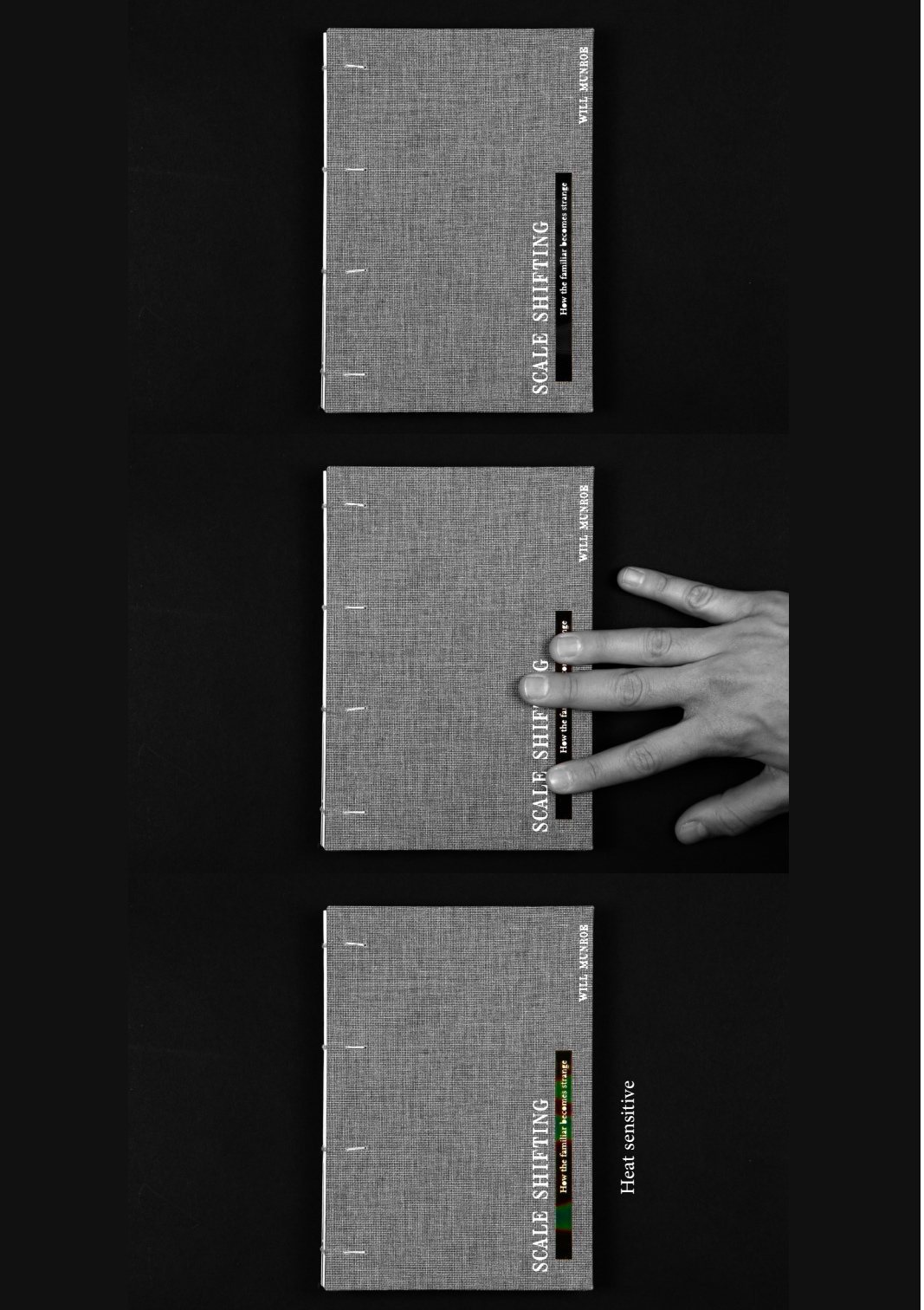
SCALE

How the familiar becomes strange

SHIFTING

Will Munroe



RESEARCH QUESTION

How can confined architecture become more multi-sensory?

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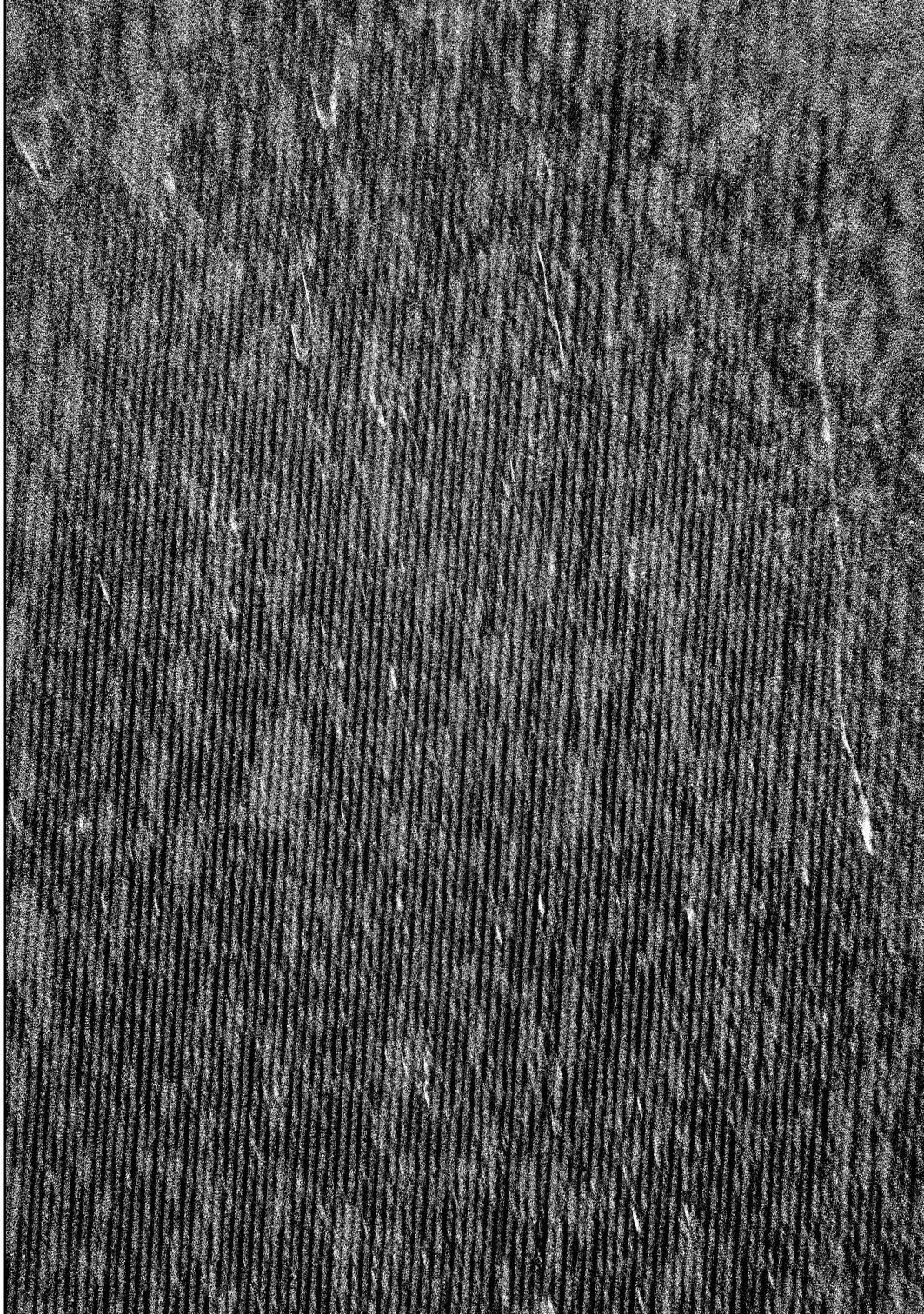
ACKNOWLEDGEMENTS

Thank you to my thesis supervisor Simon Withers, design tutors Thomas Hillier and Pascal Bronner and peers Jack Taylor, Will Jones and Asha Turner Josephs, for the support and guidance provided throughout the process.

Right: (Author)



CONTENTS

Scale shifting: How the familiar becomes strange

Above: (Author)

How can confined architecture become more multi-sensory?

WEIGHT

SCALE

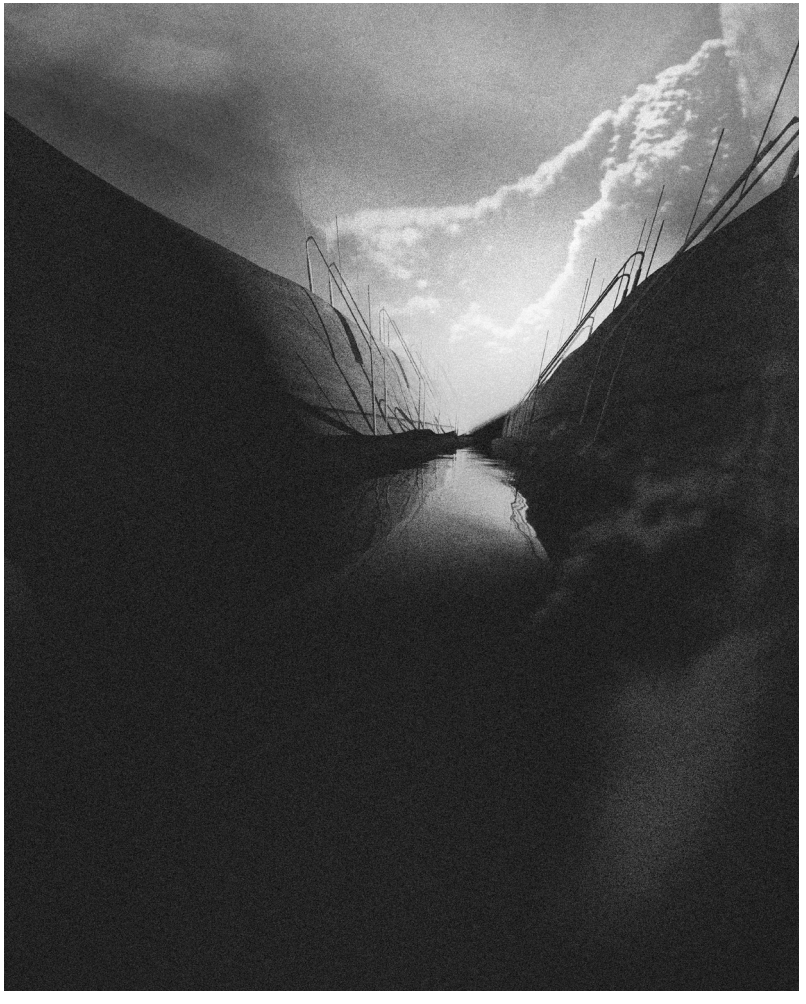
PATINA

SCENT

WALL

INVISIBLE

"I cannot remember the appearance of the door to my grandfather's farm-house from my early childhood, but I do remember the resistance of its weight, the patina of its wood surface scarred by a half-century of use, and I recall especially the scent of home that hit my face as an invisible wall behind the door"
(Pallasmaa, 1996, p. 32).



Micro scales: Inhabiting the wood grain of the Hans Christian Andersen writing desk (Author, 2022).

ABSTRACT

This thesis examines the human sensorium(1) in an architectural context, specifically how the sensual experience of the physical spaces we inhabit could become more multi-sensory. The visual sense is the principal method of perceiving space; however, by implementing haptic, olfactory, auditory and gustatory stimuli through physical methods in architecture, the human sensorium(1) can become further multi-sensory. Furthermore, this diversification can also be achieved via digital sensory integration methods, such as soft-body wearables and augmentation devices.

There is an examination and analysis of critical literature and case studies of work in the domain of the human sensorium(1) in physical space. Examples include The Eyes of the Skin, by Juhani Pallasmaa, academic and professional journal entries and design-led research. The exploration of this research will lead to an extrapolation of the human sensorium(1) concerning the physical spaces we inhabit, specifically how the sensorium(1) may be made more multi-sensory and how this knowledge can be integrated into architectural design practice.

The thesis utilises a range of methods to analyse the relationship of the human body and mind to the spaces they inhabit. Secondary research on the human sensorium(1) and its relation to space is discussed. Primary research has also been analysed, such as the literature noted previously and recorded performance investigations to speculate how these relationships could develop in the future.

(1): Definitions can be located in Chapter 00.

00:
INTRODUCTION

0.1 DEFINITIONS

Human sensorium

The sensory apparatus or faculties considered as a whole.

"Virtual reality technology directed at recreating the human sensorium"

Ocularcentrism

The privileging of vision over the other senses.

Multi-sensory

Involving or using more than one of the senses.

"People can have a fun, multi-sensory experience in an art gallery"

Crossmodal perception

Crossmodal perception or cross-modal perception is perception that involves interactions between two or more different sensory modalities (**Lalanne and Lorenceau, 2004**)

Sensory/Stimulus modality

Stimulus modality, also called sensory modality, is one aspect of a stimulus or what is perceived after a stimulus. For example, the temperature modality is registered after heat or cold stimulate a receptor. Sensory modalities include: light, sound, temperature, taste, pressure, and smell (**Small and Prescott, 2005**).

Sensory substitution

Sensory substitution is a change of the characteristics of one sensory modality into stimuli of another sensory modality. A sensory substitution system consists of three parts: a sensor, a coupling system, and a stimulator.

Extended reality

Extended reality (XR) is a term referring to all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables. It includes representative forms such as augmented reality (AR), mixed reality (MR) and virtual reality (VR) (**Gownder, 2016**).

Episodic memory

Episodic memory is the memory of everyday events (such as times, location geography, associated emotions, and other contextual information) that can be explicitly stated or conjured. It is the collection of past personal experiences that occurred at particular times and places; for example, the party on one's 7th birthday (**Schacter, Gilbert and Wegner, 2009**).

Semantic memory

Semantic memory refers to general world knowledge that we have accumulated throughout our lives (**Reisberg, 2013**).

All definitions are extracted from the Oxford dictionary, unless Harvard referenced.

Posthumanism

Posthumanism is a philosophical perspective of how change is enacted in the world (Marie Keeling and Nguyen Lehman, 2018).

Umwelt

(In ethology) the world as it is experienced by a particular organism.
"The worlds they perceive, their Umwelten, are all different"

Disquieting

Inducing feelings of anxiety or worry.

0.2 TOPIC AND LITERATURE

The perception of architecture is **multi-sensory**(1). However, as theorised by Finnish architect Juhani Pallasmaa, the built environment is **ocularcentric**(1), sensually monopolised by the visual and retinal image. In a journal paper, *EL Cine del Futuro*: *The Cinema of the Future* (Heilig, 1992), Michael Heilig ranks the senses, supporting this privileging of the visual sense (fig 1). Nevertheless, the brain simultaneously processes a range of **sensory modalities**(1), despite the architectural emphasis on visual perception. This thesis investigates these **multi-sensory modalities**(1) through physical and digital methods, to re-interpret the perception of confined space and speculate how confined architecture could become more **crossmodal**(1). The notion that modern architecture is **ocularcentric**(1) creates a niche for the thesis discussion.

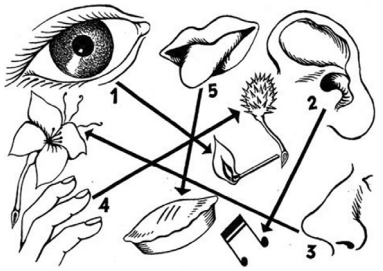


Fig. 1: Michael Heilig's hierarchical ranking of the senses (Heilig, 1992).

As research, technologies and knowledge of the **sensorium**(1) and its relation to the environment develop, architects must carefully consider this in the design strategy. The occupants of buildings are affected sensually, even if not directly apparent; the brain cognitively processes the material world.

The literature on the topic is widely acknowledged and discussed. As specified previously, Juhani Pallasmaa theorised **ocularcentrism** in *The*

(1): Definitions can be located in Chapter 00.

Eyes of the Skin, Pallasmaa asserts that architects neglect the non-visual senses in the experience of modern architecture (**Pallasmaa, 1996**). These non-visual sense systems include the haptic system, the olfactory system, the auditory system and the gustatory system. However, current research in the field of neuroscience proposes there may be up to 22 human senses (**Humphreys, 2017**). Therefore, this theory of **ocularcentrism** will be important in the thesis; it will support the speculation of how architecture could become more **multi-sensory.**

The thesis project includes four chapters and a conclusion:

Chapter one is an introduction to the critical paradigms and issues considered in writing and conducting research. The main points are introducing the human **sensorium** in architecture, **ocularcentrism**, **episodic memory**(1) and the human **umwelt**.(1)

The second chapter analyses the senses individually in the experience of architecture and briefly discusses architecture for all the senses.

Chapter three forms the thesis, the main discussion for the text. This chapter examines how architecture can become further multi-sensory through physical design methods.

Chapter four is a series of speculative works by the author, intended to be suggestive pieces utilised to evaluate the relationships of sensory experience. This chapter supports the thesis discussion.

The fifth chapter is the antithesis, discussing digital methods of creating **multi-sensory** architecture, such as wearable technologies that augment perception.

The final chapter will synthesise the research, conclude the text's key points, and speculate how architects can apply them in practice.

All chapters in the thesis analyse and critique case studies. The case studies concentrate on **crossmodal** perception, **multi-sensory** architecture, and artistic pieces.

(1): Definitions can be located in Chapter 00.

0.3 END NOTES AND REFERENCES

All definitions are taken from the Oxford dictionary unless Harvard referenced below.

Definitions:

1. Lalanne, C. and Lorenceau, J., 2004. Crossmodal integration for perception and action. Journal of Physiology-Paris, 98(1-3), pp.265-279.

2. Small, D. and Prescott, J., 2005. Odor/taste integration and the perception of flavor. Experimental Brain Research, 166(3-4), pp.345-357.

3. Gownder, J., 2016. Forrester. [online] Forrester.com. Available at: <https://www.forrester.com/report/Breakout-Vendors-Virtual-And-Augmented-Reality/RES134187> [Accessed 27 February 2022].

4. Schacter, D., Gilbert, D. and Wegner, D., 2009. Psychology. pp.6-185.

5. Reisberg, D., 2013. The Oxford handbook of cognitive psychology.

6. Marie Keeling, D. and Nguyen Lehman, M., 2018. Posthumanism. Oxford Research Encyclopedias,.

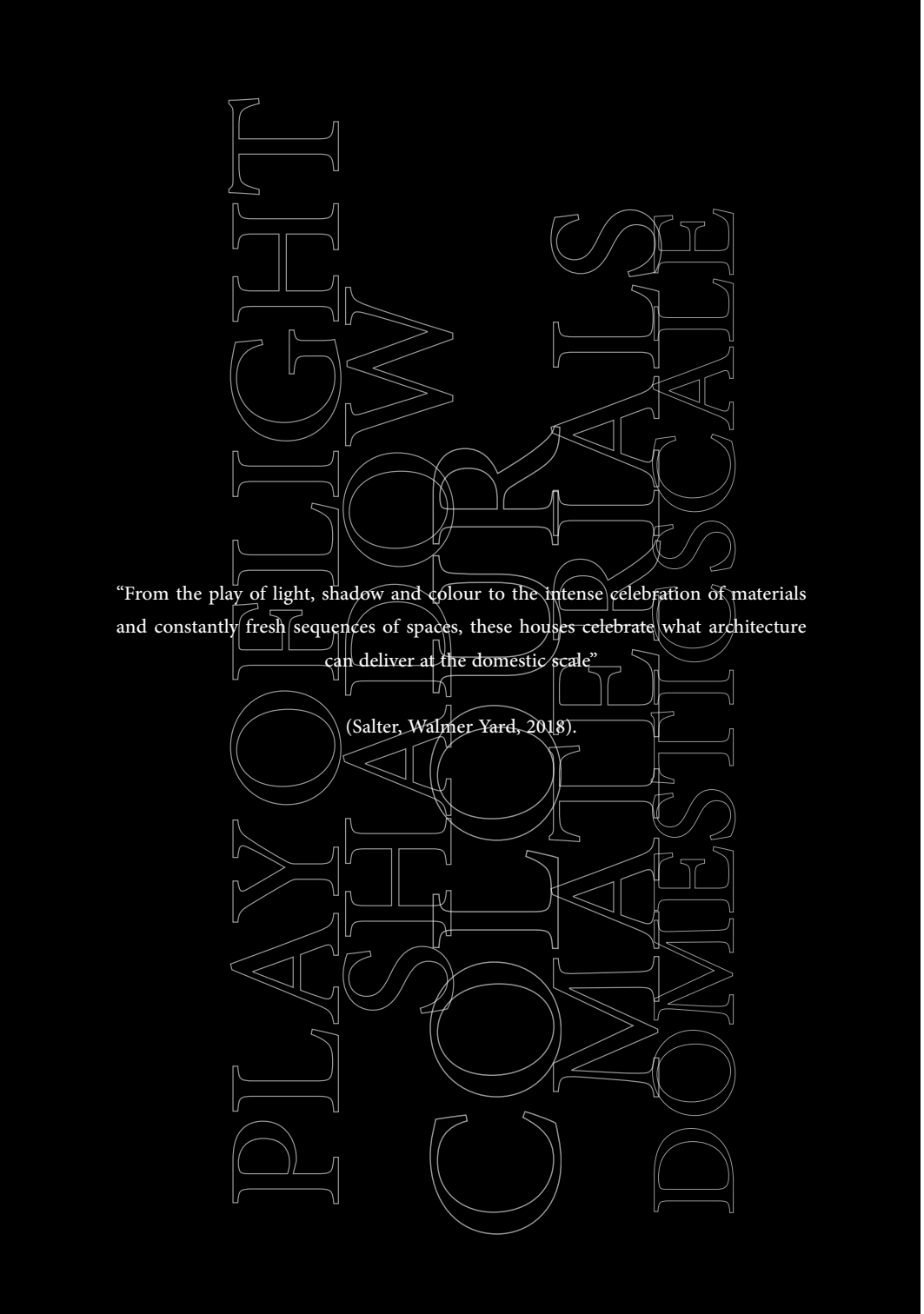
Text references:

1. Heilig, M., 1992. EL Cine del Futuro: The Cinema of the Future. Presence: Teleoperators and Virtual Environments, 1(3), pp.279-294.

2. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley.

Figures:

1. Heilig, M., 1992. EL Cine del Futuro: The Cinema of the Future. Presence: Teleoperators and Virtual Environments, 1(3), pp.279-294.



"From the play of light, shadow and colour to the intense celebration of materials and constantly fresh sequences of spaces, these houses celebrate what architecture can deliver at the domestic scale"

(Salter, Walmer Yard, 2018).

01: SPATIAL SENSUAL RELATIONSHIPS

01.01 THE HUMAN SENSORIUM IN PHYSICAL SPACE

The built environment and the human **sensorium**(1) influence one another. Architecture is human-centric, signifying it is designed based on the present perception of the surrounding environment; as a result, architecture can manipulate the senses and deceive the cognitive interpretation of space.

Architectural elements affect the senses in various ways: the scale, materiality, proximity and circulation of a space all induce distinct sensual responses, diversely integrating the senses into the spatial perception. The proximity of architectural elements impacts which sense is most prevalent; for instance, ample open space will integrate vision and sound more significantly than the other senses. The occupants must assess an extensive territory for a more prolonged period than a smaller space as they traverse through it. Conversely, if a space is claustrophobic and intimate, such as Francis Bacon's studio in *Reece Mews, London* (fig 1), the sense of touch could be prominent, as there will be a greater frequency

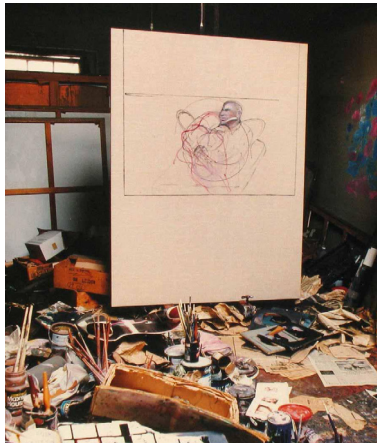


Fig 1: Francis Bacon's studio, 7 Reece Mews, London (Ogden, 1998).

Fig. 2 (right): Peter Salter's Walmer Yard (Binet, 2017).

(1): Definitions can be located in Chapter 00.

of haptic points. Later in the thesis, this studio will be used as a case study to analyse how architectural elements can influence the senses.

Small and intimate space does not signify the mundane. In the *Walmer Yard* buildings (**fig. 2 and 3**), Peter Salter integrated the human **sensorium**(1) diversely and intimately through numerous distinct methods. The following quote from the *Walmer Yard* texts highlights the multi-sensory integration: **"From the play of light, shadow and colour to the intense celebration of materials and constantly fresh sequences of spaces, these houses celebrate what architecture can deliver at the domestic scale" (Salter, 2018).** As Pallasmaa discusses in The Eyes of the Skin, some of architecture's most prevalent elements are visual, such as those depicted in the previous quote. Light, colour and shadow are visual, whereas physical materials are visual and haptic. As a result, the blending of the visual and the haptic incorporates the broader **sensorium**, which leads the occupants of the *Walmer Yard* buildings into a **multi-sensory** experience.

Fig. 3: Peter Salter's Walmer Yard (Binet, 2017).

01.02 OCULARCENTRISM

As examined by Pallasmaa in The Eyes of the skin, **ocularcentrism**(1) is a fundamental theory for architects to consider. Pallasmaa defines **ocularcentrism** as **"the hierarchical ranking of the human sensorium; vision is privileged over the other senses" (Pallasmaa, 1996)**; Pallasmaa discusses how modern-day architecture prioritises the eye's experience (**fig. 4**) heavily over the other sensual perceptions of space. The senses were

Fig. 4: Pallasmaa states that the eye is privileged by architects (Man Ray, 1984).

(1): Definitions can be located in Chapter 00.

hierarchically organised based on importance during the *Renaissance*; as a result, this influenced the course architecture assumed. Nevertheless, the other senses are deemed equally, if not more critical, by Pallasmaa. The **ocularcentrism** theory facilitates architects to regard the broader human sensorium carefully when composing a piece of architecture. It is effortless for designers to fixate on the aesthetic, primarily when the design process is entirely digital Pallasmaa describes this in *The Eyes of the Skin*: "The computer creates a distance between the maker and the object they are designing, whereas more traditional methods of working such as hand drawing and model making put the maker in direct contact with the haptic experience of the work" (Pallasmaa, 1996). This distance between the viewer and the on-screen is apparent in the built work; however, the distance is between the viewer and the architecture itself; this highlights that the design process neglects the non-visual senses; therefore, **ocularcentrism** theory promotes consideration of the broader **sensorium**.

Ocularcentric projects induce a disconnect between the viewer and the architecture due to the deprivation of the haptic touch, particularly in sterile environments. As highlighted by Pallasmaa in *The Eyes of the Skin*: "Technologically advanced architecture can often be the most alienating for the people inside them, such as hospitals and airports" (Pallasmaa, 1996). These examples diverge from the sensual experiences and aesthetics of the natural world due to being immaculate and refined, provoking a sensual disconnect.

(1): Definitions can be located in Chapter 00.

Juhani Pallasmaa speculates how designers may further integrate the non-visual senses into architecture. The theorist believes that architecture can be **multi-sensory**(1), integrating sound, smell, taste, and touch. London-based PhD student Ava Aghakouchak is also conducting research, integrating the non-visual senses into the experience of space through performative pieces, *chapter 04* analyses case studies of this type of work.

(1): Definitions can be located in Chapter 00.

01.03 EPISODIC MEMORY

Spatial **episodic memory**(1) is influential in architecture. If a person has been present in space previously, they will have an inherent cognitive notion of it. **Episodic memory** is separate from **semantic memory**(1) and closer to spatial perception (as detailed in fig 5). Prior experience of the space influences the mental representation of architecture. In addition, **episodic memory** influences the perception of the space through the non-visual senses.

This notion of memory in space influences the creative working practice, especially when the architecture is a place of work or a studio. Memory in creative work constructs nostalgia, a reminder of earlier work and inspiration for the next. Furthermore, memory allows the space to become a vehicle for imagination, particularly evident in the Hans Christian Andersen House. This 60m2 house was the breeding ground for an expansive world spawned from a childhood bedroom. Undoubtedly, intimate spaces allow creative practitioners, such as Andersen to explore and develop ideas.

Proximity is an integral factor in pre-experienced space perception; again, space can be navigated without visual perception if understood well. Therefore, when researching this field of **ocularcentrism**, it may be optimal to utilise spaces that individuals are not inherently familiar with. Architecture's proximity and pre-conceived representation will influence the sensory response to the space.

	Diagnostic feature	Episodic memory	Semantic memory
1	Source	Sensation	Comprehension
2	Units	Events, Episodes	Facts, ideas, concepts
3	Organisation	Temporal	Conceptual
4	Reference	Self	Universe
5	Registration	Experiential	Symbolic
6	Effect	More important	Less important
7	Retrieval queries	Time? Place?	What?
8	Re-collective experience	Remembered past	Actualised knowledge

Fig. 5: Episodic and semantic memory (Tulving, 1972).

(1): Definitions can be located in Chapter 00.

(1): Definitions can be located in Chapter 00.

Fig. 6: Hans Christian Andersen's childhood bedroom (Visit Odense, 2020).

01.04 POSTHUMANISM

There is potential to consider developing methods to assist in **"thinking beyond the established anthropocentric frame" (Braidotti and Bignall, 2019, p. 11)**. For instance, the human **sensorium** can extend or shift regarding the thesis topic in a **posthumanist**(1) manner. A posthumanist method of extending the human **sensorium** would be to implement additional modes of experiencing space intentionally.

The sense methods can be re-considered; research has been carried out in the neuroscience field of sensory substitution(1) by David Eagleman **(Eagleman, 2015)**. Eagleman concludes that the brain does not consider where it receives input data from; it registers the signals that arrive and processes the required response. Therefore, wearable technologies or sensual devices are supplementary methods for registering cognitive signals. The brain can minister the inputs as plug-ins, translating into sensory reactions. Eagleman proposes that the senses can be substituted, for instance, **"seeing through touching" (Eagleman, 2015)**; An instance is a vest developed to translate human voices into vibrations based on the frequency of the voice and words **(fig 7)**. A deaf wearer gradually learns to understand the vest and translates these vibrations into a comprehension of the terms. The application of technologies, such as this can apply to an architectural context. A feedback input relating to the architecture design could cause a specific sensory reaction or stimuli.

(1): Definitions can be located in Chapter 00.

Fig. 7: David Eagleman's voice sensitive haptic vest (Road to VR, 2017).

01.05 DEVELOPING THE UMWELT

The dialogue around the experience of architecture and space somewhat depends on the human **umwelt**(1). "Umwelt meaning "environment" or "surroundings", is the "biological foundations that lie at the very epicentre of the study of both communication and signification in the human and non-human animal" (Sebeok, 1985). The term umwelt generally translates to "self-centred world" (Cobley, 2010, p.47). The **umwelt** limits humans sensually to what the brain can perceive and perform. There is a significant amount of research into the **umwelt** of other species in neuroscience, and the it varies significantly across them. If architects wish for a **crossmodal perception**(1) of space, other than the **ocularcentric**, then the **umwelt** could be adapted or developed.

(1): Definitions can be located in Chapter 00.

01.06 END NOTES AND REFERENCES

All definitions highlighted(1) in the chapter can be found in Chapter 00

Text references:

1. Walmer Yard and Salter, P., 2018. Home - Walmer Yard. [online] Walmer Yard. Available at: <https://walmeryard.co.uk/> [Accessed 20 February 2022].

2. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley.

3. 16. Humphreys, J., 2017. Aristotle got it wrong: We have a lot more than five senses. [online] The Irish Times. Available at: <https://www.irishtimes.com/culture/aristotle-got-it-wrong-we-have-a-lot-more-than-five-senses-1.3079639#:~:text=Aristotle%20said%20there%20were%20five,are%20many%20more%20than%20that.> [Accessed 26 February 2022].

4. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley.

5. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley.

6. Braidotti, R. and Bignall, S., 2019. Posthuman ecologies. p. 11

7. Eagleman, D., 2015. Sensory Substitution. [online] David Eagleman. Available at: <https://eagleman.com/science/sensory-substitution/> [Accessed 04 January 2022].

8. Eagleman, D., 2015. Sensory Substitution. [online] David Eagleman. Available at: <https://eagleman.com/science/sensory-substitution/> [Accessed 04 January 2022].

9. Sebeok, T., 1985. Contributions to the doctrine of signs. Lanham, MD: University Press of America.

10. Cobley, P., 2010. The Routledge companion to semiotics. Choice Reviews Online, 47, p. 47

Figures:

1. Ogden, P., 1998. [image] Available at: <http://www.perryogden.com/projects/francis-bacon-studio/>

2. Binet, H., 2017. [image] Available at: <https://www.world-architects.com/en/architecture-news/headlines/walmer-yard-from-london-to-pittsburgh>

3. Binet, H., 2017. [image] Available at: <https://www.world-architects.com/en/architecture-news/headlines/walmer-yard-from-london-to-pittsburgh>

4. Ray, M., 1984. [image] Available at: <https://www.manray.net/glass-tears.jsp>

5. Tulving, E., 1972. Organization of Memory (pp.381-403). pp.381-403.

6. Visit Odense, 2020. [image] Available at: <https://www.visitodense.com/tourist/plan-your-trip/hans-christian-andersens-childhood-home-gdk631940>

7. Road to VR, 2017. [image] Available at: <https://www.roadtovr.com/vest-can-cure-deafness-maybe-one-day-give-us-entirely-new-senses/>

LISTEN

BREATH

"Listen to the sounds a building makes when no one is in it. It breathes with a life of its own. Floors creak, timber snaps, radiators crack, furnaces groan" (Schafer, 1977, p. 223).

CREAK

SNAP

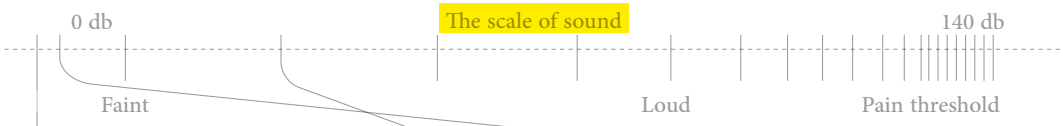
GROAN

02: THE NON-VISUAL SENSES ISOLATED

02.01 THE SENSES ISOLATED

The senses work as part of a multi-sensory system to facilitate the sensual perception of the environment. The sensory systems are subsets of the central nervous system (**fig 1**), providing the brain with the information required to perceive the world.

Fig. 1: John Evelyn, central nervous system pressed (The Hunterian Museum, 1640).

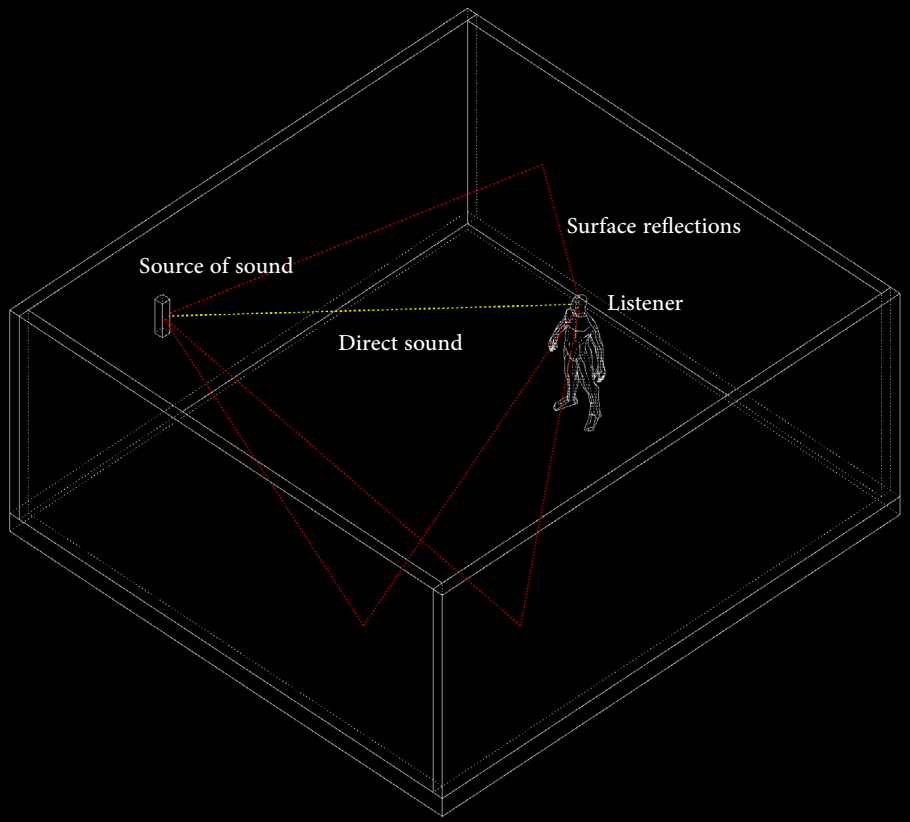


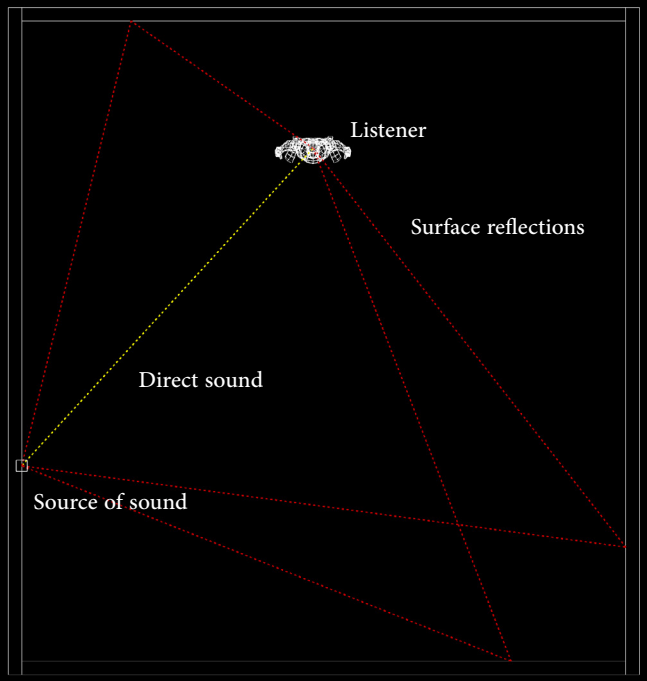
02.02 AUDITORY – THE SOUND OF ARCHITECTURE

The auditory system is responsible for processing the sounds encountered in the environment.

The sound of architecture is frequently concerned with decreasing noise pollution and managing sound in buildings, rather than using sound as an element of a **multi-sensory** experience. As stated by Schafer in the book *Tuning of the World*: **"The modern architect is designing for the deaf. The study of sound enters modern architecture schools only as sound reduction, isolation and absorption" (Schafer, 1977, p. 222)**. The minimising of sound in Architecture is a strategy that designers utilise to deliver the most optimal conditions for activity in the building. However, this technique of 'designing for the deaf', as said by Schafer, deprives the sensual auditory system. Architects often implement artificial methods such as subtle white noise to conceal sounds. The sounds of the architecture can make it appear to be alive **"listen to the sounds a building makes when no one is in it. It breathes with a life of its own. Floors creak, timber snaps, radiators crack, furnaces groan" (Schafer, 1977, p. 223)**. Architects can consider the sounds a structure may make based on the materials chosen; however, if these sounds are masked, this design tool is not apparent in the experience of the architecture.

Fig. 2 and 3 (overleaf): Auditory pathways diagrams (Author).


Surface reflections
Source of sound
Listener
Direct sound


Listener
Surface reflections
Direct sound
Source of sound

02.03 OLFACTION – THE SMELL OF ARCHITECTURE

The olfactory system is responsible for the sense of smell. It is one of two chemical senses, the second being gustation, which will be examined later in the chapter.

Similarly to the auditory system, controlling the olfactory in modern architecture is typically concerned with disfavoured scents rather than multi-sensory architecture. There are numerous examples of masking or lessening the impact of these unfavourable odours, such as the scent of bleach vamoosed from cleaning, damp buildings developing mould, or the odour of old furniture. These examples are often masked in some way by an additional pleasant aroma. However, unfavourable odours are most effective at creating an immersive, **multi-sensory**[(1)] experience. They are most prominent and evoke a reaction or sensation to be concealed by an additional pleasant one. As said by Eberhard in, *Architecture and the Brain*: **"The terrible smell of a house that was ravaged by fire or floods is seared in the memory of those who have endured one of these disasters" (Eberhard, 2007, p.47).** Therefore, unfavourable odours such as fire remains **(fig 4)** or floods are the strongest at evoking a sense of the experience. These scents create a **multi-sensory** experience through the visual, the haptic touch of the material, and the olfactory effect of sensory immersion.

'Anasmoic cube' – is a term originated by Jim Drobnick in his book *Volatile Effects* **(Drobnick J., 2005)**. The term

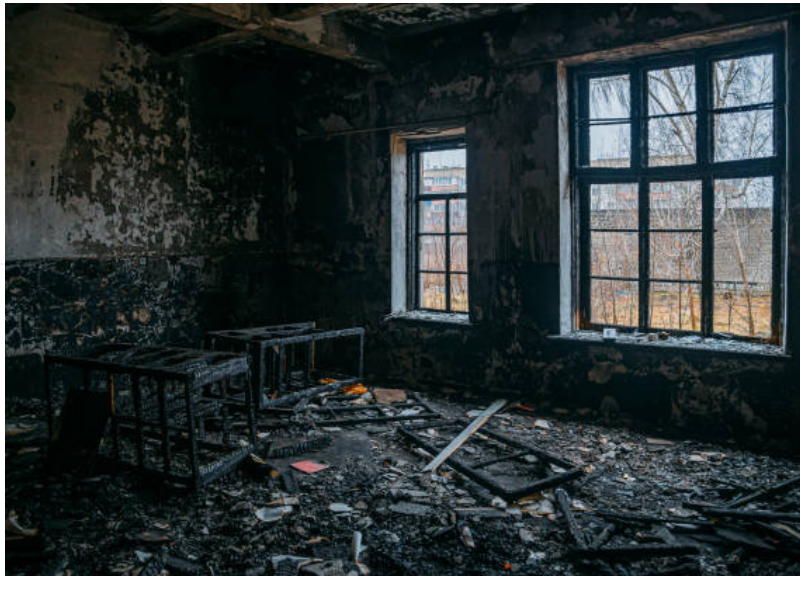


Fig. 4: A fire ruined house is highly scent stimulating (Wytrazek, 2014).

emanates from the 'white cube', a white space with no sense inducing elements to display art pieces **(Cain, 2017) (fig 5)**. An 'anasmoic' space induces no sense of smell; this term applies to many modern-day types of architecture, typically public architecture. Spaces with the loss or impairment of the sense of smell are not **multi-sensory** at all; this is a criticism by Juhani Pallasmaa in *The Eyes of the Skin*: **"The strongest memory of a space is often its odour;**

I cannot remember the appearance of the door to my grandfather's farm-house from my early childhood, but I do remember the resistance of its weight, the patina of its wood surface scarred by a half-century of use, and I recall especially the scent of home that hit my face as an invisible wall behind the door" (Pallasmaa, 1996, p. 32). The scent of architecture can be nostalgic; scent can invoke a sense of the past and therefore influence the behaviour and sentiment in the space. The scents are priming the cognitive mechanisms present earlier.

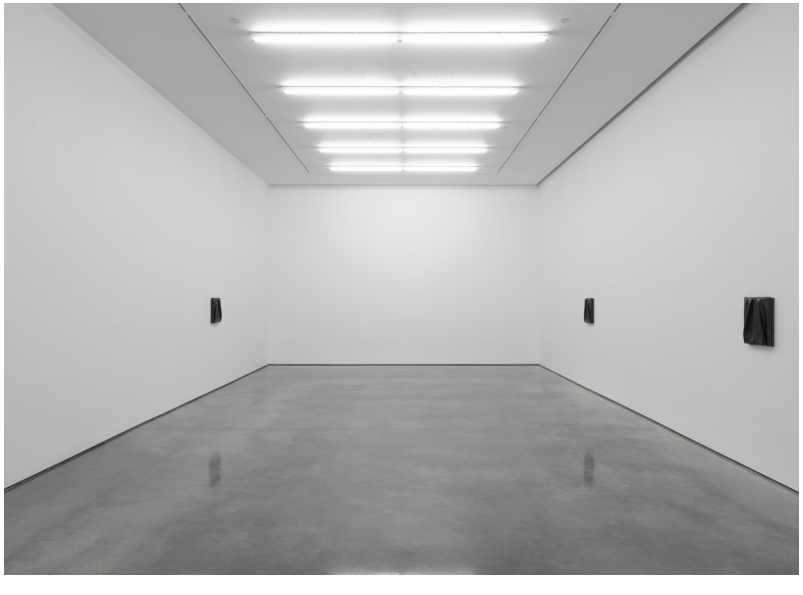


Fig. 5: The White Cube, a space intended to be sensually neglecting (The White Cube, 2012).

The scent of architecture influences the inhabitants' behaviour in myriad forms. For instance, studies have demonstrated that introducing a fragrant citrus aroma to the air decreases untidiness; cognitive reasoning is that a specific scent is associated with a condition, triggering cognitive responses; citrus is an aroma associated with cleanliness. Scents create a **multi-sensory** environment, influencing individuals' behaviour inside the architecture, even if not directly apparent.

Aromatherapy is an ancient notion used to treat particular conditions or feelings by utilising the aroma of natural plant extracts, typically for health and well-being. The historical evidence on this topic has been tentative and limited; however, recent investigations have demonstrated promising results (Lakhan, Sheaffer and Tepper, 2016, pp. 1-13). The use of aroma creates a new sensory palette for designers to regard when considering the experience of their architecture. A building that considers the olfactory system is the *Silicon House*, by SelgasCano Architects in Madrid (fig 6). Although natural flora surrounds the *Silicon House*, "the chestnuts, oaks, elms and acacias scattered within the area" provide an olfactory quality to the house (SelgasCano, 2014). The *Silicon House* is an example of architects creating a multi-sensory experience, as the plants are visually pleasing, olfactory stimulating and tactile.

Fig. 6: The Silicon House (ArchDaily, 2006).

02.04 GUSTATION - THE TASTE OF ARCHITECTURE

The gustatory system is the second of the two chemical senses; it is responsible for taste perception. This system is located in the mouth, where taste cells monitor the **modalities**(1) of sweet, salty, bitter, sour and umami (**Braun, 2021**).

There is research on the sense of taste in response to the introduction of visual colour; in a similar way, that

Fig. 7: Carlo Scarpa's Casa Tabarelli has an entry with planes of salmon, gold and green (Orsini, 2018).

(1): Definitions can be located in Chapter 00.

colour can evoke emotion based on hue and saturation. Francesca Bacci's book, *Art and the Senses*, discusses this in detail; Juhani Pallasmaa, as a guest writer, states: **'Carlo Scarpa's architectural details frequently evoke the sensation of taste" (Pallasmaa, Bacci and Melcher, 2013, p. 595) (fig 7).** Pallasmaa also proposes that the detail and choice of colour will instinctually initiate the viewer of Scarpa's work. This discussion may not be linked directly to the viewer of architecture tasting it. However, the use of colour can integrate the sense of taste into the experience of the building; this is due to the taste connotations linked to specific colours and materials. Therefore, this method can make architecture more multi-sensory.

02.05 THE HAPTIC – THE FEEL OF ARCHITECTURE

"The haptic system manages the sense of touch, body position, temperature and pain" (Sherman, 2018).

Sterility is a characteristic that influences the interaction with architecture. Modernist materials such as glass and steel are frequently visual planes or structural reinforcement, concealed or overlaid with supplementary materials. These materials lack depth, usually exceptionally smooth planes developed solely for the eye's reception; Glass accomplishes this as the viewer is discouraged from handling it, instead, it is merely a tool for viewing the exterior world or another space. Richard Sennett writes in the book, *Flesh and Stone*: **"sensory deprivation... seems to curse most modern buildings; the dullness, the monotony, and the tactile sterility which afflicts the urban environment" (Sennett, 1994, p. 15).** Tactile sterility links to Pallasmaa's quote in *Chapter 01* of the thesis concerning technologically dense environments being the most alienating. These environments are pristine and furthest diverged from the natural world. The human touch of technological elements is often minimised or restricted due to hygiene or cleanliness bases; this is evident in hospitals or airports, where there is a heightened density of technological equipment. They lack the tactility to remain sterile; thus, they are not comforting. In juxtaposition, materials comparable to nature have a contrasting sensory effect. As said by Juhani Pallasmaa in *The Eyes of the Skin*: **"Natural materials - stone, brick and wood - allow the gaze to penetrate**

their surfaces and they enable us to become convinced of the veracity of matter" (Pallasmaa, 1994, p. 29). Natural materials exhibit their age; they acquire different qualities over time as humans do (fig 8); one can envision their internal texture. Therefore, natural materials lacking sterility and displaying age can construct a multi-sensory environment, as they are more inviting to handle and rely less on the isolated visual reception.

Fig 8: Natural materials such as wood show their age, they "allow the gaze to penetrate their surfaces" (Pallasmaa, 1994, p. 29) (Freeimages, 2016)

02.06 THE 22 SENSES

Aristotle was the first to number the senses in his work, *De Anima* (Humphreys, 2017). The principal five senses are vision, audition, olfaction, gustation and tactition.

As discussed in this chapter, recent neuroscience research suggests there may be up to 22 senses or perhaps more, despite five traditional primary senses (Humphreys, 2017). The accepted sense definition is "a group of sensory cells that respond to a specific physical occurrence, corresponding with the brain" (Francis, 2020), this equates to approximately 22. There is a dialogue concerning whether there are additional senses, "including physiological experiences such as the sense of hunger or thirst, vertigo or the sense of time" (Francis, 2020).

02.07 ARCHITECTURE FOR ALL THE SENSES

The research published to date would appear to suggest that **"very often, environmental cues influence us even when we are not consciously aware of or thinking about them" (Spence, 2020, p. 15)**. Subconscious influence indicates that architecture's experience often occurs in the background without notice; it is not the focus of activity. However, the **sensorium**[(1)] naturally perceives and becomes attuned to the environment, therefore, the senses work **crossmodally**[(1)]. An example of a subtle environmental cue is a study carried out with shoppers in supermarkets. The music in the supermarkets tested whether the people shopping were affected by their sensory environmental cues. French and German music was tested, and the results indicated that when French music was playing, more purchased French wine, and when German music was played, more purchased German wine. After the trial, numerous individuals denied that the background music had influenced their choice of wine, despite the evidence being clear **(North, Hargreaves and McKendrick, 1999, pp. 271-276)**. This example highlights that although an environmental cue is not noticeable directly, it can still affect the perception of architecture and the environment.

(1): Definitions can be located in Chapter 00.

02.08 END NOTES AND REFERENCES

All definitions highlighted[(1)] in the chapter can be found in Chapter 00

Text references:

1. Schafer, R., 1977. The Tuning of the World. p. 222

2. Schafer, R., 1977. The Tuning of the World. p. 223

3. Eberhard, J., 2007. Architecture and the brain. Atlanta, Ga: Greenway Communications. p. 47.

4. Drobnick, J., 2005. Volatile Effects: Olfactory Dimensions of Art and Architecture.

5. Cain, A., 2017. How the White Cube Came to Dominate the Art World. [online] Artsy. Available at: <https://www.artsy.net/article/artsy-editorial-white-cube-dominate-ar t> [Accessed 26 February 2022].

6. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley. p. 32

7. Lakhan, S., Sheafer, H. and Tepper, D., 2016. The Effectiveness of Aromatherapy in Reducing Pain: A Systematic Review and Meta-Analysis. Pain Research and Treatment, 2016, pp.1-13.

8. SelgasCano, 2014. Silicon House. [online] Architect. Available at: <https://www.architectmagazine.com/project-gallery/silicon-house-6143> [Accessed 1 February 2022].

9. Braun, T., 2021. Gustatory system - Latest research and news | Nature. [online] Nature.com. Available at: <https://www.nature.com/subjects/gustatory-

10. Bacci, F. and Melcher, D., 2013. Art and the senses. Oxford: Oxford University Press. P. 595

11. Sherman, C., 2019. The Senses: The Somatosensory System. [online] Dana Foundation. Available at: <https://dana.org/article/the-senses-the-somatosensory-system/> [Accessed 7 February 2022].

12. Sennett, R., 2002. Flesh and stone. London: Penguin Books. P. 15

13. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley. p. 29

14. Spence, C., 2020. Senses of place: architectural design for the multisensory mind. Cognitive Research:

Principles and Implications. P.15

15. North, A., Hargreaves, D. and McKendrick, J., 1999. The influence of in-store music on wine selections. Journal of Applied Psychology, 84(2), pp.271-276.

16. Humphreys, J., 2017. Aristotle got it wrong: We have a lot more than five senses. [online] The Irish Times. Available at: <https://www.irishtimes.com/culture/aristotle-got-it-wrong-we-have-a-lot-more-than-five-senses-1.3079639#:~:text=Aristotle%20said%20there%20were%20five,are%20many%20more%20than%20that.> [Accessed 26 February 2022].

17. Humphreys, J., 2017. Aristotle got it wrong: We have a lot more than five senses. [online] The Irish Times. Available at: <https://www.irishtimes.com/culture/aristotle-got-it-wrong-we-have-a-lot-more-than-five-senses-1.3079639#:~:text=Aristotle%20said%20there%20were%20five,are%20many%20more%20than%20that.> [Accessed 26 February 2022].

18. Francis, C., 2020. A brief history of the senses. [online] Sensorytrust.org.uk. Available at: <https://www.sensorytrust.org.uk/blog/how-many-senses-do-we-have> [Accessed 26 February 2022].

19. Francis, C., 2020. A brief history of the senses. [online] Sensorytrust.org.uk. Available at: <https://www.sensorytrust.org.uk/blog/how-many-senses-do-we-have> [Accessed 26 February 2022].

Figures:

1. The Hunterian Museum, 1640. [image] Available at: <https://dabrownstein.com/2013/03/12/mapping-the-materials-of-the-human-body/> [Accessed 26 February 2022].

2. Author

3. Author

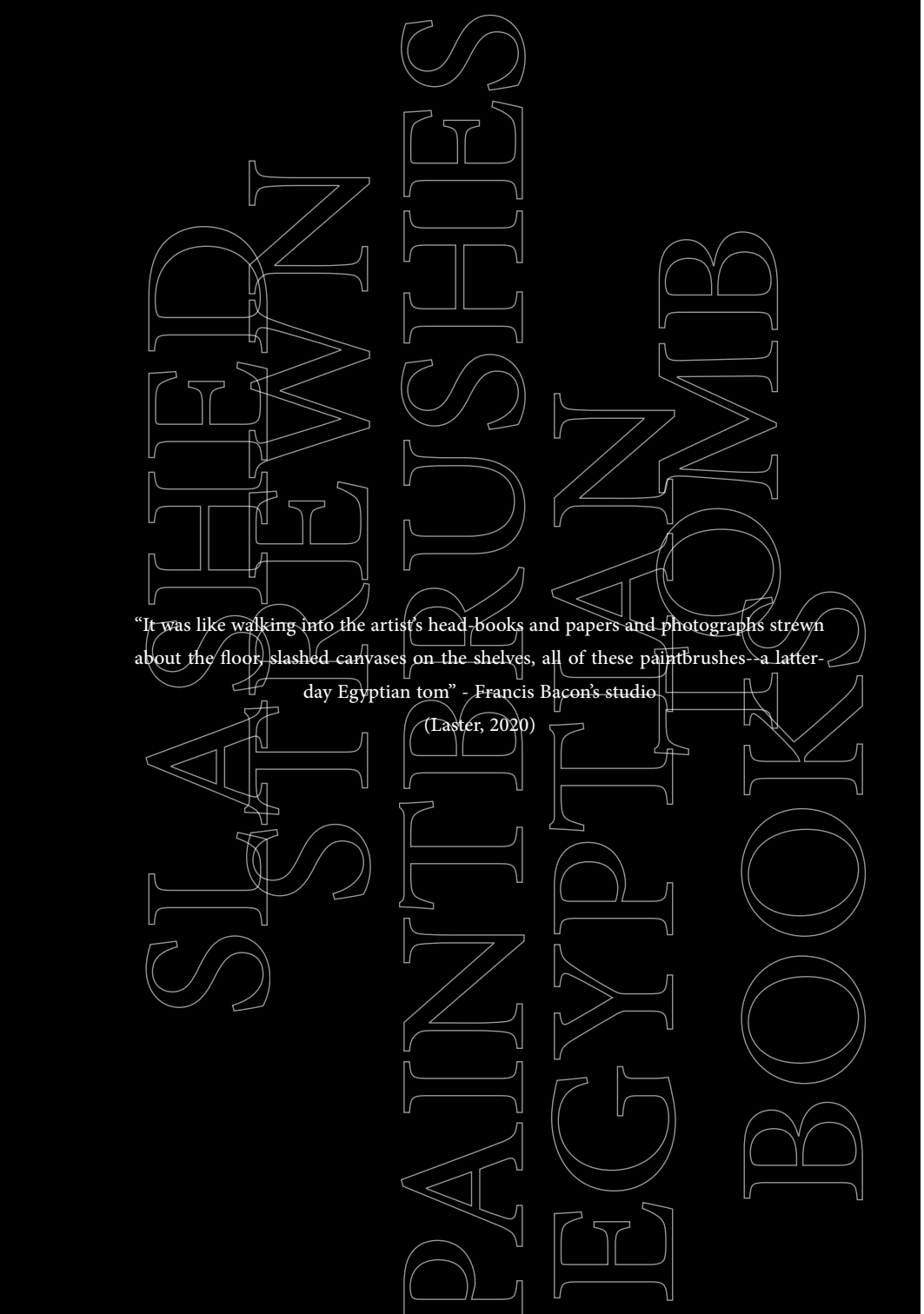
4. Wytrazek, P., 2014. [image] Available at: <https://www.dreamstime.com/old-burnt-house-ruins-fire-building-inte-old-burnt-house-ruins-fire-building-image128079770> [Accessed 23 February 2022].

5. The White Cube, 2012. [image] Available at: <https://whitecube.com/exhibitions/exhibition/daniel_turner_bermondsey_2012> [Accessed 26 February 2022].

6. ArchDaily, 2006. [image] Available at: <https://www.archdaily.com/326188/silicon-house-selgas-cano> [Accessed 26 January 2022].

7. Orsini, I., 2018. Casa Tabarelli – Carlo Scarpa. [image] Available at: <http://www.ilariaorsini.com/carlo-scarpa-tabarelli/> [Accessed 23 February 2022].

8. Freeimages, 2016. [image] Available at: <https://www.freeimages.com/photo/weathered-wood-grain-1154984> [Accessed 25 February 2022].



"It was like walking into the artist's head-books and papers and photographs strewn about the floor, slashed canvases on the shelves, all of these paintbrushes--a latter-day Egyptian tom" - Francis Bacon's studio
(Laster, 2020)

03 - THESIS:
FAMILIAR TO UNFAMILIAR THROUGH THE PHYSICAL

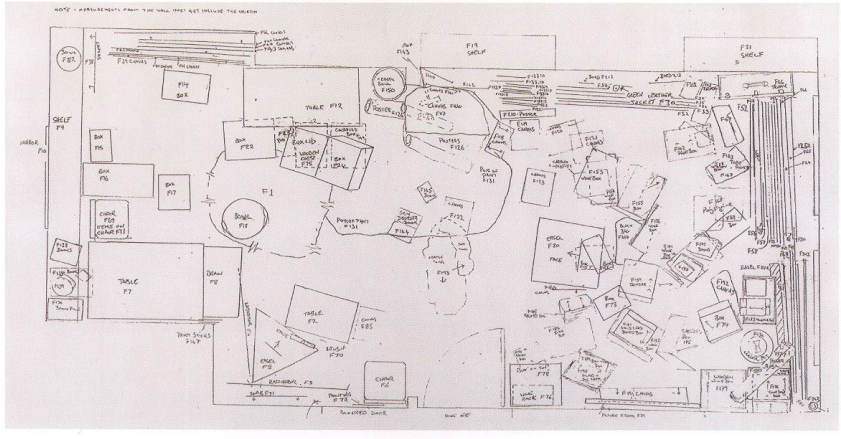
03.01 TAILORING CLAUSTROPHOBIC SPACE - FRANCIS BACON

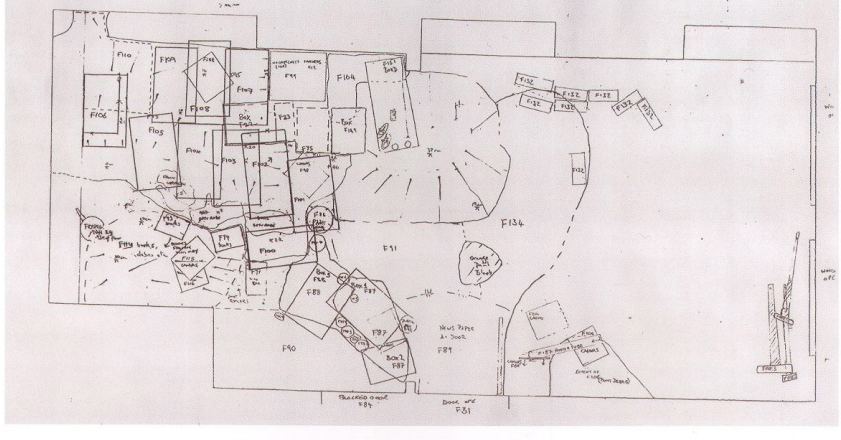
Architecture develops for creative practitioners operating in confined spaces and becomes tailored towards them; these spaces become highly intimate and crafted over time, evolving more distinctively to suit the practice. Small areas like this act as vehicles for the imagination, the sensation of claustrophobia provides privacy, intimacy and, over time, nostalgia. Privacy can provide liberation in work, as it becomes a personal experience; this was the case for figurative painter Francis Bacon (**fig. 1**).

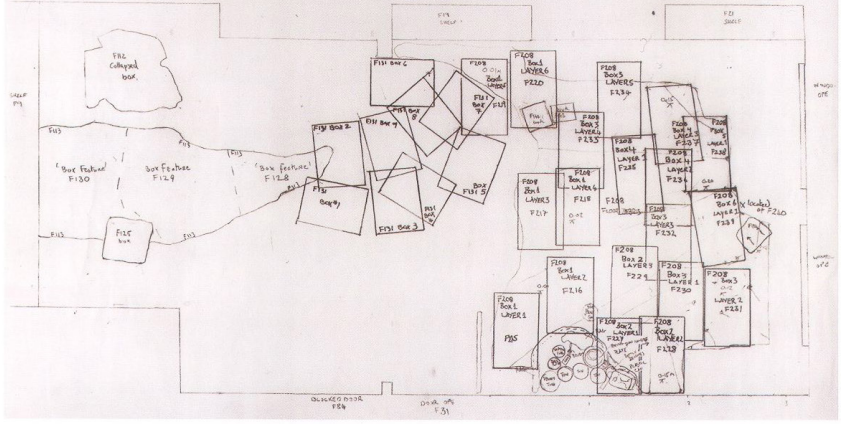
Francis Bacon utilised *7 Reece Mews*, his London studio, as a 1:1 test site for ideas and reflections (plan shown in **fig. 2**). The sensual experience of the architecture was diversified, as the artist reinterpreted mundane architectural elements as working tools in practice (**fig. 3** - the studio before tailoring); for instance, Bacon modified the walls of *7 Reece Mews* to become canvases. This adaptation is a technique of Bacon interrogating the sensory experience of his studio, switching a visual plane to a haptic interaction. The unconventional use of the space influenced the **sensorium**[(1)], as the studio became broadly more tactile

Fig. 3: Francis Bacon's empty studio (Ogden, 1998).

Fig 1 (right): Francis Bacon (Francis Bacon, Dublin City Gallery, 1992).







as **"The walls themselves are vivid with encrusted Paint, mixed and tested by Bacon" (Cappock and Bacon, 2005)**. This layering provided the walls with a rich visual and haptic touch texture (**fig. 4**).

The experience of the studio is personal; visually, it may not make sense or be the most appropriate practice for another individual; however, the questioning of the space allowed Bacon to develop his work. **"His greatest, most puzzling work of all, however, might be the chaotic London studio that he occupied for more than thirty years" (Laster, 2020)**. Bacon demonstrated that tweaking and tailoring the architecture to serve his approach dramatically affected the **sensorium**[(1)]. The studio reflects the work, the cluttered, chaotic nature of the architecture is apparent in his paintings, as shown in **fig. 5**; the paintings have a discomforting, muddled quality, as does the studio. Therefore, working in this type of space allowed Bacon to become liberated from the visual sense of confinement to an experience of intimacy that inspired his working practice. Although, as noted in the previous quote, a space like Bacon's studio physically manifests the cognitive working process, the chaotic nature of the studio makes it less precious and more liberating; the following quote emphasises this chaos (**fig. 5** and **fig. 6**): **"It was like walking into the artist's head–books and papers and photographs strewn about the floor, slashed canvases on the shelves, all of these paintbrushes–a latter-day Egyptian tomb, in a way" (Laster, 2020)**. Bacon tailored the studio to become highly strange and intimate. The **sensorium** alters over time due to

Fig. 2 (left): Bacons studio in plan (Ogden and Edwards, 2001).

(1): Definitions can be located in Chapter 00.

episodic memory[(1)], the perception of space shifts for the individual utilising it regularly; this was the case for Francis Bacon. This tailoring by Bacon highlights that architecture can become a catalyst for the senses. As architects, this notion of altering of space by the occupants is important; If an architecture, in particular, a working studio, is too sterile and orderly, it may limit the inhabitant's sensual experience and working practice. In *The Eyes of the skin*, Pallasmaa examines the notion of alienation in modern architecture

Fig. 5: Francis Bacon's organised chaos (Ogden, 2001)

Fig. 4 (left): The walls used as mixing pallettes (Ogden, 1998)

due to lack of materiality, contrasting the intimacy and personalisation witnessed in the Francis Bacon studio. **"The increasing use of reflective glass in architecture reinforces the dreamlike sense of unreality and alienation" (Pallasmaa, 1996, p. 34).** The studio became personal to Bacon, whereas reflective glass, which is seen more commonly in modern buildings, prevents any tailoring. Instead, it is a flat rigid plane where the visual sense is privileged and touch is discouraged.

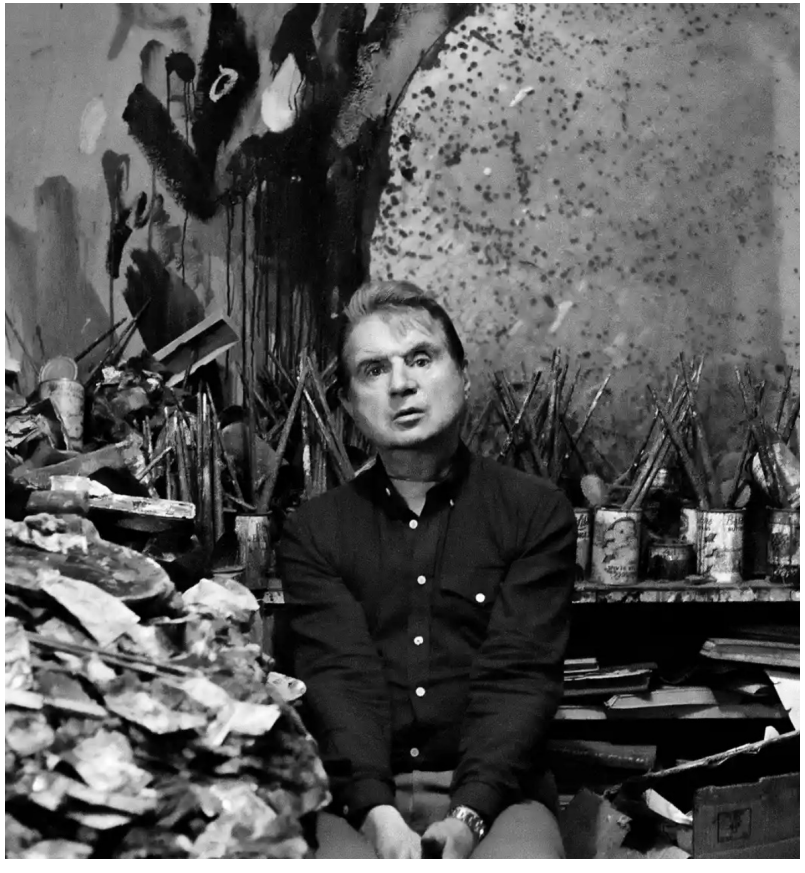


Fig. 6: Francis Bacon's organised chaos (Ogden, 2001).

(1): Definitions can be located in Chapter 00.

How can confined architecture become more multi-sensory?

03.02 SCALE SHIFTING - SWISS PAVILION, VENICE BIENALLE 2018

The architect can manipulate the senses by using design tools in physical space. The manipulation of scale is a method to achieve this, as it complicates **episodic memory**; this confusion of the senses and **episodic memory** demands increased receptiveness in a piece of architecture. As the built environment is anthropocentric, memory and form assumptions constitute the pre-conceived notion of space. Therefore, if the architect distorts the common core elements and methods utilised in structures, the **sensorium** must adapt and become more receptive; The next space or room in the architecture could be an unexpected composition if the scale persistently shifts.

Scale shifts can diversify sensual perception; the *Swiss Pavilion* at the *2018 Venice Bienalle* is a case study for blurring the pre-conceived notions of what domestic architecture typically follows. The privileging of the visual is apparent due to the low tactility of the clean space. However, when interacting with a space having distorted scales, the viewer must be more receptive than traditional domestic composition. The scale manipulation induces the sensation of existing as a child in a domestic space due to enlarged elements over the conventional scales. Conversely, it allows a child to comprehend the feeling of being an average adult proportion (**fig. 8**). The questioning of the relationship between the viewer and the architecture increases receptiveness due to the shifting of the sensual perception

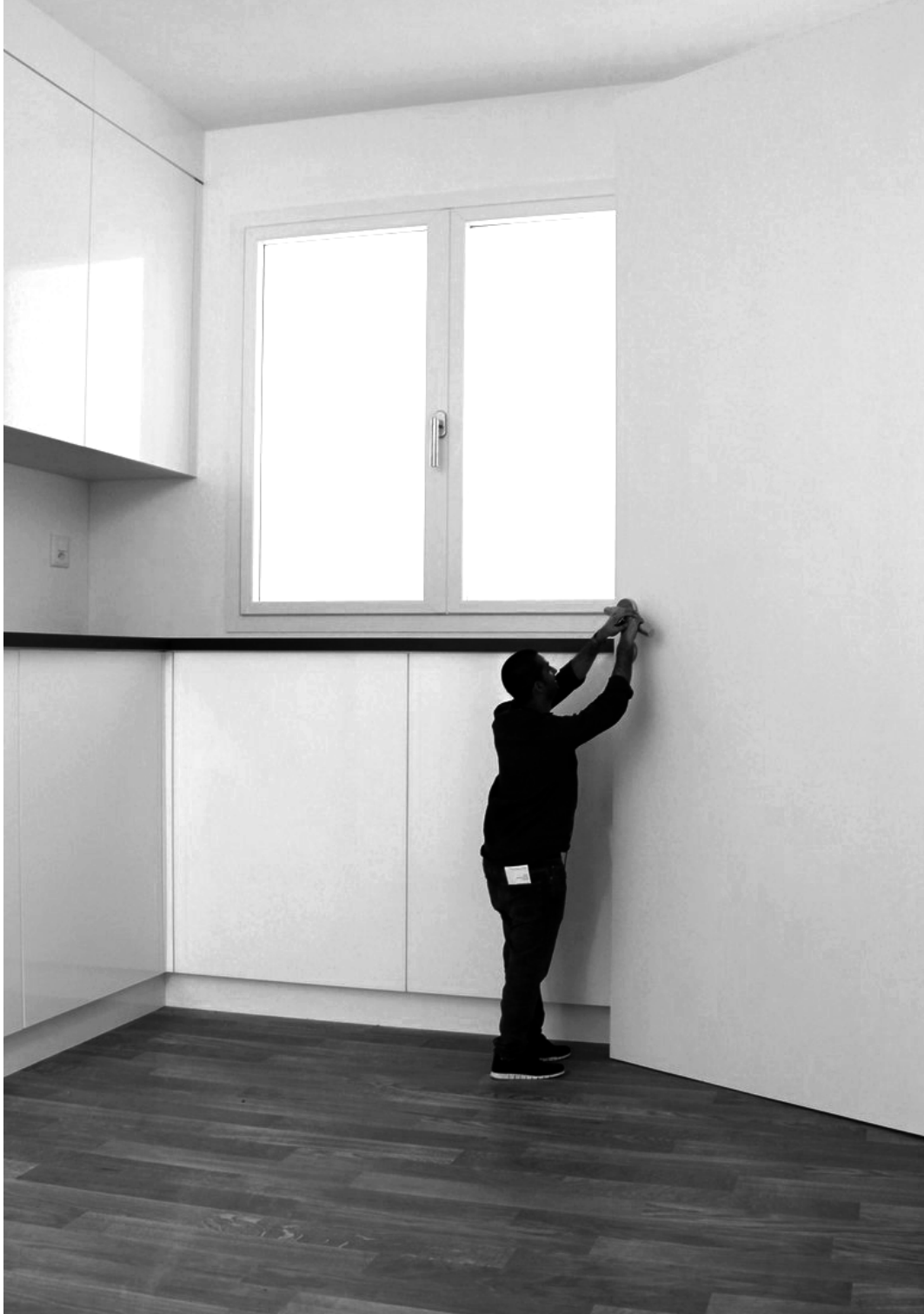


Fig. 7 (Right): The Swiss Pavilion, Venice Bienalle, 2018 (Coddou, 2018).

(1): Definitions can be located in Chapter 00.

Fig. 8: The pavilion played with scale, using child like proportions to affect the sensorium[(1)]. (Coddou, 2018)

03.03 SENSORY SUBSTITUTION – YOUR BLIND PASSENGER, OLAFUR ELLIASON

Physical methods can efficiently exploit the senses, such as in *Your Blind Passenger,* by artist Olafur Elliason. The installation is filled with a thick orange mist, depriving the viewer of their sense of sight (fig. 9). The individuals switch their reliance to the other sensory systems, such as touch and sound. Elliason stated: **"Very quickly you realise, and I mean this quite literally, that you are not completely blind after all; you have a lot of other senses which start to kick in... It shows that the relativity of our senses is much higher than we think, we have it in our capacity to recalibrate or at least stop being numb" (Brown, Elliason, 2019).** This quote demonstrates that manipulating the senses is relatively straightforward; in this case, an orthogonal cuboid becomes deeply strange and unfamiliar through vision deprivation. Your Blind Passenger effectively converts a familiar space into a disorientating one, making the experience **multi-sensory**[(1)].

Fig 9 (Overleaf) : The visual deprivation in 'Your Blind Passenger' (AP Images, 2020).

03.04 DISQUIETING ARCHITECTURE – GREGOR SCHNEIDER

Physical architecture can convey various emotions to its occupants. Linking back to the condition of **episodic spatial memory** in *Chapter 01*, the pre-conceived notion of space provides comfort and security. Mundane architecture such as that of the domestic setting can be comforting and nostalgic if it is one's own home due to their connotations of the space. Artist Gregor Schneider investigates this condition in his composition of chambers, typically resembling the domestic architecture in which we live our lives (**Lloyd, 2020**). However, Schneider's work minimalises architecture by withdrawing any element associated with comfort and security to induce anxiety and become **disquieting**[(1)]. **"Schneider's homes are often drab and forlorn, all linoleum floors, net curtains and mystery stains on tablecloths. In one room, a sad-looking dormitory bed shares a narrow space with a bathtub; in another, a disco ball lords it over a decrepit basement" (Lloyd, 2020) (fig. 10)**. This quote highlights the material qualities and the juxtapositional methods Schneider deploys in his work to induce discomfort, which originates from a sensory reaction to the space where the composition or layout is unfamiliar.

Schneider alters sensual perception in his work; he accomplishes this by investigating everyday elements of the domestic context, such as the walls that traditionally shield from the harshness of the outside world. However, in his work, he utilises these elements as

Fig 10 (Overleaf) : One of Schneider's disquieting, artificially lit chambers (Alemán, 2001).

(1): Definitions can be located in Chapter 00.

concealing and entrapping instruments to disorientate the inhabitants (**fig. 11**). In addition, the artist commonly removes the windows to make the space more claustrophobic (**fig. 12**). Schneider's work has a **multi-sensory** effect, through shifting the sensual perception of space to induce disorientation and discomfort.

Schneider's techniques to alter the sensory perception of space include dynamic architectural techniques; an example of this is constructing a space for an individual to sit and drink a coffee in a domestic setting; however, the room is revolving. The intention by Schneider was to disorientate the drinker to the point they were confused about their surroundings. As said by the artist: **"So you are in a room, and you do not know where you are anymore.**

Fig. 12: The removal of the window to turn the walls into entrapping instruments (Lloyd, 2020)

You're going on with daily life, but at the same time, you're in an unknown space and time" (Lloyd, 2020). The idea that "you don't know where you are anymore" directly juxtaposes the usual

(1): Definitions can be located in Chapter 00.

connotations of domestic architecture. This type of building is typically comforting and familiar; however, Schneider challenges this relationship as it becomes illogical to experience.

The quality of disorientation features heavily in Schneider's work and contributes to the sensory perception of architecture, as there is an endless requirement to re-attune the senses. The relationship with the architecture is constantly in flux and requires a **multi-sensory** response to perceive it. For example, Schneider created the *Haus ur*, a project involving a house he lived in yet continuously altered. This project is a house within a house, Schneider layered architectural elements on top of one another as a working piece. This layering and tweaking to the architecture can be shown by Dessau in an article regarding Schneider's Haus ur: **"continuously reconstructing its inner structure as a discontinuous, unregulated typology of rooms built inside the house's pre-existing rooms" (Dessau, 2015)**. The quality of the space being 'discontinuous' suggests gaps and intervals in the architecture; typically, this would not make sense in a domestic context. However, Schneider utilised this technique to disorientate anyone in the space and create a level of uncertainty. 'Unregulated typology' supports this, suggesting the artist built these rooms in rooms without a pre-created schedule or plan, subtracting logic and order, which has a disorientating effect sensually.

Schneider's questioning of the function of architecture and its elements **(fig. 13)** is essential for the discussion.

Fig. 11 (Left): Schneider's entrapping quality with the use of the walls and lack of natural light (Lloyd, 2020).

(1): Definitions can be located in Chapter 00.

Scale shifting: How the familiar becomes strange

Fig. 14: Schneider's layering of Architectural elements. Window frames are repeated (Schneider, 1999).

If the built environment pursues an **ocularcentric**[(1)] language, architects must question the relationships between humans and architectural elements to resolve this issue. Schneider achieves this through the unorthodox pairing of elements and categorising what function they may carry. This method of questioning can be shown by Dessau, in a critique of Schneider's work: **"With windows in front of windows, walls in front of walls, floors on top of floors. Repeating the architectural elements and materials that were already there" (Dessau, 2015).** This technique of repeating elements can be considered in architectural practice if the sensual relationship to architecture will shift in the future **(fig. 14).**

Schneider's method of treating architecture as a working composition links to the discussion about Francis Bacon's studio in *Reece Mews, London, .* Bacon and Schneider both utilised this

Fig. 13 (left): Schneider questions the composition of Architectural elements. An inverted staircase meets a door (Lloyd, 2020)

technique of tailoring their personal spaces; in Bacon's case, the studio from 1961 – 1992 and in Schneider's, it was the house he resided in from 1985 to 2001 (**fig. 15**). The layering of materials by Schneider is akin to the layering of paint on the walls by Bacon; they are utilising their familiar spaces as tools to discover, as secluded private vehicles for imagination.

Fig. 15: Schneider's Haus ur, Where he lived and worked between 1985 to 2001 (Zaaiman, 2021).

Fig. 14 (right): Schneider's layering of architectural elements. A mattress meets a make shift pallet wall (John Kaldor Family Collection, 2001).

03.05 DISQUIETING ARCHITECTURE – ZINC MINE MUSEUM, PETER ZUMTHOR

As Gregory Schneider's artistic pieces induce a sense of discomfort in the fixed domestic architecture context, Peter Zumthor creates a disquietness in a route through a public setting. Zumthor designed a series of pavilions on a historic Norweigan mine site; where they act as a route museum, a series of buildings along a path of tremendous natural beauty. There is particular intent in the placement of each pavilion concerning the historical context of the mining facility and surrounding views (**fig. 16**). The following quote from a critique of the work by Saiello highlights the specificity of the placements: **"The project of four dark rooms reveals something hidden, something you can barely see.... as each of them takes advantage from a different, extremely precise, characteristic of their position on the route" (Saiello, 2018).** The pavilions guide the walker on a sensual journey through the Nordic zinc mines site; each building differs from the previous and adds another layer of sensual quality to the experience.

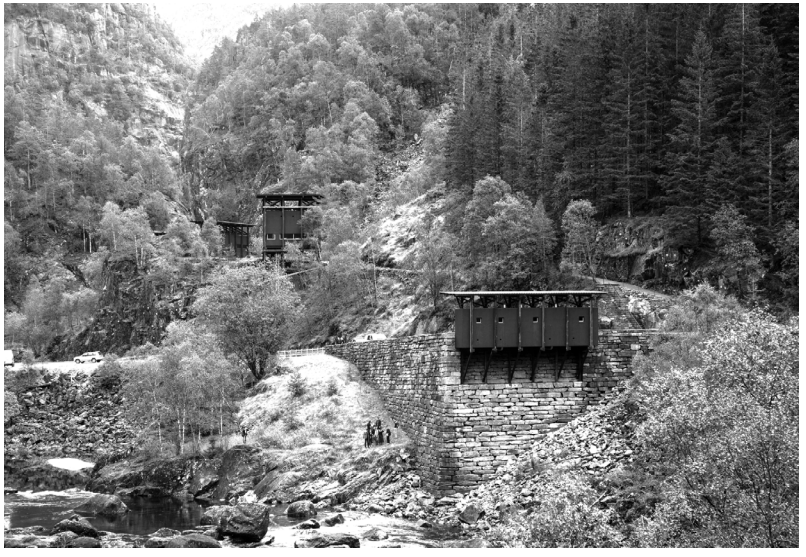


Fig. 16: Peter Zumthor's pavilions along the route (Berntsen, 2017).

The first building introduces the route, a structure that is at ground level and receptive to all forms of sensual interaction (**fig. 17 and fig. 18**). It is a portal from nature into another world; the internal atmosphere of the building is contrasting the external. Zumthor intends for the first room to be a route entrance, inducing a sense of nostalgia and a condition that resembles an element of the mining. Saiello describes the first building: **"One has the chance**

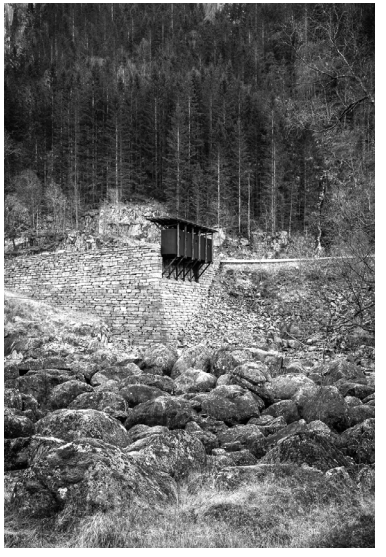


Fig. 17: Pavilion One (Berntsen, 2017).

Unbearable

'The scale of vertigo and discomfort

Comfortable

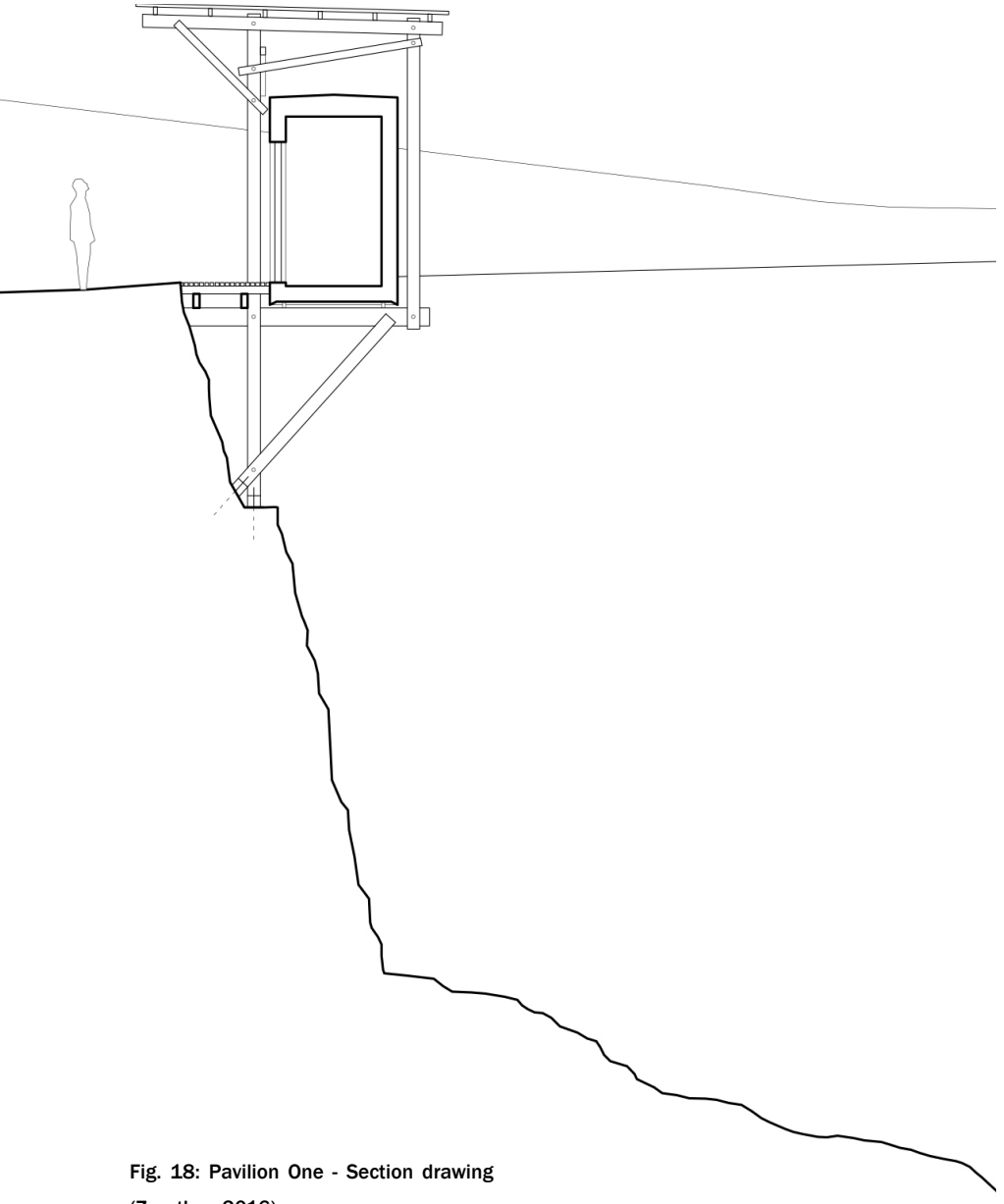


Fig. 18: Pavilion One - Section drawing (Zumthor, 2016).

Unbearable

The scale of vertigo and discomfort

Comfortable

to carefully see it, entering it, touching it, perceiving it as one" (Saiello, 2018). This accessibility to multiple sensual opportunities is comforting; the individual can assess the room they are entering from ground level without any sensation of discomfort. The building has a 15m distance to the ground on the right side; however, this is not apparent on entry, as it is a component of the road and cliff face (fig. 18).

The second pavilion differs from the first due to the structure's height (fig. 19 and fig. 20). It brings the inhabitants above the road level, forming a sensual combination of vertigo and the visual. The room appears to be floating from the inside due to the lack of visibility of the supporting structure. However, the privileging is of the visual sense looking out of the compact room across the landscape, as highlighted by Saiello: 'The extremely dark, low space of the pavilion is violently filled by the outside view... Then you realise how high up you are' (Saiello, 2018). The room is a vantage point to view the landscape; the juxtaposition of the natural beauty of the view and the apparent altitude and delicacy of the structure

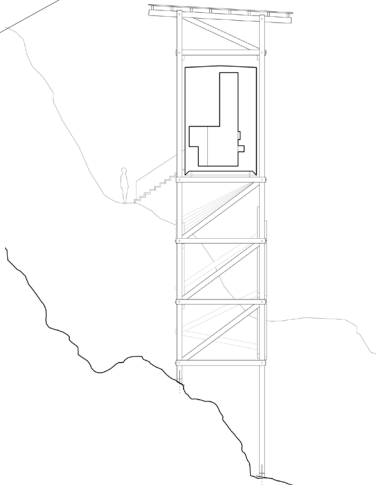


Fig. 19: Pavilion Two - Section drawing (Zumthor, 2016)

Fig. 20 (overleaf): Pavilion Two (Dezeen, 2017)

Unbearable

'The scale of vertigo and discomfort'

Comfortable

supporting it creates sensual alertness due to the precise placement of the building. The building integrates the haptic sense into the experience; the body's weight and movement creates vibrations in the lightweight structure.

The final pavilion (**fig. 21**) offers the viewer a perspective of what they have previously experienced. A comfort level is introduced that was not apparent in the earlier structures. **"A place where to be exposed to the thrill of the altitude and perceive the whole system from below, down a deep gorge. The condition of being vulnerable, almost at risk, is, in this case, inverted' (Saiello, 2018).** The sensual experience returns to the visual; the intended purpose of this structure is to view the other pavilions from below, to re-iterate their sense of altitude and fragility. The feeling of stable rock under the feet directly contrasts the precarious sense of light timber beams supporting the body 15m in the air; therefore, this pavilion also has a tactile element.

During construction, the architect discovered a chamber they chose to leave as an element of the route (**fig. 22**). However, this is not to be interacted with like the previous, where the architect's view is apparent and precisely chosen. The location is a coincidence, in contrast to the structures designed by Zumthor, where there is a specificity to the placements; this space is claustrophobic; it creates a condition of compression and discomfort, much like the Zinc mines that were once a feature of the site. Again, Saiello describes this structure with the quote: **"A dark space, tough, dangerous, where**

Fig. 21 (left): Final Pavilion (Dezeen, 2022).

Unbearable

'The scale of vertigo and discomfort'

Comfortable

the height and the width of the space compress the body to the limit. It is not a comfortable room, nor a welcoming experience" (Saiello, 2018). This final element to the route reinforces the discomfort and anxiety-inducing feeling of the complete project (fig. 23). Each pavilion has a distinct sensual effect, from the privileging of the view to the haptic sense of the precarious frames supporting the body's weight. Therefore, Zumthor has designed these pavilions to hold a relationship between them; a relationship when experienced in a sequence is multi-sensory(1).

Fig. 22: The existing mine entrance (Saiello, 2018).

(1): Definitions can be located in Chapter 00.

Fig. 23: The existing mine inside (Saiello, 2018).

03.06 PHYSICAL METHODS IN PRACTICE

Affecting the sensorium(1) in the perception of architecture through the physical is beneficial for the designer. The viewer is experiencing the space naturally, without the interference of any additional physical requirements, such as technologies. Furthermore, the architectural experience is an element of the physical world. Therefore, the senses are experiencing their environment naturally and are less susceptible to visual manipulations, distortions, or abnormalities presented through technology.

(1): Definitions can be located in Chapter 00.

03.07 END NOTES AND REFERENCES

All definitions highlighted[(1)] in the chapter can be found in Chapter 00

Text references:

1. Cappock, M. and Bacon, F., 2005. Francis Bacon's studio. London: Merrell

2. Laster, P., 2020. The Skeletons in Francis Bacon's Studio | Art & Object. [online] Art & Object. Available at: <https://www.artandobject.com/articles/skeletons-francis-bacons-studio> [Accessed 25 January 2022].

3. Laster, P., 2020. The Skeletons in Francis Bacon's Studio | Art & Object. [online] Art & Object. Available at: <https://www.artandobject.com/articles/skeletons-francis-bacons-studio> [Accessed 25 January 2022].

4. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley. p. 34

5. Brown, M., 2019. Olafur Eliasson to bring his tunnel of fog work to Tate Modern. [online] the Guardian. Available at: <https://www.theguardian.com/artanddesign/2019/jan/31/olafur-eliasson-your-blind-passenger-tunnel-fog-tate-modern-installation#:~:text=%E2%80%9CVery%20quickly%20you%20realise%2C%20and,at%20least%20stop%20being%20numb.%E2%80%9D> [Accessed 26 January 2022].

6. Lloyd, J., 2020. The Eerie Resonance of Gregor Schneider's Disquieting Interiors - ELEPHANT. [online] ELEPHANT. Available at: <https://elephant.art/the-eerie-resonance-of-gregor-schneiders-disquieting-interiors-22052020/> [Accessed 26 February 2022].

7. Lloyd, J., 2020. The Eerie Resonance of Gregor Schneider's Disquieting Interiors - ELEPHANT. [online] ELEPHANT. Available at: <https://elephant.art/the-eerie-resonance-of-gregor-schneiders-disquieting-interiors-22052020/> [Accessed 26 February 2022].

8. Dessau, O., 2015. Gregor Schneider. [online] Artreview.com. Available at: <https://artreview.com/april-2015-feature-gregor-schneider/> [Accessed 26 February 2022].

9. Dessau, O., 2015. Gregor Schneider. [online] Artreview.com. Available at: <https://artreview.com/april-2015-feature-gregor-schneider/> [Accessed 26 February 2022].

10. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].

11. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].

12. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].

13. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].

14. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].

Figures:

1. Dublin City Gallery, 1992. [image] Available at: <https://www.hughlane.ie/bacon-publications> [Accessed 26 February 2022].

2. Ogden, P. and Edwards, J., 2001. 7 Reece Mews. London: Thames & Hudson Ltd.

3. Ogden, P. and Edwards, J., 2001. 7 Reece Mews. London: Thames & Hudson Ltd.

4. Ogden, P. and Edwards, J., 2001. 7 Reece Mews. London: Thames & Hudson Ltd.

5. Ogden, P. and Edwards, J., 2001. 7 Reece Mews. London: Thames & Hudson Ltd

6. Ogden, P. and Edwards, J., 2001. 7 Reece Mews. London: Thames & Hudson Ltd.

7. Coddou, F., 2018. [image] Available at: <http://www.flaviocoddou.com/portfolios/swiss-pavilion-venice-biennale-2018/> [Accessed 26 February 2022].

8. Coddou, F., 2018. [image] Available at: <http://www.flaviocoddou.com/portfolios/swiss-pavilion-venice-biennale-2018/> [Accessed 26 February 2022].

9. AP Images, 2020. [image] Available at: <https://www.ft.com/content/054f388c-a227-11e9-974c-ad1c6ab5efd1> [Accessed 26 February 2022].

10. Alemán, P., 2001. [image] Available at: <https://cc-catalogo.org/site/pdf/muac051gregorscheider-interiores-72dpi.pdf> [Accessed 26 February 2022].

11. Lloyd, J., 2020. [image] Available at: <https://elephant.art/the-eerie-resonance-of-gregor-schneiders-disquieting-interiors-22052020/> [Accessed 26 February 2022].

12. Lloyd, J., 2020. [image] Available at: <https://elephant.art/the-eerie-resonance-of-gregor-schneiders-disquieting-interiors-22052020/> [Accessed 26 February 2022].

13. John Kaldor Family Collection, 2001. [image] Available at: <https://www.artgallery.nsw.gov.au/collection/works/L2012.20/> [Accessed 26 February 2022].

14. John Kaldor Family Collection, 2001. [image] Available at: <https://www.artgallery.nsw.gov.au/collection/works/L2012.20/> [Accessed 26 February 2022].

15. Zaaiman, J., 2021. [image] Available at: <https://medium.com/counterarts/gregor-schneider-haus-u-r-totes-haus-u-r-1985-today-22755f918fb5> [Accessed 26 February 2022].

16. Berntsen, P., 2016. [image] Available at: <https://www.archdaily.com/796345/allmannajuvet-zinc-mine-museum-peter-zumthor/57ed0b71e58ece02a000011d-allmannajuvet-zinc-mine-museum-peter-zumthor-photo> [Accessed 26 February 2022].

17. Berntsen, P., 2016. [image] Available at: <https://www.archdaily.com/796345/allmannajuvet-zinc-mine-museum-peter-zumthor/57ed0b71e58ece02a000011d-allmannajuvet-zinc-mine-museum-peter-zumthor-photo> [Accessed 26 February 2022].

18. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].

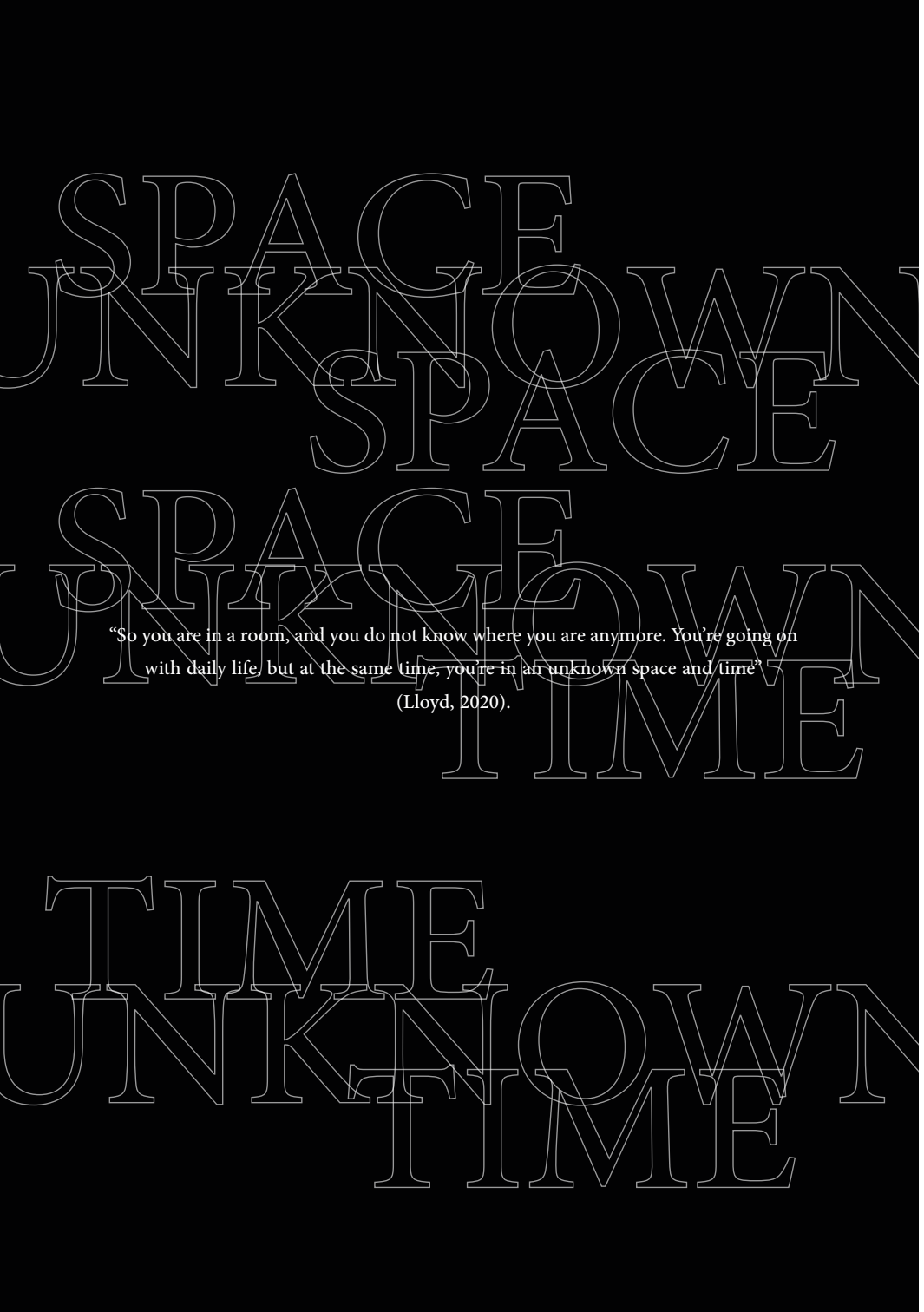
19. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].

20. Dezeen, 2017. [image] Available at: <https://www.dezeen.com/2017/06/02/peter-zumthor-stilted-zinc-mine-museum-buildings-aldo-amoretti-photography-norway/> [Accessed 26 February 2022].

21. Dezeen, 2017. [image] Available at: <https://www.dezeen.com/2017/06/02/peter-zumthor-stilted-zinc-mine-museum-buildings-aldo-amoretti-photography-norway/> [Accessed 26 February 2022].

22. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].

23. Saiello, D., 2018. Peter Zumthor. Allmannajuvet Zinc Mine Museum – Striving for Objectivity. [online] room of possibilities. Available at: <https://www.roomofpossibilities.com/index.php/2018/11/09/striving-for-objectivity/> [Accessed 26 February 2022].



"So you are in a room, and you do not know where you are anymore. You're going on with daily life, but at the same time, you're in an unknown space and time" (Lloyd, 2020).

04 - THESIS:
SPECULATIVE MEDIUMS

04.01 MAKING THE FAMILIAR UNFAMILIAR

By applying the research in the previous chapter to architectural design practice, a common thread utilised by Francis Bacon, Olafur Elliason, and Peter Zumthor is the questioning of traditional relationships with architecture and its elements to the individuals inside. This re-thinking of elements allows designers to implement other unorthodox architectural methods to make the experience **multi-sensory**. The relationship to domestic architecture is one that Gregor Schneider analyses, as discussed previously; by making the familiar unfamiliar, the artist is able to facilitate this shifting of sensual relationships. Speculative architectural drawings and models are an effective way to explore and investigate these relationships.

The following pages include exploratory pieces by the author, utilising the *60m2 childhood home* of 18th-century Danish fairy teller Hans Christian Andersen as a test site. The primary focus for these works involves manipulating scale and everyday, seemingly mundane architectural elements to become portals to external worlds. The thesis's parallel design project includes investigating this site at multiple scales, from inhabiting the micro scale wood grain to a cavity in the wall. The application of the work to **multi-sensory** architecture is the re-thinking of sensual relationships to objects, for instance, transforming the relationship from the visual to the haptic to experience something additional.

(1): Definitions can be located in Chapter 00.

04.02 SCALE SHIFTS - MACRO PHOTOGRAPHY

Scale shifting is one of the critical methods for shifting sensual perception of a space or object. The challenge of the pre-conceived spatial notions requires the **sensorium** to adapt to experience the architecture in its scale shifted form. Macro photography is a method to alter everyday objects into the unfamiliar, making them alien to the viewer. The sensual effect can be altered by using this medium as a design tool or merely as an untried route to investigate architectural elements.

The following pages include macro photography investigations (**fig. 1**, **fig. 2**, **fig. 3**, **fig. 4** and **fig. 5**).

(1): Definitions can be found in Chapter 00

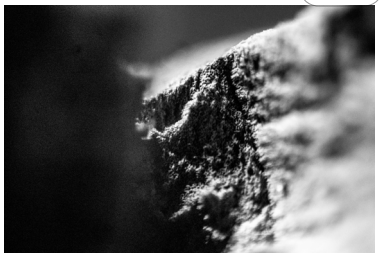


Fig. 1: Wood grain becomes a canyon of landscapes and surfaces.

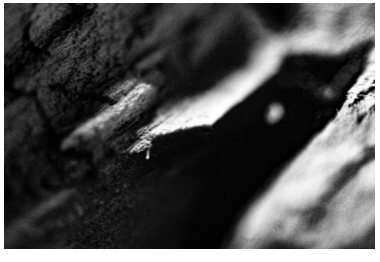


Fig. 2: Wood grain becomes a series of crevices.

Fig. 3: Wood grain becomes a textured landscape or surface.

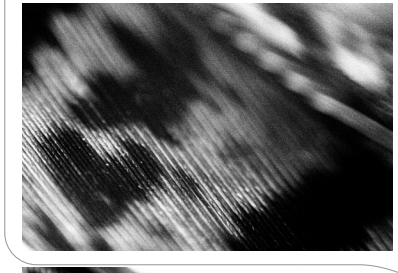


Fig. 4: A feather becomes a delicate landscape of piano wire like forms.

Fig. 5: A feather becomes an artificial metallic landscape.

How can confined architecture become more multi-sensory?

04.03 SCALE SHIFTS - SPECULATIVE DRAWING

Relationships that are more difficult to capture through physical methods, such as modelling or photography may be better explored through speculative architectural drawings. These drawings intend to be suggestive, sensual stimuli on paper; their objective is not to be constructed but to induce a collection of ideas about how architects may re-interpret confined or claustrophobic space. Akin to the case studies analysed in the previous chapter, the work is intended to be alienating and **disquieting**(1). Investigations using this method are included on the following pages (**Fig. 6**, **Fig. 7**, **Fig. 8**, **Fig. 9**, **Fig. 10** and **Fig. 11**)

(1): Definitions can be located in Chapter 00.

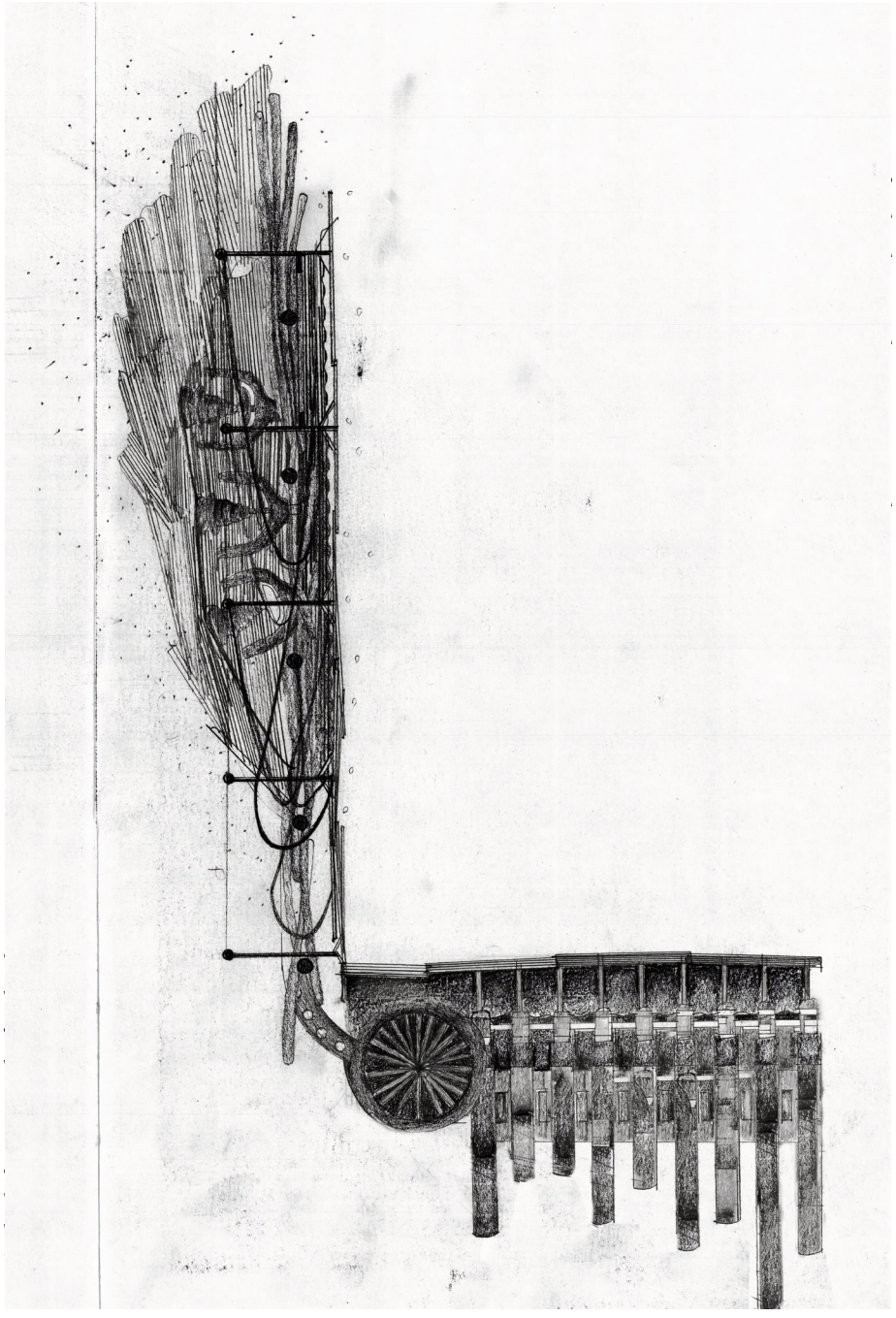


Fig. 6 (left): Section drawing - The layering and questioning relationships of architectural elements. The wall cavity and floorboards are potential areas of integrate design and inhabitation.

How can confined architecture become more multi-sensory?

Fig. 7 (above), 8 (right): Inhabiting micro worlds. Hans Christian Andersen's bookshelf as a metaphor for designing into claustrophobic sites.

1x The scale of required magnification 250x

Fig. 9 (left): Inhabiting micro worlds. Hans Christian Andersen's wall cavity as a metaphor for designing into claustrophobic sites.

1x The scale of required magnification 250x

How can confined architecture become more multi-sensory?

Fig. 10 (right): Inhabiting micro worlds. Inhabiting the wood grain on Hans Christian Andersen's writing desk.

Fig. 11 (left): Inhabiting micro worlds. Inhabiting the floorboards of the Hans Christian Andersen house.

END NOTES AND REFERENCES

All definitions highlighted[(1)] in the chapter can be found in Chapter 00

All figures in this chapter are by the author.

VIBRATING CLUSTER OF POINTS

"The performers are represented as a moving and vibrating cluster of points with a voice projected inside the visitors' headphones... The voice steers the way" (Zimm, 2019).

VOICE STEERS THE WAY

05 - ANTITHESIS: DIGITAL AUGMENTATION

05.01 DIGITAL AUGMENTATION INTRODUCTION

Digital technologies acting as multi-sensory inducers have existed in the architectural domain for around sixty years, the earliest example being *Sensorama*, by Morton Heilig (**fig. 1**). Sensorama is one of the earliest attempts at forming a **virtual**(1), immersive environment that is phenomenal through a device the user takes a seat on and places the hand inside. *Sensorama* integrates multiple senses with instruments, such as a dynamic chair, scent emitters, and an auditory sound system (**Regrebsubla, 2015**). Since the invention of this device, technologies have developed rapidly and become more subtle and immersive; this is the case for **augmented reality**(1), wearables and smart devices, such as watches. Tools, such as those mentioned can drive the experience of architecture to be multi-sensory by implementing stimuli to integrate the non-visual senses further This links to Pallasmaa's theory of architecture being **ocularcentric**(1) (**Pallasmaa, 1996**), as these developing sensual pathways can challenge the theory.

Although the perception of architecture can be pushed to be more multi-sensory by utilising physical methods, as discussed in the *Chapter 03*, there is the alternative option of using digital methods to enhance the human **sensorium**(1). Wearable technology can significantly expand the sensory reception to stimuli in space; digital technology can allow architects to rethink how the senses interact with

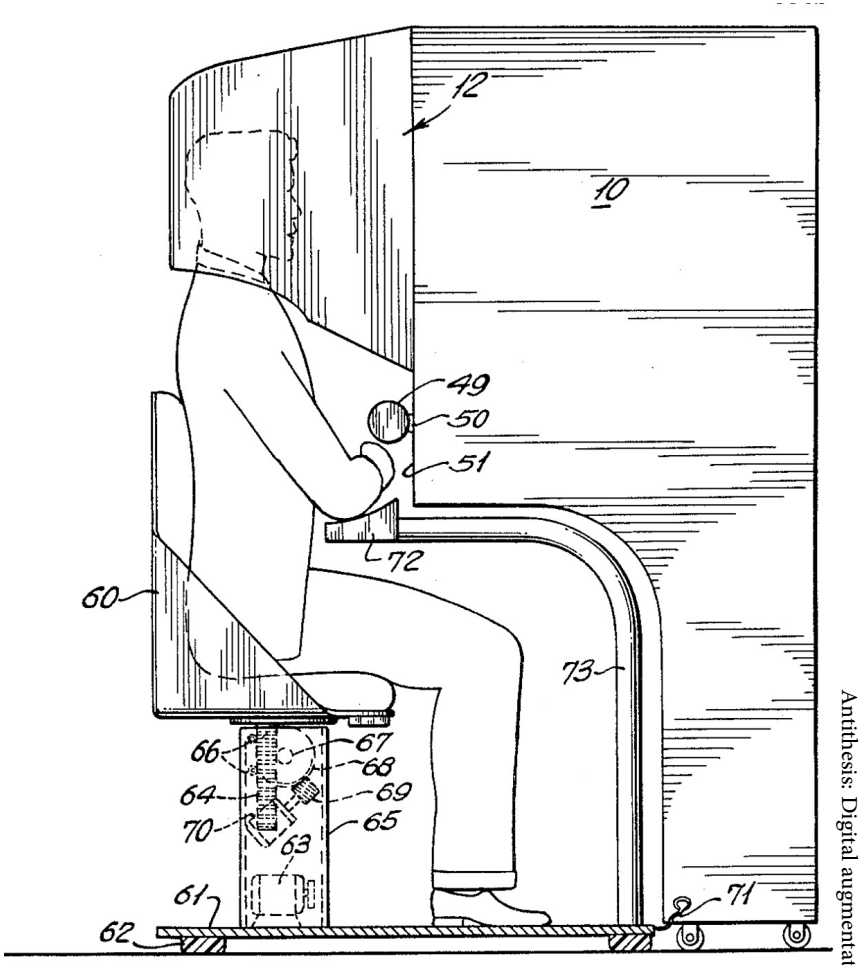


Fig. 1: The Sensorama device (Heilig, 1962).

(1): Definitions can be located in Chapter 00.

space. Furthermore, technology allows one to experience the work in novel ways, which would be impossible without it. As a result, there can be an exploration into a new relationship between inhabitants and architecture. Furthermore, architecture can become more performative to augment it with components, such as trigger points in the space.

05.02 ETERNAL RETURN - SCANLAB PROJECTS

Eternal Return is an interactive architecture installation by Lundahl, Seitl and ScanLAB projects (**fig. 2 and fig. 3**) (**ScanLAB Projects, Lundahl, Seitl, 2019**). The exhibition is an archive of memory, housing elements from different points of *Western European* history. When the viewer physically interacts with the objects, they are presented with different sensual stimuli, varying from visual to auditory, gustatory and haptic.

Eternal Return integrates the non-visual senses into the exhibition, relating them to the objects in the installation. This sensory integration is displayed in a quote from a *Memor*

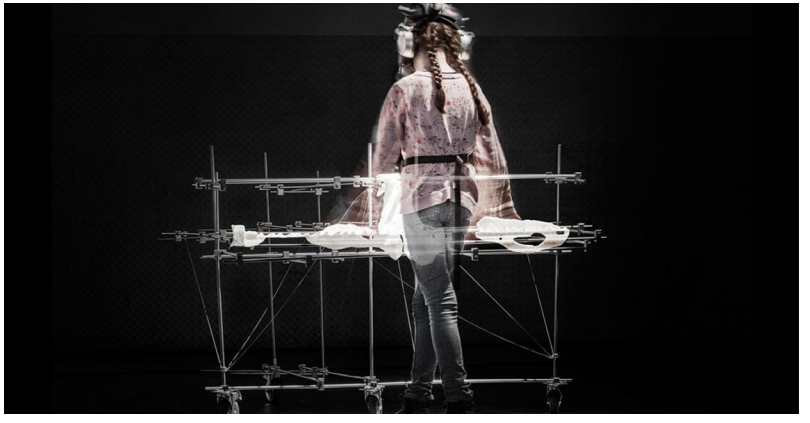


Fig. 2: Eternal Return is a digital interactive sensory experience (ScanLAB Projects, 2019).

on the exhibition: **"High-end isolating headphones cancel out all sound from the outside. There is a scent of petrichor (water and soil) and fresh cold air by an ozone scent' (Zimm, 2019).** The exhibition is an immersive experience intended to blur the lines between the physical and digital sensual worlds. A petrichor scent induces a condition of emotion; if the inhabitants have sensed this scent before, then a nostalgic feeling is induced. *Eternal Return* is a **multi-sensory**[(1)] experience as it requires interacting viewers to form connections with the precise sensual feedback they receive. For instance, the sound of crashing waves combined with the scent of water and soil is compelling emotionally, as natural world stimuli are nostalgic and deeply connected to us.

Eternal Return operates 'invisible

Fig. 4: 'Invisible performers', to guide the viewer through the space (ScanLAB Projects, 2019).

Fig. 3 (left): Eternal Return plan view (ScanLAB Projects, 2019).

(1): Definitions can be located in Chapter 00.

performers; they are guiding the viewers in the exhibition (**fig. 4**); however, the viewers have headsets on so they cannot directly see them. This element involves the haptic, the visual and the auditory, as highlighted by the quote: "**The performers are represented as a moving and vibrating cluster of points with a voice projected inside the visitors' headphones... The voice steers the way**" (**Zimm, 2019**). This reliance on the voice is a form of **sensory substitution**(1), used similarly by Olafur Elliason, in *Your Blind Passenger*, as discussed in *Chapter 03*. Elliason deprives the inhabitants of their sense of sight through a thick orange haze, and the sense of touch and sound immediately become dominant. *Eternal Return* works similarly, where the dependency on the acoustic sounds and the haptic vibrations provided by the performer's movements are the dominant sensual stimuli. These tactics utilised by ScanLAB projects make the experience of their work more **multi-sensory**, as the **ocularcentric** visual dominance is challenged through the digital technology, and the **sensorium** becomes more attuned to the surroundings through the non-visual senses.

Eternal Return blurs the sensual lines between the physical and the digital world. However, a close connection between the two is apparent in the work, where physical-world elements are carried into the digital view (**fig. 5**), and digital stimuli are experienced physically by the viewer through haptic, auditory, and gustatory feedback. This use of the physical and digital qualities makes the experience **multi-sensory,** due to the designer's ability to implement multiple sensual feedbacks into each stage of the work.

(1): Definitions can be located in Chapter 00.

Fig 5: Physical elements in the space are experienced as digital spaces, blurring the lines between the physical and digital (ScanLAB Projects, 2019).

(1): Definitions can be located in Chapter 00.

05.03 HAPTIC FEEDBACK - SAROTIS, AVA AGHAKOUCHAK

Ava Aghakouchak is a PhD student at *The Bartlett School of Architecture*, based in London. Her work concentrates on expanding the sense of the haptic touch in the experience of space. The placement of subtle, soft-body sensors provides haptic feedback based on specific parameters in the architecture, such as location or proximity. Aghakouchak's projects are communication tools aimed at rejecting the **ocularcentric** approach to architecture and making the experience integrative for the non-visual senses. As stated by Aghakouchak in a lecture given to the *University of Greenwich* in 2021: **"The project, Sarotis is about creating speculative worlds with no physical, but all sensual inputs" (Aghakouchak, 2021).** The soft-body wearables that Aghakouchak used (**fig. 6**) are capable of depth perception and object recognition; applying these technologies allows the architecture experience to be more multi-sensory. Furthermore, the use of this by designers introduces them to a new palette of design parameters, where the physical world's limitations are not present.

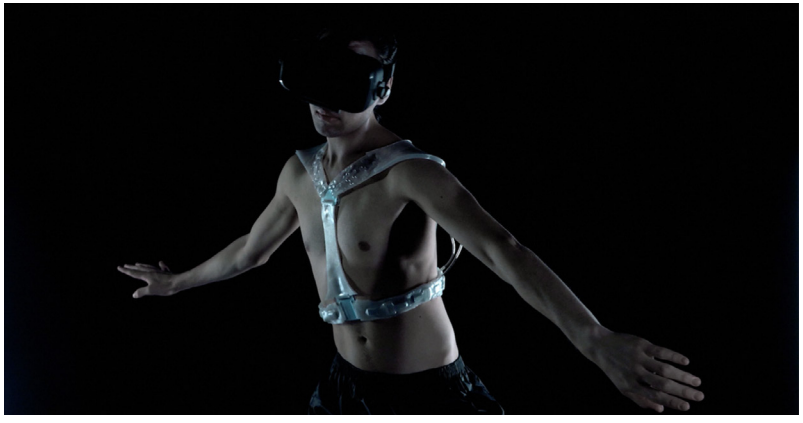


Fig 6: Soft-body haptic wearables in combination with augmented reality(1) devices create a multi-sensory experience (Aghakouchak, 2019).

The research in this field can expand sensory spatial potential as it extends the **sensorium** to an additional set of stimuli and parameters in architecture. Currently, the sensual pathways are limited by the **umwelt**, as discussed in *Chapter 01*; however, by implementing devices, such as those employed by Aghakouchak, or others such as *augmented reality* devices, the architecture can offer an untried set of parameters for the sensory stimuli. This increased sensory stimulus makes the experience of architecture more multi-sensory. In the physical world, the non-visual senses, particularly the chemical senses of the olfactory and auditory systems, are concealed to deliver the most optimal conditions as discussed in *Chapter 02*. Therefore, through digital methods, these senses can be re-integrated into architecture through sensory stimuli.

(1): Definitions can be located in Chapter 00.

(1): Definitions can be located in Chapter 00.

05.04 DIGITAL AUGMENTATION IN PRACTICE

The perception of architecture can evolve to be more **multi-sensory** through the digital methods discussed; however, these methods have drawbacks for the wearer and the architect; the technology can be inconvenient to wear. Whereas devices such as soft-body wearables are very subtle, instruments like virtual reality[(1)] headsets are cumbersome and often require the wearer to be linked umbilically to a computer to use them. Therefore, they may transport the wearer out of the physical world and detach them from the built environment, which would harm the experience of physical architecture. Furthermore, whilst additional sensory stimuli can be introduced utilising these methods, an additional layer of sensory stimuli can also take the focus away from the architecture or create a sensory overload.

(1): Definitions can be located in Chapter 00.

05.05 END NOTES AND REFERENCES

All definitions highlighted[(1)] in the chapter can be found in Chapter 00

Text references:

1. Negrebsubla, N., 2015. Determinants of Diffusion of Virtual Reality. GRIN, [online] Available at: <https://www.grin.com/document/318329> [Accessed 26 February 2022].

2. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley.

3. ScanLAB Projects, Lundahl, Seitl, 2019. Available at: <https://scanlabprojects.co.uk/work/eternal-return/>

4. Zimm, M., 2019. Eternal Return - The Memor. P. 12

5. 2. Zimm, M., 2019. Eternal Return - The Memor. P. 12

6. Aghakouchak, A., 2021. Arts informed practice led Research, Lecture, The University of Greenwich.

Figures:

1. Heilig, M., 1962. [image] Available at: <https://www.researchgate.net/figure/Sensorama-the-first-virtual-immersion-system-the-technical-table-and-the-pictures-shown_fig1_321142137> [Accessed 26 February 2022].

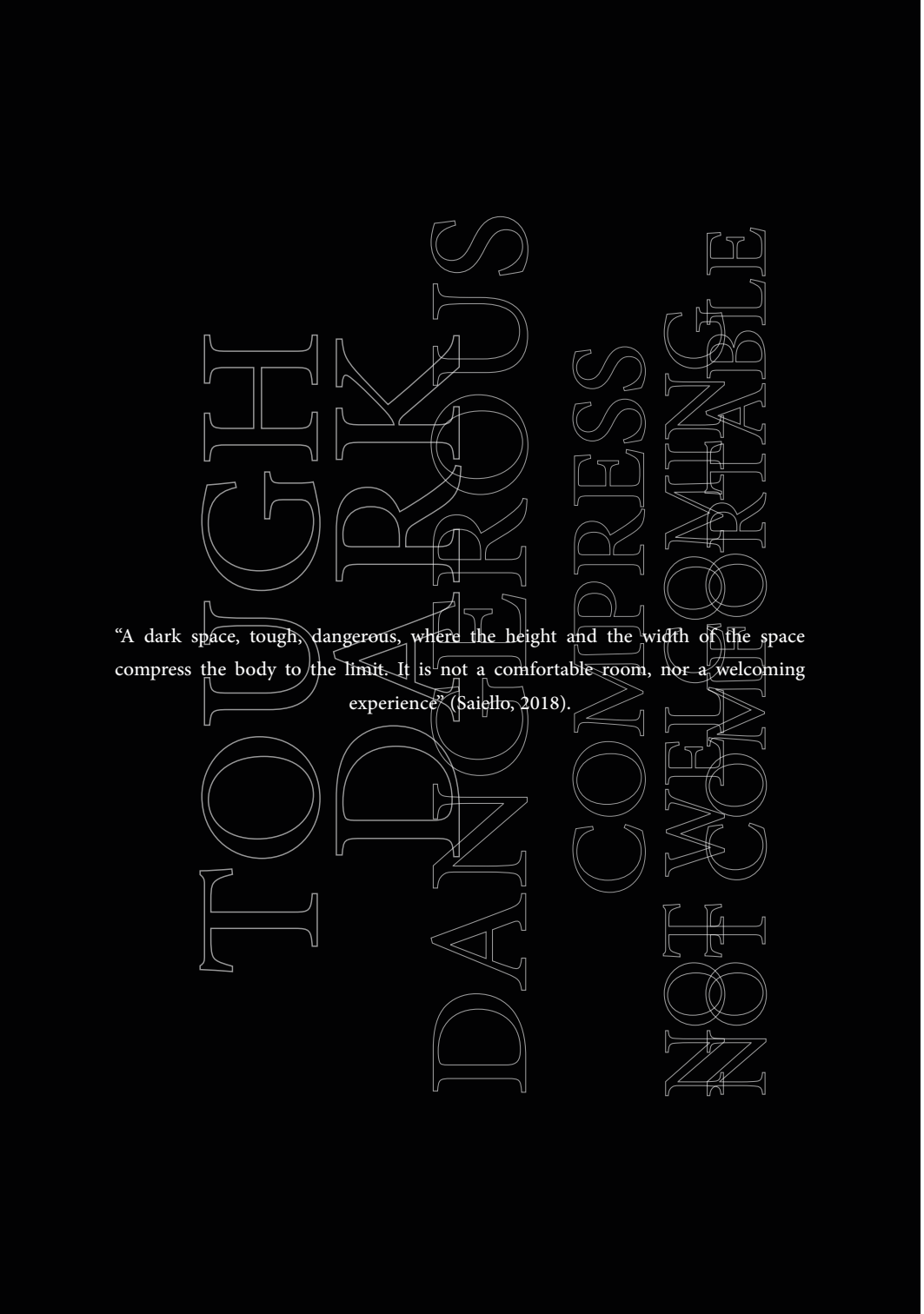
2. ScanLAB Projects, 2019. [image] Available at: <https://scanlabprojects.co.uk/work/eternal-return/>

3. Zimm, M., 2019. Eternal Return - The Memor. Pp. 42-43

4. ScanLAB Projects, 2019. [image] Available at: <https://scanlabprojects.co.uk/work/eternal-return/>

5. ScanLAB Projects, 2019. [image] Available at: <https://scanlabprojects.co.uk/work/eternal-return/>

6. Aghakouchak, A., 2019. [image] Available at: <https://www.avakouchak.co.uk/sovar> [Accessed 26 February 2022].



"A dark space, tough, dangerous, where the height and the width of the space compress the body to the limit. It is not a comfortable room, nor a welcoming experience" (Saiello, 2018).

06 - CONCLUSION - SYNTHESIS: RESEARCH PROJECT TO PRACTICE

06.01 SUMMARY OF THE RESEARCH PROJECT

The research project analysed the isolation of the senses in the perception of architecture. The discussion utilised the research on how the human **sensorium**(1) can become more **crossmodal**(1) or **multi-sensory**(1) in an architectural context. Critical literature, such as Juhani Pallasmaa's *The Eyes of the Skin* (Pallasmaa, 1996) was considered throughout the research project, as well the theory of ocularcentrism(1); this is the theory that modern architecture is visual-centric and often neglects the wider **sensorium**. Architects do not always consider the broader **sensorium** in the process; therefore, case studies in the thesis were analysed to understand the specific effects each had sensually. Qualities were extracted that could be extrapolated into the future design process and projects of architects.

Chapter 01 began with an introduction to the critical paradigms, theories, data, literature, and background research on the human **sensorium** and **multi-sensory** perception. *Chapter 01* focused on the human **sensorium** in physical space, **ocularcentrism** theory, **episodic memory**(1), **posthumanism**(1) and developing the **umwelt**(1). This chapter was necessary for the text, as it addressed the pivotal issues being dealt with in the thesis and provided the reader with knowledge on the topics.

Chapter 02 was an isolated discussion of the non-visual senses and the current state of how they are integrated and treated in the experience of architecture.

The *Third Chapter* formed the text's *thesis*; this was a discussion concerning how the human **sensorium** can be made more **multi-sensory** through physical architectural methods. Case studies included *Francis Bacon's studio*, The *Swiss Pavilion* at the *Venice Bienalle*, *2018*, *Your Blind Passenger* at the Tate Modern, an artistic piece by Olafur Eliasson, work by Gregor Schneider and built work by Peter Zumthor. *Chapter 03* discussed ways to make the familiar and unfamiliar and how this can facilitate questioning the sensual relationships with architecture. Finally, the chapter analysed the limitations of physical methods in practice.

Chapter 04 was a series of investigations supporting the *thesis*, where speculative mediums, such as drawing and photography were tested and analysed in exploring new ways the senses can be integrated; these works were produced to be exploratory and suggestive.

Chapter 05 is the *antithesis* of the research project. *Chapters 03* and *04* discussed physical methods of making architecture more **multi-sensory**; focused on how digital methods can be utilised. This discussion included wearable devices with the ability to augment the perception of space. In addition, this chapter investigated how the physical and digital worlds can be layered with one another to deliver a **crossmodal** perception of space. Case studies in this chapter included: *Eternal Return,* by ScanLAB projects and *Sarotis*, by PhD student Ava Aghakouchak.

Finally, this concluding chapter is the *synthesis* of the research project. The *synthesis* has concluded the critical findings of the research and extrapolates how these methods may

(1): Definitions can be located in Chapter 00.

(1): Definitions can be located in Chapter 00.

influence the architect's practice in the future.

06.02 SCALE SHIFTING

The scale shifting in the Swiss Pavilion (*Chapter 03*) is effective and distorting for the **sensorium**, as the proportions of the space are constantly altering. Adults are driven to experience space as a child would, and vice versa (**fig. 1**). This shifting of scale allows the architect and occupants to experience the space in additional ways and develop new relationships with it.

Fig 1: The pavilion manipulated proportions in relation to the child and adult size, Questioning relationships with architecture (Coddou, 2018).

(1): Definitions can be located in Chapter 00.

06.03 TAILORING SPACE FOR CROSSMODAL PERCEPTION

A key finding of the research project was the theory that confined, intimate space can be tailored and composed over time to make it more **crossmodal** and supportive for creative work. This finding was based upon research into artists Francis Bacon and Gregor Schneider, and how both tailored seemingly mundane small spaces into chambers for expression. *Bacon's studio* was able to become a piece of work itself, holding as much weight as the paintings he produced inside it. As discussed in the thesis, Bacon transformed his walls from a visual plane into a haptic surface encrusted with dried paint layered over time as a physical testing site. Not only did this transform the studio from a space of visual perception to one of numerous haptic points (**fig 2**). It also transformed the studio into a **crossmodal** sensory chamber, allowing Bacon to develop his work. He formed a relationship with the architecture apparent in the work; the studio's organised chaos aided his creative thought process.

Gregor Schneider followed a similar method to Bacon's. He treated his domestic house as an ongoing project, where he built rooms within rooms, layering architectural elements on one another, such as windows and doors. This method made the house deeply strange and was demonstrated to be **disquieting**[(1)], meaning it was uncomfortable and required higher levels of sensory attuning.

(1): Definitions can be located in Chapter 00.

This research is supported by *The Eyes of The Skin* literature, where Juhani Pallasmaa states that sterile environments prohibited from being manipulated or tailored are alienating. Bacon and Schneider juxtapose this with the complete reconsideration of the architecture; nothing is sterile and too precious or clean to be moved.

Fig 2: Francis Bacon transformed the walls into haptic planes layered with paint (Ogden, 1998).

06.04 SENSORY SUBSTITUTION

The critical digital method of the research is the tool of sensory substitution. **Sensory substitution**(1) involves re-thinking the perception of space sensually and how the senses react to stimuli. The conventional reactions of the senses are substituted for one another; this can be done well through digital technologies. The research project discovered that triggered responses, such as haptic feedback, could be achieved to provide the inhabitant with a more **crossmodal** perception of the space. This is discussed in *Chapter 04's antithesis*, where Ava Aghakouchak's work was analysed. Aghakouchak's PhD questions the relationship with the physical world; the work employs haptic feedback sensors based on body position and location in the space to make the experience of the space more **crossmodal**, increasing reliance on the haptic over the visual.

The Olafur Eliasson case study in *Chapter 03's thesis* also utilised this method, where his Artistic installation, *Your Blind passenger*, was critiqued. Elliason deprived the occupants of the space of their sense of sight through a thick layer of orange mist (**fig. 3**). Immediately, the reliance on the sense of touch was apparent to the individuals as their dominant sense of sight is less valuable.

ScanLAB projects with their installation, *Eternal Return*, explored **sensory substitution**, analysed in *Chapter 04's antithesis*. They introduced multiple sensory feedback based on the objects on display. Audio, gustatory, visual and olfactory feedback were used based on the object's story, as a result, the work is **crossmodal** in sensory perception.

Fig. 3: Elliason deprived the viewer of their sense of sight, quickly substituting the sensory dominance to the haptic and auditory (AP Images, 2020).

(1): Definitions can be located in Chapter 00.

(1): Definitions can be located in Chapter 00.

06.05 RESEARCH APPLICATION TO PRACTICE

The research project has prompted an internal thought process of how these theories of crossmodal perception can be considered more carefully in architectural design practice. All of the senses can be considered more diversely, and the modern methods of sensory suppression can be minimised.

In practice, this thesis provokes the thought of making the familiar unfamiliar through the implementation of physical and digital methods. This allows designers to question the existing relationships in place with the built environment, which is a notion to apply to practice to allow architecture to be less **ocularcentric**, and more sensually integrating. The consideration privileged to the visual, can be diversified to the non-visual senses. This method of thought provides architects with an enhanced and more elaborate set of design tools to make the experience of space more **multi-sensory**, intimate and immersive.

(1): Definitions can be located in Chapter 00.

06.06 END NOTES AND REFERENCES

All definitions highlighted (1) in the chapter can be found in Chapter 00

Text references:

1. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley.

Figures:

1. Coddou, F., 2018. [image] Available at: <http://www.flaviocoddou.com/portfolios/swiss-pavilion-venice-biennale-2018/> [Accessed 26 February 2022].

2. Ogden, P. and Edwards, J., 2001. 7 Reece Mews. London: Thames & Hudson Ltd.

3. AP Images, 2020. [image] Available at: <https://www.ft.com/content/054f388c-a227-11e9-974c-ad1c6ab5efd1> [Accessed 26 February 2022].

INDEX

BIBLIOGRAPHY

Books, Journals and Articles:

1. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley.
2. Gibson, J., 1974. The perception of the visual world. Ithaca: Cornell University Press.
3. Mongiat Farina, C. and Eco, U., 2015. How to Write a Thesis
4. Classen, C., Toner, J., Newhauser, R., Roodenburg, H., Vila, A. and Howes, D., 2014. A cultural history of the senses in the Renaissance.
5. Fraser, M., 2013. Design research in architecture.
6. Beesley, P., Ohrstedt, P. and Isaacs, H., 2010. Hylozoic ground. [Cambridge, Ont.]: Riverside Architectural Press.
7. Organs Everywhere, Pearce, T. and Sheil, B., 2020. The Scan - Prototypes for a post-human scenography.
8. Zimm, M., 2019. Eternal Return - The Memor. Pp. 42-43
9. Forlano, L., 2017. Posthumanism and Design. She Ji: The Journal of Design, Economics, and Innovation, 3(1), pp.16-29.
10. Schafer, R., 1977. The Tuning of the World. P. 222
11. Fetell Lee, I., 2018. Joyful: The surprising power of ordinary things to create extraordinary happiness.
12. Kissane, S., 1977. In praise of shadows. Milano: Charta.
13. Legarnisson, E., 2018. Elyne Legarnisson - Un(Balance) @ Interactive Architecture Lab,
14. Kelly, C., 2013. (University of Greenwich Thesis) Tardis – The possibilities of Utilising Virtual[ly impossible Environments in Architecture.
15. Suma, E., Lipps, Z., Finkelstein, S., Krum, D. and Bolas, M., 2012. Impossible Spaces: Maximizing
16. Natural Walking in Virtual Environments with Self-Overlapping Architecture. IEEE Transactions on Visualization and Computer Graphics, 18(4), pp.555-564.
17. Aplin, S. and Fischer, M., 2011. A Cultural Perspective on Mixed, Dual and Blended Reality.
18. Cappock, M. and Bacon, F., 2005. Francis Bacon's studio. London: Merrell
19. Braidotti, R. and Bignall, S., 2019. Posthuman ecologies. Pp. 11
20. Walker, M., 2017. Why We Sleep. [Place of publication not identified]: Scribner.
21. Wolfe, J., Kluender, K. and Levi, K., 2012. Sensation & perception (3rd ed.).
22. Bacci, F. and Melcher, D., 2013. Art and the senses. Oxford: Oxford University Press. P. 595
23. Drobnick, J., 2005. Volatile Effects: Olfactory Dimensions of Art and Architecture.
24. Eberhard, J., 2007. Architecture and the brain. Atlanta, Ga: Greenway Communications. p. 47.
25. Heschong, L., 2002. Thermal delight in architecture. Cambridge, Mass.: M.I.T. Press.
26. Heywood, I., 2017. Sensory arts and design.
27. Rybczynski, W., 2001. The look of Architecture.
28. Sennett, R., 2002. Flesh and stone. London: Penguin Books. P. 15
29. Blesser, B. and Salter, L., 2009. Spaces speak, are you listening?. Cambridge, MA: MIT Press.
30. Tulving, E., 1972. Organization of Memory (pp.381-403). pp.381-403.
31. North, A., Hargreaves, D. and McKendrick, J., 1999. The influence of in-store music on wine selections Journal of Applied Psychology, 84(2), pp.271-276.
32. Anderton, F., 1991. Architecture for all senses. Architectural Review,
33. LeDoux, J., 2003. The emotional brain, fear, and the amygdala. National library of Medicine,.
34. Bülthoff, H. and Christou, C., 2000. Perception, representation and recognition: A holistic view of recognition Spatial Vision, 13(2-3), pp.265-275.
35. Burgess, N., Maguire, E. and O'Keefe, J., 2002. The Human Hippocampus and Spatial and Episodic Memory Neuron, 35(4), pp.625-641.

36. Pathman, T., Coughlin, C. and Ghetti, S., 2018. Space and time in episodic memory: Effects of linearity and directionality on memory for spatial location and temporal order in children and adults. PLOS ONE, 13(11), p.e0206999.

37. Lakhan, S., Sheafer, H. and Tepper, D., 2016. The Effectiveness of Aromatherapy in Reducing Pain: A Systematic Review and Meta-Analysis. Pain Research and Treatment, 2016, pp.1-13.

38. Pallasmaa, J., 2000. Hapticity and time: Notes on fragile architecture. Architectural Review,.

39. Dalton, P. and Wysocki, C., 1996. The nature and duration of adaptation following long-term odor exposure Perception & Psychophysics, 58(5), pp.781-792.

40. Zhong, S., Ding, W., Sun, L., Lu, Y., Dong, H., Fan, X., Liu, Z., Chen, R., Zhang, S., Ma, Q., Tang, F., Wu, Q. and Wang, X., 2020. Decoding the development of the human hippocampus. Nature, 577(7791), pp.531-536.

41. Sebeok, T., 1985. Contributions to the doctrine of signs. Lanham, MD: University Press of America.

42. Cobley, P., 2010. The Routledge companion to semiotics. Choice Reviews Online, 47(06), pp.47-2994-

43. Spence, C., 2020. Senses of place: architectural design for the multisensory mind. Cognitive Research: Principles and Implications. P.15

44. Small, D. and Prescott, J., 2005. Odor/taste integration and the perception of flavor. Experimental Brain Research, 166(3-4), pp.345-357.

45. Heilig, M., 1992. EL Cine del Futuro: The Cinema of the Future. Presence: Teleoperators and Virtual Environments, 1(3), pp.279-294.

46. Lalanne, C. and Lorenceau, J., 2004. Crossmodal integration for perception and action. Journal of Physiology-Paris, 98(1-3), pp.265-279.

47. Marie Keeling, D. and Nguyen Lehman, M., 2018. Posthumanism. Oxford Research Encyclopedias,.

48. Reisberg, D., 2013. The Oxford handbook of cognitive psychology.

49. Schacter, D., Gilbert, D. and Wegner, D., 2009. Psychology. pp.6-185.

50. Small, D. and Prescott, J., 2005. Odor/taste integration and the perception of flavor. Experimental Brain Research, 166(3-4), pp.345-357.

51. Ogden, P. and Edwards, J., 2001. 7 Reece Mews. London: Thames & Hudson Ltd.

Lectures/Presentations:

1. Strunden, P., 2021. Beyond Virtual Reality, The AA School of Architecture.

2. Aghakouchak, A., 2021. Digital futures: New Hybridities – Middle Eastern Minds. Ava Aghakouchak– The pleasure in confusion of boundaries.

3. Aghakouchak, A., 2021. Arts informed practice led Research, Lecture, The University of Greenwich.

4. Eagleman, D. 2015. Can we create new senses for humans? TED Talk.

5. Lee, J., 2013. Design for all 5 senses – TED Talk.

Online:

1. Aghakouchak, A. and Paneta, M., 2016. Sarotis: Wearable futures. [online] Tomorrows.sgt.gr. Available at: <http://tomorrows.sgt.gr/project.php?lang=en&pid=60>

2. University College London. [online] Elynelegarnisson.myportfolio.com. Available at: <https:/elynelegarnisson.myportfolio.com/unbalance-at-interactivearchitecturelab>

3. SelgasCano, 2014. Silicon House. [online] Architect. Available at: <https://www.architectmagazine.com/project-gallery/silicon-house-6143> [Accessed 1 February 2022].

4. Kapogiannopoulos, S., Weiqi, C., Camilo, J. and Moreno, C., 2021. The Narrative Complex | Interactive

Architecture Lab, University College London. [online] Interactivearchitecture.org. Available at: <http://www.interactivearchitecture.org/lab-projects/the-narrative-complex>

5. MacFarlane, I., 2021. Areas with the most consistent house price growth in the last decade – Show House. [online] Showhouse.co.uk. Available at: <https://www.showhouse.co.uk/news/areas-withthe-
6. Love, S., 2018. Sick building syndrome: Is it the buildings or the people who need treatment?. [online The Independent. Available at: <https://www.independent.co.uk/news/long_reads/sick-building-syndrome treatment-finland-health-mould-nocebo-a8323736.html> [Accessed 31 January 2022].
7. Eagleman, D., 2021. Sensory Substitution. [online] David Eagleman. Available at: <https://eagleman.com/science/sensory-substitution/> [Accessed 31 January 2022].
8. Braun, T., 2021. Gustatory system - Latest research and news | Nature. [online] Nature.com. Available at: <https://www.nature.com/subjects/gustatory-system#:~:text=The%20gustatory%20system%20is%20the,nerves%2C%20and%20the%20gustatory%20cortex.> [Accessed 7 February 2022].
9. Sherman, C., 2019. The Senses: The Somatosensory System. [online] Dana Foundation. Available at: <https://dana.org/article/the-senses-the-somatosensory-system/> [Accessed 7 February 2022].
10. Laster, P., 2020. The Skeletons in Francis Bacon's Studio | Art & Object. [online] Art & Object. Available at: <https://www.artandobject.com/articles/skeletons-francis-bacons-studio> [Accessed 25 January 2022].
11. most-consistent-house-price-growth-in-the-last-decade/>
12. Sujay Vailshery, L., 2021. Wearables shipments worldwide 2020 | Statista. [online] Statista. Available at: https://www.statista.com/statistics/437871/wearables-worldwide-shipments/
13. Eagleman, D., 2015. Sensory Substitution. [online] David Eagleman. Available at: <https://eagleman.com/science/sensory-substitution/> [Accessed 26 February 2022].
14. Gownder, J., 2016. Forrester. [online] Forrester.com. Available at: <https://www.forrester.com/report/Breakout-Vendors-Virtual-And-Augmented-Reality/RES134187> [Accessed 27 February 2022].
15. Walmer Yard and Salter, P., 2018. Home - Walmer Yard. [online] Walmer Yard. Available at: <https://walmeryard.co.uk/> [Accessed 26 February 2022].
16. Cain, A., 2017. How the White Cube Came to Dominate the Art World. [online] Artsy. Available at: <https://www.artsy.net/article/artsy-editorial-white-cube-dominate-art> [Accessed 26 February 2022].

Image references

1. ScanLAB Projects, 2019. [image] Available at: <https://scanlabprojects.co.uk/work/eternal-return/>
2. Organs Everywhere, Pearce, T. and Sheil, B., 2020. The Scan - Prototypes for a post-human
3. scenography.
4. Zimm, M., 2019. Eternal Return - The Memor.
5. Gibson, J., 1974. The perception of the visual world. Ithaca: Cornell University Press.
6. Strunden, P. and Softbodies, 2020. Weightless Bricks.
7. Pallasmaa, J., 1996. The eyes of the skin. Chichester: Wiley.
8. Aghakouchak, A., 2016. [image].
9. Augstein, F., 2019. [image].
10. Coddou, F., 2018. [image].
11. Fisher, S., 1961. [image].
12. Man Ray, 1984. [image].
13. Neosensory, 2018. [image].
14. Ogden, P., 1998. [image].
15. Strunden, P., 2018. [image].

16. Binet, H., 2017. [image] Available at: <https://www.world-architects.com/en/architecture-news/headlines/walmer-yard-from-london-to-pittsburgh> [Accessed 23 February 2022].
17. Orsini, I., 2018. Casa Tabarelli – Carlo Scarpa. [image] Available at: <http://www.ilariaorsini.com/carlo-scarpa-tabarelli/> [Accessed 23 February 2022].
18. The Hunterian Museum, 1640. [image].
19. The White Cube, 2012. [image] Available at: <https://whitecube.com/exhibitions/exhibition/daniel_turner_bermondsey_2012> [Accessed 23 February 2022].
20. Unique Bespoke Wood, 2020. [image] Available at: <https://www.ubwood.co.uk/blog/what-is-weathered-wood-flooring> [Accessed 23 February 2022].
21. Wytrazek, P., 2014. [image] Available at: <https://www.dreamstime.com/old-burnt-house-ruins-fire-building-inte-old-burnt-house-ruins-fire-building-image128079770> [Accessed 23 February 2022].
22. Freeimages, 2016. [image] Available at: <https://www.freeimages.com/photo/weathered-wood-grain-1154984> [Accessed 25 February 2022].
23. Alemán, P., 2001. [image] Available at: <https://cc-catalogo.org/site/pdf/muac051gregorscheider-interiores-72dpi.pdf> [Accessed 26 February 2022].
24. AP Images, 2020. [image] Available at: <https://www.ft.com/content/054f388c-a227-11e9-974c-ad1c6ab5efd1> [Accessed 26 February 2022].
25. ArchDaily, 2006. [image] Available at: <https://www.archdaily.com/326188/silicon-house-selgas-cano> [Accessed 26 January 2022].
26. Coddou, F., 2018. [image] Available at: <http://www.flaviocoddou.com/portfolios/swiss-pavilion-venice-biennale-2018/> [Accessed 26 February 2022].
27. Dublin City Gallery, 1992. [image] Available at: <https://www.hughlane.ie/bacon-publications> [Accessed 26 February 2022].
28. Ogden, P., 1998. [image] Available at: <http://www.perryogden.com/projects/francis-bacon-studio/> [Accessed 26 February 2022].
29. Ray, M., 1984. [image] Available at: <https://www.manray.net/glass-tears.jsp> [Accessed 26 February 2022].
30. Road to VR, 2017. [image] Available at: <https://www.roadtovr.com/vest-can-cure-deafness-maybe-one-day-give-us-entirely-new-senses/> [Accessed 26 February 2022].
31. The Hunterian Museum, 1640. [image] Available at: <https://dabrownstein.com/2013/03/12/mapping-the-materials-of-the-human-body/> [Accessed 26 February 2022].
32. The White Cube, 2012. [image] Available at: <https://whitecube.com/exhibitions/exhibition/daniel_turner_bermondsey_2012> [Accessed 26 February 2022].
33. Visit Odense, 2020. [image] Available at: <https://www.visitodense.com/tourist/plan-your-trip/hans-christian-andersens-childhood-home-gdk631940> [Accessed 26 February 2022].