UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Plants Promoting Happiness: Plants as a Mechanism for Sustainable Behaviours

Within The Centre for Interactive Research on Sustainability (CIRS)

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PSYC 321

Wellbeing, Buildings

April 5, 2018

Executive Summary

The Centre for Interactive Research on Sustainability (CIRS) at the University of British Columbia was designed for the purpose of sustainability. Previous studies have indicated that the CIRS promotes an increase in sustainable behaviour amongst the people who make use of it (Wu et al, 2013). This study asked if the obvious presence of plants act as a priming mechanism to increase recycling behaviours of the individuals who recycle within the CIRS building. The sustainable behaviours of the individuals who make use of the building were observed over the course of three weeks. In the first week no plants were introduced in the lobby. In the second, nine plants were placed in and around the CIRS lobby, and in the third all the plants were removed. Sorting accuracy was observed throughout each condition and mean sorting accuracies were compared. No statistical significant difference was found between the conditions. Anecdotal evidence from people within the CIRS building shows that the plants still had a positive effect on the people who make use of the building.

Introduction

In the present study, the question of whether the presence of plants can act as a priming mechanism for sustainable behaviours is investigated. Plants are known to have a variety of health and psychological benefits on humans (Chang & Chen, 2005). For example, research suggests that plants may have an effect on the reduction of nervousness and anxiety in a work environment (Chang, 2005). Similarly, adding plants to a windowless work environment has shown to boost individual's productivity and reduce (Lohr et al, 1996). Self-report statements from the same study showed individual's "feel more attentive" when plants are present, compared those in a room with no plants (Lohr et al, 1996). Additionally, previous literature by Bernman (2008) and Nisbet (2011) show the clear psychological benefits of interacting with nature by "improving directed attention - the ability to resolve conflict, to suppress distracting stimulation." If plants can have significant psychological, and physiological effects on humans, it stands to reason that other aspects of our behaviour may also be affected. The following study conducted at the Center for Interactive Research on Sustainability (CIRS) at the University of British Columbia focuses on the effect the presence of plants may have on sustainable behaviour, as measured by sorting accuracy.

The current study attempts to demonstrate that plants increase sorting accuracy through the psychological mechanisms of nature relatedness and directed attention. Nature relatedness describes individual levels of connectedness with the natural world (Nisbet, 2009). Previous research suggests that nature relatedness correlates with environmental concerns and behaviours, but not strongly enough to explain the relationship between nature and behaviours. Therefore, the hypothesis of the current study is that the sustainable behaviours, as measured by sorting accuracy, will improve after the introduction of plants.

A similar study looking at pro-environmental behaviour hypothesized sustainable buildings promote sustainable behaviour. They compared sustainable behaviours in both non-sustainable buildings (UBC Student Union Building) and sustainable buildings (CIRS). Their findings showed that people were significantly more likely to correctly chose the proper disposal bin when inside a building designed with sustainability in mind (Wu, 2013). While patrons in this study are more "cognizant and deliberate about their bin of choice" (Wu, 2013) the psychological mechanisms at play are not specified, not investigated. The current study is interested in exploring what encourages individuals to improve their recycling behaviour within the CIRS building of UBC.

Additional research finds that sustainable attitudes and behaviours increased over time when more opportunities were presented. Specifically, recyclers who had a good "motive" for recycling (such as concern for conservation), would more often recycle than non-recyclers who viewed recycling to have "inconveniences", ergo would pass on recycling opportunities. Recycling behaviours in individuals are more influenced by elements aside from personal convenience. This is relevant to our study, because if plants really are a priming mechanism for increased sustainable behaviour, it would indicate that the presence of plants are increasing sustainable behaviours even in individuals who perceive recycling as "inconvenient", perhaps by increasing their motivation.

Mason (2006) found that self-reported attitudes towards sustainability were related to self-reported recycling behaviours. In contrast, Ahmad (2014) found that time commitment is a determining factor on whether or not an individual is willing to recycle or not. This implies that due to our priorities, our behaviours are not always a part of our thinking when restricted for time. This current study, on the introduction of plants as a priming mechanism, investigates if

plants can impact an individual's directed attention of sustainability. By introducing plants to areas that are connected to recycling attitudes, it may be the case that individuals will be reminded of the importance of sustainable attitudes and will subsequently improve their sustainable behaviours (i.e. sort accurately).

Participants

328 participants were observed. Convenience sampling was used, as all of the participants were those already using the CIRS building. The participants were those who threw out at least one item into the 'Sort-It-Out' bins on the first floor of the CIRS building. There is a chance that many of those participants were observed more than once; either coming in and out of class or the workers who used the sorting bins multiple times a day.

None of the participants were informed that they were being observed in this study and their identities remain anonymous. Because CIRS is located on the university campus, it is relatively safe to assume that the majority of those recorded were students, as indicated by their propensity to carry a backpack, laptop or go to class. The participants were not primed or debriefed after the study.

Conditions

Three conditions were used in the study, with one week allocated to each condition. In the first week of observations (t1), the lobby of CIRS remained plant free and unchanged, and served as the baseline condition (no manipulation of any variables). In the second week of observations (t2), nine plants were purchased and placed on and around the 'Sort-It-Out' bins, as well as the stairs, the windows, and study areas (Figures 1-3). This was our plant condition. The recycling and trash bins were separated into 4 categories- Food Scraps, Recyclable Containers, Paper, and Garbage, with descriptions and pictures of what types of objects belonged in each category (Figure 4). The third week of observations was used as a second no plant condition. All of the plants added during the plant condition were removed. This was used as a post treatment condition, used to observe if a regression to baseline sorting accuracies would occur.

Measures

The independent variable is the presence of plants in the first floor. The dependent variable is sorting accuracy. This study operationalizes sorting accuracy as the number of correct items sorted, divided by the total number of items sorted. For example, if a participant was disposing a coffee cup, the total number of tosses would be 3 - the lid, the thermal cover, and the cup itself. If one of these items was sorted incorrectly, the participant would score ⅔ (66.66%) accuracy. Because each participant could throw a different amount of items into the bins (i.e 30 pieces of recyclable paper into the trash = 0%), sorting accuracy per day was determined dividing the number of all of correct throws per day by the total number of throws into all of the sorting bins per day. This study uses the Sort-it-out guide provided by UBC sustainability (Figure 5) and a member of the UBC sustainability program was consulted for sorting questions.

Procedure

Due to the inability to ensure unique participants without the ability to randomly assign participants to specific conditions, this study is a quasi-experimental within groups design. For an hour every day of the working week (Monday to Friday) for three weeks, between the hours of 11am-3pm, sorting accuracy was observed. This was done by watching every item thrown into

the sort-it-out bins and referring to the UBC sustainable guide for accuracy reference (Figure 5). In order to precisely observe the participants sorting accuracy, two researchers (ensuring interrater reliability) sat across from the bins, and watched and recorded every item that was thrown away. Researchers remained inconspicuous, disguised as university students, in order to not influence participant's recycling behaviours (Figure 6).

The total number of items thrown out were counted, and then the number of correctly recycled items was recorded onto a pre-made spreadsheet (Figure 7). Each participant was labelled with a number (1 for the first participant, 2 for the second participant, ect.) and the total number of participants each day was recorded.

The accuracies for each day were compared between researchers at the end of each one-hour session to ensure the same behavioural data was observed ensuring interrater reliability. Sorting accuracy was observed the same way each day, for all three conditions. Mean sorting accuracies were determined per day and per condition.

Results

Sorting accuracy of each day was determined by dividing correct number of tosses by total number of tosses. Total mean sorting accuracy of each condition was determined by dividing the sum of the mean accuracies per day and dividing by the number of days per condition (5 days). Mean sorting accuracy per condition was determined for baseline, no plant, condition (M_{t1} = 77.99%, SD = 0.049), plant introduction condition (M_{t2} = 83.18%, SD = 0.049), and plant removal condition (M_{t3} = 74.61%, SD = 0.069) (Figure 8).

A single factor analysis of variance revealed there was no statistically significant effect of plant presence on sorting accuracy, $F(2,12) = 2.94$, $p = 0.09$. Additionally, an analysis of variance, post hoc tukey analysis revealed no statistically significant difference of the mean sorting accuracy between the baseline (t_1) and plant introduction (t_2) conditions ($p = 0.35$) or between the plant introduction (t2) and plant removal (t_3) conditions ($p = 0.61$). However, there was a marginally significant difference between the means of no plant baseline condition and no plant removal, conditions ($p = 0.07$) at the $p < 0.1$ level.

Discussion

Data analysis revealed that the difference between sorting accuracies was insignificant. Therefore, the hypothesis is not supported. The presence of plants did not have an effect on the sustainable behaviours of the people in the CIRS building. This study aimed to complement the research conducted by Wu et al., which investigated how a pro-environmental building may promote pro-environmental behaviours by looking at food disposal. They looked at the sustainable behaviours of individuals in two different buildings, the CIRS which has a reputation of being pro-environment, and the student union building, which is a center for students to gather in (Wu, 2013). Instead, this study aimed at identifying plants as the mechanism of sustainability in the CIRS. This might explain how the results were contradictory from those of Wu et al's as plants may not be the mechanism that induces sustainable behaviours, or they might be the mechanism, but their presence may not have been enough to induce sustainable behaviours. Research by Bernman et al. indicates that interactions with nature improve attention and memory (Bernman, 2008). This may serve as one of the mechanisms of plants that improve sustainable behaviours in this study as after interacting with the plants in the CIRS lobby, once a participant goes to recycle an item, they are more attentive, and would therefore pay more attention to how

they recycle, especially as four plants were placed on and around the ‘Sort-It-Out’ bins. The plants used in this experiment were obvious, they stood out in the space as they were very colourful and leafy. These qualities hopefully made participants aware of their presence, and expectantly be more inclined to pay attention to their sustainable behaviours.

There are several limitations to this study which may have had an impact on the findings. One confound to this experiment was that there was an art installation of wood panels and sounds that was present in the lobby during the first week of data collection. In the third week of data collection (plant removal condition), another study was implemented in the lobby. Three more plants were added to the CIRS after the plants from this study were removed, potentially confounding the data. These two confounds are hypothesized to result in higher sorting accuracy during no plant conditions, thus reducing the mean differences between these weeks and the plant introduction week.

Furthermore, there are limitations in the way which the data was collected, as all of the experimenters were students, data was only able to be collected for one hour each day. Which is not enough time to collect sufficient data. This may have resulted in gaps in the data, as the majority of sustainable behaviours were unable to be observed. However, to combat this issue data recording occurred at the same time for each corresponding day, as an attempt to sample from roughly the same group of individuals. Another limiting factor is that the CIRS building is built with sustainability in mind. Because of its reputation, there may have been a ceiling effect in the sorting accuracy within the participants of the study.

Future studies should investigate the minimum number of plants needed to influence an individual’s sustainable behaviours. As this study only introduced nine plants into the CIRS, one way the number of plants needed to have a beneficial effect could be determined would be through implementing multiple treatment conditions of this study. Starting with one plant, then adding singular plants steadily over time to see when there is a significant change in sustainable behaviours would be an example design. Once the minimum number of plants needed is determined, it can then be used to aid in the sustainable endeavors of other buildings.

In the same vein, a similar study could be conducted to see what kinds of plants may have an impact on sustainable behaviours, this study only introduced leafy, tropical plants. However, different kinds of plants could be introduced into the CIRS during different weeks to see which ones have a greater effect on sustainable behaviours. As the CIRS may have had a ceiling effect on the sustainable behaviours of the participants in this study, it might prove useful to implement this study in another, less sustainable building to see if plants really do have an impact of the sustainable behaviours.

Additionally, implementing an improved version of this study within the CIRS, with more control over the confounds and participants, more time to record data, and with a larger sample could prove useful. Finally, it may be beneficial to interview the people who work and make use of the CIRS daily to see what they believe makes CIRS a sustainable building, to discover possible mechanisms for sustainable behaviours. Subsequently, implement a study similar to one, and the study conducted by Wu et al. investigating these potential mechanisms, and see if they have an effect on sustainable behaviours. Additional studies should investigate directed attention and nature relatedness separately as mechanisms for sustainable behaviours; as this study failed to do so. For example, placing plants only on the bins, for directed attention, or only in gathering areas, for nature relatedness.

Implications

While the introduction of plants into CIRS as a mechanism of sustainable behaviours has not been fully supported by the data, there were numerous comments about how much the people in CIRS enjoyed the plants. It was communicated to the researchers that the people in CIRS felt as if the plants brightened up the space, people were taking the liberty to care after the plants, and Tim, the building manager spoke to the researchers about how the plants had a positive effect on the people in the building. Furthermore, past research has indicated that plants are known to have psychological and health benefits for humans, such as anxiety reduction in the work environment (Chang & Chen, 2005). Therefore, it makes sense to keep the plants within the CIRS building, as there are indications that the people who spend most of their time there feel as if the plants have had a beneficial impact on them, and it is even backed up by research. Furthermore, introducing plants into buildings designed without sustainability in mind, may have an impact on the psychological health of the people who make use of that building daily, if not their sustainable behaviours, as it is clear from the feedback from the individuals in the CIRS people do not seem to mind the intervention of plants into their spaces.

Additionally, if the hypothesis was supported a hypothetical implication of this research would be that introducing plants into a building that was not designed with sustainability in mind could act as a mechanism of sustainable behaviours and have a positive impact on the sorting accuracy of people who make use of these spaces. If that were to be the case, then this could be a way to decrease the carbon footprint of many buildings in a relatively cheap way. As these buildings would not need to be altered in any serious structural ways that costs time and money. Moreover, there might be another mechanism of sustainability at play within the CIRS building that was not accounted for within this study. This mechanism might have a greater effect on sustainable behaviours than plants may have.

Appendix

Figure 1.

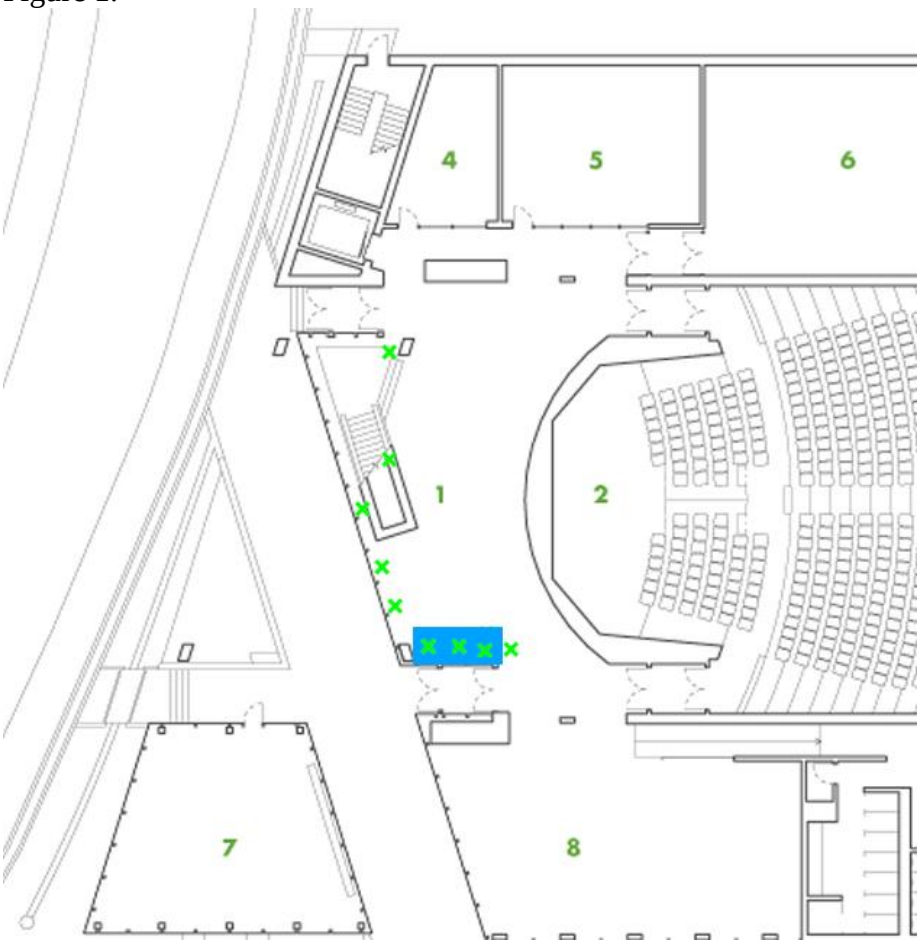


Figure 2.

Figure 3.

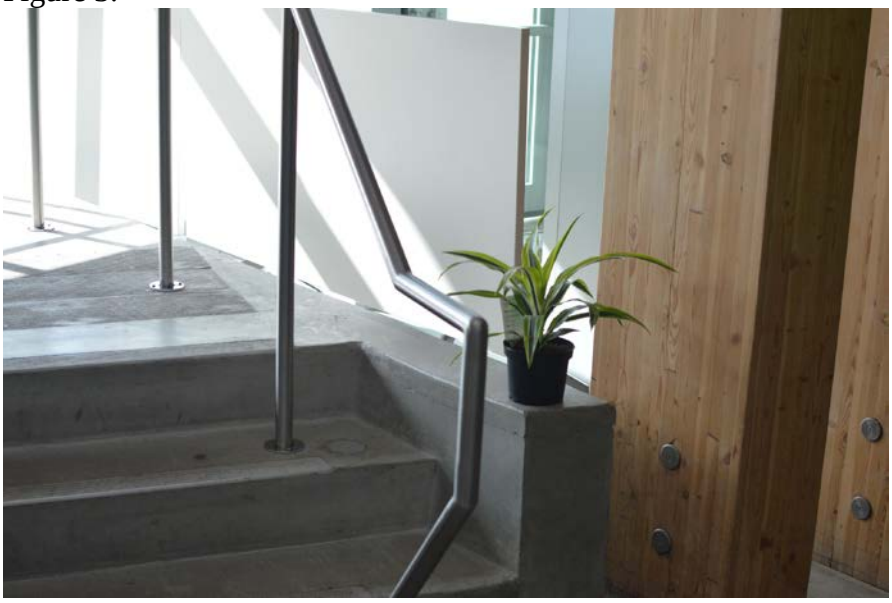


Figure 4.

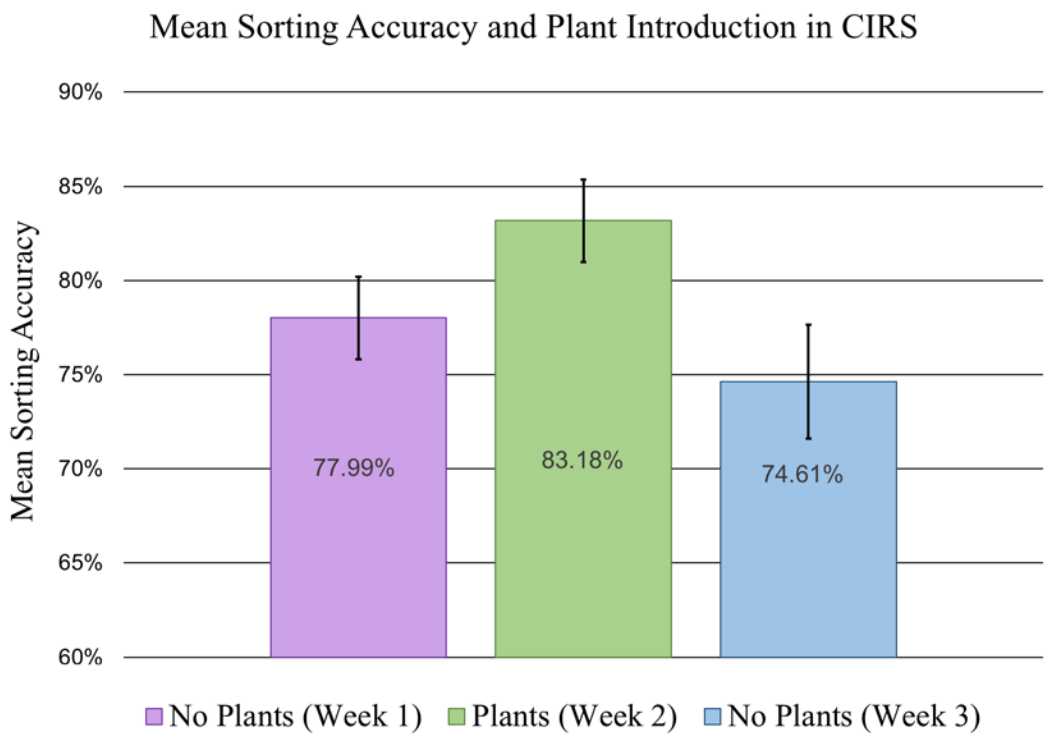
Figure 5.

Figure 6.

Figure 7.

Throws	Correct Recycled	Total Recycled	Accuracy (% correct)	Total Accuracy/Day		participants
1	1	1	100	0.823529412	<- = SUM B/C	12
2	1	1	100			
3	1	1	100			
4	0	1	0			
5	1	1	100			
6	1	1	100			
7	0	1	0			
8	1	1	100			
9	1	1	100			
10	1	1	100			
11	1	1	100			
12	1	1	100			
13	0	1	0			
14	1	1	100			
15	1	1	100			
16	1	1	100			
17	1	1	100			
18						
19						

Figure 8.



Error bars for Figure 8 represent standard error of the mean.
For weeks 1, 2 and 3 SEM ± 0.021, 0.021, 0.030 respectively.

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