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Getting in Touch with Biophilia
Directed Research
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Abstract

Many people now typically spend a portion of their day in detached built environments. Many built environments tend to ignore our inbuilt human need for sensory variety, instead many spaces are typically designed to solely be visually appealing, ignoring the other senses. Such environments can promote mental stress, restlessness, and dissatisfaction. Engaging with only our visual senses and not the others doesn't help the users feel connected to their spaces; our eye works together with our body and other senses to help strengthen our sense of reality. Static facilities that harbor routine lifestyles should accommodate to the occupants' needs.

Considering this, shouldn't it be critical to design a space that harmonizes with the occupants, an affectionate, sensory sympathetic space? Perception of our environment is always mediated by our senses. Our tactile senses is one of the most significant sense needed for us to encounter our surroundings. A simple way to engage the tactile senses is the use of indoor horticulture; plants can activate our sense of touch as well as smell, hearing, and sight.

Similarly to how humans have the innate need for sensory variety, we also have an innate connection to living systems. The proponents of the theory of biophilia argue that humans have an innate connection to living systems, such as other humans, animals and plants. Using the concept of biophilia as a point of departure to create a tactilely enriching spacescape can help give more meaning and spirit to interior environments. Introducing natural elements, such as plants, indoors undoubtedly helps improve the indoor air quality but it will also help evoke positive responses in people. Intervening a living system into a space can provide sensory variety. Practicing biophilic design can help reveal the influences and impacts that plants have to enhance our tactile experiences in interior everyday spaces.

A temporal intervention consisting of incremental placements of little pots of wheatgrass will be executed to observe the tactile involvements of the occupants. The site of choice is the second floor student lounge located within Hayes Hall. Further, the space was intended to provide opportunities for social engagement. It is an ideal location due to the manageable foot traffic, accessibility, and access to daylight. It is possible to conduct the intervention in other buildings such as Crosby Hall; however Hayes Hall's facility manager has realistic restrictions that one should familiarize oneself with. Fitting trials will be administered; the quantity of the pots of wheatgrass will increase or decrease depending on the occupants' responses to a base of research questions. The goal of this research is to analyze the human and plant engagement to help develop designs for an installation and proposals for space improvements.

The involvement and experiences that these interventions may cultivate can be far more significant than the shell that happens to house them. The intervention would encourage occupants to tend to the plants and others to rearrange them; there are several different levels of engagement possible. Observing and documenting the behavior associated with the interventions will identify the potential for using horticulture as a purposeful element of built environments in addition to simple decoration.

Significance of Sensory Relationships

Our eyes and our hands work together to help us understand our world; the hand informs us of intimate sensations and our eyes help bring far away sensations to our hands. Unfortunately for a while, designers have been creating with vision as their forefront. Built environments that only engage our eyes doesn't help users feel connected to their spaces. Juhani Pallasmaa tackles this bias towards vision and the suppression of the other senses in his text “The Eyes of the Skin”. The engagement of our other senses in architecture plays a very significant role, it informs us of our presence and existence in space. Pallasmaa emphasizes how it is necessary for our senses to communicate with our minds to feel “rooted in the continuity of time” and to feel united with the space we are presently inhabiting.

Our body utilizes our senses to navigate through space. It also connects us to how we perceive and interact with the space we occupy, as well as the capacity of our thoughts. Our tactile senses especially helps us feel present and gain a “sense of ‘aura’, the authority of presence...a necessary quality for an authentic piece of art. (Pallasmaa 2005)”. It is the boundary between our own self and the physicality of the world that is presented in front of us. Not only does our skin have the ability to “see” colors, but it helps our minds recognize and comprehend the materials we are gazing upon. Before we even touch it, we already assume its weight, material, temperature.

The contents and elements of a space not only complement, but should also help fabricate the soul of a space. A “good space” isn’t simply defined by just the tangible, but also the culture, rhythm, the dances, the essence of the space. (Malnar; Vodvarka 2004) The built environment serves many functions for humans and their day to day routines. It obviously provides shelter, but it is also a space where they interact with the tangible and intangible and where they carry out their activities.

Many built environments now have been much more conscious in terms of incorporating design characteristics that supplement the user's daily tasks. They incorporate sunlight, openness, flexibility, advanced technology, climate control, and acoustics into their spaces. However, several interiors of built environments unfortunately don’t have this sort of privilege. Not to say that all facilities are sensory deprived, but there can be ways to enhance the experience of them if needed.

In Akiko Busch’s book, “The Uncommon Life of Common Objects”, she brings up the idea of how objects can unknowingly affect our surroundings. The intimate relationships that we have with these objects can foster something much grander. It reveals humane and genuine moments that “tell a story not only about them but also about the rooms, the landscapes that they inhabit.” (Busch 2004) With this idea in mind, one could argue that artefacts do have the power to alter or enhance our sensory experiences in a space. Aside from being just decoration, indoor horticulture can have this power.

Very Touching

Our tactile sensations are sensitive to temperatures, materials, roughness, softness, pressure, and a myriad of combinations of these characteristics. A few other significant characteristics include the perception of pain and sensation. (Kruger, 1996) Even within the medical field the skin is considered very significant. It is considered the oldest and most sensitive of all of our organs. It is our first line of communication as well as first line of protection. It is “the mother of the senses”. Our skin serves many other functions, an organizer of information, mediator of sensations, a regenerating organ, regulates temperature, and most importantly it is a foundation for the most delicate of sensory receptors, touch. (Montagu, 1986)

The sensation of touch even has the power to alter one’s perception. An experiment exhibited that touch altered the perception of the involved rats; one group was only interacted with when it was time for feeding and the other was frequently handled and touched. This resulted in a very clear contrast of perception, the neglected group was much more hostile while the more nurtured group exhibited friendliness and curiosity.

Our sense of touch, our skin, is also very responsible for our haptic perceptions and haptic communication. Our haptic perception is significant because of our skin, it relies on the forces that we experience during touch. Haptic communication refers to how we communicate with others by using our sense of touch; similarly to how we use touch to understand intimate sensations, we also use it to understand intimate relationships. This can be seen between the relationship of a patient and a nurse. (Vortherms)

Enriching the Senses with a Biophilic City

The field of biophilia hypothesizes that human beings possess an inherent affection for living systems; whether it be other human beings, animals, or plants. (Similarly to how humans have an inherent need for sensory variation.) The hypothesis of biophilia was first discussed and explained by biologist Edward O. Wilson, a Harvard professor, in 1984. This fondness relates to the positive responses when people are in close proximity of other living systems. (Ulrich 1993) The emotional reactions, physical and cognitive responses to the exposure of nature has been researched and validated in many disciplines. However, biophilia concerns more about the genetic foundation that associates with those positive responses.

The research into biophilia isn’t anything new. Rather it has provided a clearer understanding of humans’ attraction to the natural environment, the affiliation of improved wellness and well being of one’s psychological state, productivity, as well as emotional state. It gives more of a reason for built environments to be designed with natural elements, utilizing biophilia as a motive. Satisfying our innate impulse to affiliate

with nature fosters emotional attachment to the place; several cities have already introduced biophilic design into their systems with intentions to create this atmosphere, a biophilic city.

The idea of a biophilic city includes lush greens of various scales where citizens can also be actively involved with the nature. It allows for “urbanites” to be exposed to native foliage and reveals the potentials of how the city can include more greenery. A biophilic city can be executed through our infrastructure roofs, patios, small urban gardens, walls, and etc (Beatley 2010).The power of nature in an urban environment can be very influential. Even just brief interactions with natural elements can be pivotal in one’s experience. “Views from indoors onto nature can support micro-restorative experiences that interrupt stress arousal or the depletion of attentional capacity. Similarly, when moving through the environment from one place to another, passage through a natural setting may provide a respite that, although brief, nonetheless interrupts a process of resource depletion. Frequent, brief restorative experiences, may over the long run, offer cumulative benefits.” (Berg, Hartig, Staats, 2007)

A biophilic city, much like a garden, is a mediator between architecture and nature. Usually, gardening has the unfortunate connotation of merely a chore which would then be paired with back breaking work and soiled knees. However, some would view it as a clearing of a space that allows for reflection, for people to be more aware of the edge condition between nature and the built. The birth of a garden is conscious, it requires *place* and human intervention. “A deliberately planted tree in a clearing or space in the forest certainly reflects intentional action, but without continued acknowledgement of its existence it becomes another tree in the forest, no longer able to claim the right of place. It is at the complete mercy of nature untamed.” (Giesecke, Jacobs 2012) As important as it is for us to understand the benefits that the garden provides for us, it is also important for us to be mindful of our influence on the garden as well.

Scaling Down: Biophilic Acupuncture

The theory of biophilic urban acupuncture encourages these nodes and threads of natural interventions within the urban fabric. Much like how acupuncture works in traditional chinese practice, it helps relieves stress from the human body. Its intentions are to produce a “socially catalytic interventions” that helps improve moods, enhances the connection of people and place, and also helps with mental health. It can be very effective in dense cities due to the amount of foot traffic. (Walker, 2015)

A good example of such interventions are the green walls that are designed and fabricated by Patrick Blanc, a french botanist. His green walls can be found in cities such as Paris, Italy, Berlin, and Hong Kong. Incorporating such designs has demonstrated its social benefits; the walls evoked amazement wonderment, engagement, and participation. (Beatley, 2010) Within New York City, there are many

examples of other biophilic acupuncture elements.. There are “node” parks scattered all over the city such as Paley Park (which is known for its waterfall feature), Elizabeth Street Garden, and “thread” parks such as The Highline.

At a much smaller scale, there are examples of contemporary use of biophilic design. Junya Ishigami designed a piece called *Tables for a Restaurant.* Within the restaurant’s small room is five different sized tables meant to seat five pairs of people. Rather than using walls or any other sort of partition, he played with the scales within the space for the objects to create their own spaces. Here he utilized the large tables and potted plants as a method of creating spatial arrangements. The tables were grand in plan, but delicate in elevation so it won't overwhelm the space. The potted plants are scattered along the side of the table that is adjacent to the neighboring users, creating a tabletop-like garden. (Kaplon, 2016)

Plant-istory

Plants have earned their place indoors a long while ago. Before they were viewed as decorative objects, they were placed indoors to provide perfumes, seasonings, and medicines for the highest classes within societies. (They were also a way of indicating social statuses.) As knowledge become more accessible to more people it resulted in advancement in of building technology. This then led to an increase in popularity for having plants indoors; making them more common decorative objects and decreasing their former functionality. (Smith) However, with all the new knowledge that is constantly being discovered, plants are starting to claim new functions.

The use of plants as an architectural elements can be dated back to around the Late Classical Period (430-323 BC). The Corinthian Order was designed by Callimachus who was inspired by a basket bunch of acanthus roots and leaves. The way the leaves grew and formed itself weaving around the basket delighted him, and thus he designed the ornamented column after the pattern (Pollio and Morgan, 104-106). Plants have also been used as a method of exploiting the uncertainty and differentiation of the interior and exterior. Sir Hugh Plat, an English writer on agriculture, does so in one of his major works, Floraes Paradise (Smith).

In ancient China, they were growing plants indoors for ornamental reasons since 1,000 BC. They have been doing it since plants are a symbol of wealth. It also gave gardeners

a chance to keep practicing, more of a reason to keep plants indoors. During Victorian times (1837-1901), plants were encouraged to be used as decorative elements within people's homes. Growing ivy around doorways help mimic the appearance of Middle Aged wood carved archways. Artists then, and during modern day too, utilized the plants for symbolism. (For example, artists would place forlorn red geranium on their windowsills to symbolize respectability.) The upper class would put plants on show for horticulturalists to judge, while the poor would have the duty to care for them. This kind of usage of plants clearly exhibits the fluctuation of relationship that we have with plants as our social history fluctuates as well.

Due to plants' ambiguous nature, they are not subject to particular environments. Their versatility and functionality stimulates numerous ways to engage within the designed environment. In Smith's article she states that plants can "exist simultaneously as a decorative object and as a living part of nature" because of their various design possibilities; soon plants will also take on the role as a purposeful architectural element.

Plants in the Built Environment

Aside from emotional and social benefits, plants can also contribute to psychological and physiological benefits. The effects that plants have on people's well being has been researched extensively in several disciplines. With the presence of plants, people have been reported to be less fatigued while in an office setting. When presented with options, plants were of higher preference opposed to none. (Raanaas, 2010)

Considering the fact that the physical environment has a significant impact on one's health and wellbeing, the implementation of natural elements in built environments was emphasized when it came to health care facilities. (Stichler, 2001) Due to the fact that these environment's initial purpose is to heal people, studies were conducted to reveal more ways to improve the wellbeing of these facilities. These findings have lead to more efficiently designed healing environments.

In environments that are known to be associated with stress and anxiety, applying natural elements into the space gives the user the ability to be exposed to its healing and restorative properties. Natural elements such as plants has the potential to help reduce stress as well as induce the sense of cheerfulness and pleasantness. More than 90% of people imagine a natural setting when asked to envision a place where they would feel calm and relaxed. (Ansbacher, 2013) Studies have been executed to test the theories of indoor plants and its effects. Stressed users presented with natural elements exhibited faster recovery in comparison to those who were exposed to urban elements. (Ulrich, 1991) It clearly shows that incorporating natural elements in a built environment can evoke stress reducing, mood enhancing, and restorative properties.

Quality of indoor air can be greatly improved with the incorporation of natural elements. Plants have the ability to clean the air due to their process of photosynthesis; it can help reduce the levels of carbon dioxide. During the process of photosynthesis, plants remove carbon dioxide from the air and replaces it with oxygen. The capacity of this process is determined by the size of plants, its position in the space, and amount of daylight. It is difficult to precisely calculate the amount of carbon dioxide that plants remove due to many different factors. However, it is estimated that it can help minimize the amount by a fifth. (Freeman 2008) This can cause a significant difference especially in spaces that have a lot of electronics that give off air pollutants.

Case Studies

Biophilia has been very impactful in the design world. Several different built environments that consisted of biophilic design were looked at, historical and contemporary. These case studies exhibits not only the history of plants in built environments but also the myriad of possibilities for utilizing plants in the built environment and biophilic design. Some built environments emphasized certain beneficial characteristics that plants provide; by doing so they are taking full advantage of the mental health as well as environmental benefits they provide. Some even utilized plants purely because they knew it would be “an easy sell” (Logan).

Darwin D. Martin House
Buffalo, NY
Frank Lloyd Wright
1905

The Naman Spa Da Nang, Vietnam MIA Design Studio 2015	
Pasona Urban Farm Tokyo, Japan Kono Designs 2010	
Tables for a Restaurant Junya Ishigami Yamaguchi, Japan 2008	

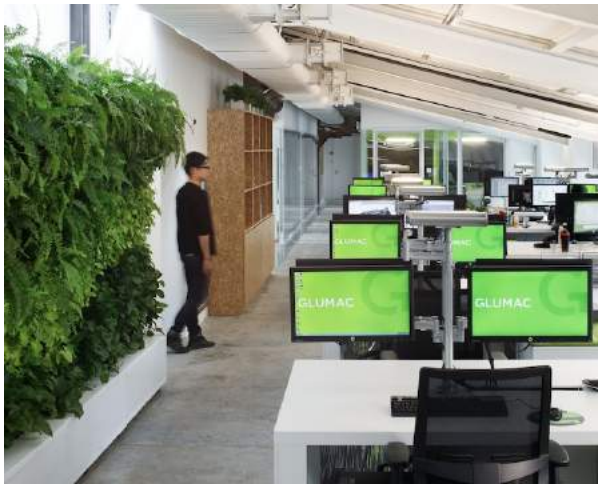
Park Royal
Pickering, Singapore
WOHA
2013

Caixa Forum, Madrid
Patrick Blanc
2007

Paley Park
New York, New York
Zion and Breen
1967

Elizabeth Street Garden
New York, New York
2013

The Highline
New York, New York
Field Operations and Diller Scofidio + Renfro
Garden Design by Piet Oudolf
2009

Glumac - Shanghai Office Shanghai, China Gensler 2014	
641 Avenue of the Americas *New York, New York* *Cook + Fox Architects* *2006*	
Kickstarter Headquarters *New York, New York* *Ole Sondresen Architects* *2014*	

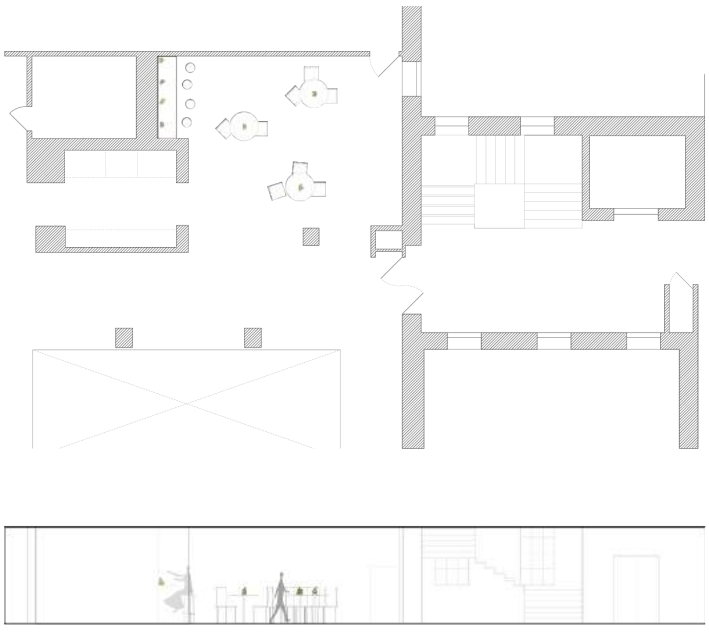
III Methodology

Questioning Engagement

The goals of this research is so understand the significance of implementing a tactile stimulating element, wheatgrass, within an interior built environment. The results of this research will contribute to possible improvements to the space and also assist in the development of an installation design. An incremental intervention will be executed at the second floor student lounge located within Hayes Hall to test the validity of the research. It is an ideal location due to space's manageable foot traffic, accessibility, and access to daylight. It is possible to conduct the intervention in another building such as Crosby Hall; however Hayes Hall's facility manager has realistic restrictions that one should familiarize oneself with.

Little 2' wde pots of wheatgrass will be placed within the space in stages. Every few days the quantity of the pots will either decrease or increase, and the configuration may change depending on how occupants respond to them. These fitting trials will help resolve several different research questions that will be asked and tested during this intervention.

- How many plants are needed to engage the occupant to the space?
- How close do the plants have to be to the occupants to encourage tactile engagement?
- Will an elaborate amount of plants encourage occupants to abduct some for themselves?
- Will the presence of plants invite other occupants to bring more or other plants?
- Does the configuration of the plants matter?
- Will occupants initiate tactile involvement if there are more plants or less?
- If given the opportunity to, would occupants tend to the plants? Or cut them?



How To: Watch People

There are many ways in which the results could be observed; controlled, natural, or participatory. In this thesis, the interventions will be under participatory observation, to a certain extent. It is a field based approach, which allows the observer to have slight control of the elements that are being measured. The site is being manipulated by the implementation of plants, but no further manipulation will be done. The observations will be execute by me personally as well as through photo documentation. User's engagement with the horticulture will be acknowledged by checking off certain categories on a matrix. Different questions would produce different configurations/quantity of plants, which would also evoke different levels of involvement; this includes ignoring, looking, touching, tending, and abducting. The frequency of involvement will be observed as well.

By studying the natural and spontaneous behaviors and not being completely intrusive on the users, it decreases the chances of The Hawthorne Effect[1]. Considering the ecological validity, it is preferable to be as unobtrusive as possible. Observing the spontaneity of the behaviors may also uncover new attributes of horticulture engagement. It will bring attention to users' mannerisms and habits within the space. However, there are a few restrictions to this method; the variables can be very arbitrary and there is a lack of ability to define the demographic of the users.

Interviews will also be conducted when the intervention is finished. The interviews will be able to help fill in the data that observation couldn't obtain. Occupants that had high and low frequency of engagement will be questioned. The aim of the interviews is to get a deeper understanding of what the occupants think about having plants in the space.

Constructing the Matrix

Before any observation can be done on users' engagement with horticulture, observations on how the users utilize and engage within the second floor student lounge is needed first. This is to help develop a base to compare with when the plant observations are executed. Different aspects of the user's behaviors within the space are observed; such as their sex, or what sort of activity they are performing. Some could be doing homework and some could just be using the space to talk to their peers. Other aspects of the users are recognized as well, such as if the user is listening to music, eating/drinking anything, using their laptop, reading, if they are alone, or if they moved any furniture. Conducting this preliminary observation can help determine the time ranges for the prospective plant intervention observations as well as a behavior base to compare and contrast to.

[1] The Hawthorne Effect is the alteration of one's behavior due to their awareness of being observed.

With the intervention, behaviors and the different levels of engagement that users have with the plants will be observed. Incorporating a tactile friendly plant, in this case is wheatgrass, is much more playful and inviting to people in comparison to cacti or aloe. This can encourage users to play[2], trim or move the plants to be closer to them. These interactions can kindle several variables. How long does the user play with the plant? How often? Did the user move the plant closer to them? Did they chose a seat closer to a plant? Displaying these intimate tactile engagements would provide better insight for each hypotheses, possibly expose some patterns / trends in people's engagement habits.

The Friendly Plant

There are many species of plants that are available for use, unfortunately, not all could be incorporated into interior built environments. From the plethora of plants that nature offers to us, it has been narrowed down to certain plants that are low maintenance. This means that some would require less sunlight or minimal watering. Due to their resilience, it can be easily manageable in interior built environments and would need very little attention. The various plants were compared and contrasted for their physical characteristics, different areas of maintenance, environmental benefits, as well as any additional advantages it may provide. With this in mind, wheatgrass was chosen for this study due to its additional health benefits[3], rapid growth rate and soft texture. The characteristics of wheatgrass is very inviting. Due to its soft fractal quality, it can be very intriguing and enriching for people to touch. (Salingaros, 11-28)

Plant Characteristics						
Plants	*size*	*filters air*	*light requirement*	*requires low maintenance*	*soft to the touch*	*additional uses?*
Areca Palm	L	x	medium to bright indirect	x	x	
Lady Palm	L	x	medium to bright indirect	x	x	
Bamboo Palm	L	x	direct sun	x		
Rubber Plant	L	x	medium to low light	x		
English Ivy	S - M	x	bright indirect	x		
Boston Fern	M	x	medium indirect	x		
Peace Lily	M	x	medium to low light	x		
Aloe Vera	S - M	x	medium indirect light	x		medicinal
Spider Plant	M	x	bright indirect	x	x	
Snake Plant	M	x	medium to low light	x		

[2] engage in activity for enjoyment and recreation rather than a serious or practical purpose

[3] The nutritional values of wheatgrass can be beneficial for both humans and pets. It provides an ample amount of fiber (which can help digestion and maintaining weight), energy, aid in detox, and helps improve blood flow.

Wheatgrass	M	x	medium to low light	x	x	nutritional benefits
Philodendron	M	x	medium indirect	x		
Devils Ivy	M	x	bright indirect	x		

The cultivation of wheatgrass was tested to see if it can be grown in the given environment, Buffalo, NY. Preparing the seeds for germination took 12 hours, and sprouting initiated a day later. By covering the soil with plastic wrap, it replicated a greenhouse effect. Because of this, evidence of growth showed in two days. In a week, the wheatgrass was about 3 ½" tall.

Introducing the Planters

The fabrication of the planters is fairly straightforward. It requires paper tubes cut at 3" high, cups, soil, and seeds. The paper tubes can be modified to be standing planters as well as tabletop planters. Considering the tube's material qualities it is very easy to manipulate them to the different variations needed for the iterations. The paper tube's shape also allows for users to easily grab them to move them if wanted. Capping the top of the paper tubes would be the cups containing the soil and wheatgrass. For anyone who seeks to enrich or activate the tactile senses within a built environment, it can be rather convenient considering the commonality of the objects used.

Intent

The main intention for this research and experiment is to discover the potential of enriching our tactile senses in interior built environments with plants. The information gathered through literature of biophilia, multisensory, built environments, and experiments can be utilized in multiple ways. It can inform researchers and designers the benefits or even the negatives of implementing plants as a purposeful architectural element in built environments to enrich the tactile senses. It can also be used to inform design recommendations for planters that are specifically designed to engage users in built environments.

The experiment's purpose is to provide information on how occupants involve themselves in the space to better develop a prospective installation that will be executed in the same space. Forming a valid base would be very beneficial for a successful installation. It can be based off of frequency of involvement, the reconfiguration, or even the abductions. The formulation of the installation is not restricted to only the information provided from the research.

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