Plants Promoting Happiness: The Affective Influences of Plants on Human Emotion

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Executive Summary

Biophilia is the phenomenon that human interaction with nature can increase their positive affect. In an ever-growing world of urbanization that is dominated by man-made structures, greenery and natural elements are slowly being erased from our visual canvas. The present study sought to discover whether adding plants to the floor of an urban building, specifically the CIRS building in UBC, can arouse the effects of biophilia and increase feelings of happiness and decrease feelings of sadness within the building's patrons. Participants of the study were asked to fill out a Scale of Positive and Negative Experience (SPANE) survey under the control condition, where no plants were introduced to the interior of the building, and the plant condition, where we introduced plants to a floor of the building. The results indicated that the introduction of plants into the CIRS building did little to nothing to increase their feelings of happiness or to decrease their feelings of sadness, a finding that is inconsistent with the biophilia phenomenon and to previous research that studied its effects.

Introduction

Imagine if there is a way to increase people's positive feelings and decrease their negative feelings using materials that can be found just about anywhere you searched. Biophilia is the phenomenon that human interaction with nature can do just that (Grinde & Patil, 2009). This phenomenon is backed up by past research that has consistently shown that people within a natural setting increases their positive affect and decreases their negative affect when compared to people in man-made settings (Nisbet & Zelenski, 2011). The effects of biophilia extend to personal health, where hospital rooms with plants are found to reduce self-reported stress and to induce pain-relief. (Lohr & Pearson-Mims, 2000; Dijkstra, Pieterse, & Pruyn, 2008). Past research findings therefore suggest that individuals in urban areas have a higher chance of experiencing signs of depression or displaying anxiety due to the high pressure of society and the crowded environment, a problem that is further aggravated by the lack of plants and greenery. (Grinde & Patil, 2009). The present study looked to discover whether the introduction of plants into urban areas can ameliorate the problem of reduced positive affect and increased negative affect due to the urban environment. Specifically, this experiment looked for biophilic effects in the Centre for Interactive Research on Sustainability (CIRS) building located in the University of British Columbia, using a between-subjects design to compare the change in self-reported positive and negative feelings between individuals near plants and those who are not.

Research Question and Hypothesis

The experiment was designed to explore our research question of "Will an urban environment with the presence of plants and greenery increase positive affect and decrease negative affect in students, faculty, CIRS staff, and non-UBC affiliated visitors?" We hypothesized that participants in the plant condition would report higher positive affect and lower negative affect than participants in the no plant condition, who would report lower positive affect and higher negative affect than participants in the plant condition.

Methods

Participants
The participants (*n*) for this experiment were 102 patrons of the CIRS building. 86 identified as UBC students, 12 as CIRS staff members, 3 as non-UBC affiliated visitors, and 1 as a faculty member of UBC.

Conditions
Participants were divided into two groups based on two conditions. The first condition is the plant condition, located on the first floor with a total of 9 plants, fully covering a 5 meter radius of all the seating areas; three plants were placed on the recycling bins, three around the seating area underneath the stairs, and three near the entrances of the CIRS building. The second condition was the no plant condition, located on the second, third and fourth floors of the CIRS building, where there were no plants.

Measures
Participants' mood was recorded through the Scale of Positive and Negative Experience (SPANE) test, a twelve item self-report questionnaire that includes six items to assess positive feelings and six items to assess negative feelings, each on a scale of 1 (very rarely or never) to 5 (very often or always). The instructions on the survey asked the following question: "Please think about what you have been doing and experiencing during the past four weeks. Then report how much you experienced each of the following feelings, using the scale below. For each item, select a number from 1 to 5, and indicate that number on your response sheet."The positive items consisted of the following: Positive, Good, Pleasant, Happy, Joyful and Contented. The negative items consisted of the following: Negative, Bad, Unpleasant, Sad, Afraid and Angry. The items were measured separately in order to obtain a score indicating positive affect and a score indicating negative affect. The SPANE-P consists of adding the scores, varying from 1 to 5, for the six positive affect terms, with the total score varying from 6 (lowest positive feelings score) to 30 (highest positive feelings score). The SPANE-N consists of adding the scores, varying from 1 to 5, for the six negative affect terms, with the total score varying from 6 (lowest negative feelings score) to 30 (highest negative feelings score). After completing the SPANE part of the survey, participants were asked to indicate the floor of the CIRS building that they were on and whether or not they perceived plants to be around them. Thus, the independent variable for the study was the presence of plants, and the dependent variable was the participant's scores of positive and negative affect on the self reported survey we administered.

Procedure
The survey was given out in person on Google Forms using smartphones and laptops. The survey was administered in the CIRS building over a period of three weeks during weekdays in March 2018 (see Appendix A). Participants were approached by the researchers and asked if they would like to participate in the survey. If the participant refused, they were not asked a second time by the researcher. If they agreed, they were given the consent form to read, and after consenting they could continue onto complete the survey.

Results

A total of four independent-samples t-tests were conducted in order to analyze our results. Although we initially only had two conditions, the raw data revealed that some participants in the no plant condition indicated that they did notice plants around them, and some participants in the plant condition indicated that they did not notice plants around them. In order to try and improve the internal validity of the study, we decided to further analyze the data with a different take on the conditions. Thus, for the third and fourth t-tests the two conditions tested were perceived plants and perceived no plants.

The first t-test (see Appendix B, Table 1) was conducted to compare positive feelings in plant and no plant conditions. The assumption of homogeneity of variances was tested and not satisfied via. Levene's F Test, $p = .035$; therefore a two-tailed independent samples t-test based on unequal variances was carried out. There was a marginally significant difference in the positive feeling scores for plant ($M = 23.30$, $SD = 2.59$) and no plant ($M = 22.09$, $SD = 3.57$) conditions; $t(93.99) = 1.96$, $p = 0.053$.

The second t-test (see Appendix B, Table 2) was conducted to compare negative feelings in plant and no plant conditions. The assumption of homogeneity of variances was tested and not satisfied via. Levene's F Test, p = .005; therefore a two-tailed independent samples t-test based on unequal variances was carried out. There was a marginally significant difference in the negative feeling scores for plant (M = 11.32, SD = 3.08) and no plant (M = 12.74, SD = 4.35) conditions; t(95.11) = -1.91, p = 0.059.

The third t-test (see Appendix B, Table 3) was conducted to compare positive feelings in perceived plant and perceived no plant conditions. The assumption of homogeneity of variances was tested and satisfied via. Levene's F Test, p = .525; therefore a two-tailed independent samples t-test based on equal variances was carried out. There was not a significant difference in the positive feeling scores for perceived plant (M = 22.27, SD = 3.04) and perceived no plant (M = 23.09, SD = 3.76) conditions; t(100) = -1.18, p = 0.243.

The fourth t-test (see Appendix B, Table 4) was conducted to compare negative feelings in perceived plant and perceived no plant conditions. The assumption of homogeneity of variances was tested and satisfied via. Levene's F Test, p = .200; therefore a two-tailed independent samples t-test based on equal variances was carried out. There was not a significant difference in the negative feeling scores for perceived plant (M = 11.97, SD = 3.83) and no plant (M = 12.78, SD = 4.31) conditions; t(100) = -0.95, p = 0.343.

Overall, these results suggest that plants only have a marginal or no significant effect on positive or negative feelings, depending on the conditions analyzed. Specifically, our results suggest that humans only marginally feel or do not feel more positive feelings or less negative feelings when they are in the presence of plants compared to when they are not in the presence of plants.

Discussion

The results of the t-test conducted under the assumption that our samples had unequal variance influenced the study in that, had our two samples had equal variance, both of the SPANE-P and SPANE-N for the plant and no plant condition would have been identified as being statistically insignificant. Nonetheless, as the samples were unequal in variance, we have to conclude that the results were marginally significant for the plant and no plant conditions, even if the calculated means were similar. However, the purpose of conducting two more t-tests was to increase internal validity, as our research question implies that being around plants will have an effect on emotional affect. Thus, it could be argued that the results of the t-tests with perceived plant and perceived no plant conditions more accurately test our research question as if the participant was unaware of the presence of plants even after it being brought to their consciousness, it is inaccurate to categorize them in the plant condition and inaccurate to assume that the presence of plants influenced their responses. Although we still acknowledge the marginal significance that was found in the two tests that compared the plant and no plant condition, as the two tests that compared the perceived plant and perceived no plant condition found no statistical significance, thus due to limitations of our study we are unable to conclude whether or not the presence of plants has marginal or no significant effect on influencing positive or negative feelings of the participants.

Contrary to our hypothesis, we found that introducing plants to the floor of a building neither increased patron's subjective happiness nor decreased their subjective sadness. This finding does not support the biophilia hypothesis, which states that human beings have an affinity for the natural world that raises their affective state, and contradicts previous studies that have found that interaction with the natural world can increase their mood (Grinde & Patil, 2009; Nisbet & Zelenski, 2011).

This study was limited in several areas. Due to logistical problems, we were only able to introduce plants into the first floor of the CIRS building. This created a confound as the first floor is significantly different to the second to fourth floors in terms of floor size, furniture, features and amenities, and overall aesthetics. We were not able to control for these factors and it may or may not have influenced subjective affect within our participant sample. In addition, the CIRS building already has a lot of plants or greenery throughout its interior and exterior even before our manipulation, most notably on the exterior face of the building, on the first floor exterior, and the central garden that is most prominent on the second floor. Therefore, even in the no-plant condition, we had participants responding "yes" to the question of whether they perceived any plants to be around them, which is at odds with the plant or no-plant conditions that we created. Future studies should therefore use larger extremes with regards to the presence or absence of plants, and within the same space to eliminate all of these potential confounding variables.

Furthermore, due to time constraints, our experiment was conducted in a time span of only three weeks within March. The short span of the experiment meant that special events or seasonal events, such as the essay and assignment rush that occurs near the end of the term (i.e. in March) may have played a role in the results. Combine that with the fact that emailing problems meant that our subject pool was largely comprised of UBC students, we cannot determine whether the effects found in the study are applicable to different population groups. We therefore also recommend that future studies measure a wider range of subjects and their positive and negative experience over a longer duration than four weeks to get more thorough results that is not upset by time-specific events and to increase internal validity.

Recommendations

While our study was not able to find any significant effect of plants on participants' affect, this is not to suggest that addings plants into the building do not induce biophilic effects. The CIRS building already has a lot of greenery throughout its structure, meaning that even in the no-plant condition, plants can still be seen by participants. This is exemplified by the fact that in the supposed no-plant conditions, many participants still answered "yes" to the question of whether they noticed any plants around them. Therefore, the CIRS building may already represent an urban area that is high in plants and greenery. Certainly, compared to other spaces on UBC, such as the Buchanan Complex or the Geography Building, the CIRS building stands out in how prominent and plentiful the plants are inside and outside. In terms of improving the affective state of patrons in the CIRS building, our findings suggest that little more can be done using plants.

For the sake of studying the effects of plants on well-being, we recommend that the client repeat the same experiment in buildings that are decidedly less plant heavy or green. If the client wishes to repeat the experiment in the CIRS building, we recommend that the client introduces and distributes more plants in all floors (as opposed to just one) in order to assess subjective affect in participant sample. Conduction of study should be done over a longer period of time, as this will allow more variance in the subjective affect of participants and it will compensate for factors such as seasons, where a participant may feel more contented during the summer due to factors such as sunlight; and stress-level during exam seasons, where participants may feel anxious and upset. Lastly, because most of our participants were student from UBC, the results of this study is not generalizable to the whole population. Thus, the client can replicate this study by using a wider range of participants and their subjective affect in CIRS.

References

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Appendix A
Date and Time of Survey Collection

Date of Collection	Time of Collection	Number of Participants
March 09, 2018	10:50-16:10	19
March 12, 2018	15:00-16:10	7
March 13, 2018	11:50-13:00	19
March 15, 2018	12:00-13:30	8
March 19, 2018	11:55-14:45	10
March 20, 2018	11:10-15:45	8
March 22, 2018	13:45	1
March 23, 2018	12:55-13:15	7
March 26, 2018	10:30-11:50	8
March 27, 2018	11:45-14:00	15

Appendix B
Independent Samples T-Test Results Tables

Table 1: SPANE-P, Plant and No Plant Condition

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Positive_Feelings_Score	Plant	37	23.30	2.591	.426
	No Plant	65	22.09	3.565	.442

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2–tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Positive_Feelings_Score	Equal variances assumed	4.572	.035	1.801	100	.075	1.205	.669	-.122	2.532
	Equal variances not assumed			1.962	93.992	.053	1.205	.614	-.014	2.424

Table 2: SPANE-N, Plant and No Plant Condition

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Negative_Feelings_Score	Plant	37	11.32	3.083	.507
	No Plant	65	12.74	4.349	.539

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2–tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Negative_Feelings_Score	Equal variances assumed	8.236	.005	-1.743	100	.084	-1.414	.811	-3.024	.196
	Equal variances not assumed			-1.911	95.111	.059	-1.414	.740	-2.884	.055

Table 3: SPANE-P, Perceived Plant and Perceived No Plant Condition

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Positive_Feelings_Score	Perceived Plant	70	22.27	3.036	.363
	Perceived No Plant	32	23.09	3.762	.665

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2–tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Positive_Feelings_Score	Equal variances assumed	.407	.525	-1.176	100	.243	-.822	.700	-2.210	.565
	Equal variances not assumed			-1.085	50.203	.283	-.822	.758	-2.344	.699

Table 4: SPANE-N, Perceived Plant and Perceived No Plant Condition

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Negative_Feelings_Score	Perceived Plant	70	11.97	3.826	.457
	Perceived No Plant	32	12.78	4.309	.762

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Negative_Feelings_Score	Equal variances assumed	1.664	.200	-.953	100	.343	-.810	.850	-2.496	.876
	Equal variances not assumed			-.912	54.211	.366	-.810	.888	-2.591	.971