Spatial Perception through Tactile Stimulation

by

Brandon Stone

Abstract

The bias that vision holds over the profession of architecture suppresses all of the other senses. In Greek antiquity, optical refinements were implemented to create the illusion that a structure was visually perfect. The hegemonic eye, with its ability to absorb information faster than any other sense, has allowed designers to create buildings that “look” good, but might not necessarily “feel” good. Pallasmaa counters that “touch is a parent of our eyes, ears, nose and mouth.” Tactile sensations can affect a person’s social behavior, self-perception, enjoyment and comfort within a building. It not only refers to one’s sense of touch through material contact, but also sensations through atmospheric conditions. Three dimensional space can be deceiving through our lens of vision. However, the tactile and haptic sensations that we experience do not misguide us. It is important to explore how tactility can be leveraged to enhance our perception of space, while diminishing the ocular-centric bias that we hold today.

A thermae bath or natatorium leverages materiality to alter atmospheric and tactile conditions as a means of affecting one’s comfort. This provokes us to ask questions such as; “how does the foot interact with the floor?” and “how does the body react to changes in temperature?” Can edge and surface conditions become altered at multiple scales to potentially change one’s perception of space? Atmospheric conditions within the thermae vary greatly. Some spaces may be hot, while some are cold. Some may be humid while others dry. The advantage of a space like this is that the method by which one “touches” space is in solid, liquid and gaseous forms. These three states of matter provide us with an opportunity to alter certain functions within a building to serve new purposes.

One approach would be to implement materials at different scales to suggest different programmatic functions. Could a material at one scale suggest a boundary condition around the edge of the bath, while a different but similarly scaled material invite one to sit upon it? Could a material at a certain scale provide stability for the foot when walking on a slippery surface, whereas at a different scale that material might serve as a warm entity for one to lie upon, assisting in drying off? The body could play an important role in shaping the space as well. Certain areas of the body could start to become targeted to help enhance the experience within a space. Based off of these targeted areas, informed decisions about program and placement of elements would start to become obvious. The extrapolation of these ideas demands that studies be performed both at the material and programmatic level.

The goal of this research is to develop a series of spaces that do not rely on one’s sense of sight as a major sensory component. The thermal bath is a program of pure function. It is a space of tactility where one’s skin comes into direct contact with very warm or very cold elements. By transmuting materials and their scale, I hope to learn how one’s perception of space could become enhanced, or even completely changed purely through tactile sensations.

Tension between the Senses

Our modern day sense of spatiality and sensory reality has been dominated through our lens of vision. A number of philosophers and theoreticians have become concerned with the hegemony of the eye and the tension it causes between our other senses.[1] David Michael Levin contends:

"I think it is appropriate to challenge the hegemony of vision in the ocularcentrism of our culture. And I think we need to examine very critically the character of vision that predominates today in our world. We urgently need a diagnosis of the psychosocial pathology of everyday seeing -- and a critical understanding of ourselves, as visionary beings."[2]

This 'ocularcentrism' in today's culture suppresses the senses that are necessary for our understanding of our spatial existence. Architecture in modernity projects retinal images for the purposes of immediate persuasion instead of creating embodied representations of the world. Flatness of surfaces and materials, uniformity of illumination, as well as the elimination of micro-climatic differences, further reinforce the tiresome and soporific uniformity of experience.[3] Advances in technology have allowed us to become so efficient with our use of conditions within a structure that there is a universal scarcity of sensory experiences within architecture.

Every interaction that one has with the environment employs the use of all of the senses. Pallasmaa asserts that 'all the senses including vision, are extensions of the sense of touch: the senses are specializations of the skin, and all sensory experiences are related to tactility.'[4] Touch is the first sense to develop within a person and it is essential to us in our ability to both gather information and when manipulating the environment. If this is the case then why has vision become such a dominant sense in both architecture and Western culture in general? One argument is that vision has the capacity to absorb information at an unbelievably fast pace. Ashley Montagu believes that the 'western consciousness' is starting to realize that other senses are being neglected:

"We in the Western world are beginning to discover our neglected senses. This growing awareness represents something of an overdue insurgency against the painful deprivation of sensory experience we have suffered in our technologized world."[5]

These neglected senses, specifically our haptic modality of touch, engage and unite us with spaces instead of creating a detachment and controlling view of it. According to Pallasmaa, "architecture is usually understood as a visual syntax, but it can also be conceived through a sequence of human situations and encounters. Authentic architectural experiences derive from real or ideated bodily confrontations rather than visually observed entities."[3] These bodily confrontations are only experienced by way of touch. The "touch" of sight can inform how one views a space from a distance, but in order to truly understand the conditions within a space, the tactile sense needs to be implemented to allow us to have new sensory experiences that are more intimate with the body.

Physiology of Touch

Pallasmaa believes that touch is the "sensory mode which integrates our experiences of the world and ourselves. It is a parent of our eyes, ears, nose and mouth" [4] This 'sensory mode' can better be described as one where sensations are aroused through the stimulation of receptors in the skin by forces of pressure, warmth, cold and pain.[6] Some attributes associated with touch are roughness, warmth, cold, pressure, size, location and weight. The localization and density of these sensations guide us in mapping out what parts of the human body respond to external stimuli most in an environment.

Eastern civilizations such as China and Japan practice ‘energy methods’ of touch that all involve the stimulation of body points to move energy throughout the body. Practitioners have discovered a series of meridians, or sensory channels, within the body (See Figure 1). These channels and systems have corresponding points on the surface of the skin, which can be pressed or punctured to affect the workings of internal organs or enhance pain tolerance.[7] ‘Meridians’ can be described as roadmaps that allow energy to both enter and exit the body. Acupressure, also known ‘shiatsu’ or ‘finger pressure’, employs prolonged pressure by the fingers that move along the meridian lines to reduce stress and slow the heart rate. Reflexology, which is another energy method, involves massaging methods that transmit energy from a point that is touched across a network of nerves to other parts of the body.[7] For example, touching a certain part of the heel affects the lower back. The feet and hands are considered the connection to the rest of the body (See Figure 2). These effects of touch had not previously been scientifically proven until recently.

Much of what the Eastern cultures practice and believe in are precursors to modern scientist’s research. E.H. Weber, an influential physiologist in Leipzig, developed the ‘compass’ test which he used to determine the smallest discriminable distance between two points of contact on the skin. The application of these methods led to important findings regarding the spacial acuity of the skin.[5] It revealed that there was a large variation of spacial acuity throughout the body. This is important when determining which areas of the skin are most sensitive to touch. Those areas that display a particularly high resolution of spacial acuity are the fingertips, face, lips and tongue. Whereas the back, upper arm and leg have a very low sensitivity to touch.

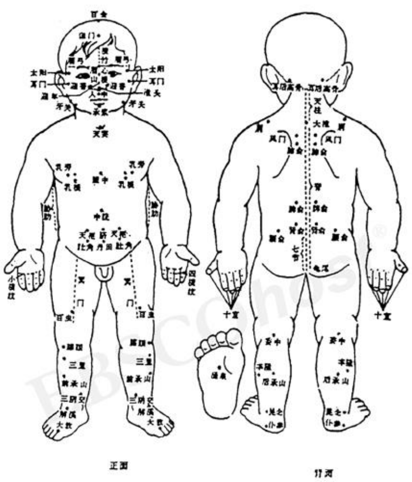

Figure 1 Ancient Chinese drawing of the meridians or sensory channels throughout the body.

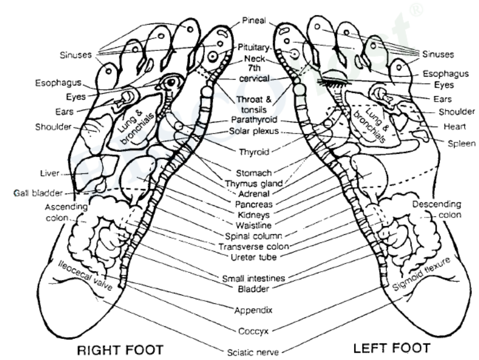

Figure 2 Ancient Chinese drawing of the pressure points on the feet.

The establishment of 'sensory spots', based off of Weber's research, was discovered by a series of physiologists; Blix, Goldscheider and Donaldson, all in a three year span. A sensory spot is a tiny area of the skin that elicits a sensation when touched by a needle (pain), a hair (pressure), or by the tip of a temperature controlled device (warmth or cold). This technique led to the construction of punctiform maps of the skin based on the four different types of touch.[5]

Among the different types of touch, the body is most sensitive to changes in warmth and cold. It is much more responsive to cold temperatures than warm.[5] When proper care is exercised, the degree of heat that can be applied to the skins surface can exceed 340ºF without any adverse effects.[6] This is due to the fact that there are many more cold spots than warm spots on the skin, which enables us to be less sensitive to heat. The body has about 29 times as many cold as warm spots on the surface of the forearm (See figure 3). These spots of interaction affect us at a psychological level when hot and cold is applied to them. The continuous application of moist heat acts as a relaxant to the surface of the body whereas when cold is applied persistently to any part of the body it acts as a very powerful depressant. [6]

Psychology of Touch

Touch is both the first sense to develop and a critical means of information acquisition. It remains the most underappreciated sense in behavioral research despite its importance to both our intrapersonal and interpersonal lives.[8] There are two types of touch that impact us at a psychological level. Those being passive and active touch. Active touch allows us to gather information about a particular object. For example, if one touches a coin, they can measure the depth of its grooves and its surface conditions. Passive touch enables us to touch objects from a distance. For instance, if one brushes a coin with a feather. This act would only allow one to feel the grooves through the feather but it would not allow one to explore any of the other valuable characteristics of the object itself.[9]

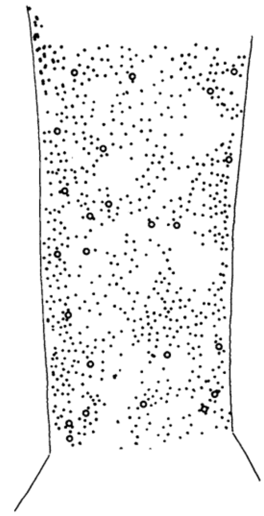

Figure 3 Map of warm and cold spots over an area of the forearm; small dots = cold spots, open circles = warm spots

Ackerman, Nocera and Bargh are interested in the three dimensions of haptic experience that Krueger is also fascinated in. Those being weight, texture and hardness. These three factors have the ability to nonconsciously influence judgements and decisions about unrelated events, situations and objects.[8] It is important to understand why our sense of touch might influence judgements or direct our impressions of objects being touched or untouched. Ackerman, Nocera and Bargh describe what is called the 'scaffold' for the development of conceptual knowledge. Physical-to-mental scaffolding is reflected through the use of shared linguistic descriptors, such as metaphors.[8] This is why a texture being rough or smooth is metaphorically associated with idioms such as; 'having a rough day' and using 'coarse language'.

In a series of experiments, Ackerman, Nocera and Bargh studied the effects of rough and smooth textures on people and their social coordination. The first experiment employed the use of a rough and soft puzzle that participants were told to solve. The results indicated that the participants that completed the rough puzzle rated the interaction as less coordinated (more difficult and harsh) than did participants who completed the smooth puzzle. Participants that were classified as prosocial/cooperative chose to complete the smooth puzzle 70.6% of the time. Those who were classified as individualistic chose to complete the rough puzzle 75% of the time.[8]

The last two experiments tested haptic experiences with hardness. In one study, participants were told to sit on either a hard or smooth chair while completing a series of tasks. First, they were to negotiate with an 'employee' on the price of a car. It was discovered that those who sat in the hard chairs judged the employee to be more stable and less emotional. The second study dealt with a re-negotiation of prices. It was expected that those who sat in the hard chair would be less willing to change their offer price. This was in fact the case. Among participants who made a second offer, hard chairs indeed produced less change in offer price. This experiment proved that hardness does in fact produce perceptions of strictness, rigidity, and stability, reducing change from one's initial decisions, even when the touch experience is passive in nature.[8] This series of studies suggested that our haptic mindset can be triggered over all areas of the body. It is not just limited to the hands and feet. Could simply changing the texture of a space affect how one interacts with others within it?

Physiology and Psychology of Touch within Architecture

It has been made clear that both the physiological and psychological relationships between tactility and people cause one to experience space in different ways. Can these factors be leveraged to the benefit of our architectural experience? If the human body is most sensitive to external stimuli in the form of hot and cold, then could one start to alter the atmospheric conditions to control how one feels within a space? Phillippe Rahm has experimented with spaces that play with notions of interior atmospheres where one is no longer occupying a surface, but an atmosphere. Can the consideration of texture enable us to create spaces that affect one both physiologically and psychologically through smooth and rough surfaces? At one scale can the surface have the ability to affect how one moves within a space through the tactile experience within their feet?

The eastern civilizations spoke of these meridians that allow us to affect certain parts of the body through the stimulation of other parts. Ackerman, Nocera and Bargh contest that one can indeed affect the way one perceives space through changes in hardness and texture. At another scale can hardness and texture be utilized to affect ones mood and how they 'feel' within a space? These shifts of perception through tactile sensations would allow us to experience architecture in entirely new ways.

Functional Tactility in Architecture

The particular focus of tactility within the context of architecture, and how it affects us both physiologically and psychologically, has not been employed to the benefit of all occupants within a space. It has traditionally been used as a means of wayfinding for the blind, or as a means to suggest boundary or edge conditions within a space. This is not to say that there is anything wrong with the application of tactility in this particular manner, but rather an observation. Hazelwood School (Figure 4), located in Glasgow, Scotland, is a school that was designed for those who have a deficiency of the senses; blind children in particular. The architects, Alan Dunlop and Gordon Murray, designed surfaces that provided tactile cues for those circulating throughout the space. On the vertical surfaces, the alteration of texture within a series of wooden panels provides one with the ability to place themselves in space. On the horizontal surfaces, in particular the ground, a louvered metal system allows those who are impaired to recognize where the boundary conditions of hallways are.

Similarly, many subway stations including the Nagoya Diagaku Station (Figure 5) located in Japan employ a panelized textured floor surface that provides both visual and tactile sensations to warn passengers of the edge condition and change in elevation on the subway platform. Both Hazelwood School and the Nagoya Station require the use of one's hands and feet for tactile experiences.

A more intrusive method of tactility within the urban fabric today is the introduction of spikes (Figure 6) on both surfaces and furniture within our cities. This intervention is used as a method of dissuasion for those who loiter. By creating a hostile architecture, the impression of those who would benefit from these spaces otherwise, changes.


Figure 4 Hazelwood School


Figure 5 Nagoya Diagaku Station


Figure 6 Anti-Homeless Spikes

Atmosphere and Climate in Architecture

Atmospheric and climatic architecture affects us primarily at the physiological level. It acts upon our skins sensory mappings of hot and cold and has the ability to control our perception of comfort within a space. Philippe Rahm's 'Domestic Astronomy' (Figure 7) is a prototype of a potential space where one no longer occupies a surface, rather an atmosphere. Leaving the ground, function and furniture rise up and disperse, evaporating in the atmosphere of the apartment, stabilizing according to certain temperatures in relation to the body, clothing, and activity.[10] The outcome of the creation of a space such as this results in a space that is no longer used as a shelter from the environment, but rather a space consisting of its own atmosphere that requires one living within to change their way of life.

The Blur Building (Figure 8), designed by Diller, Scofidio and Renfro Architects, is an entire structure of atmosphere. Both manmade and natural fog are employed to impair ones sense of sight. The structure is one of 'low resolution' where there is nothing to see but our dependence on vision itself.[11] This structure wasn't made to address tactile connections between space and user. Its purpose was to address the bias of our eye within architecture and our reliance on it as a gatherer of information.

The Rain Room (Figure 9), designed by Random International, is an installation rather than an architectural intervention, but it still plays with the idea of creating space through tactile experiences, or lack thereof. It demands us to rethink our perceptions of environmental conditions and how they affect us.

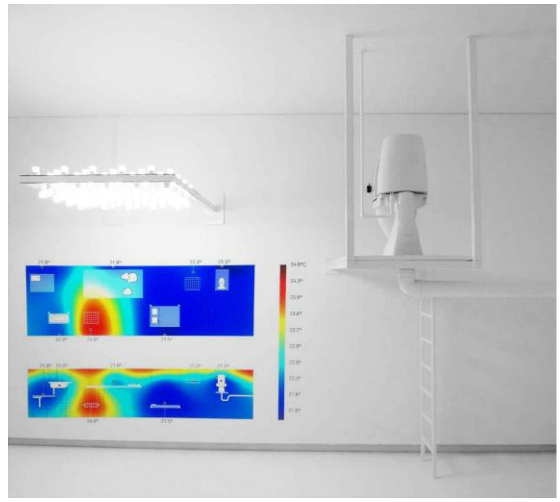

Figure 7 Domestic Astronomy – Philippe Rahm

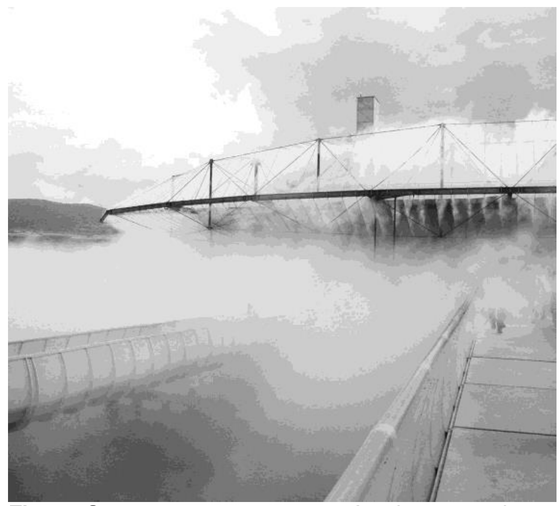

Figure 8 Blur Building – Diller, Scofidio, Renfro

Figure 9 Rain Room – Random International

Interactivity in Design

The nature in which we interact with objects or space can often affect our perception of other elements. Meret Oppenheim's famous 'Object' (Figure 10) enables us to think about the implied use of everyday objects and how we interact with them. By altering the materiality of a tea cup and spoon from ceramic to fur, the notions of tactility, particularly within the mouth, become strained. The tension between taste, texture and touch results in a change in perception of the object.

The Design Academy of Eindhoven's students developed 'Pin Gloves' (Figure 11) along a similar line of thought. This piece of apparel is lined with sharp quills that prevent the user from closing their hand. It causes a tension between pain and security within the mind. Traditionally gloves have been used as a means of protection from the environment. This iteration flips the idea of protection and dares us to rethink the functionality of this every day piece of clothing.

The 'Living Breathing Wall', designed by Behnaz Farahi (Figure 12), was developed to respond to one question; "how might we imagine a space that can develop an understanding of its users through their sounds and movements and respond accordingly?" The wall responds to tactile interactions through movement. Through this movement and through different interactions the wall changes shape. Could architecture that responds to touch affect the way we perceive it?


Figure 10 Object – Meret Oppenheim


Figure 11 Pin Gloves – Design Academy Eindhoven


Figure 12 Living Breathing Wall – Behnaz Farahi

Program as a Catalyst for Engagement

The introduction of a program is integral when attempting to provide a context in which these tactile exchanges take place. A thermae bath or natatorium leverages materiality to alter atmospheric and tactile conditions as a means of affecting one's comfort. The thermal bath, or large imperial bath, originated in Ancient Rome and was a facility used for bathing. The material properties from which it was built allowed a series of tactile exchanges to take place. Traditionally, the baths were constructed from marble and situated on top of geothermal springs (Figure 15). This is because marble is a great conductor of heat and the springs would carry warm water to the surface, which would then be used for both heating and bathing. The typology of the bathhouse has not varied greatly from the past to the present. Peter Zumthor's 'Therme Vals' (Figure 14+16), located in Vals, Switzerland, employs the same technique of heating. The nature of these spaces allow for the exchange of tactile sensations in three different physical forms. The first being in a solid form, or the interaction with the space's surfaces; whether it be by walking, sitting, or touching with the hand. The second form being liquid. The act of bathing or relaxing within water allows for the exchange of both sensations of hot and cold, as well as wet and dry. The final form of touch takes place through the gaseous state. The 'sweat stone', or sauna, allows one to interact with a space through the creation of steam. All of these interactions affect one both at a physiological and psychological level. It is critical to examine how the physiology and psychology of touch can be explored through the typology of the bathhouse to enable new tactile sensations.

Figure 13 Roman Public Bath, Bath, England

Figure 14 Therme Vals, Vals, Switzerland

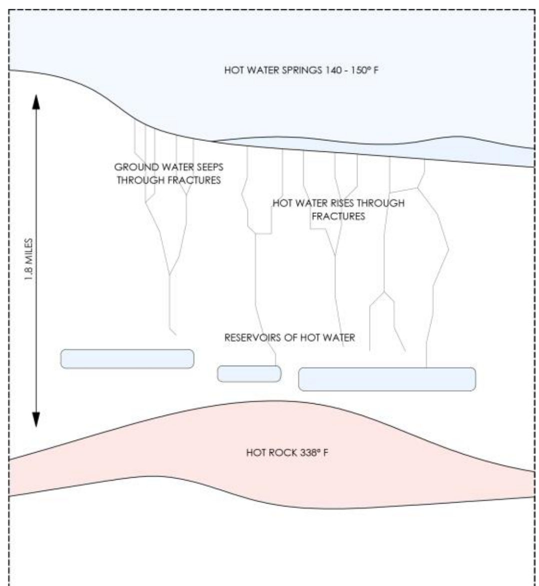

Figure 15 Geothermal systems diagram

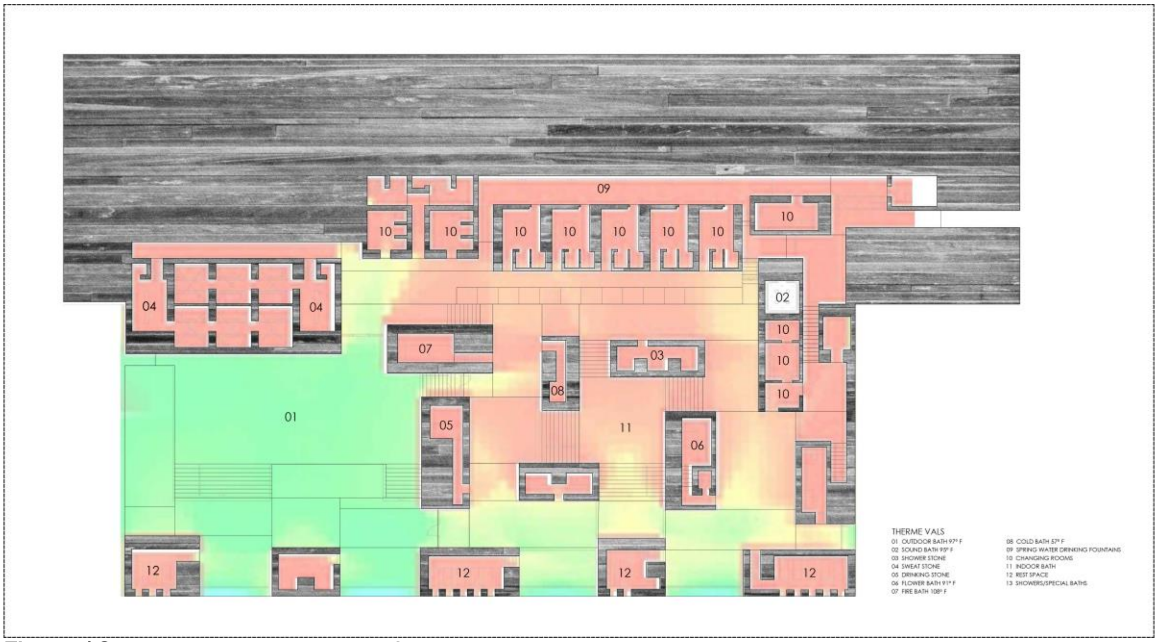

Figure 16 Therme Vals heat map of hot (red) and cold (green) spaces

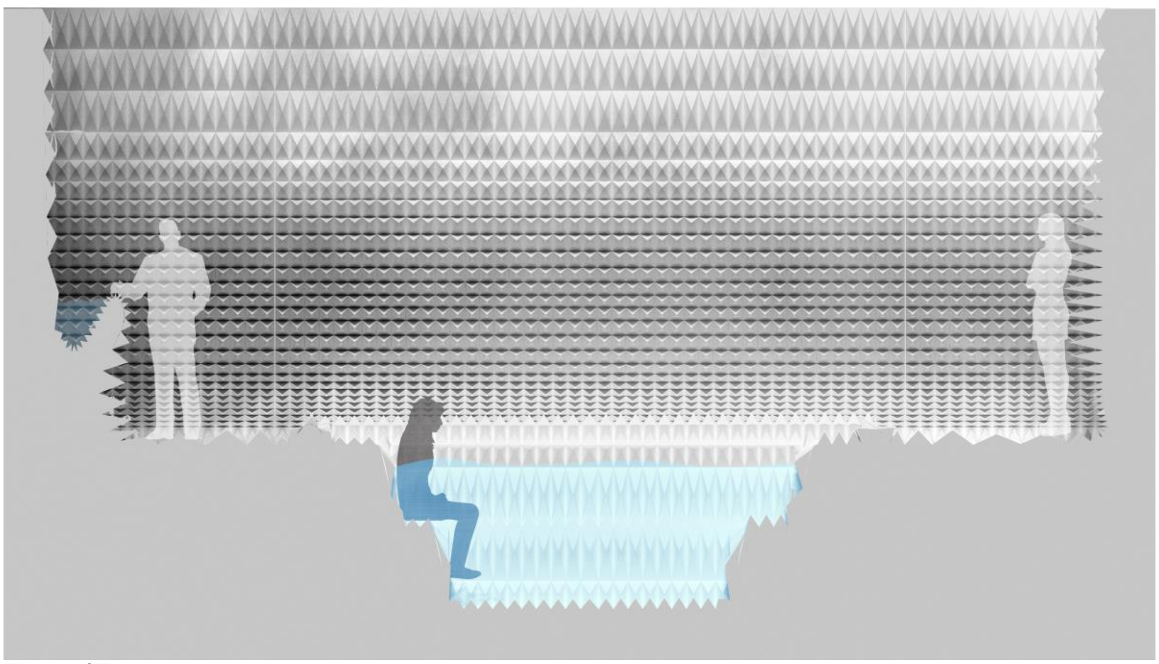

Figure 17 Prototype space within bath-house

Bath and Body

The bathhouse is a space that is meant to cleanse both the body and mind. It is the perfect place to utilize tactility as a means of changing ones perception, or feeling of space. That is not to say that the bathhouse is the only space where these techniques can be employed to do so. Rather, the bathhouse is a catalyst for engagement utilized to display changes in perception though tactile sensations.

The development of a prototype space allows for the generation of specific areas of intervention in relationship to programmatic elements within the bathhouse. In Figure 17, there are a series of interventions that occur at various scales in relationship to the body. Changes in tactility, provided by scalar shifts in textural elements, allow one to occupy a space that consists of a single surface that undulates and gradates from wall to floor. This gradation changes based upon the program and each specific site of engagement. Figures 18+19 display the gradation of texture within the space that have direct relationships to the body.

The physiology of one's body could unwittingly enhance ones experience of a space. Reflexology allows us to target points within the body, specifically within the hands and feet, which transmit nerve signals to other parts of the body and subsequently activates those areas. By studying these areas of stimulation, one can start to imagine how certain areas of the body can be targeted to activate others that are used most within the typology of the bathhouse. These areas of the body are sensitive to pressure. Based off of Ackerman, Nocera and Bargh's experiments with the hard vs. soft chair, it is also apparent that hard and soft materials affect the way we perceive ourselves within a certain context. So by altering surface's textural qualities and by

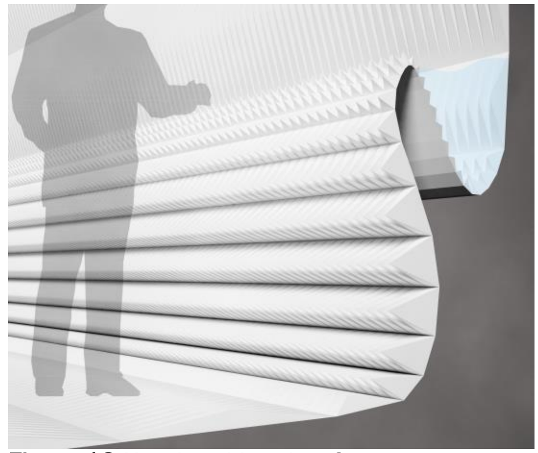

Figure 18 Hand and Lumbar Support

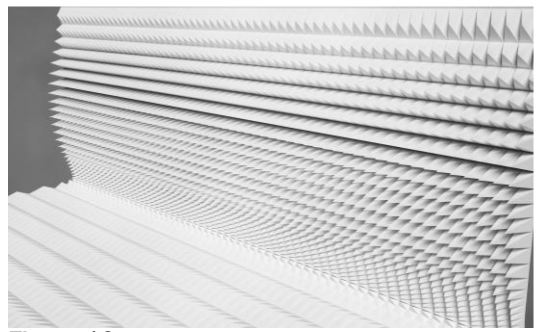

Figure 19 'Massage Wall'

targeting specific parts of the body, one could start to change a person's perceived notions and experiences within a space through tactility.

Maps of the body, similar to the ancient Chinese drawings (Figures 1+2) can be studied to determine which parts of the body should be targeted to change ones perception of space within the bathhouse. Figure 20 displays the body's meridian lines in conjunction with all of the points of pressure along these pathways. It is interesting to note that many of the aforementioned pathways stem from either the hands, feet or head.

Figure 21 portrays specific meridian lines and pressure points and how they change as a person moves. One can study the locations of these points and start to correlate parts of the body with specific programmatic elements within the space. These elements can then be designed in a

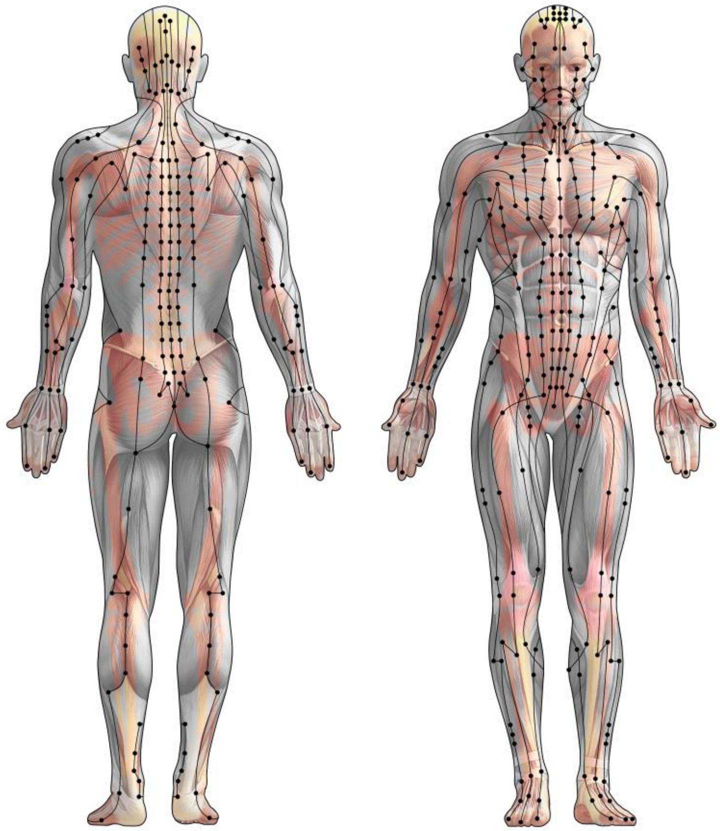

Figure 20 Pressure points in relationship to meridian lines within body

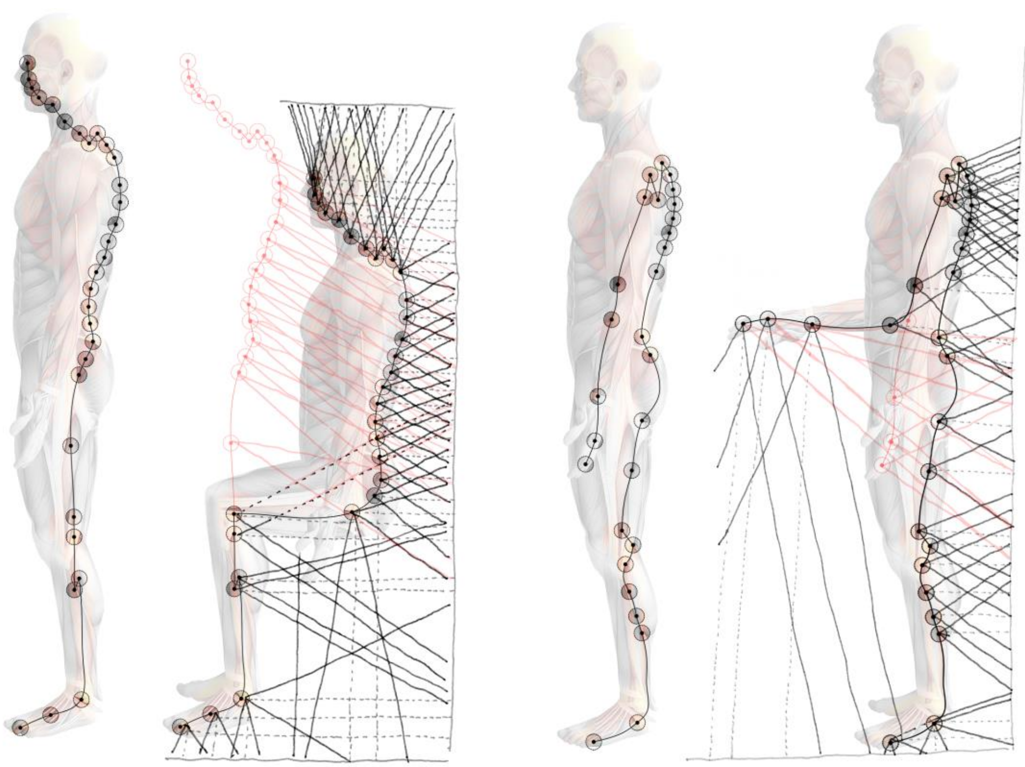

Figure 21 Pressure points in response to change in program

way to target the specific points within the body that would enhance ones perception of the space.

Figure 22 portrays the hand with the areas of engagement that directly relate to parts of the body used within the thermae. When the map of the hand becomes three-dimensionalized (Figure 24), a gradated surface starts to target those specific areas within the hand that activate other parts of the body. This surface could then be applied to the bathhouse as a railing, or as an element of support so that upon contact particular parts of the body would become activated within the space. These pressure points, located all over the body, could be targeted at other moments within the space as well. The idea of the massage bed could change to become a wall that one leans against (Figure 19) with textural elements that start to target specific areas of ones backside. The floor could start to become textured in a way that activates parts of the body just by walking through the space. Different parts of the body could be targeted based off of atmospheric conditions as well.

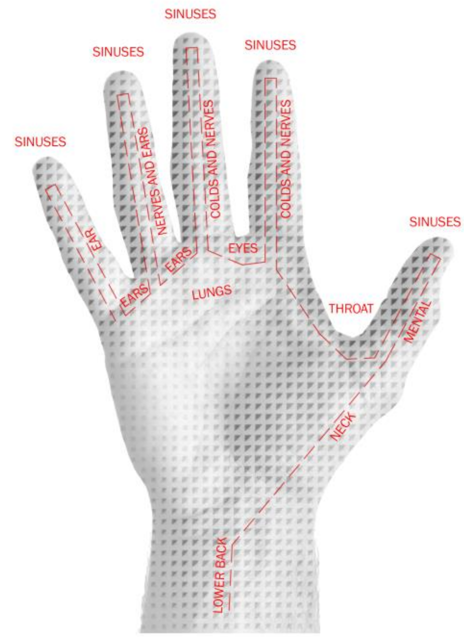

Figure 22 2D reflexology gradient map

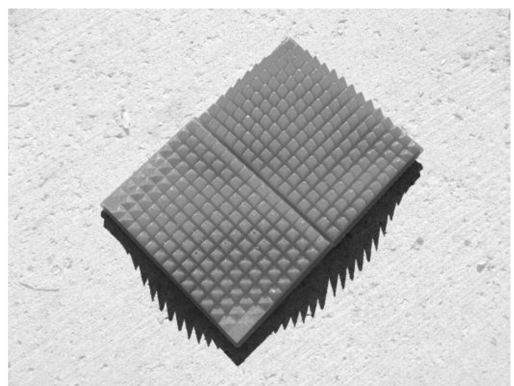

Figure 23 3D reflexology map of hand

Figure 24 Map becomes support for hand while targeting specific parts of hand to activate others

Material Connections

A major element to experiment with when thinking about many different programmatic interventions is the materiality being used at different moments within a space. Surfaces that act as elements of rest, particularly those areas where users will be sitting would employ the use of softer materials. The pyramid (Figure 25) was an attempt at creating an element at a larger scale that visually looks like something that one may not want to sit on, but upon the act of sitting, the material gives and provides a comfortable surface to rest on.

The properties of rubber (Figures 26-28) enable us to think about programmatic elements that require both flexibility and stability. It could be applied to act as a handrail, or an element to grasp when entering or exiting a pool. Or it could start to become integrated into the vertical surface to provide the user with a different experience. The benefit of using rubber is that it is not only durable, but it can be either hard or soft. The material is not porous, like foam, but it is also not completely solid, like plaster. It is a material that exists between the two and could be used to potentially transition between the two.

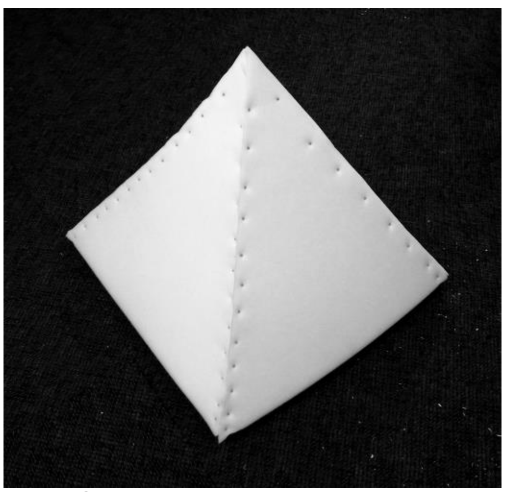

Figure 25 ‘The Pyramid’ resting place

Figure 26 Interactive rubber wall

Figure 27 Rubber cast of large cone shaped elements

Figure 28 Rubber cast of smaller pyramid shaped elements

Exploring Functional Tactility

When thinking about architecture in relationship to the senses, it is important to understand how these interactions operate at a physical level. Experiencing sensations of touch and tactility first hand allows one to understand how variations within tactility can affect the way they perceive space.

Similar to the precedents that took on a purely functional form, the introduction of a series of studies dealing with scalar shifts (Figures 29 + 30) allowed for the exploration of the idea of boundary and edge conditions. By creating a series of tiles with differently scaled textures, one can walk on, and experience a surface that provides a means of pleasure, comfort, pain and discomfort. These tiles can be arranged in many different patterns, some of which provide therapeutic benefits. Other patterns create boundary conditions that enable one circulate through a space in a particular way based on scalar shifts. These scalar shifts operate by creating a pathway at a smaller textural scale where people can walk comfortably. As the scale increases the farther one moves away from the path, the level of discomfort rises, dissuading those from leaving the path. The introduction of a gradient within the tile system allowed for a much smoother transition between changes in scale. In figures 29 + 30, there is a sudden change in scale when one steps from one tile to another. The goal is not to create a tile system, but rather a single surface (Figures 31-33) that undulates and changes scale based on circulation and programmatic elements within the space. This system would allow users to circulate through space without relying on vision as their primary sense of wayfinding. Touch, purely through the bottom of one's foot would allow one to experience a space in a much more tactile manner.

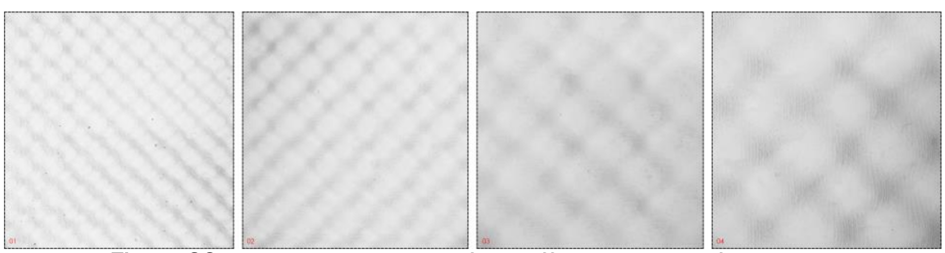

Figure 29 Plaster tile system at four different stages of gradation

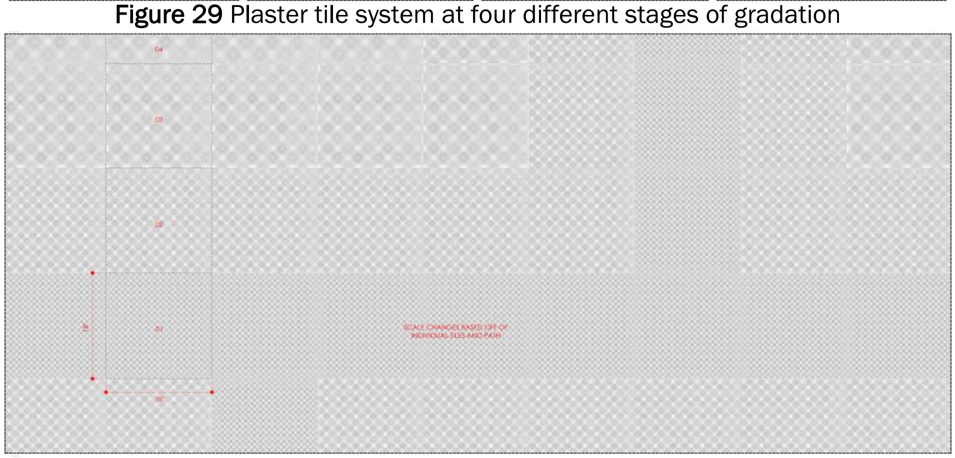

Figure 30 Rendering of arrayed system used to create pathways based on different scalar shifts

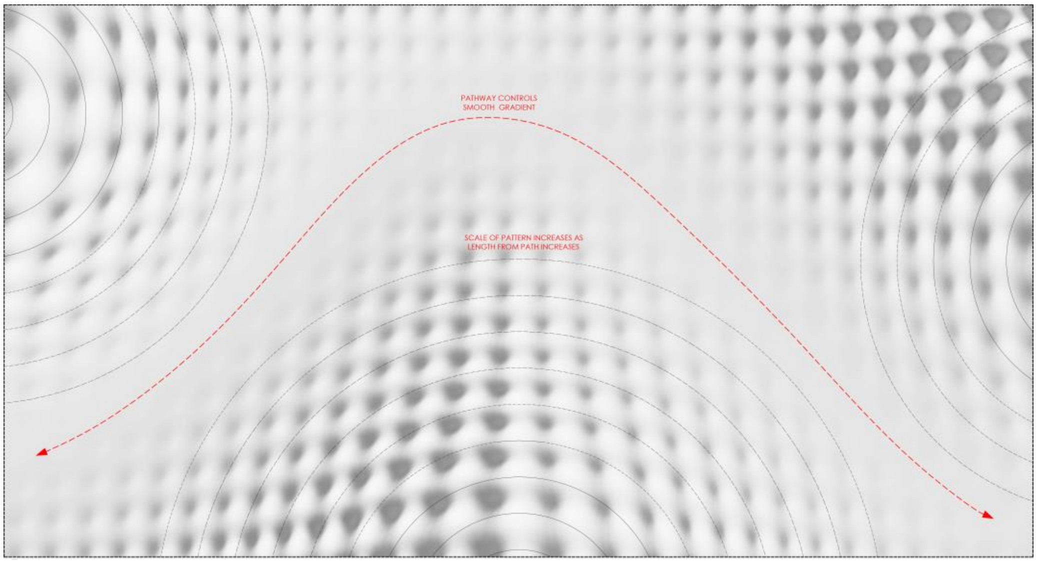

Figure 31 Rendering of gradient pathway with scalar changes

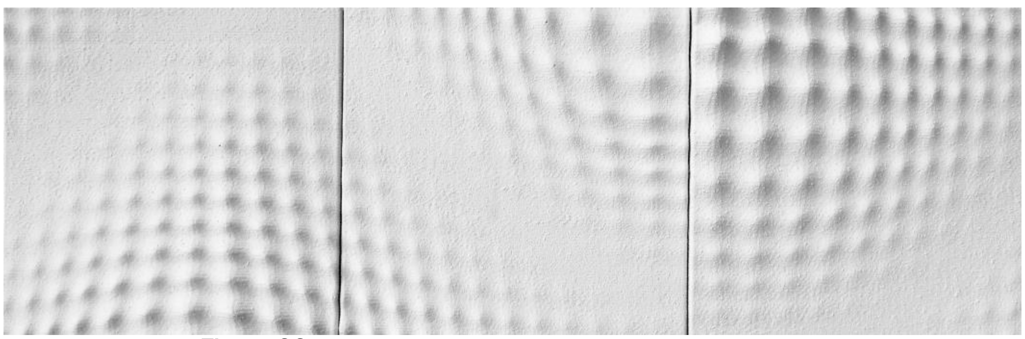

Figure 32 Plaster system employing transitive gradation

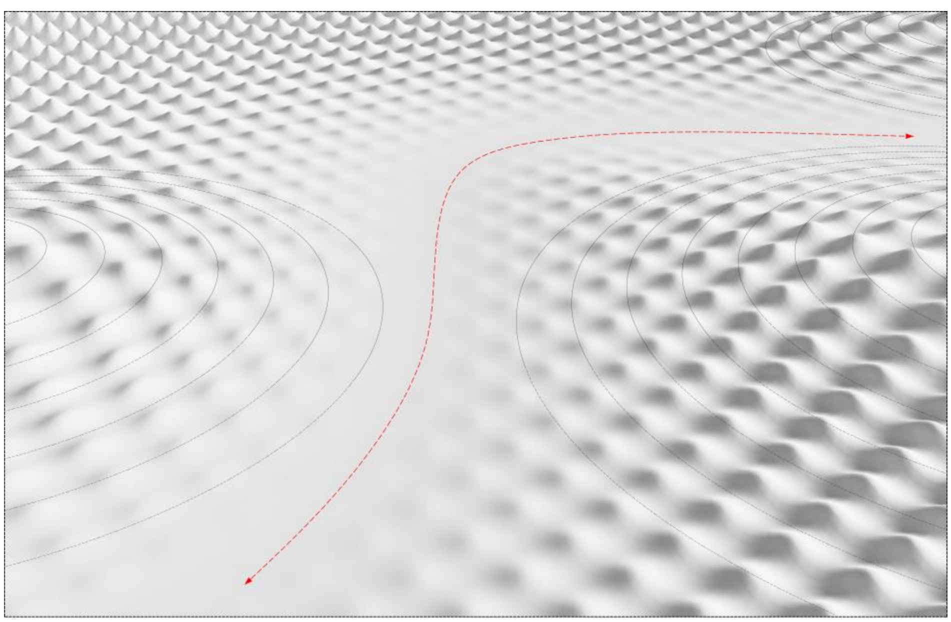

Figure 33 Perspectival rendering displaying scalar changes in relationship to elevational changes

Exploring Climatic Conditions

Atmospheric conditions provide for the opportunity to affect a person at a microscopic level. The fact that we are most sensitive to changes in temperature means that subtle changes in climatic conditions can have a large impact on how we feel within a space. Surface's properties may start to change based on atmospheric conditions as well. They can start to become hot and cold or dry and slippery. Puddles of water may start to form that affect the way one moves through a space. The 'Weeping Wall' (Figure 34) was developed as a response to the traditional wall within architecture. The static properties of the wall are offset by the performative nature of water in the form of mist. An alteration of this scheme led to the integration of nozzles within a tactile plaster tile (Figure 35). The intent was to study how water could affect how one interacts with a surface by walking on zones in which the relationship between scale and tactility are affected. Are zones with texture at a smaller scale that are dry meant to be walked upon, while zones that have a texture at a larger scale with puddles meant to be avoided? Could the puddles provide some sort of therapeutic relief? Could this system be turned vertically to act as a wall in which a gradated surface directs where the flow of water goes? The idea was not only to start integrating this system into the walls and floors. Through these systems, we can start to understand how elements could become integrated into surfaces to alter atmospheric conditions within the space that affect us at the microscopic level? To better understand the points in which these atmospheric elements affect us the most, diagrams were created portraying the hot and cold zones within the body (similar to figure 3). These zones (Figure 36) can then be overlaid onto the maps of the pressure points on the body. The result of this enables us to start to study and understand what types of materials and surfaces can be utilized to affect one at both the physiological and psychological level.

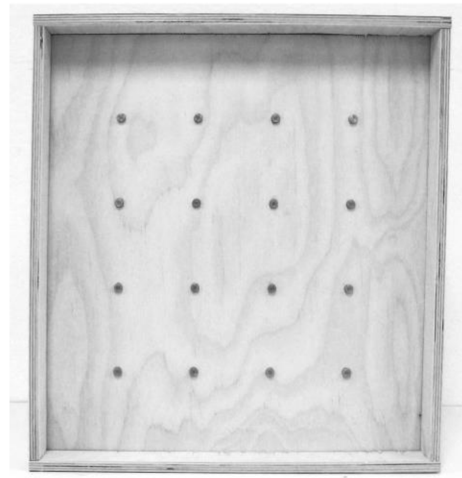

Figure 34 Weeping Wall

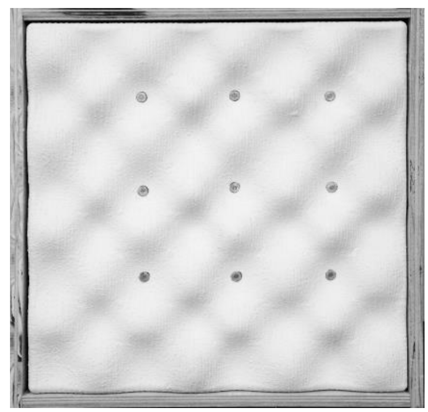

Figure 35 Spray nozzles integrated into floor tile

Hard and soft elements within a space have different effects on the body when climatic conditions change. If parts of the body are wet and soft, then they will be more sensitive to hard textures. Whereas, areas that are warm and dry will be more sensitive to cold and wet textures. The integration of atmospheric-altering elements within the materials that make up the bathhouse would allow for the development of a space where tactility affects our perception and experience.

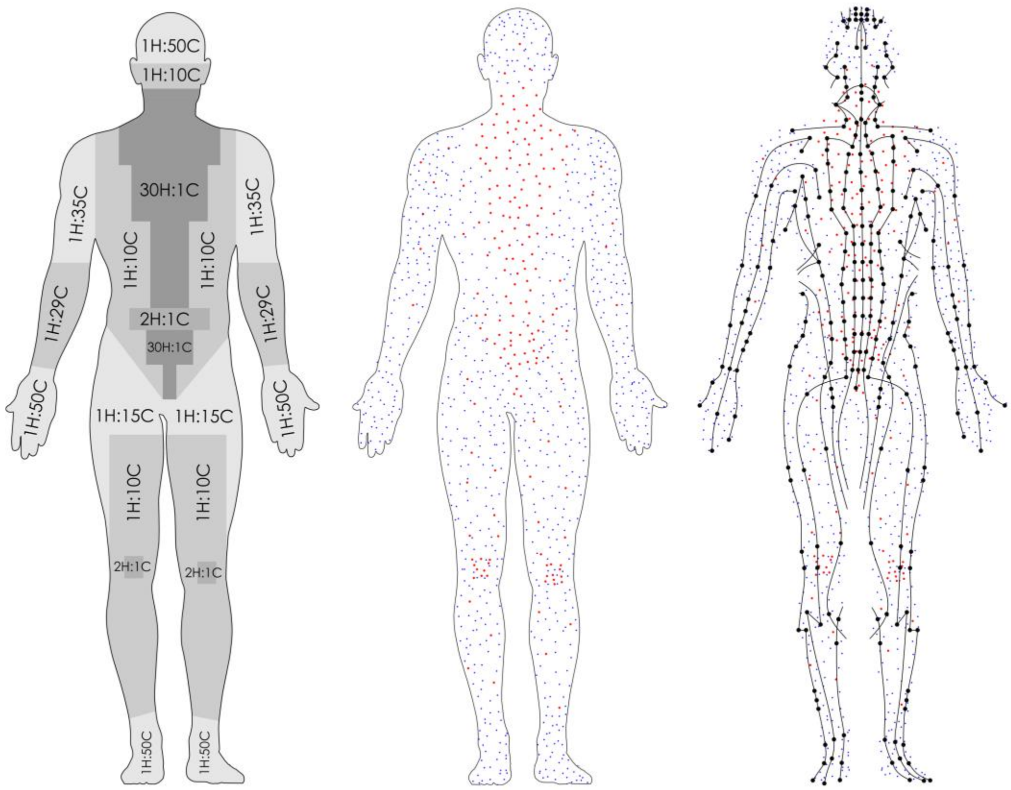

Figure 36 Ratio of hot to cold zones on body (Left, Middle) Pressure points and hot/cold zones (Right)

Figure 37 Hot and cold zones in relationship to pressure points and different body positions

References

[1] Jay, Martin. 1993. "Downcast Eyes: The Denigration of Vision In Twentieth-Century French Though." (University California Press, Berkeley and Los Angeles).

[2] Levin, David Michael. 1993. "Modernity and the Hegemony of Vision." (University of California Press, Berkeley and Los Angeles).

[3] Pallasmaa, Juhani. 1999. "Hapticity and Time." *RIBA Discourse Lecture.* RIBA.

[4] Pallasmaa, Juhani. 2005. *The Eyes of the Skin: Architecture and the Senses.* Chichester: Wiley-Academy.

[5] Krueger, Lawrence. 1996. *Pain and Touch.* San Diego: Academic.

[6] Wood, Horatio C. 1888. *Therapeutics: its principles and practice.* Philadelphia: J.B. Lippincott Co.

[7] Montagu, Ashley. 1986. *Touching: The Human Significance of the Skin.* New York: Columbia University Press.

[8] Ackerman, Joshua, Christopher Nocera, and John Bargh. 2010. "Incidental Haptic Sensations Influence on Social Judgements and Decisions." *Science 328.5986* 1712-1715.

[9] Mashiago, Andrew. 2013. *Active Touch versus Passive Touch.* April 23. Accessed November 3, 2016.

[10] Rahm, Philippe. 2009. *Domestic Astronomy.* Accessed November 8, 2016. http://www.philipperahm.com/data/projects/domesticastronomy/.

[11] Renfro, Diller Scofidio +. 2002. *Blur Building.* Accessed November 10, 2016.

Fig. 1: Flaws, B. 1985. *Turtle Tail and Other Tender Mercies: Traditional Chinese Pediatrics.* Blue Poppy Press.

Fig. 2: Owens, M. K., and D. Ehrenreich. 1991. "Application of nonpharmacologic methods of managing chronic pain." In *Holistic Nursing Practice* 6, 32-40. Aspen Publishers, Inc.

Fig. 3: Rein, F H. 1925. "Uder die Topographie der Warmempfindung, Beziehungen zwischen innervation und receptorischen Endorganen." *Zeitschrift fur Biologie* 515-535.

Fig. 4: 2007. *Hazelwood School.* Accessed November 8, 2016. http://www.dev.ihcdstore.org/?q=node/128.

Fig. 5: LERK. 2010. *Nagoya Daigaku Station platform.* March 16. Accessed November 8, 2016. https://commons.wikimedia.org/wiki/File:Nagoya-subway-M18-Nagoya-daigaku-station-platform-20100316.jpg.

Fig. 6: Lowe, Josh. 2015. *What Britain has learned about social mobility.* December 18. Accessed November 8, 2016. http://www.prospectmagazine.co.uk/blogs/what-britain-has-learned-about-social-mobility.

Fig. 7: Rahm, Philippe. 2009. *Domestic Astronomy.* Accessed November 8, 2016. http://www.philipperahm.com/data/projects/domesticastronomy/.

Fig. 8: Renfro, Diller Scofidio +. 2002. *Blur Building.* Accessed November 10, 2016.

Fig. 9: International, Random. 2012. *Rain Room.* Accessed November 10, 2016. http://random-international.com/work/rainroom/.

Fig. 10: Oppenheim, Meret. 1936. *Object.* Accessed November 10, 2016. https://www.moma.org/learn/moma_learning/meret-oppenheim-object-paris-1936.

Fig. 11: Eindhoven, Design Academy. 2009. *Pin Gloves.* Accessed November 10, 2016. https://inprogress.designacademy.nl/Projects/tabid/1431/articleType/ArticleView/articleId/252/In-Search-of-a-New-Tactility.aspx.

Fig. 12: Farahi, Behnaz. 2013. *The Living Breathing Wall.* Accessed November 10, 2016. http://behnazfarahi.com/the-living-breathing-wall/.

Fig. 13: Diliff. 2006. *Roman Baths in Bath, England.* July 2. Accessed November 27, 2016. https://en.wikipedia.org/wiki/Ancient_Roman_bathing#/media/File:Roman_Baths_in_Bath_Spa,_England_-_July_2006.jpg.

Fig. 14: 2009. *The Therme Vals / Peter Zumthor.* February 11. Accessed November 17, 2016. http://www.archdaily.com/13358/the-therme-vals/.

Fig. 15: Stone, B. 2016. *Geothermal Springs Diagram.* Unpublished, University at Buffalo, SUNY.

Fig. 16: Unknown. 2011. *Systems.* November 8. Accessed November 17, 2016. https://jcf2cmsystems.files.wordpress.com/2011/11/1288298107-therme-vals-plan-01b.jpg?w=300&h=212.

Fig. 17: Stone, B. 2016. *Prototype space within bathhouse.* Unpublished, University at Buffalo, SUNY.

Fig. 18: Stone, B. 2016. *Hand and lumbar support rendering.* Unpublished, University at Buffalo, SUNY.

Fig. 19: Stone, B. 2016. *Massage Wall.* Unpublished, University at Buffalo, SUNY.

Fig. 20: Stone, B. 2016. *Pressure points in relationship to meridian lines within the body.* Unpublished, University at Buffalo, SUNY.

Fig. 21: Stone, B. 2016. *Pressure points in response to change in program*. Unpublished, University at Buffalo, SUNY.

Fig. 22: Stone, B. 2016. *2D Reflexology Gradient Map.* Unpublished, University at Buffalo, SUNY.

Fig. 23: Stone, B. 2016. *3D Reflexology Map of Hand.* Unpublished, University at Buffalo, SUNY.

Fig. 24: Stone, B. 2016. Hand Support. Unpublished, University at Buffalo, SUNY.

Fig. 25: Stone, B. 2016. *The Pyramid.* Unpublished, University at Buffalo, SUNY.

Fig. 26: Stone, B. 2016. *Interactive Rubber Wall.* Unpublished, University at Buffalo, SUNY.

Fig. 27: Stone, B. 2016. *Rubber cast of large cone shaped elements.* Unpublished, University at Buffalo, SUNY.

Fig. 28: Stone, B. 2016. *Rubber cast of smaller pyramid shaped elements.* Unpublished, University at Buffalo, SUNY.

Fig. 29: Stone, B. 2016. *Plaster Tile System.* Unpublished, University at Buffalo, SUNY.

Fig. 30: Stone, B. 2016. *Rendering of Arrayed System.* Unpublished, University at Buffalo, SUNY.

Fig. 31: Stone, B. 2016. *Rendering of gradient pathway.* Unpublished, University at Buffalo, SUNY.

Fig. 32: Stone, B. 2016. *Plaster tile system employing transitive gradation.* Unpublished, University at Buffalo, SUNY.

Fig. 33: Stone, B. 2016. *Perspectival Rendering Displaying Scalar Changes.* Unpublished, University at Buffalo, SUNY.

Fig. 34: Stone, B. 2016. *Weeping Wall.* Unpublished, University at Buffalo, SUNY.

Fig. 35: Stone, B. 2016. *Weeping Wall v2.* Unpublished,
University at Buffalo, SUNY.

Fig. 36: Stone, B. 2016. *Ratio of hot to cold zones on body*. Unpublished,
University at Buffalo, SUNY.

Fig. 37: Stone, B. 2016. *Hot and cold zones in relationship to pressure points.* Unpublished,
University at Buffalo, SUNY.