University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

The Effect of Nudges on Likelihood to Travel to Tree-shaded Areas in Heatwaves

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Prepared for: Campus and Community Planning

Course Code: PSYC 421

University of British Columbia

Date: 15 April 2023

The Effect of Nudges on Likelihood to Travel to Tree-shaded Areas in Heatwaves

Executive Summary

Given the benefits that tree-shading provides, and the proven effectiveness of effort-based nudges, our research question was "How do convenience and tree-shading impact students' likelihood to go to designated indoor cooling area?". We recruited students from UBC campus, and administered a survey. In the survey, we used Google Maps link and a visual map with the designated area's address inputed for our convenience nudge, and presence of tree-shading for our environmental nudge. A 7-point Likert scale was used to measure student response for likelihood of going. Our results found no main effect for either convenience or tree-shading nudging. Neither convenience nor environmental nudging increased students' likelihood of going. Results suggest that manipulation of the independent variables was poor. Limitations to our study suggest that students may lack motivation to travel in a heatwave. Other possibilities include, failure to include enough information, lacking student awareness or care for the environment.

Introduction

In recent years, Vancouver has experienced extremely hot weather conditions, especially during the summer. This naturally leads to a high air conditioning demand. The high costs of air conditioning account for an estimated 3.9% of global greenhouse gas emissions (Woods et al., 2022), so efforts should be made to encourage student participation in more environmentally sustainable alternatives. Tree shading has been associated with lower cooling energy costs in buildings and moderating temperature fluctuations (Balogun et al., 2013; Lou et al., 2012), suggesting its role in lower carbon emissions. For indoor spaces, Lou et al., (2012) found temperatures in a tree-shaded room to be 2-3℃ lower in temperature than the unshaded room, making it a viable cooling support. This study aims to introduce an external intervention in the form of nudging–a predictable way to alter behaviours without prohibiting options or changing economic incentives (Thaler & Sunstein, 2009). Earlier research has also shown nudging with signage in recycling helped students make better decisions at sorting garbage (Wu et al., 2018), while Luo, Li, Soman and Zhao (2021) found that effort-based nudges, among others, are the most effective approach. However, there is not yet literature pertaining to the effect of nudges on traveling in heatwaves. This study hopes to investigate effort-based and environmental nudges, namely, how convenience and tree-shading impact students' likelihood to go to a designated indoor cooling area. Our project had three hypotheses. First, convenience nudging will significantly increase the likelihood to go to the designated indoor cooling area compared to a condition without convenience. Second, tree-shading nudging will significantly increase the likelihood to go to the designated indoor cooling area compared to a condition without tree-shading. Third, both convenience and tree-shading, together, will significantly increase the likelihood to go to the designated indoor cooling area compared to the control condition, which has neither convenience nor tree-shading.

Methods

In a power analysis using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007) assuming a minimum effect size=0.2, alpha=0.05, power=0.8), we determined that a minimum of 200 participants total in our study. We aimed to recruit 200 participants. 197 undergraduate and graduate students from UBC Vancouver campus completed our survey. In our sample, five participants did not fill in their demographic information. Of the 192 who did, 34.9% of the participants were men and 63.5% of the participants were women. 1 participant was non-binary, while 2 participants preferred not to say. 10.9% of the participants were first year students, 16.1% from second year, 27.6% from third year, and the majority, 45.3%, were fourth year and higher. The mean age was 21.69 (SD=3.32), with a minimum of 18 years and maximum of 46 years. All participants in the online survey provided informed consent.

The study utilized a 2 by 2 factorial, independent groups design. We had two independent variables, convenience nudging and tree-shading environmental nudging. Convenience nudging was operationalized by either providing the participant a written address alone, or a Google Maps link with the address to the designated area already inputted, alongside a visual map with the designated area circled in red. Tree-shading nudging was operationalized by the mention of whether there was or wasn't tree-shading at the designated area. There were four conditions in total. The convenience-only condition had the visual map and Google Maps link to a designated area mentioned to be without tree-shading. The tree-shading condition mentioned tree-shading at the designated area, with only a written address to it provided. The convenience and tree shading condition had the Google Maps link and the visual map to the designated area, mentioned to have tree-shading. The control condition, with neither convenience nor environmental nudging, had a written address to the designated area, mentioned to be without tree-shading.

The dependent variable in our study was participants' likelihood of going to the designated area during a heatwave. Participants were asked, "How likely are you to go to the designated indoor area for cooling during a heatwave if you were shown the information above?". This question fully addressed our research question, and asked what we hoped to investigate. Response was measured with a sliding 7-point Likert scale (1932), where 0=extremely unlikely to go, and 7=extremely likely to go.

The survey consisted of three sections; the consent form, the assigned condition, and the demographics section. Participants were presented with a consent form upon clicking the survey link, and randomly assigned to one of the four conditions upon consent. All participants were next provided the following information: Studies have shown that indoor areas shaded by trees

are effective for decreasing temperature, lowering building cooling energy costs, thus lowering carbon emissions. They were then given certain information on the designated area, depending on their condition, and it was mandatory that they indicate their response on the Likert Scale before moving on. This was followed by a few optional demographics questions, asking their gender, age, and student year, then the survey was closed.

Data collection began in March of 2023, and ended in April the same year. Data was collected mainly from spreading the survey among friends. The link was also posted to mutual student group chats on social media apps like Instagram and Wechat. A major challenge was the large number of participants we had to gather, as we did not have enough friends to reach the 200 participant goal. We ended up asking professors of our other classes to distribute the survey link, and asked our friends to help spread the survey link to other UBC students, and friends of friends.

Results

Table 1. Convenience and Tree-shading: Cell sizes, Means, and Standard Deviations

Descriptives - Likelihood ▼

Convenience	Tree Shading	N	Mean	SD	SE	Coefficient of variation
Convenience	No tree	48	4.354	2.245	0.324	0.516
	Tree	56	4.571	1.818	0.243	0.398
No convenience	No tree	46	5.196	1.857	0.274	0.357
	Tree	47	4.638	2.026	0.296	0.437

The cell sizes, means, and standard deviations for the 2x2 factorial design are presented in Table 1. The mean Likert rating in the control group (M=5.20, SD=1.86) was the highest of all four condition groups. The mean Likert rating in the tree-shading only group was second highest (M=4.65, SD=2.00), followed by the convenience and tree-shading group (M=4.56, SD = 1.83). The mean Likert rating in the convenience only group was the lowest (M=4.35, SD=2.25). Our third hypothesis, that the convenience and tree-shading group would have a higher mean likelihood of going than control, was not supported.

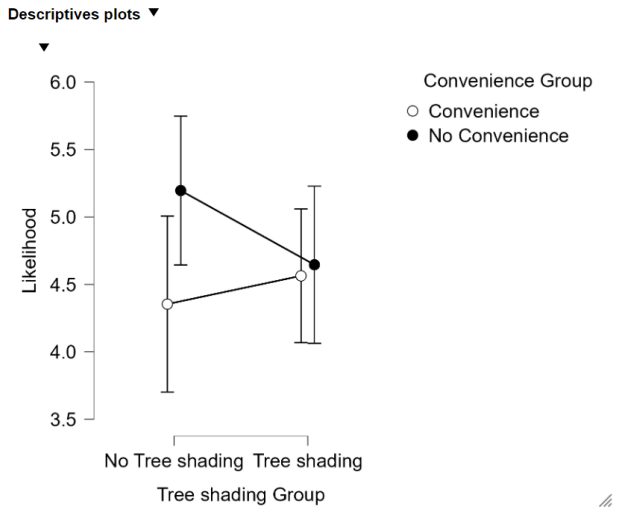


Fig 1.

A two-way analysis of variance (ANOVA) was performed to analyze the effect of tree-shading nudging and convenience nudging on likelihood to go to a designated area. The two-way ANOVA revealed (Fig 1.) that there was not a statistically significant interaction between the effects of tree-shading and convenience (F(1, 195)=1.788, p=.183).

Table 2: Two-way ANOVA for Convenience and Tree shading

ANOVA – Likelihood

Cases	Sum of Squares	df	Mean Square	F	p	η^2
Convenience	10.098	1	10.098	2.555	0.112	0.013
Tree Shading	1.416	1	1.416	0.358	0.550	0.002
Convenience ∗ Tree Shading	7.344	1	7.344	1.858	0.174	0.009
Residuals	762.784	193	3.952			

Note. Type III Sum of Squares

A main effects analysis (Table 2) showed that convenience did not have a statistically significant effect on participants' likelihood of going to the designated area (F(1, 195)=2.646, p=0.105), nor did tree-shading have a statistically significant effect on likelihood of going to the designated area (F(1, 195)=0.359, p=0.550). Overall, no main effect of convenience was found, so our first hypothesis was unsupported. No main effect of tree-shading was found either; our second hypothesis was also unsupported.

Discussion

No main effect of either convenience nor tree-shading was found. Further, the convenience and environmental mean was lower than the control group. Our study has several limitations. First, there could have been a better way to implement the tree-shading environmental nudge. In the current study, participants were given information about the benefits of tree-shading, then whether or not the designated area had tree-shading was alternated. This operationalization may have introduced a disconnect, especially for the no tree shading conditions, as the benefits of tree-shading would not have mattered if the designated area was without tree-shading. Second, we failed to control the distance or starting point. Not all UBC students live near Ponderosa, or even on campus. If the walk were to take those students 30 minutes, or 2 hours of transit, they are unlikely to make the journey even if they were influenced by the nudges. That is to say, location distance may have been an additional variable that influenced likelihood of going.

With regard to current literature, our results showed that in the study's current state, neither form of nudge had an impact on students' likelihood of going to a designated indoor cooling area. Our manipulations of convenience and tree-shading were ineffective. Thus, future studies should not use our methods of manipulation for either nudge. Further, future studies are advised against using physical locations, as we did with Ponderosa Arbutus and Ponderosa Ballroom. Instead, a method that might control for physical distance, could involve asking participants to imagine a tree-shaded building location within what is walking distance for them, instead of providing a physical location.

Recommendations

For the client, given that the mean for the convenience and environmental condition was lower than that of the control group, it is possible that the level of convenience we provided was not convenient enough. Students may not care for minute conveniences, as inputting an address is not very difficult. Further, students may not have wanted to travel in a heatwave, or wanted to travel at all–and as such, the convenience provided did not matter. Towards this, UBC may want to implement more tree planting programs, to plant more trees around buildings. This would prepare more tree-shaded buildings in the future, which means students would not have to travel very far to access tree-shaded indoor cooling areas.

The results also suggest that students may not care about the benefits that tree-shading provides to the environment, in how it lowers carbon emissions and building cooling costs (Balogun et al., 2013; Lou et al., 2012) with could further imply a lack of care towards environmental sustainability. As such, UBC should try to foster a culture of environmental responsibility witihin students and get then directly involved. This could involve partnering with local business organizations to create internship or volunteer opportunities for students. This would create personal investment for the student, and also build connections in the community. Alternatively,

students may not have been made aware enough of the benefits, or not enough information was provided. In this case, it would be wise to spread flyers, or infographics with comprehensive information about the benefits of tree-shading on bulletin boards, or through UBC broadcast emails, so students who are interested may read and educate themselves.

Note that our participants were from UBC only, so the results cannot be generalized to other populations.

Appendix

Survey

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, collect and analyze data, present their findings in class, and submit a final report. Their final reports will be published on the SEEDS online library (https://sustain.ubc.ca/teaching-applied-learning/seeds-sustainability-program). Their projects include online surveys and experiments on a variety of sustainability topics, such as waste sorting on campus, student health and wellbeing, food consumption and diet, transportation, 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 be asked to answer a few questions in the survey. 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 encrypted and password protected so that only the principal investigator and course instructor, Dr. Jiaying Zhao and the teaching assistants will have access to it. Following the completion of the study, the data will be transferred to an encrypted and 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.

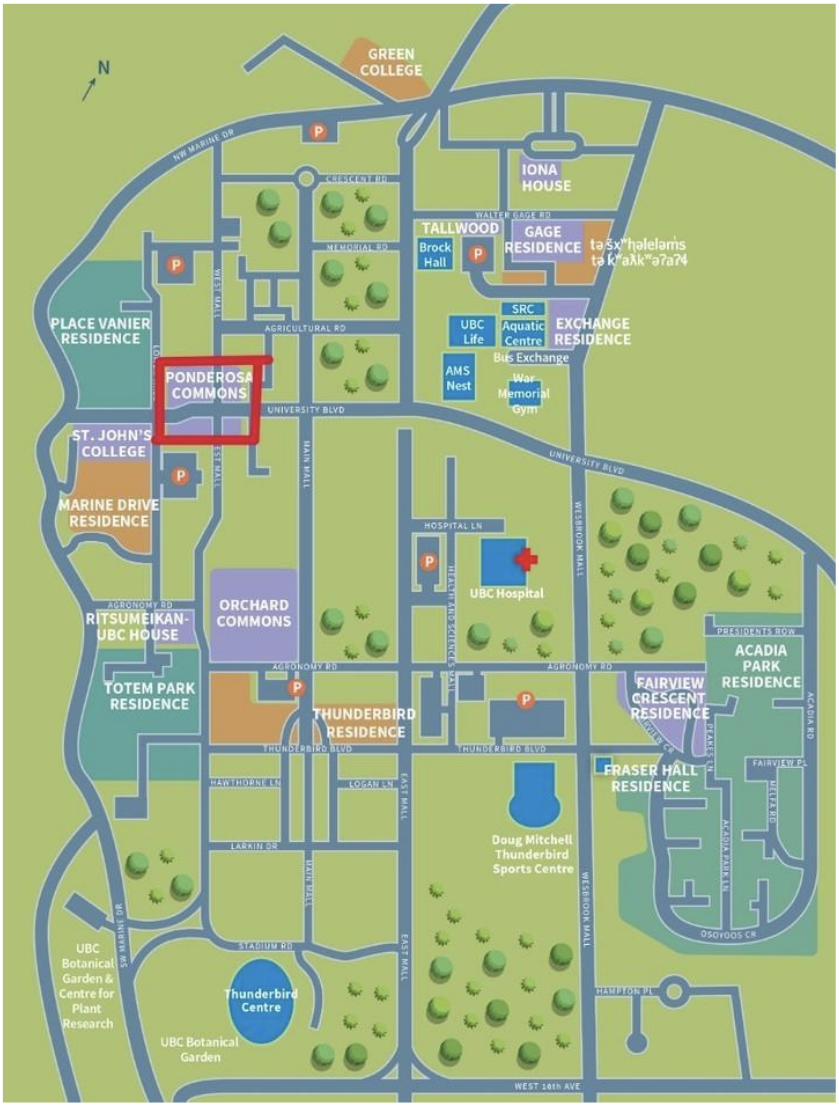
Consent: Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time. You also may postpone your decision to participate for 24 hours. You have the right to choose to not answer some or any of the questions. By clicking the "continue" 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 investigators any additional questions that you have about the study.

Ethics ID: H17-02929

- ○ I agree, start the survey
- ○ I do not agree

Convenience only condition

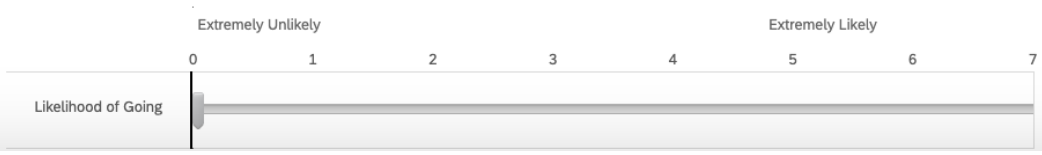
Studies have shown that indoor areas shaded by trees are effective for decreasing temperature, lowering building cooling energy costs, thus lowering carbon emissions. Ponderosa Arbutus house, marked on the map below in red, has indoor air-conditioned areas **without tree-shading** available for students.



Google Maps Navigation: Link

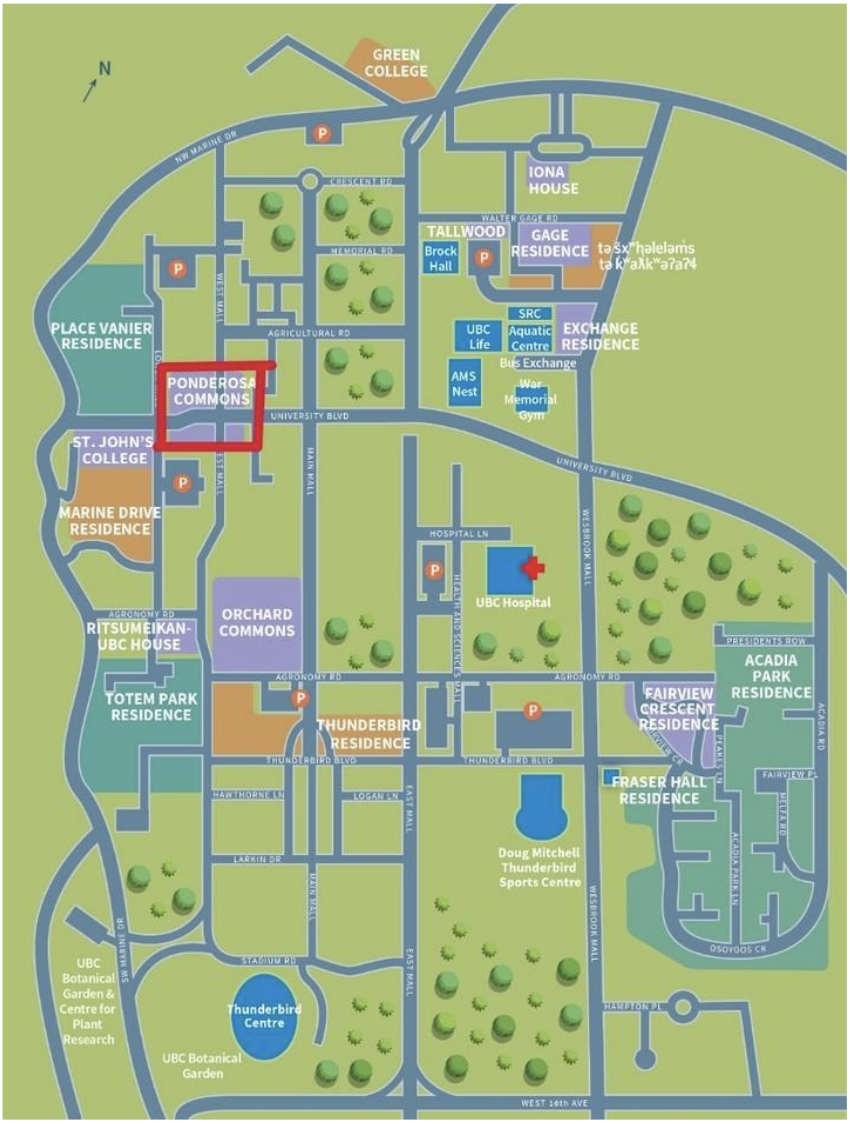
How likely are you to go to the designated indoor area for cooling during a heatwave (35°C) if you were shown the information above?

0 = Extremely Unlikely
7 = Extremely Likely



Convenience and Tree-shading condition

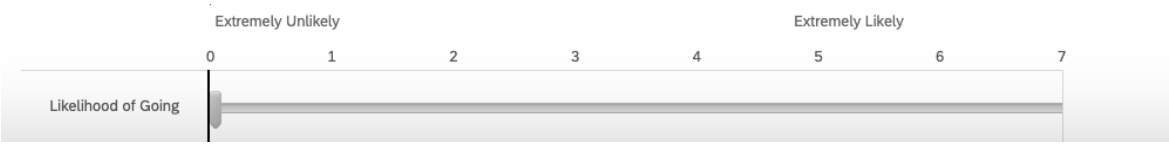
Studies have shown that indoor areas shaded by trees are effective for decreasing temperature, lowering building cooling energy costs, thus lowering carbon emissions. Ponderosa Residence Ballroom, marked on the map below in red, has indoor air-conditioned areas **with tree-shading** available for students.



Google Maps Navigation: Link

How likely are you to go to the designated indoor area for cooling during a heatwave (35°C) if you were shown the information above?

0 = Extremely Unlikely
7 = Extremely Likely



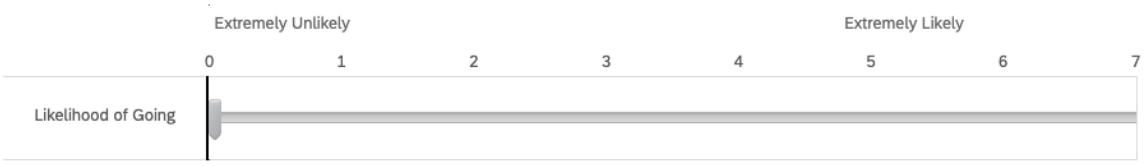
Tree shading only Condition

Studies have shown that indoor areas shaded by trees are effective for decreasing temperature, lowering building cooling energy costs, thus lowering carbon emissions. Ponderosa Residence Ballroom has indoor air-conditioned areas **with tree-shading** available for students.

Ponderosa Ballroom Address: 2075 West Mall, Vancouver, BC V6T1Z2

How likely are you to go to the designated indoor area for cooling during a heatwave (35°C) if you were shown the information above?

0 = Extremely Unlikely
7 = Extremely Likely



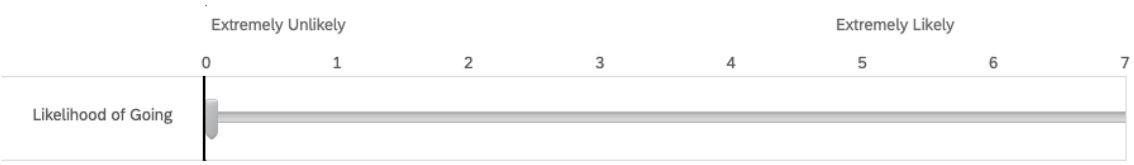
Control condition

Studies have shown that indoor areas shaded by trees are effective for decreasing temperature, lowering building cooling energy costs, thus lowering carbon emissions. Ponderosa Arbutus house has indoor air-conditioned areas **without tree-shading** for students.

Ponderosa Arbutus House: 6488 University Blvd, BC V6Z1Z4

How likely are you to go to the designated indoor area for cooling during a heatwave (35°C) if you were shown the information above?

0 = Extremely Unlikely
7 = Extremely Likely



Contribution

Each team member worked together through the entire term. Beenle contributed most to the proposal, with the initial idea, but we all worked together to write it. Tina and Jennifer primarily ran most of the data analyses, but everyone contributed to data collection, spreading the survey among friends and classmates. Weiting contributed many ideas, especially for our report recommendations. The presentation was a mutual effort, as the team made the initial presentation, each person responsible for a slide. Individual sections were assigned to each team member, and then put together. Natalie worked on most of the formal writing throughout the term, such as presentation script and typing up the final report.

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