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Student Research Report

Effects of Biophilic Wallpaper on University Students' Mental Wellbeing

Prepared by: Jiayu Wei, Koei Yang, Axl Xu, Mark Ma, Fanying Zhou

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Effects of Biophilic Wallpaper on University Students' Mental Wellbeing

Hexa Dimension

Jiayu Wei, Koei Yang, Axl Xu, Mark Ma, Fanying Zhou

Department of Psychology, University of British Columbia

PSYC 421 001 Environmental Psychology

Dr. Jiaying Zhao

University of British Columbia

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Executive Summary

Studies have suggested the benefits of biophilic designs on people's wellbeing, however, none has investigated the effects of biophilic wallpaper on people's mental wellbeing, especially in school settings. This project aimed to fill this research gap by investigating the following research question, how does biophilic wallpaper impact university students' positive affect and negative affect? We hypothesized that staying in a classroom with biophilic wallpaper will increase students' positive affect and decrease their negative affect, and students will prefer biophilic wallpaper over non-biophilic wallpaper and a plain wall. We conducted an online experiment which randomly assigned the participants to view a picture of a classroom with either biophilic wallpaper, non-biophilic wallpaper, or a plain wall. Then, we asked them to imagine being in the classroom and indicate their likings for the picture and their current positive and negative affect. We obtained 246 valid responses and performed an ANOVA analysis. Results showed that the participants have a stronger preference towards the biophilic wallpaper than towards the non-biophilic wallpaper and the plain wall; they have less negative affect in the biophilic condition than in other two conditions. However, the results were not statistically significant, so we rejected our hypotheses.

Introduction

Interacting with nature is often considered an effective way to improve physical and mental wellbeing at zero cost. Indeed, an overwhelming amount of literature has demonstrated that spending time in nature positively affects physical and mental health (Li et al., 2018; Annerstedt et al., 2013). The finding led to a growing interest in the benefits of biophilic building designs on wellbeing. Most of these studies focused on the design of offices, primary schools, and retail stores, but few have focused on university settings. A previous study has shown that students in a classroom with a natural view behaved more enthusiastically and outperformed students in a non-natural view classroom (Benfield, Rainbolt, Bell & Donovan, 2015). However, making all places accessible to nature is unrealistic, neither visually nor physically. Conversely, biophilia is easier to access than nature. The biophilia hypothesis was first proposed by Wilson in 1984 (2007), which stated that people have an innate affection for the natural world. Biophilia has been widely applied to interior and exterior design. Recently, the multifaceted benefits of biophilia on health have been discovered. Felly and Susanto (2020) found that biophilic designs could reduce the level of dementia in elders and increase human memory. Indoor biophilic environments can reduce stress, and anxiety and compared to non-biophilic settings, biophilic habitats showed a more significant healing effect (Yin et al., 2020). Moreover, people's short-term memory was shown to be improved by 14% when working in an office with biophilic elements (Yin et al., 2018). Nevertheless, limited research has been conducted on the effects of biophilic wallpaper on people's mental wellbeing. Therefore, the current study seeks to fill this gap by investigating the impacts of biophilic wallpaper on university students' mental wellbeing.

Driving forces are factors that motivate our research. The driving force for implementing biophilic wallpaper is to improve students' mental well-being because biophilic wallpaper is eye-pleasing and can bring a closer connection between people and nature. Restraining forces are factors that discourage the implementation of our research. The restraining forces are that there is a lack of biophilic wallpaper in UBC buildings, and biophilic wallpaper may be costly to implement, manage, and maintain. Even after implementing biophilic wallpaper, there might be a lack of awareness in students to access the building with biophilic wallpaper.

Research question and hypothesis

In the current study, wallpaper is considered a factor contributing to students' mental well-being. It is intended to shed light on our research question, how does biophilic wallpaper impact university students' positive affect and negative affect? We hypothesized the following: 1) when the participants imagine themselves being in the classroom with biophilic wallpaper, their positive affect will increase and negative affect will decrease, while the plain wall condition and non-biophilic wallpaper condition will not impact positive and negative affect, 2) the participants will prefer the biophilic wallpaper over the non-biophilic wallpaper and the plain wall.

Methods

Our sample size was determined by computing estimated statistical power. In a power analysis (assuming a minimum effect size= 0.2, alpha=0.05, power=0.8), we need a minimum of 246 participants in our study. We recruited 414 participants in this study via social media like Facebook, Instagram, and WeChat from March to April 2022. After careful filtering and cleaning, we excluded 168 participants since they failed to complete all questions on the survey. The final sample consisted of 246 participants. The participants were mainly university students,

accounting for 79% of all participants. Within these university students, roughly a third of them are from UBC (34%) , about two third of them are undergraduate students (76%). They were between the ages of 17-25 and had an average age of 23 year. Gender wise, the 246 participants consist of 60% female, 38% male and 2% non-binary. The ethnicity of the participants is mostly Asian with only 5% Caucasian and 4% for all the other ethnicities.

The independent variable of the current study was biophilic wallpaper. To test our hypothesis of the effects of biophilic wallpaper on positive and negative affect of the participants, we operationalized it as a digitally created virtual static image of the same simulated classroom in each condition with different wallpapers including wallpaper with nature elements, a random wallpaper with no nature elements and a blank wall. The wallpapers were the only differences between the conditions, with everything else staying the same. Figure 1-3 shows the pictures we used for the three conditions. For the experimental condition, the classroom wall has a biophilic wallpaper. For the first control condition, there was no wallpaper on the classroom wall, so the classroom wall was just a regular white wall. This condition controlled any possible effects of looking at a regular classroom on positive and negative affect. The second control condition was the same classroom with a non-biophilic wallpaper on the classroom wall. This condition controls the possible effects of seeing just any wallpaper on positive and negative affect.

Figure 1

Control condition: classroom with plain wall



Figure 2

Control 2 condition: classroom with non-biophilic wallpaper



Figure 3

Treatment condition: classroom with biophilic wallpaper



The dependent variables for this study were the students' preference for different wallpapers, positive affect and negative affect. To measure preference, we used a 5-point likert (1 = "strongly dislike", 5 = "strongly like") that asked the participants "how much do you like the picture you just saw?". To measure positive and negative affect, we used the International Positive and Negative Affect Schedule Short Form (I-PANAS-SF) to measure participants' positive and negative affect in each condition after imagining being in the classroom with different wallpapers. I-PANAS-SF contains 5 items that assess a person's positive affect and 5 items that assess negative affect using a 5-point scale (1= "never"; 5= "always").

The entire experiment was carried out on Qualtrics, an online survey platform. During the experiment, we first randomly assigned participants to one of the three conditions, which asked them to imagine that they are in the classroom in the picture. Then, we asked them to rate how much they like the picture. Next, we asked them to indicate their current feelings through filling out the I-PANAS-SF (Thompson, 2007). Finally, we asked about their demographic information including age, gender, ethnicity, and education level. After obtaining enough responses, we cleaned the data to acquire valid responses which was particularly challenging due to question skipping and unfinished responses from many participants.

Results

To investigate the effects of wallpaper on mental wellbeing, we first calculated the mean and standard deviation of the participants' positive affect and negative affect. We also conducted a one-way between-subjects ANOVA through JASP to test whether the participants' positive affect and negative affect among the three conditions were similar or not. A two-sided alpha level of 0.05 was employed to determine statistical significance. For positive affect, Figure 4 shows that the participants have slightly more positive affect in the non-biophilic condition ($M = 11.79$, $SD = 4.73$) than in the control condition ($M = 11.40$, $SD = 3.81$) and in the biophilic condition ($M = 11.22$, $SD = 3.71$). However, ANOVA analysis showed no significant difference between the positive affect of the three conditions, $F(2, 243) = 0.41$, $p = .66$, $\eta_p^2 = .003$. For negative affect, Figure 5 shows that the participants have slightly less negative affect in the biophilic condition ($M = 8.96$, $SD = 4.23$) than in the non-biophilic condition ($M = 9.20$, $SD = 4.64$) and control condition ($M = 9.68$, $SD = 3.70$). Nevertheless, ANOVA analysis showed there was no significant difference between negative affect of the three conditions, $F(2, 243) = .60$, $p = .55$, $\eta_p^2 = .005$.

Figure 4

The positive affect of the three conditions.

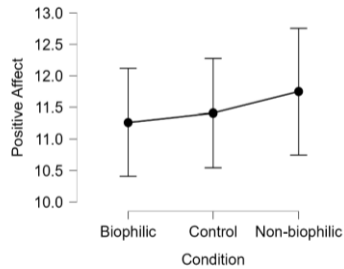
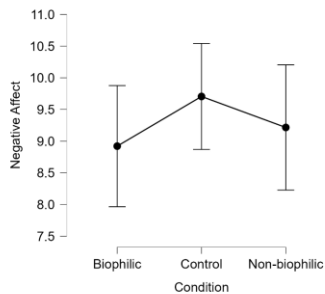


Figure 5

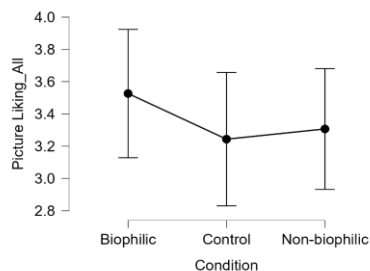
The negative affect of the three conditions.



To examine whether the participants prefer the biophilic wallpaper over the non-biophilic wallpaper and the plain wall when it is implemented in a university classroom, we also calculated the mean and standard deviation of the participants' liking for the classroom pictures and conducted a one-way between-subjects ANOVA ($\alpha=.05$). Figure 6 shows that the participants prefer the picture with biophilic wallpaper better ($M = 3.47$, $SD = 1.75$) than the picture with non-biophilic wallpaper ($M = 3.34$, $SD = 1.78$) and the picture with no wallpaper ($M = 3.24$, $SD = 1.82$). However, ANOVA analysis showed no significant difference between the picture likings of the three conditions, $F(2, 243) = .34$, $p = .34$, $\eta_p^2 = .003$.

Figure 6

The picture likings of the three conditions.



To summarize our results, although the descriptive data indicates that the participants have a stronger preference towards biophilic wallpaper than towards non-biophilic wallpaper and plain wall, the differences between the preferences of the three conditions were not statistically

significant. Similarly, although the descriptive data indicates that the participants have less negative affect in the biophilic condition than in the other two conditions, the differences were not statistically significant. Thus, we reject our two hypotheses and conclude that participants did not have a specific preference towards biophilic wallpaper and biophilic wallpaper did not affect the participants' positive affect and negative affect.

Discussion

Nevertheless, we spotted a few limitations in our study. First, imagining being in virtual classrooms with biophilic wallpaper on a screen is different from physically being in a classroom with viewing biophilic wallpaper in real life. Due to the pandemic, an online survey was the only available option for us to conduct the experiment. Although we tried to include multiple conditions to show participants with different wallpapers (i.e., non-biophilic wallpaper vs. regular classroom), simply imagining being in a classroom might not produce the same sensory stimulus such as auditory, olfactory, thermal comfort, and people's interaction with the surrounding as in the real world. This factor might have contributed to our non-significant results. Second, when analyzing the data, we found that the length of time the participants spent on the survey ranged from 20 seconds to 70 hours. This might suggest an abnormal level of attention as well as seriousness from some participants which could have affected the validity of our results. Thus, the second limitation is that we did not time how long the participants viewed the picture. In other words, other stimuli such as phone distractions during their viewing time might also affect their final judgment on the image they saw. One of our biggest challenges was that we had a hard time deciding what form of "wallpaper" was the best to show our participants. If we have a chance to reconduct the study in the future, providing an in-person experiment is our priority to validate our results. Adding other types of wallpaper with different biophilic elements (i.e., water, wood, or plant) to the experiment might also be an excellent way to test out our hypotheses. Moreover, we recommended future studies to absorb the experiences from our experiment to further investigate the effects of biophilic wallpaper in other university settings instead of the regular classroom we used. For example, installing biophilic wallpaper in relaxing places like restaurants, resting areas, and gyms instead of classrooms.

Recommendations

Due to our results and the limited research on the effects of biophilic wallpaper on mental wellbeing, it might not be an ideal choice nor a priority for our clients to implement biophilic wallpaper on UBC campus at the moment. However, to our knowledge, we are the first to analyze the effects of biophilic wallpaper on mental wellbeing. Although the results were statistically insignificant in ANOVA analysis, our project could inform academia about the research gap on biophilic wallpaper's impacts on people's mental wellbeing. Therefore, for our clients, we would recommend them to consider implementing the biophilic wallpaper in the future if there are more relevant studies on the topic.

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Appendix

Contributions of each group member

Fanying created the pictures of the virtual classroom. Tarva and Axl were in charged of participant recruitment. Koei designed the Qualtrics survey, monitored data collection. Mark, Axl, and Koei ran the statistical analysis. All group members contributed to the presentation and writing the proposal and final paper.

Figure 1

Control condition: classroom with plain wall



Figure 2

Control 2 condition: classroom with non-biophilic wallpaper



Figure 3

Treatment condition: classroom with biophilic wallpaper



Figure 4.

The positive affect of the three conditions.

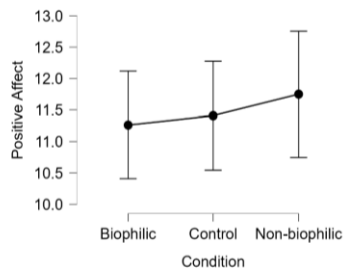


Figure 5.

The negative affect of the three conditions.

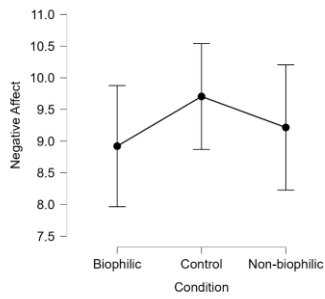
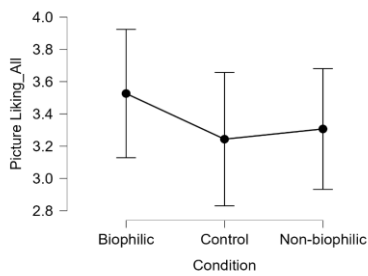


Figure 6.

The picture likings of the three conditions.



Survey

Group 6 Class Research Project in PSYC 421

Start of Block: Consent Form

Q1

Consent Form

Class Research Projects in PSYC 421 - Environmental Psychology

Principal Investigator:

Dr. Jiaying Zhao

Course Instructor

Department of Psychology

Institute for Resources, Environment and Sustainability

Email: jiayingz@psych.ubc.ca

Introduction and Purpose

Students in the PSYC 421 – Environment Psychology class are required to complete a research project on the UBC campus as part of their course credit. In this class, students are required to write up a research proposal, conduct a research project, analyze data, present their findings in class, and submit a final report. Their projects can include surveys, observations, and simple experiments on waste sorting on campus, student health and wellbeing, food consumption and diet, biodiversity perception, and exercise habits. The goal of the project is to train students to learn research techniques, how to work in teams and work with UBC clients selected by the UBC SEEDS (Social Ecological Economic Development Studies) program.

Study Procedures

If you agree to participate, the study will take about 10 minutes of your time. You will answer a few questions in the study. The data will be strictly anonymous. Your participation is entirely voluntary, and you can withdraw at any point without any penalty. Your data in the study will be recorded (e.g., any answer you give) for data analysis purposes. If you are not sure about any instructions, please do not hesitate to ask. Your data will only be used for student projects in the class. There are no risks associated with participating in this experiment.

Confidentiality

Your identity will be kept strictly confidential. All documents will be identified only by code number and kept in a locked filing cabinet. You will not be identified by name in any reports of the completed study. Data that will be kept on a computer hard disk will also be identified only by code number and will be password protected so that only the principle investigator and course instructor, Dr. Jiaying Zhao and the teaching assistant will have access to it. Following the completion of the study, the data will be transferred to a password protected hard drive and stored in a locked filing cabinet. Please note that the results of this study will be used to write a report which is published on the SEEDS library.

Remuneration

There is no remuneration for your participation. Contact for information about the study
This study is being conducted by Dr. Jiaying Zhao, the principal investigator. Please contact her

if you have any questions about this study. Dr. Zhao may be reached at (604) 827-2203 or jiayingz@psych.ubc.ca.

Contact for concerns about the rights of research subjects

If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the UBC Office of Research Ethics at 604-822-8598 or if long distance e-mail RSIL@ors.ubc.ca or call toll free 1-877-822-8598.

Consent

Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time. You also may postpone your decision to participate for 24 hours. You have the right to choose to not answer some or any of the questions. By clicking the “continue” button, you are indicating your consent to participate; hence, your signature is not required. The researchers encourage you to keep this information sheet for your records. Please feel free to ask the investigator any additional questions that you have about the study.

End of Block: Consent Form

Start of Block: Experiment - Biophilic condition

Q2 Now, imagine that you are sitting in this university classroom shown in the picture below.

Q3 How much do you like the picture you just saw?

	Strongly dislike	Somewhat dislike	Neither like or dislike	Somewhat like	Strongly like
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Experiment - Biophilic condition

Start of Block: Experiment - Non-biophilic condition

Q4 Now, imagine that you are sitting in this university classroom shown in the picture below.

Q5 How much do you like the picture you just saw?

	Strongly dislike	Somewhat dislike	Neither like or dislike	Somewhat like	Strongly like
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Experiment - Non-biophilic condition

Start of Block: Experiment - Control condition

Q6 Now, imagine that you are sitting in this university classroom shown in the picture below.

Q7 How much do you like the picture you just saw?

	Strongly dislike	Somewhat dislike	Neither like or dislike	Somewhat like	Strongly like
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Experiment - Control condition

Start of Block: PANAS

Q8 Thinking about yourself and how you feel right now, to what extent do you feel:

	<i>Not at all</i> 1	2	3	4	<i>Extremely</i> 5
Upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hostile	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ashamed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inspired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Attentive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Afraid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: PANAS

Start of Block: Demographics

Q9 Are you a student?

- Yes, I'm a UBC student
 - Yes, but I'm not UBC student
 - No
-

Q10 Which year are you in?

- Undergraduate Year 1
 - Undergraduate Year 2
 - Undergraduate Year 3
 - Undergraduate Year 4
 - Undergraduate Year 5+
 - Graduate
-

Q11 Which gender do you identify with?

- Woman
 - Man
 - Non-binary
 - Transgender
 - Two spirited
 - Other
-

Q12 What is your age (in years)?

Q13 With which of the following do you identify? (select all that apply)

- White
- Asian
- Indigenous peoples of North America
- Arab
- Latin, Central or South American
- Black
- Other

End of Block: Demographics
