

I Abstract

Many people now typically spend a portion of their day in detached and dispassionate built environments. Such environments can produce mental stress, restlessness, and dissatisfaction. Static facilities that harbor such routines should accommodate to the occupants' needs. Many of these built environments tend to ignore our inbuilt human need for sensory variety, but many spaces are typically designed to solely be visually appealing, ignoring the other senses. 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.

Considering this, shouldn't it be critical to design a multisensory space that harmonizes with the occupants, an affectionate, sensory sympathetic space? Perception of our environment is always mediated by our senses. A simple way to engage the senses is the use of indoor horticulture; plants activate our sense of smell, touch, hearing, and sight. 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 multisensory 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 facility can encourage social engagement. A series of orchestrated interventions can help reveal the influences and impacts that plants have to enhance sensory experiences in interior public spaces. Proximity, versatility, visual access and exposure define the possibilities and limits of the interventions. Analyzing the engagement that occupants have with these interventions will help to identify and develop design recommendations. These temporal interventions will be executed in the 2nd floor student lounge located within Hayes Hall. It is an ideal location due to the heavy foot traffic, accessibility, and access to daylight. Further, it was intended to provide opportunities for social engagement.

The involvement and experiences that these interventions may cultivate can be far more significant than the shell that happens to house them. Each intervention will generate different qualities of engagement. Some would encourage occupants to tend to the plants while others may encourage occupants to rearrange them. 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.

II Literature Review

Significance of Sensory Relationships

For a while, designers usually create 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. 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. (Pallasmaa 2005)

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 others 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.

Enriching the Senses with Biophilia

The field of biophilia hypothesizes that human beings possess an inherent affection for living systems; whether it be other human beings, animals, or plants. 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)

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 relieve stress from the human body. Its intentions are to produce a "socially catalytic intervention" 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 210) Being a part of a biophilic city sounds like something out of a fairy tale. It may seem impossible to do, but it is gradually getting there, many cities are taking steps towards it. There are many benefits and strategies of how to foster a biophilic city, these recommendations could also be scaled down to better fit for indoor built environments.

A biophilic city can be viewed as a garden, a mediator, between architecture and nature. Usually, gardening has the unfortunate usual connotation of merely a chore which would also pair with back breaking work and soiled knees. Some would view it as a clearing of a space that allows for reflection, for people to become 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.

Plants in the Built Environment

Aside from emotional and social benefits, biophilia also contribute 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

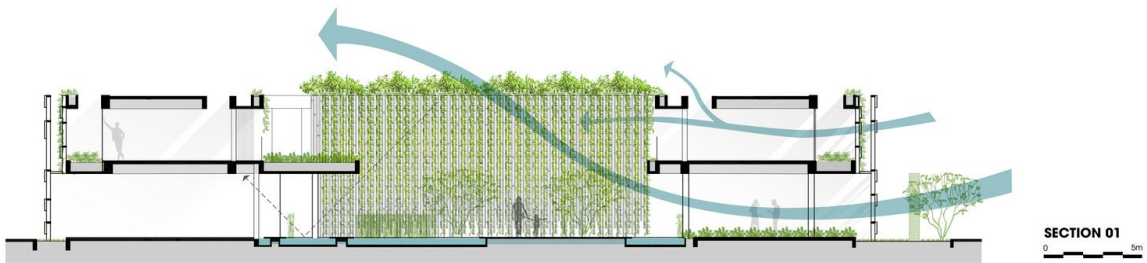
oxygen. The capacity of this process is determined by the size of plants, its position in the space, and amount of daylight. It is difficult to precisely calculate the amount of carbon dioxide that plants remove due to many different factors. However, it is estimated that it can help minimize the amount 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. Some built environments emphasize certain beneficial characteristics that plants provide. These spaces are taking full advantage of the mental health as well as environmental benefits they provide. The Naman Spa located in Da Nang, Vietnam, designed by MIA Design Studio in 2015, engulfs the space with many varieties of greenery to help evoke a space of tranquility. The spa also maintains its cool temperature by utilizing the greenery as a shading device. The Naman Spa exhibits very well the intangible and spiritual well-being greenery can provide. ¹



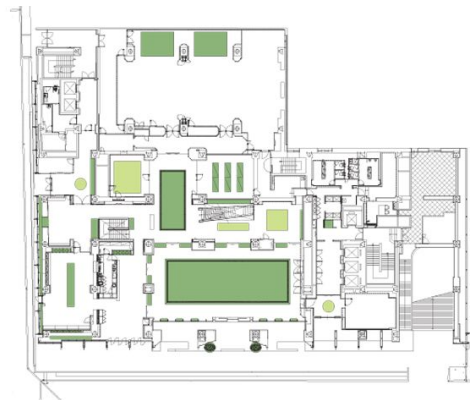
¹ "Naman Spa / MIA Design Studio" 21 Jul 2015. ArchDaily. Accessed 14 Nov 2016.
<<http://www.archdaily.com/770560/naman-spa-mia-design-studio/>>



In Tokyo, Japan, Kono Designs designed Pasona Urban Farm, the recruiting company incorporated an urban farm within their common space which encouraged their employees to propagate their own produce at work. This nine story renovated office building contains 3995 square meters of green space that house various species of plants, fruits, and vegetables. Its intentions are to encourage people to reflect upon their routines and to enlighten people about the improvements that advanced urban agriculture can provide. This improved work environment helps promote efficiency, interaction, as well as sustainability. ²



² Andrews, Kate. "Pasona Urban Farm by Kono Designs" 12 Sept 2013. dezeen. Accessed 14 Nov 2016. <<http://www.dezeen.com/2013/09/12/pasona-urban-farm-by-kono-designs/>>

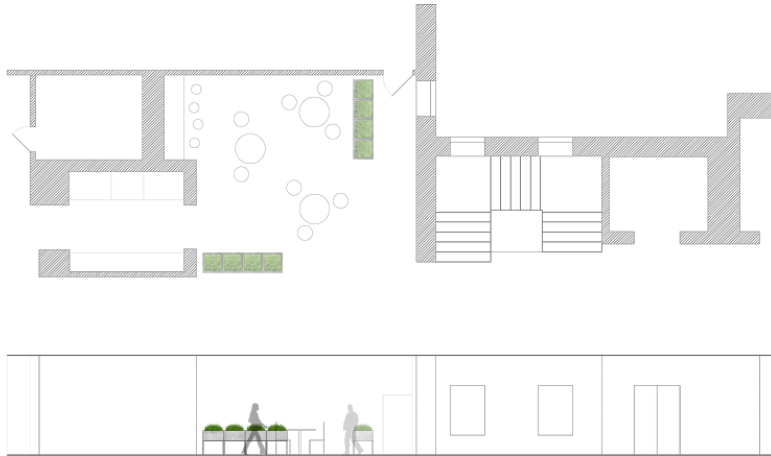


III Methodology

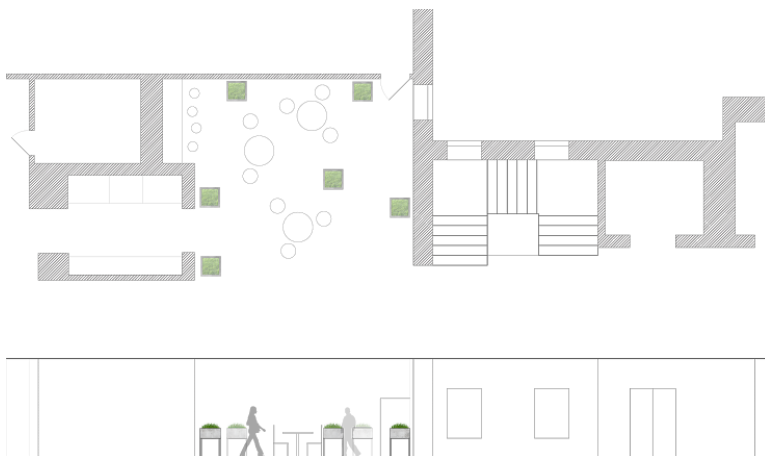
Hypothesizing Engagement

The primary objective of observational studies, such as interventions, is to test and analyze proposed hypotheses. They help test the efficiency and the impact of each hypotheses. The interventions that will be carried out gives users the opportunity to engage with the horticulture; they can tend to them or they can rearrange the planters to their liking. The series of orchestrated interventions are designed with the intention of engagement. Each one is devised accordingly to their hypotheses. The hypotheses proposed tackle different assumptions of engagement from the users:

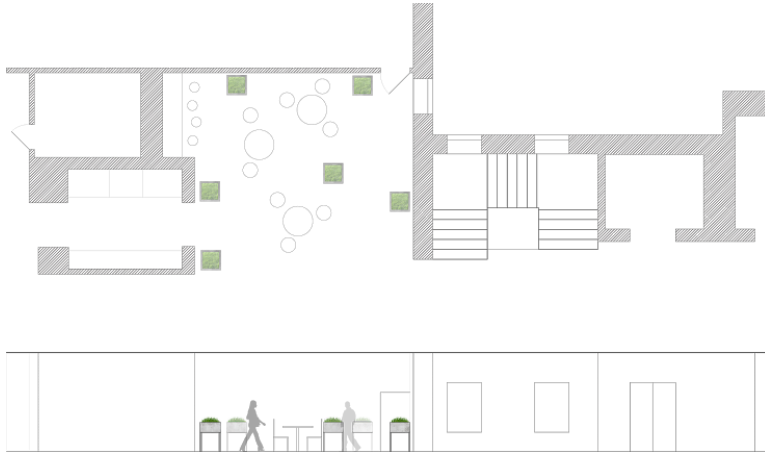
Hypothesis 01_ plants are intrusive and viewed negatively if they disrupt visual access/exposure



Hypothesis 02_ people will adjust their environment to be in closer proximity to natural elements



Hypothesis 03_ people will engage with the plants more if they are in closer proximity



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 naturalistic observation. The main benefits of naturalistic observation is the unobtrusiveness. The environment being studied is in no way manipulated or created by the observer. Ethnographic methods will also be applied to this study. It is a field based approach, which allows the observer to have slight control of the elements that are being measured.

By studying the natural and spontaneous behaviors and not being intrusive on the users, it decreases the chances of The Hawthorne Effect. The Hawthorne Effect is the alteration of one's behavior due to their awareness of being observed. 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.

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 of a matrix. (Engagement implies acknowledgement of the horticulture by the users; this ranges from ignoring to stroking the plants to abducting the plants as a whole) As the interventions would get closer in proximity to the user's it may prompt an increase in the level of involvement.

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.

With the different interventions, behaviors and the different levels of engagement that users have with the plants will be observed. Incorporating a tactile friendly plant, in this case will be wheatgrass, is much more playful and inviting to people in comparison to cacti or aloe. This can encourage users to play³, 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 benefits⁴, 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	soft to the	additional

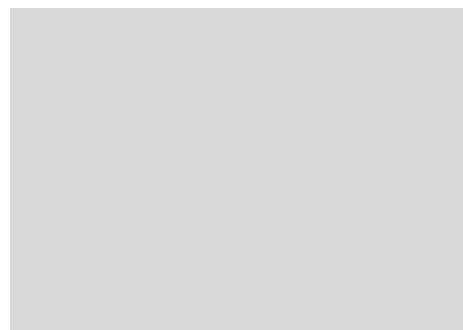
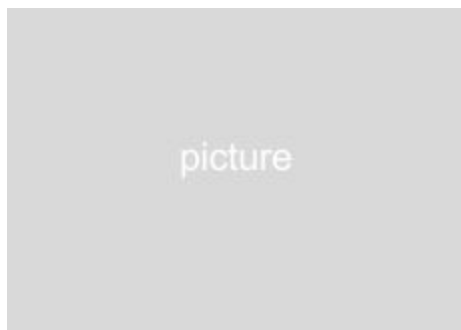
³ engage in activity for enjoyment and recreation rather than a serious or practical purpose

⁴ 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.

				<i>maintenance</i>	<i>touch</i>	<i>uses?</i>
<i>Areca Palm</i>	L	x	medium to bright indirect	x	x	
<i>Lady Palm</i>	L	x	medium to bright indirect	x	x	
<i>Bamboo Palm</i>	L	x	direct sun	x		
<i>Rubber Plant</i>	L	x	medium to low light	x		
<i>English Ivy</i>	S - M	x	bright indirect	x		
<i>Boston Fern</i>	M	x	medium indirect	x		
<i>Peace Lily</i>	M	x	medium to low light	x		
<i>Aloe Vera</i>	S - M	x	medium indirect light	x		medicinal
<i>Spider Plant</i>	M	x	bright indirect	x	x	
<i>Snake Plant</i>	M	x	medium to low light	x		
<i>Wheatgrass</i>	M	x	medium to low light	x	x	nutritional benefits
<i>Philodendron</i>	M	x	medium indirect	x		
<i>Devils Ivy</i>	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.

[Insert timeline of grass growth?]



Introducing the Planters

The fabrication of the planters is fairly straightforward. It requires a paper tube, air pillows, concrete zipties, cups, soil, and seeds. Aside from the necessary elements needed to cultivate the wheat grass, the other materials can be usually found or easily accessible within the facility. The paper tubes will be modified to be standing planters as well as table top planters. Considering the tube's material qualities it is very easy to manipulate them to the different variations needed for the iterations. The planters will be slightly filled with concrete to give them a sturdier base, making them less likely to tip over. Above the concrete foundation would be filled with reused air pillows, shipping cushions usually used to secure product shipments. Capping the top of the planter would be the cup containing the 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.

Level of Involvement

The different iterations can evoke different levels of involvement. Bearing in mind how the iterations control the proximity of the wheatgrass to the users, it has the ability to stimulate behaviors that are different from the base observations.

Interviews

Interviews from the different categories of behaviors will be conducted after the iterations have been executed. Acquiring personal reactions to the iterations can provide deeper insight to its success or failure.

[interview questions to be made]

IV Intent

From the data gathered, I intend to ...

Introduce the overall methodological approach for investigating your research problem. Is your study qualitative or quantitative or a combination of both (mixed method)? Are you going to take a special approach, such as action research, or a more neutral stance?

- Indicate how the approach fits the overall research design. Your methods should have a clear connection with your research problem. In other words, make sure that your methods will actually address the problem. One of the most common deficiencies found in research papers is that the proposed methodology is not suitable to achieving the stated objective of your paper.
- Describe the specific methods of data collection you are going to use, such as, surveys, interviews, questionnaires, observation, archival research. If you are analyzing existing data, such as a data set or archival documents, describe how it was originally created or gathered and by whom.
- Explain how you intend to analyze your results. Will you use statistical analysis? Will you use specific theoretical perspectives to help you analyze a text or explain observed behaviors? Describe how you plan to obtain an accurate assessment of relationships, patterns, trends, distributions, and possible contradictions found in the data.
- Provide background and a rationale for methodologies that are unfamiliar for your readers. Very often in the social sciences, research problems and the methods for investigating them require more explanation/rationale than widely accepted rules governing the natural and physical sciences. Be clear and concise in your explanation.
- Provide a justification for subject selection and sampling procedure. For instance, if you propose to conduct interviews, how do you intend to select the sample population? If you are analyzing texts, which texts have you chosen, and why? If you are using statistics, why is this set of statistics being used? If other data sources exist, explain why the data you chose is most appropriate to addressing the research problem.
- Describe potential limitations. Are there any practical limitations that could affect your data collection? How will you attempt to control for potential confounding variables and errors? If your methodology may lead to problems you can anticipate, state this openly and show why pursuing this methodology outweighs the risk of these problems cropping up.

- Interventions (Why interventions)
 - To calibrate/measure

- Interventions have been utilized in many
- What precedents I am looking at
 - Any precedents that involve interventions
- What are my own planned interventions?
 - Sq footage of plants
 - What kind of plants? Indoor and why?
 - Passively - to not intrude with results
- Research design
 - Research questions
 - Hypotheses
 - Research methods
- Observations
 - Frequency of use
 - Duration of use
 - Satisfaction of use

V Bibliography that isnt in EndNote

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