

University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

# Applications of Wood on Stress, Affect, Likability, Willingness to Study

Prepared by: Ann Hong, Catherine Huang, Dave Su, Miji Lee, Sophie Mok

Prepared for:

Course Code: PSYC 421

University of British Columbia

Date: 14 April 2022

*Disclaimer: "UBC SEEDS Sustainability Program provides students with the opportunity to share the findings of their studies, as well as their opinions, conclusions and recommendations with the UBC community. The reader should bear in mind that this is a student research project and is not an official document of UBC. Furthermore, readers should bear in mind that these reports may not reflect the current status of activities at UBC. We urge you to contact the research persons mentioned in a report or the SEEDS Sustainability Program representative about the current status of the subject matter of a report".*



**Applications of Wood on Stress, Affect, Likability, Willingness to Study**

Group 14: Dr. Lorax

Ann Hong, Catherine Huang, Dave Su, Miji Lee, Sophie Mok

University of British Columbia

Course: PSYC 421

Instructor: Dr. Jiaying Zhao

Date: April 14, 2022

### **Executive Summary**

This study investigated whether simulated material imitating the appearance of wood yields the same restorative benefits as its authentic counterpart (material made from genuine wood). Upon viewing images of classrooms containing either authentic wood, simulated wood or no wood as their wall materials, participants were measured on their positive/negative affect, stress, likability and willingness to study. One extra measure was added to examine if participants' could accurately perceive the wall material. Conducting one-way ANOVA tests for each measure, we found that the degree of authenticity in wood wall materials had no effect on participants' level of affect and stress. However, further statistical analysis revealed that participants' willingness to study and likability were significantly affected by the degree of authenticity in wood wall materials. Additionally, results measuring the perceived material demonstrated that, at large, participants failed to accurately report the wall material presented to them in the survey. Taken together, these findings shed light on the potential effects authentic materials have on students' general subjective experiences; which can have far-reaching implications for how UBC approaches biophilic building materials.

**Keywords:** Biophilia, simulated biophilia, non-biophilia, wood, stress, positive affect, negative affect, likability, willingness to study, university students

### **Introduction**

From academic achievement to financial stability, it is common knowledge that university students experience substantial levels of stress in their everyday life. Recent literature on student mental well-being has identified the physical school environment as a critical predictor of student stress levels; specifically, stress levels depend on how well students can adapt to the physical environment on their campus (Essel, 2017; Pourbagher et al., 2020). Extrapolating this notion to interior environments, recent research has found that indoor spaces containing natural elements—specifically interior spaces with biophilic design—are associated with inducing positive physiological effects, reducing stress levels and improving general psychological well-being (Jo et al., 2019; Tran et al., 2016).

Narrowing biophilic designs to the level of elements, one branch of research has specifically focused on investigating the biophilic use of wood in interior spaces and its restorative properties. One such study has found that increased use of wood is associated with stress recovery (Burnard et al., 2015). In another study comparing perceptions of visual comfort between wood and non-wood settings, it was observed that wood rooms were more effective in inducing comfort (Watchman et al., 2016). While the restorative effects of natural elements and genuine wood materials have been well-researched, little is known about its imitated counterpart. That is, whereas there is sufficient empirical support for the positive effects of authentic wood (defined as genuine wood material) as compared to non-biophilic elements (defined as material in which no natural elements are visible), the effects of simulated wood (defined as material that mimics the appearance of wood) have yet to be observed. This indicates a knowledge gap within the current literature. Seeking to bridge this gap, our study implements the novel use of simulated wood as a means of testing the effects of simulated elements compared to authentic biophilic and non-biophilic elements. Results from this study are significant and can have far-reaching implications on how universities like UBC establish effective financial strategies and approach environmentally-protective measures all whilst improving student psychological well-being.

The driving force of our research and its potential interventions will focus on motivations targeting connections with nature, as well as the lowering of stress levels, improvements in positive affect, likability, willingness to study and mitigation of negative affect as a result of the exposure to natural materials and education of the mental health impacts from the biophilia. Concerning the restraining forces of our study, potential interventions can focus on minimizing one's unawareness pertaining to the beneficial effects of biophilic designs (especially biophilic wood designs) and the inaccessibility of actual biophilic design elements.

### **Research Question and Hypothesis**

Our research question asked how levels of authenticity in wooden materials on walls influence positive affect, negative affect, stress, likability, and willingness to study. Subsequently, our hypothesis was two-fold. First, we hypothesized that as participants look at pictures of classrooms containing authentic wood on their walls, their positive affect will increase, negative affect will decrease, and stress levels will be reduced compared to participants looking at pictures of classrooms containing simulated wooden wall elements or a classroom containing no wooden wall elements. Second, we predicted that participants would rate classrooms containing authentic wood higher on likability and willingness to study compared to classrooms containing simulated wood and no wood wall elements.

## Methods

**Participants:** Based on our power analysis (assuming that minimum effect size=0.25, alpha=0.05, power=0.95), our target sample size was 252 participants. During the duration of data collection, our survey recruited a total of 208 participants. However, amongst the 208 responses, 59 were excluded from our final data analysis as a result of them being incomplete responses. All 149 remaining participants were college students, with the average undergraduate year level being 3.01 years. 63.1% of our participants reported as female, 30.2% as male, 4% as non-binary, and 2.7% preferred not to say. The average age of participants was 22.4 years old, and the majority of the participants identified as Asian.

**Conditions:** The independent variable of our study was the type of wall material presented to participants. The type of wall material was operationalized to match the three conditions described in our study: (1) wall material containing real wood established our authentic biophilia condition, (2) wall material containing fake wood established our simulated biophilia condition and, (3) wall material containing no wood established our no biophilia condition. After participants were randomly assigned to one of the three conditions, they were presented with three images of classrooms whose wall materials reflected their condition. As such, participants assigned to the authentic biophilia condition were presented with images of classrooms containing wall materials that were made of genuine wood. In the simulated biophilia condition, participants were shown pictures of classrooms whose walls contained elements that were not made of wood but mimicked certain aspects of wood (such as colour and/or pattern). The participants in the no biophilia condition were given pictures of classrooms whose walls neither were wood nor resembled wood. The purpose of presenting three different photos in each condition was to eliminate the potential confounds such as lighting, openness, and floor material (see Appendix B).

**Measures:** Our research measured six dependent variables by employing a variety of different scales. First, a multiple-choice questionnaire was used to gauge if participants could accurately recognize the wall materials presented in their condition. Second, to measure general feelings/likability towards the classrooms, participants indicated how much they liked the rooms on a 5-point scale. Similarly, a five-point scale was also used to measure how willing participants were to study in the presented classrooms. In order to measure participants' positive and negative affect between conditions, the Positive and Negative Affect Schedule (PANAS) short form was implemented in our survey (Watson et al., 2007). Lastly, the stress subscale from the Depression Anxiety Stress Scale-21 (DASS-21) was employed to measure participants' stress levels (Lovibond & Lovibond, 1995). In an attempt to better understand participants' current stress levels, the DASS-21 question prompt that asked participants to reflect on the listed statements was changed from "the past week" to "the last few days" (see Appendix C). The use of these validated scales (PANAS and DASS-21) help to ensure that our study attains high validity, while the novel scales (5-point scale and the multiple-choice questionnaire) were implemented in an attempt to keep the survey brief and straightforward.

**Procedure:** Our research was conducted via participants filling out a five-minute Qualtrics survey. Following the completion of our consent form, participants were randomly assigned to one of the three conditions. The randomization of participant assignment was achieved through the Qualtrics Randomizer function. Participants were then shown three photos that reflected their assigned condition. The following three questions would then be answered by the participants: "What type of wall material do you perceive these rooms to be?" "How willing would you be to study in these rooms?" and "How much do you like these rooms?" Participants

then answered the stress items from the DASS-21, followed by completing the PANAS short form (see Appendix C). Finally, participants were asked to answer four demographic questions (see Appendix D).

Data collection began on March 9, 2022 and ended on April 7, 2022. During this duration, a few challenges have arisen. Midway through our data collection process, some participants reported only being able to select one option for the demographic question regarding their ethnicity; this posed a concern for our mixed-race participants. This problem was fixed immediately upon it being made known to us. At the end of our data collection, we faced another challenge: we did not meet the target number of participants as established in our power analysis. Implications for this challenge will be discussed in later sections.

## Results

Since our research question aimed to see if the manipulation of wall material would result in effects on positive affect, negative affect, stress, likability, and willingness to study that significantly differ from each condition, we conducted one-way between-subject ANOVAs for each variable.

**First Hypothesis:** Our first hypothesis which predicted that positive affect will increase, negative affect will decrease, and stress levels will be reduced in the authentic biophilic condition was overall not supported by the statistics analysis. ANOVA testing revealed that measures of positive affect from PANAS ( $F(2, 146) = 0.803, p = 0.450, \text{partial } \eta^2 = 0.011$ ), negative affect from PANAS ( $F(2, 146) = 2.367, p = 0.097, \text{partial } \eta^2 = 0.031$ ), and stress from DASS-21 ( $F(2, 146) = 0.088, p = 0.916, \text{partial } \eta^2 = 0.001$ ) all yielded statistically insignificant results. Therefore, these findings suggest that both stress and affect were not affected by the manipulation of classroom wall materials in our experiment. (Tables and figures for DASS, PANAS positive, and PANAS negative can be found in figure/table 1, 2, 3).

**Second Hypothesis:** Despite the null results in our first hypothesis, our second hypothesis — which predicted participants to rate classrooms containing authentic wood higher on likability and willingness to study compared to the other conditions — was supported by our data analysis. Specifically, we found that both willingness to study ( $F(2, 146) = 3.397, p = 0.036, \text{partial } \eta^2 = 0.044$ ) and the likability of the rooms ( $F(2, 146) = 9.153, p < 0.01, \text{partial } \eta^2 = 0.111$ ) yielded statistically significant results. Following this, post hoc tests (Tukey's HSD) were conducted to analyze both the mean of the dependent variables for each group and Tukey's HSD.

In the post hoc test for the willingness to study measure, we found that when comparing the authentic biophilia condition ( $M = 3.250$ ) with the simulated biophilia condition ( $M = 2.640$ ), people were significantly more willing to study in the rooms presented in the real biophilia condition ( $p = 0.039$ ). In contrast, when comparing the authentic biophilia condition to the no biophilia condition, no significant difference was found regarding participant's willingness to study in those rooms ( $p = 0.122$ ). A comparison between the no biophilia condition and the simulated biophilia condition also yielded a non-significant result regarding willingness to study in those rooms ( $p = 0.865$ ).

In the post hoc test conducted for the likability of the rooms, we found that when comparing the authentic biophilia condition ( $M = 3.479$ ) to the simulated biophilia condition ( $M = 2.680$ ), participants preferred the rooms in the authentic biophilia condition over the rooms in the simulated biophilia condition ( $p = 0.002$ ). Moreover, when comparing the authentic biophilia condition ( $M = 3.479$ ) with the no biophilia condition ( $M = 2.588$ ), we found that the authentic biophilic rooms were preferred significantly more than the no biophilia rooms ( $p < 0.01$ ). In contrast, there was no significant difference between simulated biophilia and no biophilia in

terms of likability ( $p=0.913$ ). (Tables and figures for Willingness to study and Likability for rooms can be found in figure/table 4 and 5)

**Extra Measure (Perceived Material):** In gauging if participants could accurately perceive the wall material, this extra measure functioned in enabling us to understand the manipulation strength as well as elucidating the underlying mechanism for the willingness to study and likability measures (as explicated in the Discussion section). Our findings on this measure reveal that a majority of participants in the simulated biophilia condition (64%) could accurately recognize the wall material as fake wood. In our authentic biophilia and no biophilia conditions, however, only a minority of participants correctly recognized the material as the one presented in their respective conditions; with only 29% of participants in the real biophilia condition accurately reporting the material as real wood and 39% of participants in the no biophilia condition claiming that the material was something other than wood. The low percentage of participants accurately reporting the perceived material may call the manipulation strength of our study and findings into question.

### Discussion

**Implications:** Returning to our research question, our results demonstrated that positive/negative affect and stress levels are not influenced by wooden materials regardless of the degrees of authenticity. In other words, our first hypothesis was not supported because the effect of real and simulated wooden materials yielded the same results in participants' affect and stress. In support of our second hypothesis, our results revealed that participants indeed preferred and were more willing to study in the biophilic rooms compared to the simulated and no biophilia rooms. These results suggest that being shown rooms with a high level of authenticity of wooden materials (in our case, containing real wood) can be used to induce subjective preference and willingness to study.

Although our results partially support our hypotheses, our findings demonstrated that likability and willingness to study are not applicable in determining the mechanisms behind how affect and stress can be influenced. That is, likability and willingness to study appear to be functioning independently from our measures of stress and affect rather than working in conjunction. Our results on preference and willingness to study do, however, support the overarching biophilia hypothesis which maintains that people are attracted to and enjoy the presence of natural elements in our everyday infrastructure. This has far-reaching implications on how universities can approach biophilic study spaces in virtual settings (discussed in detail in the recommendations section).

**Limitations:** Several limiting factors could affect the external validity of our findings. The first formidable challenge we faced was our sample size. As discussed in prior sections, we needed to recruit 252 participants in order to yield results with statistical power; but we were 103 participants short. As a result, this small sample size reduces the ability to generalize our findings to the larger UBC student population.

Another limitation of our study involves an incident in which a small incentive (less than 10 cents CAD) was distributed to three participants even though our consent form stated that no remuneration would be included in the participation in our study. If we were to re-run our study, more clarity on the recruitment process would be communicated within our research team to prevent the distribution of incentives. Please refer to Appendix E for the implications of insufficient sample size and the provision of incentives.

Additionally, as discussed in the Results section, the general failure to accurately recognize the presented wall materials (as demonstrated in participants in both the authentic biophilia and no biophilia condition) indicates an insufficient manipulation. In other words, our attempt to convey variations of wall material was largely unsuccessful because participants were unable to correctly identify the manipulated material (authentic, simulated, or no wood). Methods for improvements are included in Appendix E.

While we attempted to control other potential confounds by presenting multiple images containing a similar manipulation in wall material, our survey still contains many other confounding factors, such as the room layout or size. As such, these confounds may have affected our results. The implications of confounds can be found in Appendix E.

A final limitation of our study is concerning limited generalisability. Since our study was delivered online digitally, we are uncertain if our results can be generalized to physical spaces and rooms other than lecture halls (Appendix E). While the UBC SEEDs program may discover that our findings are applicable to virtual learning spaces, these results may not be appropriate for physical interior spaces.

### **Recommendations for Our UBC Client**

By virtue of the online/digital confines of our study, our findings are wholly applicable to virtual spaces (as mentioned above); but this limitation does not render our findings irrelevant in UBC's Green Building plan. Given our results, our recommendations are two-fold: separated based on whether UBC's intentions are to prioritize (1) reducing student stress levels and increasing affect or (2) increasing students' positive subjective feelings and motivation to study.

First, given that our results demonstrated that the degree of authenticity in wood wall materials has no effect on participants' level of affect and stress and that participants tend to fail at recognizing the wall material, the UBC SEEDs program can note that wall materials need not be limited to authentic wood elements when planning virtual spaces that aim to decrease student stress and increase positive affect. This has direct implications for the interior spaces in online meetings and lectures. Specifically, lecturers and meeting-heads may be informed that the degree of biophilic wood material in their backgrounds do not play a significant role in influencing student stress and affect. This opens up options for possible building materials. That is, UBC can opt for more cost-efficient and environmentally sustainable building materials for virtual spaces if their concern is influencing student stress and affect levels. We recommend future research be tailored to testing in-person spaces in order to deduce if the degree of authenticity in wooden wall elements in physical spaces influences student stress and affect levels.

Second, our results reveal that willingness to study and their likability were significantly affected by the degree of authenticity in wood wall materials and that willingness to study and their likeability towards the rooms were not mediated by stress or affect, nor were they related to their emotional status of affect and stress. Knowing this, we can increase study motivations for students in virtual study spaces by implementing wood elements (authentic or simulated). We would recommend confirming this subjective/motivation boost with future research geared specifically towards the subjective feelings felt when students are present in real, physical spaces containing different wall materials; although we suspect that it would yield similar results because of the innate human attraction towards nature posited by the biophilia hypothesis.

More broadly, we recognize that wood is not the sole biophilic material with psychological benefits; therefore, we encourage future research to investigate the effects/relationships between authentic natural materials and their simulated counterpart.

### References

- Burnard, M. D., & Kutnar, A. (2015). Wood and human stress in the built indoor environment: A review. *Wood Science and Technology*, 49(5), 969-986.  
<http://dx.doi.org/10.1007/s00226-015-0747-3>
- Jo, H., Song, C., & Miyazaki, Y. (2019). Physiological Benefits of Viewing Nature: A Systematic Review of Indoor Experiments. *International journal of environmental research and public health*, 16(23), 4739. <https://doi.org/10.3390/ijerph16234739>
- Lovibond, S.H. & Lovibond, P.F. (1995). Manual for the Depression Anxiety & Stress Scales. (2nd Ed.) Sydney: Psychology Foundation.
- Pourbagher, S., Azemati, H. R., & Bahram Saleh, S. P. (2020). Classroom wall color: A multiple variance analysis on social stress and concentration in learning environments. *The International Journal of Educational Management*, 34(1), 189-200.  
doi:<http://dx.doi.org/10.1108/IJEM-06-2020-0282>
- Tran, B., Koç, G., Claes, M., & Christiansen, B. (2016). *Psychological (and emotional) architecture: The values and benefits of nature-based architecture – Biophilia*. IGI Global.
- Watchman, M., Potvin, A., & Demers, C. M. H. (2016). Wood and comfort: A comparative case study of two multifunctional rooms. *Bioresources*, 12(1), 168-182.  
<https://doi.org/10.15376/biores.12.1.168-182>
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology*, 54(6), 1063. <https://www.doi.org/10.1037/0022-3514.54.6.1063>

**Appendix A**  
Results

**<Result of positive affect measure>**

**Table 1A**

ANOVA - PANAS - Positive Affect

Cases	Sum of Squares	df	Mean Square	F	p	$\eta_p^2$
Condition	24.118	2	12.059	0.803	0.450	0.011
Residuals	2191.747	146	15.012			

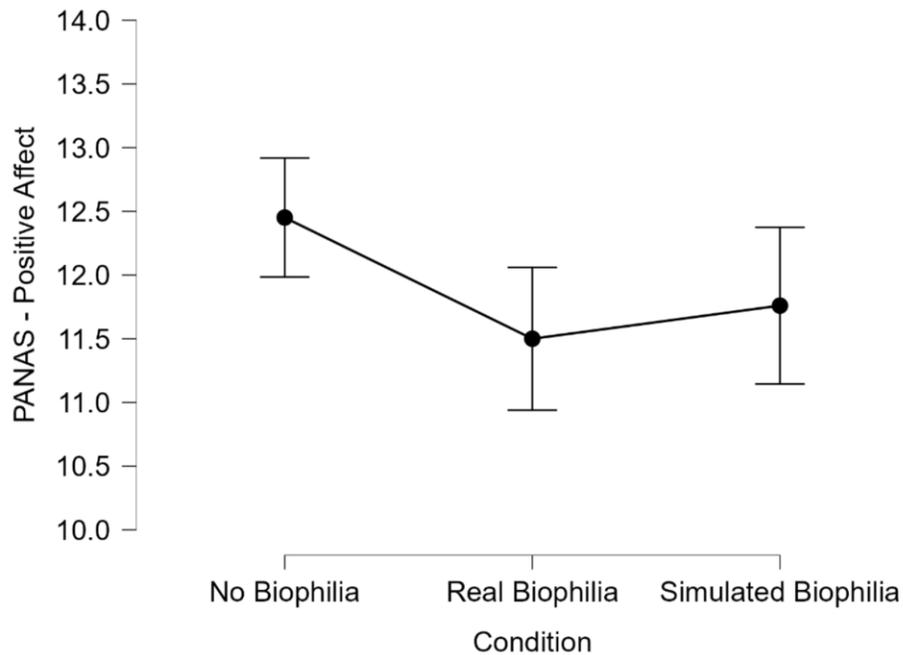
Note. Type III Sum of Squares

**Table 1B**

Descriptives - PANAS - Positive Affect

Condition	Mean	SD	N
No Biophilia	12.451	3.331	51
Real Biophilia	11.500	3.887	48
Simulated Biophilia	11.760	4.350	50

**Figure 1C**



<Results of negative affect measures>

**Table 2A**

ANOVA - PANAS - Negative Affect

Cases	Sum of Squares	df	Mean Square	F	p	$\eta_p^2$
Condition	86.793	2	43.396	2.367	0.097	0.031
Residuals	2677.167	146	18.337			

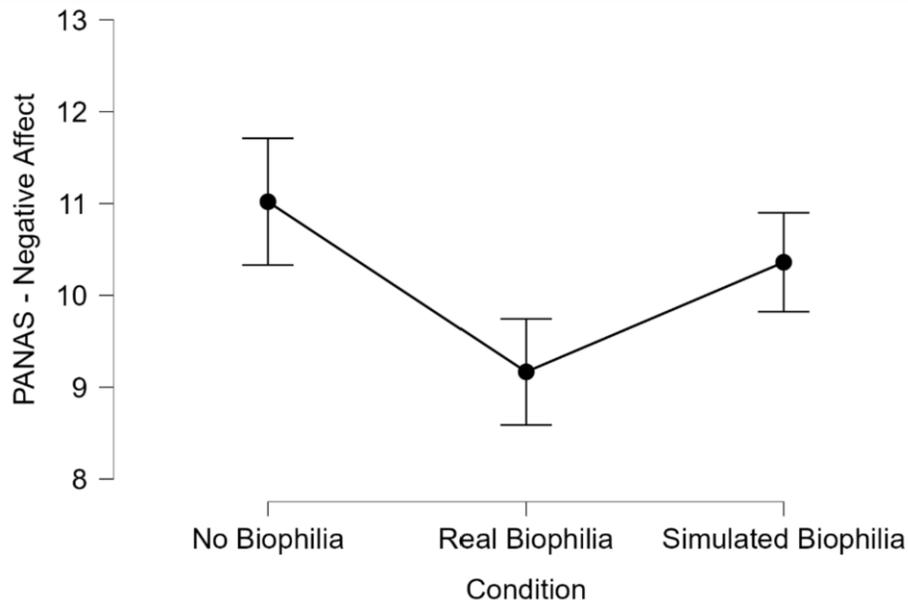
Note. Type III Sum of Squares

**Table 2B**

Descriptives - PANAS - Negative Affect

Condition	Mean	SD	N
No Biophilia	11.020	4.925	51
Real Biophilia	9.167	4.002	48
Simulated Biophilia	10.360	3.811	50

**Figure 2C**



<Result of Stress measure>

**Table 3A**

ANOVA - DASS-21 Stress

Cases	Sum of Squares	df	Mean Square	F	p	$\eta_p^2$
Condition	3.282	2	1.641	0.088	0.916	0.001
Residuals	2715.604	146	18.600			

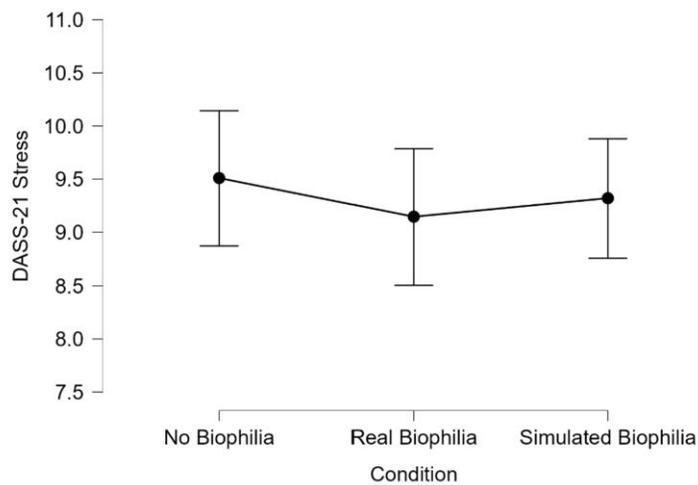
Note. Type III Sum of Squares

**Table 3B**

Descriptives - DASS-21 Stress

Condition	Mean	SD	N
No Biophilia	9.510	4.527	51
Real Biophilia	9.146	4.434	48
Simulated Biophilia	9.320	3.956	50

**Figure 3C**



## &lt;Result of Willingness to Study measure&gt;

**Table 4A**

ANOVA - Willingness to Study

Cases	Sum of Squares	df	Mean Square	F	p	$\eta_p^2$
Condition	10.129	2	5.065	3.397	0.036	0.044
Residuals	217.696	146	1.491			

Note. Type III Sum of Squares

**Table 4B**

Descriptives - Willingness to Study

Condition	Mean	SD	N
No Biophilia	2.765	1.290	51
Real Biophilia	3.250	1.176	48
Simulated Biophilia	2.640	1.191	50

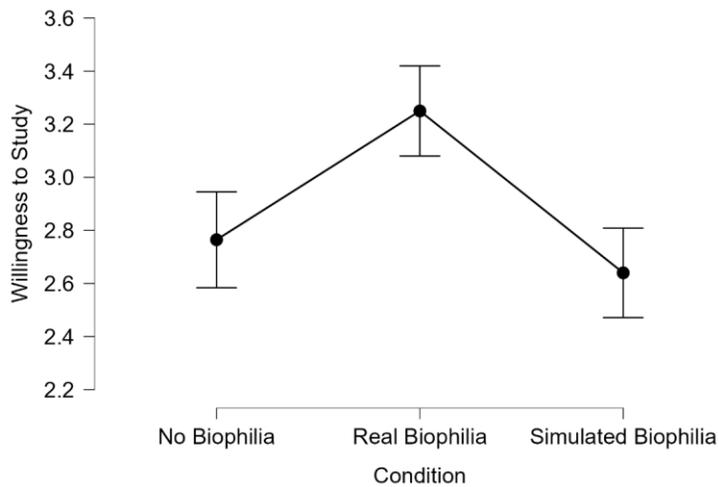
**Table 4C**

Post Hoc Comparisons - Condition

		Mean Difference	SE	t	Ptukey
No Biophilia	Real Biophilia	-0.485	0.246	-1.976	0.122
	Simulated Biophilia	0.125	0.243	0.513	0.865
Real Biophilia	Simulated Biophilia	0.610	0.247	2.472	0.039

Note. P-value adjusted for comparing a family of 3

**Table 4D**



<Results of Likability measure>

**Table 5A**

Descriptives - Likability

Condition	Mean	SD	N
No Biophilia	2.588	1.169	51
Real Biophilia	3.479	1.185	48
Simulated Biophilia	2.680	1.039	50

**Table 5B**

ANOVA - Likability

Cases	Sum of Squares	df	Mean Square	F	p	$\eta_p^2$
Condition	23.472	2	11.736	9.153	< .001	0.111
Residuals	187.212	146	1.282			

Note. Type III Sum of Squares

**Table 5C**

Post Hoc Comparisons - Condition

		Mean Difference	SE	t	Ptukey
No Biophilia	Real Biophilia	-0.891	0.228	-3.912	< .001
	Simulated Biophilia	-0.092	0.225	-0.407	0.913
Real Biophilia	Simulated Biophilia	0.799	0.229	3.493	0.002

Note. P-value adjusted for comparing a family of 3

**Table 5D**

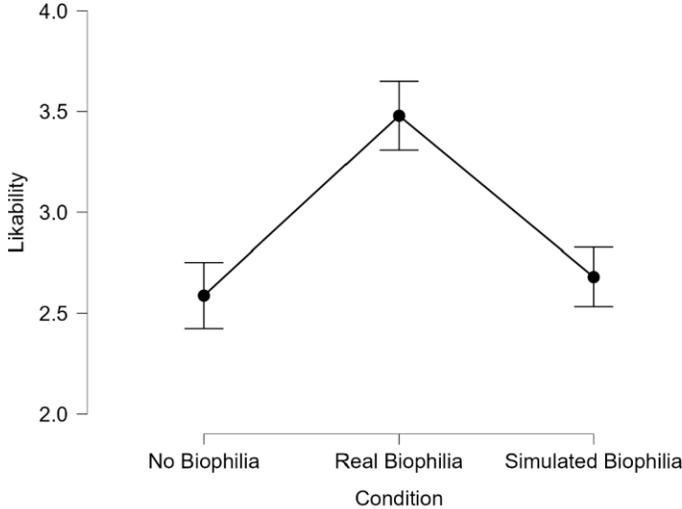


Figure A2: Relationship between the condition and how much participants liked the rooms presented to them

**Appendix B**

Qualtrics Survey Pictures Provided in Each Three Conditions

<Real Biophilia condition>





<Simulated Biophilia condition>





<No biophilia condition>





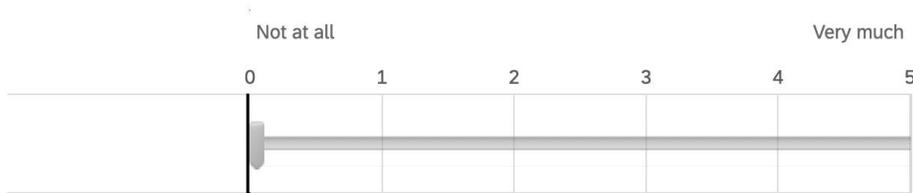
### Appendix C Qualtrics Questions of Our Measures

#### Customised Questions:

What type of wall material do you perceive these rooms to be?

- Real wood
- Fake wood
- Other

How willing would you be to study in these rooms?



How much do you like these rooms?



#### Depression Anxiety Stress Scale (Stress items):

With which of the following do you identify? (select all that apply)

- White
- Asian
- Indigenous people of North America
- Arab
- Latin, Central or South American
- Black
- None of the above or other

Please rate how much the following statements apply to you in the last few days.

	0 (Did not apply to me at all)	1 (Applied to me to some degree, or some of the time)	2 (Applied to me to a considerable degree or a good part of time)	3 (Applied to me very much or most of the time)
I found it hard to wind down	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tended to over-react to situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I was using a lot of nervous energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found myself getting agitated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found it difficult to relax	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was intolerant of anything that kept me from getting on with what I was doing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I was rather touchy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**PANAS Short Form (Positive and Negative Effects):**

Indicate the extent you currently feel:

	Very Slightly or not at all	A little	Moderately	Quite a bit	Extremely
1. Upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Hostile	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Alert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Ashamed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Inspired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Determined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Attentive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Afraid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Appendix D**

## Qualtrics Questions for Demographic Information

Which year are you in?

- Undergraduate year 1
- Undergraduate year 2
- Undergraduate year 3
- Undergraduate year 4
- Undergraduate year 5+

Which gender do you identify with?

- Male
- Female
- Non-binary / third gender
- Prefer not to say

What is your age (in years)?

## **Appendix E**

### Elaboration on Limitations

**Implications of an insufficient sample size:** As we needed a higher number of 252 participants to have the ability to detect an effect if there was one, our insufficient sample size lowered our chances of finding an effect and statistically significant difference in our measures between the three conditions. Moreover, due to the insufficient sample size, it may not have been enough to provide a diverse sample needed to eliminate the inherent differences within the participants, such as confounds in participants' existing levels of stress and affect. Therefore, our results are not generalisable to the larger population of all UBC students because of the lack of diversity. More effort would be needed to recruit participants to meet the target sample based on our power calculations to ensure we have statistical power in our findings on top of a diverse sample.

**Implications of the provision of incentives:** The three participants who received remuneration were an exception to the rest of the sample. However, consistent with the other participants, they were not provided information about the goal and hypothesis of the study. Thus, the 2% of participants were not provided information that allowed them to exhibit demand characteristics.

**Improvements for manipulation failure:** An experiment run in-person may allow the participants to more accurately perceive the wall materials if they saw the walls in-person instead of virtually.

**Implications of having confounds:** Initially, only one picture of a room for each condition was inserted in the survey. However, the images used were not strongly controlled because factors such as room layout, size, or angle were different. We attempted to cancel out the differences of each picture by providing three images in total per condition to demonstrate the similarity of the wall material within each condition's pictures. For each condition, we found three rooms for each of the conditions and asked participants to turn their attention to the wall material specifically. Nevertheless, despite using multiple images for each condition, many confounds were still present that may have affected the participants' responses. Our paper does not provide strong enough conclusions for whether it was indeed the type of wall materials or other factors such as room lighting or angle, that led to the results in levels of willingness, likability, stress, and affect.

**Appendix F**  
Contribution of Group Members

**Ann:** Method for the presentation and this paper, partial results for presentation, general editing.

**Catherine:** Recommendations for Client for this paper, General Editing, Presentation slide, Sorting data/JASP analysis

**Dave:** Results for the presentation, results for the paper, understand ANOVA tests and Tukey's HSD, infer the meanings behind these scores, analyze statistics generally, general editing for the paper

**Miji:** Introduction for the presentation, executive summary, introduction, appendix for the paper, general editing for the paper, helping with sorting data, Qualtrics survey questions.

**Sophie:** Qualtrics survey questions, data analysis for statistics meeting, prepared data for analysis data, implications for the presentation, discussion for the paper, edited paper

**All members contributed to attend all meetings, writing proposals, running data collection and analyzing data.**