

ENHANCING USER EXPERIENCE THROUGH EXPANDED CORK

A MULTI-SENSORY EXPLORATION OF TOUCH, SOUND, SMELL AND VISUAL APPEAL

INTRODUCTION

In 1891, the accidental discovery of expanded cork transpired within the premises of John T. Smith's buoy and lifejacket factory. Cork, derived from the outer bark of the cork oak tree (*Quercus suber*), had traditionally been associated with its conventional application as stoppers for wine bottles, a practice with a rich history dating back to ancient Greece. Expanded cork however, paved the way for innovation due to its insulating properties, stemming from the formation of air bubbles within cork granules during the process of heating and compression (Wilton & Howland, 2020).

This revelation of the remarkable insulating properties prompted the widespread adoption of expanded cork boards as an insulation material, notably improving the thermal performance of thousands of residences. Nevertheless, it was not until the twenty-first century that architects began to utilize expanded cork boards as an external façade cladding. Architects Álvaro Siza Vieira and Eduardo Souto de Moura initially introduced cork façade cladding in their Pavilion of Portugal for the Exposition in Hannover in 2000, paying tribute to Portugal as the primary manufacturer of this cork. Later, in 2015, ATKA Arquitectos utilized expanded cork's acoustic properties to suppress noise from a school playground nearby Casa Bonjardim. More recently, Associate Professor in Architecture Matthew Barnett Howland, together with Dido Milne and Oliver Wilton, introduced an entirely new approach to expanded cork as a building material in their design for Cork House. Its monolithic walls and corbelled roofs are predominantly crafted from expanded load-bearing cork blocks, offering a highly innovative self-build system that is designed as a kit-of-parts. The components are prefabricated off-site and then meticulously assembled on-site without the need for mortar or adhesive.

While extensive research has been conducted on the technical and sustainability aspects of expanded cork as a building material, there exists a notable gap in the academic field. The realm of multi-sensory engagement with expanded cork cladding, with its potential to evoke tactile, visual, and olfactory sensations, remains relatively unexplored. This research seeks to bridge this gap, delving into the understudied dimension of expanded cork's multi-sensory qualities, thereby highlighting its potential in the field of architectural design and user experience.

THEORETICAL FRAMEWORK

The theoretical framework forms the primary review of existing theories, serving as a guideline for developing arguments within the research. To establish a strong foundation, key concepts will be defined.

Expanded Cork

Expanded cork is, according to Wilton and Howland (2020), 100% cork with no added ingredients, formed by heating cork granules causing them to expand, blacken and meld together. During this process, cork's natural binder, suberin, is extracted by super-heated steam.

Multi-sensory

The term multi-sensory is, according to Vermeersch's PhD dissertation *Less Vision, More Senses. Towards a More Multisensory Design Approach* (2013), expanded from adding various senses together to the interplay of those senses.

These senses can be understood as the five traditional main senses: "the sense of sight, the sense of hearing, the sense of touch, the sense of taste, and the sense of smell." (Maclachlan 1989, p. 3) Though other senses have been added, such as the sense of temperature, the sense of pain, the kinaesthetic sense, which involves various parts of our bodies.

Multi-sensory design

Multi-sensory design is defined by Schifferstein's publication *Multi sensory design* (2011) and claims that designers are more likely to achieve success in creating deliberate experiences for individuals, such as feelings of delight, trust, or care, when they possess an awareness of the messages communicated through various senses and understand how these messages contribute to the overall experience.

Sensory quality

Quality refers to the extent to which an object or entity meets a defined set of characteristics or standards. According to the research of Dümen et al. *Unfolding the material: A proposal of a multi-sensory experience oriented material exhibition medium* (2022), sensory evaluation methods can be used to determine if a materials meets these sensory qualities.

Many philosophers, however, doubt that one can provide any successful explanation of sensory qualities - of how things look, feel, or seem to a perceiving subject.

User perception

According to J.J. Gibson's ecological perception theory (1981), individuals perceive their environment solely based on the information it offers and make precise judgments according to the sensory information they receive. It suggests that

perception is an active process influenced by the properties of the environment (Ben-Ze'ev, 1981).

In the context of the research, this theory could emphasize the importance of sensory qualities to the user's perception.

User experience

User experience can be defined as a user's perceptions and response, resulting from the user or anticipated use of a product, service, system, or space. User experience includes user's emotions, beliefs, responses, preferences, responses, and accomplishments before, during and after use (Vermeersch, 2013).

Experience with a product or a space occurs via various interfaces and one significant interface is the material (Dümen et al., 2022). Material experience can be defined into experiential levels: sensorial (sensory properties of materials), interpretive (associated values), affective (evoked emotions) and performative (referring to the human interaction)

This research, while shedding light on the multi-sensory experience of expanded cork in architectural design, does not investigate the diverse experiences of users who may not engage all their senses. For instance, it does not address the specific needs and sensory encounters of visually impaired individuals. Their unique perspective and interaction with architectural environments and materials are an essential aspect that warrants consideration in future research.

RESEARCH AIM

The aim of this research is to uncover the multi-sensory qualities inherent in expanded cork, and, in doing so, explore its potential role and contribution within the field of architecture. By delving into the tactile, visual, olfactory, and potentially auditory experiences offered by expanded cork, this research seeks to gain a comprehensive understanding of its sensory impact. This exploration extends beyond the investigation of the material's technical properties. By unveiling the potential of expanded cork as a sensorial building material, this research aspires to shed light on its potential to enhance the quality of architectural spaces and elevate the overall user experience.

RELEVANCE

Historically, architectural practice primarily centered around visual perception, yet recent decades have witnessed a notable shift as architects and designers increasingly acknowledge the significance of engaging other senses, including touch, sound, and scent (Spence, 2020). Nevertheless, the research into sensory interplay remains under-developed in the architecture field. This research not only offers valuable insights into the important role of the human senses in architectural design but also undertakes a material-focused investigation, centered around expanded cork. Looking ahead, the aspiration is for the architectural design practice to incorporate this increasing awareness of sensory interplay and its profound influence. By adopting a multi-sensory design approach, a future where buildings and urban spaces are thoughtfully crafted to enhance our social, cognitive, and emotional well-being can be realized.

METHODOLOGY

This research will be carried out using multiple research methods. As mentioned in the theoretical framework, existing theories will serve as a guideline for developing arguments and defining key concepts within the research. Literature review will be conducted to gain insights into these existing theories and to gather information regarding expanded cork. Given the sensorial nature of the subject matter, the majority of the research will be executed through a series of carefully designed experiments.

Literature review

The literature review to be undertaken in this research serves a threefold purpose, focusing on three distinct areas of knowledge: expanded cork, multi-sensory user perception, and multi-sensory design. The examination of expanded cork will draw

extensively from Wilton and Howland's *Cork Construction Kit* (2020), which promises to offer valuable insights into the material and its architectural applications. Furthermore, the defining of guidelines for multi-sensory user experience will rely on established theories, such as J.J. Gibson's influential work on ecological perception theory (1981). Finally, Schifferstein's publication *Multi-Sensory Design* (2011) will be examined to facilitate the translation of these theoretical foundations into practical design strategies. This comprehensive literature review will provide a knowledge base for the forthcoming research, bridging the domains of material science, sensory perception, and architectural design.

Experimenting

An experiment will be conducted to gain deeper insights into the user's perception of expanded cork. A total of 50 participants will be presented with a 200 mm x 200 mm expanded cork board. The participants will be organized into five smaller groups, with four groups focusing on individual senses, and one group engaging all senses simultaneously. The experiment will be carried out in distinct phases to systematically explore the sensory dimensions.

To evaluate the visual qualities of expanded cork, participants will be instructed to observe the expanded cork board without physical contact. As defined in the research of Dümen et al. (2022) *Unfolding the material: A proposal of a multi-sensory experience oriented material exhibition medium*, visual perception can be determined by the texture, colour, thickness and transparency.

In addition, the research of Dümen et al. (2022) offers a method for evaluating haptic or tactile material qualities. Participants can touch, lift or apply pressure to the expanded cork board, therefore experiencing its texture, temperature, hardness, stiffness, elasticity and weight.

To assess the olfactory qualities of expanded cork, participants will be instructed to exclusively focus on the sense of smell while eliminating the other senses, such as by wearing a blindfold. Following the olfactory experience, they will be asked to assess the aroma based on various criteria. These criteria, as defined in McLean's study titled *Nose-first: Practices of Smellwalking and Smellscape Mapping* (2019), include aspects like the strength of the scent, its duration, personal preferences (liking or disliking the scent) and any associations the scent may evoke in the user.

Finally, the acoustic qualities of expanded cork will be analyzed by the participants, who will engage their auditory sense in the assessment. The focal point of this evaluation will be the material's sound absorption, shedding light on its potential contributions to acoustic comfort and quality within architectural environments.

This experiment, however, only assesses the user's perception of the material on a limited scale of 200 mm x 200 mm. In the field of architecture, expanded cork is typically applied over larger surfaces, often in combination with other materials, like

glass. This might cause apparent variations in the results of the user's perception of this controlled experiment setting, versus the user's perception of the material in the applied environment.

In addition, the surrounding context can potentially influence the multi-sensory experience. Sounds, smells and even lights of the city or landscape can overtake the user's sensory impressions. On the contrary, the experience can be intensified by the context. For example, the acoustic qualities of expanded cork are mostly noticeable when surrounding noise is present.

Case study

Consequently, a case study will be conducted to examine how the surrounding context and architectural scale impact the multi-sensory experience of users. The chosen site for this investigation is the Float in Leiden, a houseboat designed by studio RAP in 2022. This case study will also consider the interplay with other materials. Notably, the large, translucent glass doors and windows are in contrast with the expanded cork facade cladding, adding an extra layer to the sensory experience.

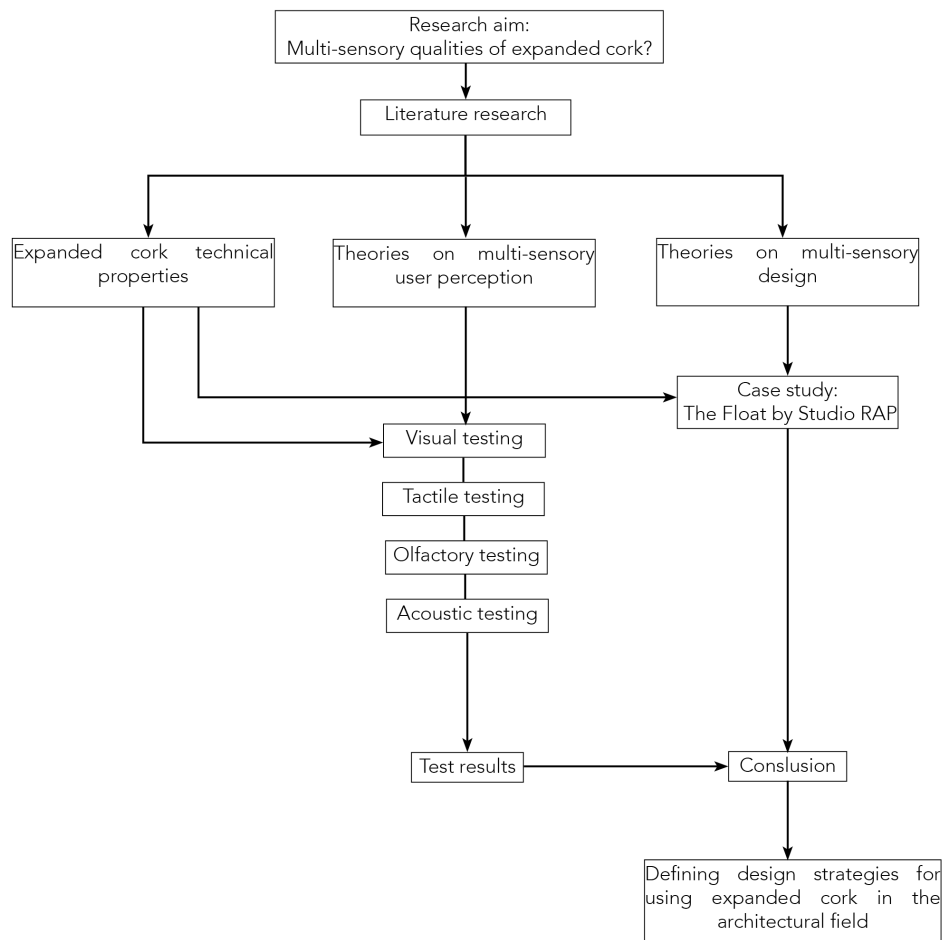


FIGURE 1: CONCEPTUAL DIAGRAM OF RESEARCH (OWN WORK)

After conducting extensive research, a conclusion will be reached, ultimately forming design strategies for using expanded cork in the architectural field. However, the extent to which cork facades contribute to multi-sensory architecture will depend on how architects and designers integrate these qualities into their projects. For some projects, the focus on sensory experiences may be more pronounced, while in others, it may play a supporting role.

BIBLIOGRAPHY

- Ben-Ze'ev, A. (1981). J.J. Gibson and the ecological approach to perception. *Studies in History and Philosophy of Science*, 12(2), 107–139. [https://doi.org/10.1016/0039-3681\(81\)90016-9](https://doi.org/10.1016/0039-3681(81)90016-9)
- Dümen, A. Ş., Koyaz, M., & Çeliker-Cenger, Y. (2022). Unfolding the material: A proposal of a multi-sensory experience oriented material exhibition medium. *Materials & Design*, 219, 110740. <https://doi.org/10.1016/j.matdes.2022.110740>
- Maclachlan, D. L. C. (1989). *Philosophy of Perception*. Prentice Hall.
- McLean, K. (2019). *Nose-first: practices of smellwalking and smellscape mapping*. <https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.781993>
- Schifferstein, H. N. (2011). Multi sensory design. *Network Conference on Creativity and Innovation in Design*. <https://doi.org/10.1145/2079216.2079270>
- Spence, C. (2020). Senses of place: architectural design for the multisensory mind. *Cognitive Research: Principles and Implications*, 5(1). <https://doi.org/10.1186/s41235-020-00243-4>
- Vermeersch, P. W. (2013). *Less Vision, More Senses. Towards a More Multisensory Design Approach* [PhD dissertation]. Katholieke Universiteit Leuven.
- Wilton, O., & Howland, M. B. (2020). Cork Construction Kit. *The Journal of Architecture*, 25(2), 138–165. <https://doi.org/10.1080/13602365.2020.1733812>