Spring 5-4-2012

Haptic Vision

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HAPTIC VISION

by

Adam H. Donner

A Terminal Project
Presented to the Faculty of
The College of Architecture at the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Master of Architecture
Major: Architecture
Under the Supervision of Professor Christopher Ford
Lincoln, Nebraska
May, 2012
To My Daughter Kaylee
Thank You
For Your Patience and Understanding
While Putting Up With a Sleep Deprived Dad
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“While our experience of the world is formulated by a combination of five senses, much architecture is produced under consideration of only one - sight. The suppression of the other sensory realms has led to an impoverishment of our environment, causing a feeling of detachment and alienation.”

Pallasmaa, Eyes of The Skin
In a visually biased world can one design in such a way as to improve the experiential qualities of a space through the sense of touch?
**Haptic Vision** is an investigation into the idea that the experience of architecture is lacking because of the bias Western society has placed on vision, that the other senses are stifled by this and that it is a result of us living in an occularcentric society. Architect and theorist Juhani Pallasmaa has said that, “While our experience of the world is formulated by a combination of five senses, much architecture is produced under consideration of only one - sight. The suppression of the other sensory realms has led to an impoverishment of our environment, causing a feeling of detachment and alienation.” In order to combat this “detachment”, and increase the experiential qualities of our environment, architecture should be designed in consideration of the other senses, in particularly that of touch. Touch is the sense that is most closely related to vision’s ability to understand our environment.

Human experience can be improved upon if sensual experiences are more duly considered. When the other senses besides the visual are regarded there can be an experience that is created that is more embodied with an increased feeling of attachment to our spaces, buildings, and environments.

An in-depth inquiry into how one experiences was done to gain an understanding of how one comes to understand their embodiment with the world. Under the assumed doctrine by John Locke of the tabula rosa, or “blank slate,” the senses are the only sources of knowledge about the world. This is directly related to research into sensual psychology, sensory deprivation and sensory overload. These were researched to form a solid base of information towards the consideration of the physiology and psychology of how one senses and perceives the world. From there, an investigation was undertaken to understand physical objects in regards to their inherent haptic nature. This was accomplished by building various three-dimensional artifacts as a physical manifestation of the ideas received from the research. Each artifact had a recipe for design intent that dealt with the sense of touch regarding the hand, and the eyes. This is research for the exploration of relationships using contextual, rather than quantitative data. The design process, the creation and, observations of these artifacts are considered for the qualitative research and evidence. The results were not necessarily generalizable, but were transferable.

The artifact research was done to understand the relationships between vision and touch, exploratory touch, sensual information received through touch, and what happens when a physical object considers its own haptic qualities for aesthetic and pragmatic interaction. It is important to note that with these it is the hand that is of value. Because of their scale they are tailored to the intimacy of the hand. What was learned from the artifacts was then taken and applied to the concepts of a wall, a space, and to architecture. This was done for the sake of the body as well as the hand. Because the back will interacts differently than the hand, the feet differently than the elbow.

As an architectural investigation into **Haptic Vision** there was a designed addition to the Southern entrance of the link of Architecture Hall. Three programs were exercised into the design to fully investigate the potentials and limitations in consideration of the haptic dimension in architectural design.
In Pallasmaa’s affirmation he is arguing that the experience of architecture is lacking because of the bias Western society has placed on vision. That the other senses are stifled by this and that it’s a result of us living in an ocularcentric society. The term ‘ocularcentrism’ was conceived by Martin Jay in his book Downcast Eyes, “which is an intellectual history of the gaze.” Jay was “recognizing the primacy of the visual image and the privileging of the ocular observation as a path to certainty and knowledge.” This is exemplified by society’s forgetting of the second half of the popular expression “seeing is believing”. The full expression goes, “seeing is believing but, feeling is the truth.” (Paterson, 2007)

The historical aggrandizement of the visual sense has arguably developed starting from the abstracted symbolic measuring of geometry, through advancements of visually accommodating technologies to the consumerist culture dominated by the need to express a thing in the fastest, most easily stimulating way possible. Humans at one point in history used the body as a means to measurement. The Egyptian Cubit for example was one mode of measurement that had a direct connection to the body, and a way to visualize geometry in comparison to the body. Measurement was then slowly standardized and abstracted into symbolic visual terms. The idea of geometry somewhat lost its connection to the body to a supposedly distanced, abstracted visualism that obscures the actual body processes of measurement. (Paterson, 2007)

Throughout history there have been advancements in technologies that have privileged the eye. From the printing press, to the camera, to the television, these technologies have been mediums of transferring visual imagery to the masses. These avenues of vision have developed an ease and production of imagery that has compounded the commercialism and tourism of today to an image based commodity. Susan Sontag, author of On Photography, said, the camera has become the prime instrument of tourism, and “The omnipresence of photographs has an incalculable affect on our ethical sensibility.” (Pallasmaa, 2005) Pallasmaa, says that, “through are evident compulsion for” a simplification and objectification of mental images, that “Our sensory contact with the world becomes ‘colder’ as visual remoteness gains supremacy over the intimacy of tactility. (Pallasmaa, 2005)

Architecture too has fallen into this image based aggregation. It is implicit that we live in a culture where image is a commodity and it only makes sense that image based architecture would fall into the category of this as well. One can argue that architecture is judged mostly for how it looks. This is not a good thing. Guy Dubord, author of, The Society of the Spectacle, argues that, “the perceptible world is replaced by a set of images that are superior to that world, yet at the same time impose themselves as eminently perceptible.” (Vidler, 2008) We experience architecture through its image; the image is what is pushed into the consumer culture, so it only makes sense that there would be a bias towards vision, and a disregard to the other senses. According to Terry Smith, Professor of Contemporary Art History and Theory at the University
of Pittsburgh, there has been a build-up of architecture typologies that have fed into this consumerist and touristic society that has, in a way, set the bar for what architecture is “supposed to be” in people’s eyes and the world of architecture. (Vidler, 2008)

Pallasmaa argues that standardization and industrialization go along with the embodied detachment of the senses that our bias towards vision has caused. He says that, “As the art of architecture sinks under the current payload of practical demands”... there has been an “increasing anonymity of building in the industrialized world and its detachment from human experience. (Pallasmaa, 2005) Human experience would be improved upon if sensual experiences were more duly considered. When the other senses besides the visual are regarded there can be an experience that is designed that is more embodied, with an increased feeling of attachment to our spaces, buildings, and environments.
Experiencing Through Sensing

In order to combat Pallasmaa’s argued, feeling of “detachment” and increase the experiential qualities of our environment architecture should be designed in consideration of the other senses.

We come to understand the world we live in through our experiences and how we physiologically interact with it. Our sensual interactions are the ways in which people pick-up information by looking, listening, sniffing, tasting, and touching. This is the ACT OF SENSING. Our sensual interaction is divided up into three areas; the anatomy, physiology, and psychology of the senses. The anatomy is the naming of the parts of the body and the physiology is how those parts mechanically, or chemically operate. It was decided that the anatomy and physiology were less important in dealing with the nature of this thesis as it pertains to the experiential undertakings of the research and investigation. If they were touched on it was as a bodily measured way to help with the formal and material qualities of objects and spaces. Building codes and ergonomics played the largest role for the interplay of the body with the architecture as it pertains to the anatomy and physiology.

Under the assumed doctrine by John Locke of the tabula rasa- “blank tablet” the senses are the only sources of knowledge about the world.
Naturalistic Inquiry

Prior to this thesis some sensual environment analyses were done as an avenue to experiment with ways one might increase their awareness of an embodied experience in a space. These are two such examples of an auditory visualization and descriptive narrative of the environment.

It is 2:00 pm. The sun is hot. The breeze occurs infrequently and is cool from coming off of the surrounding water. I am poolside. There is a subtle white noise of tailing water. This comes from a small fountain about 50 feet away. It dwarfs out any distinguishing conversation from anybody passing by. In the distance there is music. The beat can be heard but not deciphered. It competes with other music. Less can be heard from the second music. Birds are chirping. There are two birds at this moment. They seem to echo each others call with well pronounced short chirps. The breeze is sporadic. When it gusts it can be heard. I am curious as to the varying wind speed and their resulting noise levels. This wind is faint to the ear.

No leaves rattle and no footsteps are heard. This has to be because of the water noise. There are bushes and trees all around with stone for walking. A lot of the people that do walk by are barefoot. The only other noise is a plane flying overhead every once and a while. There must be a commercial airport in the vicinity. After an hour of listening I realize that these are not the only noises I hear. My noises can also be heard. These are my pen on the paper, my movements and my breath when I breathe out my nose.

The sun is warm on my face and arms. I can feel it slightly through my shirt. There are moments of chilled breeze. It is noon. A six story building blocks the sun from reaching about half of the public space. I hear heeled shoes on the marble and granite paving. Chairs sliding and adjusting on the wood deck upon which I sit. Strollers are frequently going by. Other than conversation these are the noisiest things. There is music playing from the six story building. I close my eyes to try and distinguish what and how many people pass by. Just through listening, I always guess low for the numbers of people. Not every shoe makes noise and not every person talks. Luggage and strollers are rolling by and are very distinguishable. The music playing out loud does not drown out babies crying from afar and pigeons flapping their wings twenty feet away. Casual chatter from people up to 12 feet away can be heard clearly. The music has a decent beat, but it is a poor soundtrack for this scene of life. I am now in the shade; the six story building is blocking the sun from me. A half a block away chairs can be heard clanking onto the marble floor. I notice when the song changes to one without a beat causing me to no longer want to tap my foot along. There are slight amounts of traffic heard from a very busy street to the South. The street is a half a block away. The opening for the noise to reach the space is only about 45 feet in total length. There are no other noises.
Psychology of the Senses

“Psychology has allowed for the objectivity of feelings and sense perception.”
Edward T. Hall - The Hidden Dimension

Sensual psychology deals with the physiological, anatomical and psychological ways in which one perceives through the senses, and the mental act of cognition as the process of knowing through the mental behaviors of perception, intuition, reasoning and the spatial behaviors manifested in physical actions and responses.

Sensations are a function of the biomechanical and neurological events that begin with the impinging of a stimulus upon the receptor cells of a sensory organ. By the observing, encountering, and undergoing of things generally as they occur in the course of time. It is through the senses that every individual becomes conscious of, and perceives architecture. (Gibson, 1966)

Perceptions are the mental processes or states that are reflected in statements like, “I see a uniformly blue wall”, representing awareness or understanding of the real-world cause of the sensory input. They are the cognitive interpretations of our senses. When considering perceptions as the vehicle to understanding sensation, “any reference to the perceived world is considered subjective, lacking in real value.” (Gibson, 1966)

There are sensation-based theories that deal with the supposed units of perception, sense data, and to explain how these are put together in the brain. Physiologists attempted to discover the fundamental sensations and their receptor element. Transactionalists emphasize the privacy of each individual’s perceptual world. Thus what is perceived is a function of an individual’s life history, motivations, and values. Individuals, they say, create their own world: and assumptive one, of objects, people and events out of transactions with the environment. The subjective nature of these perception and sensation-based theories places the environments that an individual experiences on a level of continuum outside of a designer’s control. It wasn’t until environmental psychology and psychophysics started to focus on the stimulants of the world instead of on the perceptions of the individual, that one started to make the experiences less subjective. This made it possible to qualify the stimulants on the effects on the individual.
Psychophysics

A discipline within psychology that quantitatively investigates the relationship between physical stimuli and the sensations and perceptions they effect.

- Employ experimental stimuli that can be objectively measurable. For example, pure tones varying in intensity, or lights varying in illuminance and measurable distances of texture that are perceptive according to cortical density for body parts.

- Work in thresholds of absolute and difference.

Historically, it has been understood that we have five senses; Sight, Hearing, Touch, Smell and Taste. These are based on the Aristotelian idea that we have a sense for each organ through which we perceive the world. The senses were then categorized around these organs such as, hearing because of the ears, tasting because of the mouth and seeing because of the eyes, etc. Touch, on the contrary, was a departure from the other senses because it didn't have a single understood organ for which to classify it. Touch is distinct in that it is the flesh that acts as a medium rather than the organ of touch. Aristotle, in De Sensu, claimed that if touch corresponded to any particular organ it would be the heart. (Classen, 2005)

It is important to note that the 5-classical senses as they were known were considered to be passive in nature. Stimuli was thought to be imposed onto them. Only responding when stimulated. An idea that was challenged by Psychophysics in the 1970's
Perceptual Systems

“The senses were know to be exteroceptive or outwardly directed. This became problematic in regards to the sense of touch because there are internal sensations that could not be explained through Aristotelian’s ideas. So apart from the familiar, outwardly directed (exteroceptive) senses of sight, touch, taste, smell and hearing, some psychologists proposed the inwardly directed (interoceptive) senses of proprioception, kinesthesia, and the vestibular sense. These three somatic senses work in synergy, complicating the previous belief in the distinctness and separation of the sense....."these three bodily senses are therefore interrelated and codependent, in Merleau-Ponty’s words, working as a 'synergic totality'."

Vestibular Sense - a sensory system located in structures of the inner ear that registers the orientation of the head. 
Proprioception - perception governed by proprioceptors, as awareness of the position of one’s body. 
Kinesthesia - the sensation of movement or strain in muscles, tendons, and joints along with their the joints angles; muscle sense.

Environmental psychologist James J. Gibson challenged the notion of looking at the senses through the organs. He decided that in order to help understand the senses they should be looked at as, not from the person, but from the environment. The senses internally are subjective to the individual, but when you focus, instead of on the senses, but on the stimuli acting on the sense, one can then categorize them in such a way as to better understand what it is that is effecting one’s sense. This then enabled Gibson to rearrange the senses in accordance to the stimulants as opposed to the organs. This ultimately is a way to help objectify the senses. He called them Perceptual Systems.

This is an important perspective into what are essentially architectural qualities, that should be used when thinking about the senses in regards to the stimulants. It’s like looking at the world through a lense of the senses. And, its important to look at these as if the senses were actors in these mediums.

Gibson’s strategy was to regard the senses as aggressive seeking mechanisms, and not merely as passive sensation receivers. By characterizing the senses as active detecting systems constantly seeking out information from the environment, he was able to produce a new and more compact inventory of the senses. He did this by focusing on the types of environment information the body dealt with, rather than on the variety of sensory apparatuses and responses to the body. In a way, he was able to objectify the senses. 
Gibson’s model is important because he regroups the senses around the types of information that individuals seek in their transactions of the physical environment. (Gibson, 1966)
Gibson’s Perceptual Systems include the Basic Orientating System, the Auditory System, The Haptic System, the Taste-Smell System and the Visual System.

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<tr>
<th>Name</th>
<th>Mode of Attention</th>
<th>Activity of the Organ</th>
<th>Stimuli Available</th>
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<td>Exploration of Many Kinds</td>
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<td>Contact with the Earth, Mechanical encounters, Object shapes, Material states, Solidity or viscosity</td>
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<td>Taste-Smell System</td>
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<td>Sniffing</td>
<td>Composition of the medium</td>
<td>Nature of volatile sources</td>
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<td></td>
<td>Tasting</td>
<td>Savoring</td>
<td>Composition of ingested objects</td>
<td>Nutritive and biochemical values</td>
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<tr>
<td>Visual System</td>
<td>Looking</td>
<td>Accommodation, Pupillary adjustment, Fixation convergence, Exploration</td>
<td>The variables of structure in ambient light</td>
<td>Everything that can be specified by the variables of optical structure (information about objects, animals, motions, events, and places)</td>
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*Perceptual Systems (Gibson, 1966)*
BASIC ORIENTING SYSTEM
This is the simplest kind of orientation, to the direction up-down and to the plane of the
ground. With this, goes a basic type of perception on which other perceptions depend,
that is the detection of the stable permanent framework of the environment. This is
sometimes called the perception of “space,” but that term implies something abstract
and intellectual, whereas what is meant is concrete and primitive - a dim, underlying
and ceaseless awareness of what is permanent in the world.

AUDITORY SYSTEM
The function of the auditory system is not merely to permit hearing. Its exteroceptive
function is to pick up the direction of an event, permitting orientation to it, and the
nature of an event, and permitting identification of it. Its proprioceptive function is to
register the sounds made by the individual, especially in vocalizing.

HAPTIC SYSTEM
Is an apparatus by which the individual gets information about both the environment
and his body. He feels an object relative to the body and the body relative to an object.
It is the perceptual system by which animals and men are literally in touch with the
environment. When we say figuratively that a man is in touch with the environment by
looking or listening, the metaphor is something to think about.

TASTING & SMELLING SYSTEM
Tasting is basically a system for the control of ingestion. It is part of the nutritive appa-
ratus that all animals possess, but it has the special use of standing guard over eating,
selecting certain things and rejecting others. Along with smelling, it is a component of
the food-getting system. It consists of a whole chain of activities -finding food, taking it
in, biting or chewing it, testing it for numerous qualities with numerous kinds of sensi-
tivity, and only in the end swallowing it.

If tasting is an accompaniment of eating, smelling is an accompaniment of breathing.
Just as all animals must take in food, so too must all animals take in oxygen. Tasting
monitors and controls the intake of food. Smelling, however, cannot be said to con-
trol the intake of air, for the animal must breathe. Its main function is the detection of
things at a distance by means of their odors or, more exactly, their effluvia.
These are the stimulants in the terrestrial world that Gibson used to organize the perceptual systems around. One can use these as a way to think about architectural qualities. If one views elements in architecture as the stimulants that our senses seek out, one can then increase the chances of achieving a more sensual environment and hence increase the embodiment of the space.

**Rigidity of Objects**
The solid environment is a support for behavior. It supports locomotion, orientation and manipulation.

**Gravity**
Is a universal and continuous constant that everyone responds to. There are stresses inside the body as well as mechanical deformations in correspondence to the ground.

**Electromagnetic Radiation**
Spectrum of the Sun’s radiation. Creation of energy exchanges through heat, light energy and life.
Light
Only a small portion of light that a terrestrial being comes in contact with is direct from the sun. Most of it is diffused light or light scattered and reflected about.

Air as a Medium
Permits unhindered movements of beings and displacement of objects. “Space” permits the flow of information. It permits the flux of light, it transmits vibration and it mediates diffusion of volatile substances. Mechanical Disturbances: Solids undergoing shear, rupture, friction, collision, explosion; Liquids undergoing turbulence, splashing or boiling; Odor disturbance in the air carries information about its source and does so in a wholly objective or physical way.

Chemical Contacts with the Environment
People breathe, drink and eat, which means they take into their bodies air, fluids and solid parts of the environment.

Mechanical Contacts with the Environment
Part of the classical physics branch of mechanics. It is the study of collision, friction, the elastic deformation of bodies, sliding, vibration, bending, torsion, stretching and others. It is the same regarding large objects colliding into each other as it is motion of your hand through your hair.
SENSORY DEPRIVATION & OVERLOAD
Experiments

There is a large spectrum of variety to the research, anything from being left alone in a room to being subjected to complex get-ups combining goggles, mittens and darkened cells that quickly drove subjects into psychotic states.

Side Effects

Fundamental coping methods for dealing with information overload

Omission - A failure to process the information. An example of this is a telephone system. Rather than overload a line in use, the caller gets a busy signal.

Queuing - Delaying responses during overload periods, with the expectation of catching up during a lull. This is what the postal system does during the Christmas rush. There is no busy signal, but letters may be late.

Filtering - A systematic omission of certain categories of information, while processing others. A busy executive’s secretary may read his mail and give her employer only the items which require his attention.

Multiple Channels - Adopting parallel transmission subsystems which can do comparable tasks at the same time. A family whose phone is constantly in use by teenage children may have another line installed.

Approximation - The system responds in a general way, but is not precise. For example, a subject required to monitor lights which rapidly change in color might report that a color change had occurred, but not have time to report the exact color.

Error - Processing incorrect information, which may enable the system to return to normal functioning at a later time.

Escape - Taking steps to stop the input of information, or leaving the situation entirely.

(Zubek, 1969)
If changes in the environment are not severe compensatory responses are limited in scope, and may have little effect in the over-all functioning of the system.

**Effects cont.**
- Visual imagery somewhat resembling hallucinations
- Deterioration in the capacity to think systematically
- Hallucinations akin to mescaline of sight and sound
- Breakdown akin to psychosis
- Marked deterioration in intellectual function
- Increased separation anxiety in children
- Gross motor development are endangered in the absence of certain amount of tactile and kinesthetic stimulation
- Sensory stimulation reduction
- Difficult concentration
- Difficulty in organizing thoughts

The result of this research is that if there are any effects at all, they are in EXTREME CASES. There aren’t any adverse effects at levels inside of the extremes in the normal range of stimulus for daily living. There is not a deprivation or suppression of the other senses in our daily lives or an overload of vision on the other end, at least to a level to have any adverse effects. We don’t live in a vacuum where all we can do is see.

Even if the architecture of today does suppress the other senses, they are still going to be stimulated by the environment. They are aggressive and are constantly trying to find sources of stimulation. The only way for the senses to be effected by suppression is to go into extreme isolation.

**Result**
We live in a world that is accommodating to the visual perceptual system. One has to look at it as a provocation, accommodation thing. The stimulants, i.e. architecture, are not provoking or accommodating to the other aggressive senses.

---

**Where We Live**

Deprivation  
Overload

There is Always a Level of Experience Through All the Senses
Understanding is the result of an embodied experience, and intimate experience.

“Our very being in the world is fused with an embodied and sensory understanding, through which we ‘understand’ the ‘meaning’ of our life situation as well as of the works of art that we encounter”

Perez-Gomez, The Religious Imagination in Modern and Contemporary Architecture
Knowledge is a prerequisite to understanding. There are two types of knowledge gained by the act of experiencing through the senses. There is an intellectual knowledge and a sensual knowledge. The intellectual knowledge being the less embodied of the two. The intellectual knowledge gained is usually a confirmation of information acquired by unrelated sensual experiences. The intellectual knowledge is a sensual disconnect from the immediate source, our intellect is coming with preconceived notions, or information from different sources like what we have read about a stimulant, or what we have artificially seen about it. This creates a disembodied idea of the stimulant.

Through these two types of knowledge there is a sensory feedback loop that occurs.
The intellectual knowledge compared to the sensual knowledge is like a comparing the diagram of a hammer or a definition of a hammer, to the actual holding of a hammer. One can start to see how you can start to better understand a hammer and how the experience is more embodied through the sensual knowledge.

**INTELLECTUAL KNOWLEDGE**

![Hammer Diagram]

*hammer (hām’ər)*

n.
1. A hand tool consisting of a handle with a head of metal or other heavy rigid material that is attached at a right angle, used for striking or pounding.
2. A tool or device similar in function or action to this striking tool, as:
   a. The part of a gunlock that hits the primer or firing pin or explodes the percussion cap and causes the gun to fire.
   b. Music One of the padded wooden pieces of a piano that strikes the strings.
   c. A part of an apparatus that strikes a gong or bell, as in a clock.
3. Anatomy See malleus.
4. Sports A metal ball weighing 16 pounds (7.2 kilograms) and having a long wire or wooden handle by which it is thrown for distance in track-and-field competition.
5. A small mallet used by auctioneers.

**SENSORY KNOWLEDGE**
Why HAPTIC?

CAN I SEE THAT, PLEASE?
Touch allows us to establish a “sense of form” which tells us whether a knife is sharp, a stone is hard, or a ball round without the need to touch them. In this way people can remember and re-experience a feeling of touch just by seeing or thinking about an object.

_Hulten, Sensory Marketing_

Texture is appraised and appreciated almost entirely by touch, even when it is visually presented...it is the memory of tactile experiences that enables us to appreciate texture.

_Hall, Hidden Dimension_

Touch is associated with verification, the connotations of tangibility being solid, foundational, undeceiving

_Heller, The Psychology of Touch_

At the moment that the player of a ball game hits or catches the ball the eye-hand-mind complex has already gone through instantaneous and unconscious computations of relative spatial positions speeds and movements, as well as a series of strategic planning

_Pallasmaa, The Thinking Hand_

Kinesthesia is a corrective to vision: The mountain that never looks the same once it has been climbed by the viewer

_Hall, Hidden Dimension_
The loss of touch, more than any other sense, leads to feeling like an orphan in the world....Correspondingly, loss of sight embeds the subject in a far more tactile world, a world that retains a felt unity, a coherence.

Paterson, The Senses of Touch

The experiencing of one’s own body as a body at all is reliant on touch. It becomes a body only through the introduction of sensations, etc. in short, through the localization of sensations.
One hand touching another, or eyes perceiving hands.

Paterson, The Senses of Touch

Touch is the most personally experienced of all sensations. For many people, life’s most intimate moments are associated with the changing textures of the skin. The hardened, armor like of resistance of unwanted touch, or the exciting ever-changing textures of the skin during love-making, and the velvet quality satisfaction afterward, are messages of one body to another....

Hall, Hidden Dimension
(Above) Depiction of the importance of the hands in haptic sense stimulation. This is a representation of the body as it might appear if the surface area was proportional to the cortical area. This correlates to the varieties of scale for textural and contoured surfaces. For example, the back perceives stimuli differently than the hand because it is less sensitive. One should consider this in regards to what part of the body haptic stimulation is anticipated to be associated in a design.
Affordance is a quality of an object, or an environment, which allows an individual to perform an action. For example, a knob affords twisting, and perhaps pushing, while a cord affords pulling. (Gibson, 1966)

Attributes
Are those extrinsic, relational characteristics of things or classes of things that relate them to other things for specific purposes. Attributes are contingent upon what things do in relation to other things. The concern is with functions, rather than essences. Efficiency, flammability, hazardousness, visibility, intelligence, and competence are all attributes. They link things to contexts. In effect, they are the performance characteristics of the situations created when things come together in time and space. Whereas properties provide a fairly objective set of constraints from which all other characteristics of things derive a part of their existential status, attributes are only conventions. The qualities of attributes are functions of both the nature of the relationships which they characterize and the intentions of those who find such characterizations useful.

Properties
Are those intrinsic, defining characteristics of a thing or a class of things that make it what it is. Properties are always present, even if they are not fully understood or utilized by those who construe a thing in a particular way. Something’s color, density, tensile or compressive strength, bilateral symmetry, opposable handedness and binocular vision are all properties. They impose limits on what things can do.
MECHANICAL AFFORDANCES

MANUAL AFFORDANCES
Touch and visual spatial experiences are so interwoven that the two cannot be separated. Think for a moment how young children and infants grasp, reach, fondle, and mouth everything. And how many years are required to train children to subordinate the world of touch to the visual world.

**HAPTIC PERSONAL SPACE**

Conductive Contact - Heat gains through physical contact between people
Radiation - Radiant heat gain awareness between people
1. <.5' Head, pelvis, thighs, trunk can be brought into contact or members can accidentally touch. Hands can reach and manipulate any part of trunk easily.

2. <.8' Hands can reach and hold extremities easily but with much less faculty than above. Seated can reach around and touch other side of trunk. Not so close as to result in accidental touching.

3. <1' One person has elbow room.

4. <1.5' Two people barely have elbow room. One can reach out and grasp an extremity.

5. <2.5' Just outside touching distance.

6. <3.4' Out of interference distance. By reaching one can just touch the other. Two people whose heads are 8'-9' apart can pass an object back and forth by both stretching.
Haptic Movement Visualization
This is a visualization of the haptic radius for one’s body as it moves through space. There was a parametric tool made that can show this visualization through any space to see movement densities of space and key points of consideration that are likely to be interacted with haptically.
Material and Surface- Material as a sense expression can elucidate a space’s identity and values.

Natural materials, such as leather and wood, are commonly perceived as warm and soft and they can be used to make people feel relaxed and in harmony with nature. Brick can create a warm feeling because it’s color is associated with fireplace heating stoves interior walls, or cozy terraces.

Unnatural materials, such as glass and metals are commonly perceived as hard and cold. Such materials are often associated with outdoor environments, but they can be used indoors to create a free feeling of order and symmetry.

Temperature and weight- Heavy objects symbolize quality whereas light and plastic products are often perceived as cheap and low quality.
STATIC VS LOCOMOTIVE SITE STUDY

This is a study of an architectural environment to analyze elements that are touched. They are called out into four categories to differentiate between those of the hand and the body, and between those of movement and non-movement.

**Static Hand** - The hand as it grasps, touches, pushes or any other actions that, when in contact with an environmental stimulant does not move. Even for the brief moment the hand grasps and turns a door knob, it does not move, it is the wrist and arm that moves.

**Locomotive Hand** - This requires movement by the hand while in contact with a stimulant. For example, sliding ones hand along a railing or wall.
If one pays attention while walking through a building one can feel the connection between their eyes and their bodily touch and movement. We see before we touch, and when we touch. When we touch, we see in our mind the textural, and formal qualities of what we feel.

**Static Body** - This includes standing in place, leaning against a column, railing or wall. The brief moment during walking where the foot is planted, waiting to lift up and step forward.

**Locomotive Body** - This is when the body rubs up against a stimulant, or the pulling open of a door. The body moving through space and experiencing gravity and kinesthesia.
CONSCIOUS AND SUBCONSCIOUS TOUCH

Every stimulant that one interacts with through the sense of touch is done by either a subconscious or conscious means. When one grabs for a door handle it is a purposeful conscious action and the awareness of this act is inclusive to the architectural qualities of that stimulant. The shape of the handle and the material are two examples that are considered in this interaction. There are of course different levels of mental awareness of this occurring. The mental awareness is in direct correlation to whether it is a subconscious or conscious thing. For example, one can mentally shift between conscious and subconscious touch. If one were to hold an object in your hand and change the focus of their attention from the pressure of the object in your hand to the physical exertion performed by your muscle. When this mental transfer occurs, the touch that is happening that is not focused on, immediately shifts to the subconscious realm. When one first leans against a railing with your foot against the rung it is a conscious touch but the second your attention shifts away from this and your focus is directed to something else, like a conversation for example, the touching act becomes subconscious.

If this individuals attention is focused onto the screen of his ipod all of these other points of touch are subconscious. The instance his focus shifts to something else he is touching, that focus then becomes conscious touch.
This is research for the exploration of relationships using textual, rather than quantitative data. The design process, the creation and, the observations of these artifacts are considered for the qualitative research. The results are not necessarily generalizable, but are transferable.

The observations made from each artifact are transferred from one context to another similar context. Also, these are inviting for the audience to make connections between the artifacts and their own experiences.

The art and architecture of our day is often accused of being too abstract. The argument is false, for abstract does not signify meaninglessness; on the contrary, it stands for a concentration of significance.

Pallasmaa, Encounters
The drywall cube acts as a constant in opposition to different variables. This is done to test for haptic relationships between aesthetic form and materials and the subsequent artifact abstractions. It is made of painted drywall, and the idea of the cube is representative of being indistinctive to the sense of touch. It is the initial example of an intimate haptic experience that started my understanding of the sensual feedback loop.
NATURAL

This artifact is made of a natural material in contrast to the industrialized drywall. Variances in the texture of the wood confirm that incongruities can solicit one's desire for exploration of the differences, and lends itself to a sensual comparison.

To test this further the edges were filleted. This divulged the white cubes edges as being of a diminished sensual quality. The afforded opportunity of placing one's hand on the edge or wrapping one's fingers around it are not as appealing with the square corner.
Some of my readings referred to the hand in the process of making to having an embodied relationship with the outcome of that which is produced. This artifact was created in regards to the hand and the knowledge gained through the sensory feedback from the making. This was unsuccessful in the fact that the senses involved in the process of making and design are beyond the scope of this thesis.

This was successful in validating one example of how closely vision and touch are related. Visual interest can play a large role with enticing one to touch something.

At a conscious touching level, it is vision that gives us our first tactile impressions of a thing, but it is not until we actually touch the object that we begin to haptically understand it.
FORM & MATERIAL

Variable qualities of form and material were chosen and utilized to try and solicit the sense of touch. Words like curvilinear, soft, fitting, and simple were used as a recipe for this design. The results of this study showed that the form of a material can diminish or enhance the haptic qualities of a thing and the material(s) of an object can diminish or enhance the haptic qualities of a form.
NON-PRESCRIPTIVE

Through form and monolithic materiality this artifact was designed to not have any prescribed areas for grasping. The observations afterwards showed that people found themselves exploring the artifact. They would rotate it in their hands grasping it in unique areas every time. Each placement of the hand was unique because of how it afforded the ability to grasp it, sometimes with just the fingers and other times with the entirety of the hand. It was a variable grouping of affordances that allowed this exploration and discover. When one found a pleasant place to grasp it the hand would linger. This artifact is made of a plastic foam material. After touching this the observer be left with a residue on their hands causing a hesitation and lack of desire to touch it again. This strengthens the idea of the sensual knowledge, where one might have a desire to touch this but it is not until afterwards they do because then they understand that it is not pleasant to.
GENERIC PRESCRIPTIVE

This artifact played off the idea of the last one which was designed for non-prescriptive grasping, this one was designed with specific areas for holding. Generic handles were designed and located in awkward locations around the cube. People who touched this artifact went right for the handles integrated throughout. They would shift their hand from each handle to the next and they did this almost entirely in disregard to the parts of the artifact where there were no handles. It was as if the visual symbolic nature of form and placement of the handles were enticing to the hand.
This artifact is an extension of the last. The handles produced for the last one were generic in formal qualities, designed to lack any consideration for the hand to hold it other than its circular circumference that the hand could wrap around. The handles were located at awkward locations like the corner of the cube or imbedded within it with the sizes of the holes small enough to make it uncomfortable to the handler. This artifact is the second part of the process, where the handles were developed to better consider the grasp of the hand. The handles were shaped to better form to the specificities of the hands grasp. Ridges where carved out to make the handle easier to hold, and contours where cut to entice specifically to either the left or right hand.
Getting away from the form of the object in consideration to soliciting one’s touch, this artifact looks at a material shift to enhance or diminish a specific location to the quality of its haptic sensibility. Keeping the same form throughout the artifact, the handle is, again, placed in an awkward location. The material difference is a soft to hard comparison and a thermal conductivity difference. Again, the hand seems to linger and locate the material difference even though it is of the same form. This leads one to think that it is a visual thing prior to touching it or a haptic exploratory thing, where, once the hand realizes the difference or that it is a nicer quality, one lets it linger.
ARTIFACT OBSERVATION

None of the artifacts are necessarily asking to be touched and they are definitely not accommodating one’s touch, at least at a performatory level or functional level. They just are. Perhaps some of them are enticing to the touch but that is through a visual means. It’s not until you touch them that the hand starts to wonder and settle and wonder some more. But what some of them do is afford the opportunity for interactions and for intimacy, for touch. But its important to note that with these it is the hand that is of value. Because of their scale they are tailored to the intimacy of the hand. From here I can take what I have learned and apply their concepts to a wall, to a space, and to architecture. This should be done for the sake of the body as well as the hand. Because the back will interact differently than the hand, the foot differently than the elbow. This is the exciting potential for where this can go.

By laying hold of something, a person can detect its size, its shape, its surface texture, and its material substance or consistency. Its relative temperature can also be perceived, as we shall note in the next section. All these qualities are picked up by exploratory manipulation, that is, by the hands considered as a perceptual subsystem. But the hands are not the exclusive possessors of these discriminative abilities. The feet are also quite capable, as scattered evidence indicates, although they are normally unused for perception by man. Other extremities can be substituted for the hands, as is demonstrated by the abilities of persons with amputations.

Gibson, Perceptual systems
Haptic Vision Anticipating Architecture

Observations taken from the research for ideas of thought when designing for haptic vision. These are not prescriptive, or a set of canons, but rather, things to take into consideration at the forefront of one’s architectural design thinking.

(Above) It is the integration of the body with the architecture, not just the body through space. Spaces should be thought of in regard to more than just the eye. Bodies will interact with the architecture and this should be highly considered.

(Right) It’s about allowing for opportunity of interaction or affordances. This column base is not a seat, yet it still affords the opportunities for interaction. Architecture that frequently invites informal inhabitation and opportunities to sit, and lean, enables us to feel at home with the architecture. This transcends any narrow functional reading and offers formal places that invite us, but never dictate to a level of appropriation.
The integration should be done through a visually and physically appealing way. So ingrained are the senses of sight and touch that something that looks sensual to touch is enticing to touch.

Visual elements are brought into proximity to the touch. We have an idea of what something feels like that is at a visual distance away. Seeing something that it is out of reach sparks visual and haptic memories of something one has felt in the past that is the same or similar. We immediately have a sense of what it might feel like in comparison to that memory. But it is not until we actual touch the thing that we know for sure. Touch is a corrective to vision. The eyes can be deceiving.
Visual anticipation of the touch and projecting one’s self into the architecture are important. Anticipation is as important as memory, and there are opportunities in creating memory of architectural qualities as a sequence of movement.
Three programs were exercised in order to fully investigate the potentials and limitations in consideration of the haptic dimension in architectural design. Thee three program’s diversity include, time frames of interaction, direction of user focus, formalness of the spaces, and the sensibility to the haptic detail.

**Threshold** - A threshold being the symbolic transition from one space to another, from outside to inside. Normally thought of as the threshold of a doorway it can be extruded horizontally to create a longer transitional space compared to one of just walking through a door. The experience of a threshold is usually a short lived frequent one, where designing for it should consider the locomotive body and hand in that space.

**Conference** - A conference room is a space of infrequent use. The idea for this design is to have it be a destination of privacy, removed from the business of the rest of the building. The table is a major focal point for haptic interaction and should be highly considered in the design process.

**Critique Space** - A critique space would have more infrequent use but when used would have a more sustained habitation. It would also have a different engagement compared to the other two programs between the people utilizing the space, and the architecture.

The diversity of the three types of spaces will allow for the design of three different types of atmospheres in regards to haptic vision.
To further test this in an architectural manner this design was done as an addition to a fourth program for comparison. The designed is an addition to the Southern entrance of the link at Architecture Hall.
Existing Ground Floor Plan - See Previous Page

Existing Second Floor Plan

Existing Third Floor Plan

Existing Attic Plan

Existing Basement Plan
Oscillation Between Human Scale & Architectural Scale

Because this thesis is so ingrained with the body, the design process was constantly shifting between designs for the body and designs for the architecture. The ideas from both would be independent at first and then slowly start to interact with each other until they became completely immersed within each other.
Site Plan
Threshold & Gallery Transverse Section

Highly Textural Facade

Door inside of Door

Display Shelving
Gallery & Site Seating Transverse Section

- Railing
- Integrated Seating
- Exterior Seating
Renderings
This is an addition that extends South out of the existing “link”. It extends out to the existing sidewalk in order to be more intimate with the passers-by. This makes the point of reference to enter the building the sidewalk and the threshold rather than the intersection of the two sidewalks. This way the approach becomes immediate to the realm of touch as opposed to a visual distance.

The landscape is raised for two reasons. 1) In order to create a more intimate pedestrian area to frame a sense of place. 2) Allow for an affordance of sitting and interaction.

Integrated into the landscape is a textural quality that is the same as the facade of the conference room. Because the conference room is at a visual disconnect the only haptic interaction would normally only be visual but the fact that the same material and texture are brought down to the physical haptic zone one can actually feel the texture they would normally only be able to see.

The exterior of the building has built in seating created under the integrated seating that is inside of the gallery space. The undercut space allows for physical interaction with the architecture and gives a “feeling” of presence to what is going on inside of the building and on the other side of the wall.

The Threshold acts as an introduction to the building. It is an opportunity for creating a visual anticipation of the touch through the allowance of views to what they have yet to interact with. There is a common metaphor that says the door handle is like the handshake of a building. This metaphor is not quite right. For when one shakes someone’s hand there is also a visual acknowledgement to the introduction, or eye contact. This Threshold considers that with views from the front of the door through the entirety of the links major axis as well as views to the extended second floor which extends into the threshold as a way to project one’s self into the architecture.

One example of how the visual anticipation of the touch and the build up of memories to what the user will experience later in the architecture is accomplished is by the use of wood columns that are referential to the columns of used in the attic in architecture hall.
The Crit space also doubles as a gallery. This increases its use by allowing people to use it when there are not critiques going on. Critiques are infrequent so most of the time it would not be occupied. It acting as a gallery allows for the display of students work. There are windows into the gallery from the threshold to allow the user to have a better understanding of what this building is.

The crit space has a balcony area for informal participation. This offers one the ability to either enter through the normal entrance and be apart of the activities or to use the balcony to integrate themselves from above as spectators but not participants. A functional diversity is created.

The main entrance to the Crit/Gallery space has two doors. One door inside of the other. The idea is that when it is not in use for a critique the large door could remain open creating an inviting space. This would allow access to the gallery at all times of the day without the worry of impeding on a critique. This would be symbolic to the openness of the gallery to the public.

When a critique would occur the large door would be closed. This would be a symbolic act to let everyone know that the space is in use with the all important critique of inherent of architecture schools. The large door has a glass door imbedded within it to help solidify the knowing of the activity happening on the other side of the door. This glass door would be of a normal size to allow for easy and quiet entering and exiting during the critique.
The railing for the approach to the conference room is contrast to the industrial manufactured extruded steel tube railing that inhabits the link. This railing is made of wood and is formed in anticipation of one to interact with it by more than just grasping it with one's hand. People are constantly leaning against the railing to look down into the link. The existing railing does not account for this fact and does not feel very good on the forearms as one does this. The new railing anticipates this act as well as the act of placing one's foot on the lower rungs.

The ramp to the conference room acts as a miniature promenade as a build up to an anticipated haptic event. It starts off as a wood flooring and may or may not take note of this. But as they get to the threshold of the doorway the floor and walls shifts to a steel environment. This is done to compliment the door way by contrasting with the wood floor to make it stand out more. The door handle to the conference room is also made of wood as a way to make it stand out even more. The idea is similar to the way complementary colors make each other stand out. Red next to green makes the red brighter, and the floor shifting from wood to steel only to have the door handle be wood makes the door handle haptically stand out more.
The center of the conference table is steel. The center is out of normal reach ranges for the user so there is not a need for it to be sensually appealing to the touch.

The top of the table is wood. It is a highly sensual material and according to Frank Lloyd Wright, wood is one of the most intimate materials.

The edge of the table is the part that should be most considered for its haptic qualities. It is the part of the table that is touched the most. This design has a rounded edge that is made of leather. Leather is very, soft and warm making it highly sensual.

As one leaves the conference room and descends back down the stairs they are introduced again to the textural and material qualities of the exterior of the conference room as a culmination to the visual anticipation, and the memory of seeing the exterior prior to entering the building. The facade continues into the link allowing the user to now have the opportunity to experience it first hand.
The Senses Considered as Perceptual Systems

**Sensory deprivation:** fifteen years of research. Edited by John P. Zubek

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**The Book of Touch**

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