observation from audience feedback was that a particular sensory cue that evokes nostalgia for one person might cause discomfort for another. This diversity underscores the importance of personalization in scent-based products, where different sensory combinations can be used to tailor experiences for specific user groups or markets.

Most participants believed that multisensory experiences could influence their purchasing decisions. As one of the participants even admitted, she never really liked woody scents, but after this experience, she became interested in this scent and tend to buy it. However, a few participants noted that they only buy products based on necessity but acknowledged that such experiences could influence their choices when deciding between similar products. All participants stated that they would recommend the installation to others.



*Figure 18: The immersive space experience, Figure by author.* 

Participants provided qualitative insights that revealed the following key themes:

• Immersion & Engagement: Many found the combination of sound, visuals, and texture highly engaging, reinforcing the effectiveness of a multisensory approach. However, perceptions varied, while some participants felt that all sensory elements were equally engaging, others found one sense more dominant than the others. It seems this corresponded to responses in the pre-experience questionnaire, where participants expressed personal preferences for specific sensory modalities (visual, auditory, tactile, olfactory).



*Figure 19: The immersive space experience, Figure by author.* 

- Interaction & Interactivity: Some participants desired more control over the interaction process, suggesting that a more dynamic or responsive interaction system would enhance the experience.
- Technical & Spatial Challenges: A few participants noted that projection size and layout constraints affected the full immersive experience. Due to limitations in projection wideness, it was difficult to cover the entire wall while maintaining consistent image quality across all projectors.

## 4.3. Final Installation: Exhibition Setup

For the final phase of the project, an immersive, multisensory installation was designed and presented as part of the graduate exhibition.

### 4.3.1. Making

The installation space was intentionally minimal to create a calm and focused environment for sensory engagement. All four walls were fully covered with large, soft white fabric, transforming the room into a neutral canvas for light and projection. In the center of the space, a simple round table was placed, serving as both the physical and symbolic center of the experience.

On the table, three custom-made candles were displayed, each representing a distinct scent:

- Ocean: fresh and expansive
- Woody: earthy and nostalgic
- Rose: soft and romantic



Figure 20: Interior view of the space, Figure by author.

Each candle was positioned atop a hidden pressure sensor, seamlessly integrated into the table. When a participant lifted a candle, it activated a corresponding sensory sequence across the entire environment:

- Sight: Videos were projection-mapped across all four walls and the table surface, evoking natural landscapes that matched the selected scent: rolling ocean waves, dense forests, or blooming roses.
- Sound: A tailored soundscape filled the room, featuring sounds such as ocean waves, rustling leaves, or birdsong to complement the visual and olfactory elements.
- Smell: Participants engaged directly with the scent through the candle they held, triggering personal memories and emotional responses.

Touch: Each candle's texture was specifically selected to align with its theme: rough hemp rope for the woody scent, soft fabric petals for the rose scent, and seashells embedded in sand for the ocean scent.



Figure 21: One shot from each scent, Figure by author.

Five projectors, one for each wall and one mapped onto the table, created an immersive and synchronized sensory environment. Participants were free to explore at their own pace, with no explicit instructions provided. This open-ended interaction encouraged natural curiosity and personal interpretation, reinforcing the emotional and embodied goals of the project.



Figure 22: A shot from the inside of installation space, Figure by author.

The final installation marked a deliberate shift away from traditional, screen-based interfaces toward a more ambient, bodily form of interaction. It embodied the central proposition of the thesis: that multi-sensory design can foster deeper emotional engagement, activate memory, and create a more holistic experience of design.

### 4.3.2. Challenges and Encountered

Several challenges emerged during the final setup and exhibition phase.

One major challenge was transforming an awkward, completely open and brightly lit space into a controlled, immersive environment. The exhibition venue was not originally designed for intimate installations; it was large, open, and exposed to ambient light. Finding a solution that would shape the space, block out excess light, and create a focused atmosphere required extensive experimentation. After considering several options, the decision was made to fully enclose the installation area with large white fabric on all four sides. This not only helped define a clear boundary but also served as a projection surface, allowing the visuals to blend seamlessly into the environment.

Another key difficulty involved achieving precise synchronization between the pressure sensors and the five projection systems. Even small technical delays could disrupt the seamless sensory immersion that the installation sought to create. Fine-tuning the sensitivity of the pressure sensors was also critical, as overly sensitive triggers risked false activations, while insufficient sensitivity made the interaction feel unresponsive.

Maintaining the minimal aesthetic while integrating all necessary technology presented another set of challenges. Ensuring that cables, sensors, and projectors remained hidden without interfering with functionality required careful spatial planning and iterative adjustments on-site.

Finally, designing for a wide range of visitor behaviors posed difficulties. Some participants engaged slowly and thoughtfully, while others interacted more quickly and casually, which occasionally disrupted the intended pacing of the experience. Balancing openness with enough guidance to ensure meaningful interaction was an ongoing consideration.

### 4.3.3. Feedback and Insights from the Exhibition

Feedback gathered during the exhibition provided valuable insights into the effectiveness of the installation.



*Figure 23: The way people start to interact with the installation, Figure by author.* 

Many visitors reported strong emotional reactions to the scents, with several spontaneously sharing personal memories triggered by the woody or rose candles. The ocean-themed visuals and soundscape were particularly noted for their calming effect, often prompting visitors to linger in the space for extended periods.

Several participants commented on the immersive quality of the environment, appreciating how sight, sound, smell, and touch worked together harmoniously. The absence of explicit instructions was seen positively by most, who enjoyed the freedom to explore and interpret the experience on their own terms.

Many visitors offered suggestions regarding the potential applications and expansions of the installation. Several identified opportunities for use in therapeutic settings, wellness spaces, meditation, education, retail environments, and museum experiences. In particular, some suggested that the installation could serve as a valuable tool for individuals with disabilities or sensory impairments, by offering rich, alternative ways to engage with an environment beyond purely visual input. This feedback reinforced the idea that multi-sensory design can foster inclusivity and broaden access to meaningful experiences for diverse audiences.

A particularly interesting insight came from comparisons to virtual reality (VR) environments. Some participants noted that the immersive space created by this installation felt more natural and comfortable than VR experiences. They shared that VR often causes dizziness or disorientation after just a few minutes, while in contrast, the physical, ambient immersion of this installation allowed them to stay engaged and relaxed without discomfort. This comparison underscored the advantages of physical, real-world sensory environments for prolonged emotional engagement.

However, feedback also highlighted areas for future improvement. Some visitors initially hesitated to pick up the candles, unsure whether they were permitted to interact. This suggests that even within a minimal setup, subtle environmental cues or gentle prompts could further encourage participation without disrupting the aesthetic of openness.

Overall, the responses affirmed the thesis' core argument: that carefully designed multisensory interactions can create powerful emotional experiences, encourage memory recall, foster inclusivity, and deepen engagement beyond purely visual or screen-based communication.

# 5. Conclusion and Further Discussions

### 5.1. Reflection on Project

Through the development and testing of the Feeling Scents prototypes, this study has demonstrated the potential for integrating tactile, visual, auditory, and olfactory elements to create a more immersive and emotionally engaging experience. The findings indicate that multisensory integration enhances perception, strengthens emotional connections, and increases memorability, directly influencing brand association.

The research supports the idea that when multiple senses are engaged in a cohesive manner, users are more likely to form strong associations with a product or brand. This aligns with existing literature on the role of memory in branding, emphasizing that emotional and sensory-driven experiences contribute to long-term brand recall. It also resonates with Donald Norman's Emotional Design theory, which outlines how products can create deep emotional engagement through three levels of design: visceral (sensory appeal), behavioral (usability and performance), and reflective (personal meaning and cultural relevance). Incorporating these layers offers a valuable direction for refining multisensory experiences in future iterations (Norman, 2004).

Furthermore, the study highlights the value of sensory marketing in premium products, where deep emotional connections and distinctive brand identities play a significant role in consumer decisions. Findings reinforce the potential of multisensory design in advertising by demonstrating its effectiveness in enhancing user engagement and memorability. However, the study also highlights areas for improvement, such as refining the integration of scents and optimizing the physical layout for better immersion. These insights will inform future iterations of the project and contribute to discussions on how multisensory design can shape consumer perception and emotional response in advertising.

Participants reported heightened engagement with scent-based interactions when paired with complementary visuals, textures, and soundscapes, reinforcing the idea that a well-designed sensory experience strengthens consumer-brand relationships. However, individual differences in perception and emotional response also emerged as crucial factors, suggesting that personalization in multisensory branding could be an important area for future exploration.

Traditional fragrance marketing is often heavily reliant on visual and textual elements, but this study suggests that expanding into tactile, auditory, and interactive experiences could deepen consumer engagement and increase product recall. The prototype's interactive nature also highlighted the importance of user agency, as some participants desired more control over their engagement with the installation. This insight suggests that future multisensory designs should consider adaptable or personalized sensory interactions to maximize user engagement.

This study raises new questions about the nature of sensory engagement in branding. How do different sensory combinations influence cognitive processing beyond memory, such as decisionmaking and emotional resonance? How can brands design engagement strategies that cater to diverse cultural and personal sensory preferences? These inquiries open new avenues for further investigation, underscoring the evolving role of multisensory design in consumer experiences. Building on the findings of this study, future research could explore more adaptive and responsive sensory experiences in advertising and design. One potential direction is integrating machine learning or AI-driven personalization to tailor sensory elements based on user preferences, enhancing engagement and emotional impact. Additionally, improving scent delivery mechanisms beyond scented candles, such as micro-diffusers or controlled scent emitters, could offer a more precise and immersive olfactory experience. Addressing spatial constraints by optimizing projection mapping techniques could also refine the visual impact of similar installations. Expanding the study with a larger participant pool or testing in commercial environments could provide further insights into the practical applications of multisensory design in consumer behavior. These refinements and future explorations will help push the boundaries of multisensory branding and experiential marketing, reinforcing the power of sensory integration in shaping audience perception and decision-making.

### 5.2. Next Steps

Moving forward, this research can expand in several key directions. While the current study focused on the impact of multisensory design on memory and emotional engagement, future investigations could explore how other cognitive processes, such as attention dynamics and perception biases, contribute to immersive experience and brand recall. Additional sensory modalities, such as haptic feedback or adaptive digital environments, could be tested to deepen understanding of how different sensory systems interact across diverse contexts.

The potential of adaptive and personalized multisensory experiences offers another rich avenue for development. Future iterations could integrate real-time scent diffusion technologies, tactile feedback variations, or AI-driven systems that tailor sensory outputs based on individual user profiles. Exploring how physical sensory engagement could be simulated or suggested within digital and virtual environments also presents exciting opportunities, particularly in spaces where direct physical interaction is limited.

Feedback from the exhibition pointed toward broader applications, particularly in designing experiences for individuals with disabilities or sensory impairments. Building on this insight, future work could explore ways to compensate for a missing sense or amplify remaining senses, creating inclusive and emotionally resonant environments. Tailoring sensory triggers for individuals with low vision, mobility challenges, or sensory processing differences could significantly expand the accessibility and societal impact of multisensory design.

This project also aligns with emerging conversations around Zero UI, an approach that envisions seamless, screenless interaction through natural sensory engagement. Rather than relying on graphical interfaces, the installation invites users to interact through touch, smell, sound, and spatial movement, creating a frictionless and intuitive experience. Additionally, the project hints at possibilities for designing under sensory constraints, where missing senses are compensated through alternative modalities, advancing accessibility-focused design practices (Inkbot Design, 2023).

On a broader professional level, future development will involve expanding the work into domains such as wellness design, therapeutic settings, experiential retail, meditation environments, and educational spaces, contexts where emotional connection, memory activation, and embodied presence can significantly enhance user outcomes. Collaborations with technologists, neuroscientists, and accessibility experts will be key to refining these prototypes into more scalable, impactful, and inclusive experiences.

As a next step in my own practice, I aim to continue developing multisensory experiences that bridge physical and digital environments. I am particularly interested in exploring how real-time adaptive sensory systems can enhance emotional engagement, both in public spaces and therapeutic contexts. Moving forward, I hope to collaborate across disciplines to push the boundaries of sensory interaction design, with a continued focus on inclusivity, accessibility, and emotional resonance.

Ultimately, this project emphasizes the importance of designing experiences that move beyond passive consumption toward deeper, more meaningful human engagement. By embracing the full complexity of multisensory interaction, future research and practice can shape more empathetic, inclusive, and emotionally resonant design ecosystems.

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# Appendices

Appendix A: Poster



# Appendix B: Invitation Letter

	All information collected	will be kent confidential and used solely for research numbers. Data
Invitation to Participate in a Multisensory Design Research Study	will be anonymized to protect your identity. Your involvement is entriely voluntary. You may will decide to participate, relater review the attached or To appress interest or for any quadratic about These interpretations of the terms of the attached or table to the minimum of the attached or 68). Forume adhermon to entrical research attached Research Ethics Office through research (glocadu.or	In the two control of the study at any time without any consequences. If you need that the study at any time without any consequences. If you need that the study of the stu
Date:	Thank you for considering this invitation. Your partie multisensory design in consumer experiences.	cipation would contribute significantly to our understanding of
	Sincerely,	
Dear You are insted to participate in a research study for Feeling Scents. The purpose of this study is enhancing sensory experience through multi-modal design.	Principal Investigator: Dr. Cindy Poremba, Faculty Supervisor Faculty of Art and science OCAD University opprembe@poradu.ca	Team member: Nastaran Bizmark, student Digital Futures Program OCAD University nbizmark@bocadu.ca
We are conducting a research study at Enhancing sensory experience through multi-modal design to explore how multisensory design influences consumer perceptions, particularly in relation to perfume products. Your participation would provide valuable insights into this area.		
Your activities involve these items:		
Completion of a consent form     Completion of a pre-experience questionnaire.     Participation in a sensory evaluation session involving exposure to various scents.     Completion of a post-experience questionnaire.		
As a participant, you will be auked to engage with an interactive installation to see different outcome, touthur and bound to get the feeling of a semal which is exceeding, a participant get apparent the present participant of by part movements, traggering visual, auditory, and offactory leedback. Your participation will involve waiking on this pathway and experiencing the sensory response generated.		
Participation will take approximately 30 minutes of your time.		
Possible benefits of participation include contributing to a deeper understanding of sensory integration in design, which may inform future developments in interactive installations and experiential at Additionally, you will have the opportunity to engage with a unique sensory experience that many enhance your approxision of materially and novement.		
Please consider that this study involves exposure to various scents, which may cause discomfort or sensory overload in some individuals. If you have a known sensitivity to scents or fragrances, this study may not be suitable for you.		
Although, to reduce the possibility of any unpleasant sensations, this scent will probably be presented to participants in the form of scented candles in a very mild and temporary form. So, you <u>type the googdupty to be</u> aware of the type of scent before the experience begins or to by it if you with.		
We will conduct a pre-screening to identify any known allergies or sensitivities to fragrances to ensure participant safety. Moreover, Participants will be monitored throughout the session, and any discontion can be addressed immediately.		
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# Appendix C: Consent Form

Consent Form Date: 203/02/15 Project Title: Fredrig Scents: Enhancing sensory experience through multi-modal design Project Title: Fredrig Scents: Enhancing sensory experience through multi-modal design	A freedback, sher interacting with the installation, you will be instead to share your thoughts and feelings about the experience through a short, informal discussion or questionnaire.  Participation will take approximately 30 minutes of your time.	COREGENTIALIZE Toor phanos is of atmost importance in this study. All information coll will be kept confidential and used solidy for research purposes. Data will be kept confidential and used solidy for research purposes. The student rease presental detertifiers, such as your name, will be replaced with parkedomys in all report publications. Too trend real were list to published any publications.
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# Appendix D: Screening Questionnaire

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	Form I
	Let
Eligibility Screening for Multisens	ory Design Study
Participation	
Student Researcher: Nastaran Bizmark (Contact: <u>nbizmark@ocadu.ca</u> ) Primary Supervisor: Cindy Poremba (Contact: <u>cporemba@ocadu.ca</u> )	
Dear Participant, Thank you for your interest in our research study on <b>multi-sensory des</b> complete the following screening questionnaire.Your responses will help	ign in advertising. To determine your eligibility, please o us ensure that participants meet the study criteria.
* Required	
1. Are you currently residing in Toronto, Ontario? *	
○ Yes	
O No	
2. How frequently do you use or purchase perfume produc	ts?
O Weekly	
() Rarely	
O Never	
3. Do you have any known allergies to fragrances or perfun	ne products?
O ves	
O No	
4. Are you willing to provide informed consent to participat	te? * 🗔
⊖ Yes	
⊖ No	
5. Please enter your contact email address.	
Enter your answer	
Submit	
Microsoft 365	
This content is created by the owner of the form. The data you submit will be sent to privacy or security practices of its customers, including those of this form owner. Ne Microant Forms [Al-Powered survey: guizze and note Create must be formed and the second survey of the second survey.	o the form owner. Microsoft is not responsible for the ver give out your password.
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## Appendix E: Pre-Experience Questionnaire



### Appendix F: Post-Experience Questionnaire



# Appendix G: Hardware components were used for the setup

Item	Quantity
Optoma Projector	4
HDMI (Long Cable)	4
HDMI to USB-C Adapter	4
Auto Pole	4
Spigot	4
Maffer Clamp	4
Magic Arm with Gear in the Joint	4
Safety Chain	10
Extension Cable for Power	2
Power Strip	2