The Effect of Peer Influence On Environmental Impact In Labs

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PSYC 321

April 06, 2017

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Psychology 321: Environmental Psychology
The Green Hot Chili Peppers:
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EXECUTIVE SUMMARY

This study aims to examine whether peer groups or lab user roles have significant effects on motivating lab users to engage in energy-saving behaviour. We approached lab users in the Forestry and CEME buildings to elicit responses for a short survey concerning their views on this subject. The majority of participants indicated that they had frequent interactions with their lab peers. We did not find a significant influence of peer group on following environmental impact reduction practices. Controlling for physical cues and participants' attitude toward environmental impact reduction also led to finding that the UBC department's influence on energy-saving behaviours was insignificant. Our findings suggest that lab users from the Forestry building were more likely to engage in energy-saving behaviour than lab users from the CEME building. Moreover, we found that lab users from both the Forestry and CEME buildings would be most motivated to participate in a hypothetical resource conservation competition by other labs in their respective departments.

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RESEARCH QUESTION AND HYPOTHESIS

Our research question is: *Do peer group or the roles of lab users have an effect in motivating other lab users' behaviour to reduce energy consumption in the lab?*

We predict that peers who have had more interaction with the interviewee will have a greater effect on behaviour change. We also predict that people in peer groups that engage in energy saving behaviour will positively influence others within the same group by creating provincial norms for others to follow. Therefore, our hypothesis is *interaction with peer groups who exhibit and/or promote energy saving behaviour will decrease excessive energy consumption behaviour in the lab.*

METHODS

Participants

We have 24 responses from Forest Science Building and Civil Engineering and Mechanical Engineering Building (CEME). Among those 24 responses, 12 of them are from the lab users in CEME and the other 12 are from the lab users in Forest Science Building. 12 of the 24 participants are PhD students, 5 of them are Master students, 4 of them are lab managers, 2 undergraduate students, and 1 staff scientist.

Conditions

There are 3 conditions in our study that we looked at, (a) the lab from which the participant works at (CEME vs Forestry), (b) the lab role that participant identifies with (undergrad, PhD student, post-doc, lab manager, staff scientist, principal investigator, other), and (c) presence of practices aimed at reducing environmental impact in the lab.

Measures

We wanted to see if peer groups had an influence in decreasing energy consumption behaviour in the lab. To measure this, we asked to what extent did each respective peer group have an influence on the participants' energy saving behaviours. If their lab has adopted practices aimed at reducing environmental impact, we also asked how often they followed those practices. These are the two variables we are correlating with the conditions.

As a separate measure we recorded what peer group the participant felt would most convince them to join a energy saving competition in the lab setting.

Procedure

We had the option of going to the Civil Engineering and Mechanical Engineering Building, the Life Sciences and the Forestry Building. Initially, we waited in the lounge areas of the buildings and asked people to complete our surveys. However, the response rate was poor due to a low number of people willing to fill out the survey. Additionally most of the people in these areas were undergraduate students who our client emphasized were the least important survey targets as they spend the least time in the lab environment. Therefore we decided to ask the administration of these buildings for permission to go door to door to their labs and ask the lab users inside directly if they would like to complete our survey. We were denied access to the

lab floors of the Life Sciences building but allowed in the CEME and Forestry buildings to knock on the labs directly. Thus we limited our study to these two buildings.

We collected our data over the course of four days from March 10 - March 20 around 1:00 PM to 2:00 PM, either in a group of 3 or two groups of 2. Our procedure was to knock on a lab door and wait for a response. If no one opened the door in a minute we left. If someone answered the door, we asked if they or any others in the lab would mind completing a short two minute survey about energy consumption in the lab. If they accepted we handed over a Macbook 13" laptop or Samsung tablet on which they could fill out the survey.

RESULTS

Frequency

We asked how frequently participants interacted with their lab peers (in person or online) on a scale of 1-5, with 1 being not at all and 5 being often. No participant responded lower than 3, with 96% of participants answering 4 or higher. That is to say that nearly all of our participants were interacting with their lab peers frequently to very frequently.

Peer Group x Reducing Environmental Impact in the Lab

We found no significance between peer group and reducing environmental impact in the lab at the 5% level. However, we did find a moderate positive correlation between the extent of the influence of the UBC department on participant reducing energy consumption in the lab, and this relationship was significant at a 6% level ($r = 0.436$, $p = 0.06$). But again this is not significant.

We conducted a multiple regression to control for participant's own importance for reducing environmental impact and whether there were physical cues in the lab. If reducing environmental impact was already important for the participant, it may explain why they were more likely to follow practices that reduce environmental impact in the lab. We also controlled for physical cues in the lab because if a lab had cues to reduce environmental impact, their likelihood to follow practices that reduce environmental impact in the lab may be due to that instead of labmate influence. After controlling for physical cues and participants' own importance for reducing environmental impact in their own lives, the relationship between the influence of UBC department and participant reducing energy consumption in the lab became insignificant ($p = 0.124$).

Building x Reducing Environmental Impact in the Lab

Participants from Forestry were more likely to follow practices that reduce environmental impact in the lab compared to participants from CEME. Specifically, we see a difference of .75, with participants in the Forestry building more likely to follow those practices. We ran a two-sample t-test to compare the means between Forestry and CEME, and the results were significant ($t = 2.43$, $p = 0.02$). That is to say, participants from Forestry were more likely to follow practices that reduce energy consumption compared participants from CEME.

Building x Competition Motivation

Our client was also interested in looking at the relationship between peer groups and motivation to participate in a resource conservation competition, and we found that 71% of participants responded with "other labs in the department".

Since there was a difference between buildings and reducing environmental impact in the lab, we also looked at whether there was a difference between building and what would motivate participants to participate in a resource conservation competition. 75% of participants from

Forestry and 67% of participants from CEME responded with "other labs in the department". We found that this difference was not significant (t = -0.94, p = 0.35).

DISCUSSION

We did not find any significant results between peer groups (as defined by fellow lab mates, other lab users, postdoctoral students, PhD students, peer institutions and UBC department) and reducing energy consumption in the lab. However, we did find a difference between building and following practices that reduce energy consumption in the lab. Specifically, our results suggest that participants from Forestry were more likely to follow those practices compared to participants from CEME.

Our lack of significant results may be due to our small sample size and methodology. In regards to our sample size, it was due to the difficulty of recruiting participants since our only means of reaching lab users such as principle investigators, PhD students, and postdoctoral students was by knocking door to door of lab buildings available to us. Additionally, we were further limited to the Forestry labs and the Civil Engineering and Mechanical Engineering (CEME) labs. We did not seek participants in the Life Sciences building since lab access was totally restricted (we could not knock door to door) and only the café was available to us. Since we would have higher chances of meeting lab users by directly going to labs, we chose not explore the Life Sciences building.

Furthermore, our question measuring reduction of energy consumption in the lab may not accurately portray actual energy reducing behaviour since the question was contingent on whether their lab had practices aimed at reducing environmental impact or not. Therefore, those who did not have practices in the lab could not answer the following question for which we were measuring energy consumption reduction. Specifically, how often they follow those practices. However, regardless of whether the participant was aware of explicit practices aimed at reducing environmental impact or not, they should still be able to answer whether they try to reduce energy consumption in the lab. Also since our measures were based on a survey, the participant reported how much they followed practices that reduce environmental impact and therefore was not measured empirically. Additionally, the questions we designed to measure peer group influence may have been confusing for participants. We asked, "To what extent has [peer group] influenced your energy saving behaviours?" on a scale from 1 being greatly reduced to 5 being greatly improved. Participants may have interpreted "greatly reduced" as in the peer group influencing them to greatly reduce their energy consumption instead of the other way around as we intended.

To improve our study it would be ideal if we could recruit participants in a more efficient way since knocking door to door is time consuming and chances of bumping into the same lab users is likely. We would also change the question used to measure reduction of energy consumption in the lab to a more general question such as "how often do you try to reduce your energy consumption in the lab?" instead of the conditional question we have originally. Thirdly, we would change the scale used to measure peer group influence to 1 being negatively impacted and 5 being positively impacted, as our current 'greatly reduced vs greatly improved energy saving behaviour' question caused confusion in some participants.

Since there is a relationship between building and following practices that reduce energy consumption in the lab, this finding can be explored in further studies to explain why participants in Forestry are more likely to follow practices that reduce energy consumption in the lab compared to participants from CEME. Future findings may assist in guiding other lab users to

reduce energy consumption in the lab. This would help UBC's Climate Action Plan 2020 to reduce GHG emissions by 67%, since buildings with labs account for 95% of UBC's GHG emissions.

RECOMMENDATIONS FOR YOUR UBC CLIENT

If we are aiming to administer energy-saving intervention plans, we should know which level on the lab hierarchy has the greatest influence on lab users. To further explore the implications of this study and to establish recommendations for this subject, we will address the two results that imply significant correlations.

From the building condition used in this study, we found that the approaches toward energy-saving for lab users were likely influenced by which building their lab was located in. This result suggests that different buildings may hold different priorities in terms of energy conservation, so it could be beneficial to adapt specialized energy-saving plans depending on the target building. For future studies, it would be important to know if this relationship is generalizable across all lab buildings. Neither peer groups nor the labs' respective departments were significant predictors of energy-saving behaviour, so it is curious that the buildings would hold this predictive relationship. One possible explanation to look into is whether this relationship is affected by the buildings' respective lab procedures or utilized equipment. Some buildings may contain labs that generally use more energy-intensive equipment, which in turn could establish different building norms for energy-saving behaviour than buildings consisting of labs that generally use lower energy-consuming equipment. However, the results could also be interpreted as participants who are in Forestry are more likely to follow practices that reduce energy consumption in the lab compared to participants in CEME. Since this was a correlational study, we cannot definitely say which direction the relationship goes. Therefore we recommend looking into whether building or participant affect reduction in energy consumption in the lab.

Another result to address is the general agreement across buildings that participants would be most likely motivated to participate in resource conservation competitions by other labs within their respective departments. This suggests that it could be beneficial to consider a two-layered approach when designing specialized intervention plans. We first consider the buildings that belong to a specific department, and then further specialize by looking at the labs within these buildings.

Appendix A: Survey Questions

1. **Which lab do you work in?**

2. **What is your role in the lab?**
   - ❑ Undergrad
   - ❑ PhD
   - ❑ PostDoc
   - ❑ Lab Manager
   - ❑ Principal Investigator
   - ❑ Staff Scientist
   - ❑ Other _____

3. **How many people are in your group/team**?

4. **How important are energy saving practices to you in general (outside of lab)?**

   1 2 3 4 5

   Unimportant Very important

5. **Are there any current energy saving practices being used in your lab?**

   Yes No

6. **How often do you follow these practices?**

   1 2 3 4 5

   Not At All Very Often

7. **Are there physical cues in your lab, such as posters, to remind you of energy saving practices?**

   Yes No

8. **If yes, how effective do you feel they are to you?**

   1 2 3 4 5

   Not At All Effective Very Effective

9. **How important are energy saving practices to your usual/standard lab routine?**

   1 2 3 4 5

   Unimportant Very important

10. **How frequently do you interact with your lab peers?**

    1 2 3 4 5

    Not At All Very Often

Appendix A: Survey Questions

11. To what extent has your lab peer group influenced your energy saving behaviors?

1	2	3	4	5
Greatly Reduced				Greatly Improved

12. To what extent have other lab users, students, post-docs, influenced your energy saving behaviors?

1	2	3	4	5
Greatly Reduced				Greatly Improved

13. To what extent have lab supervisors, technicians and Principal investigators influenced your energy saving behaviors?

1	2	3	4	5
Greatly Reduced				Greatly Improved

14. To what extent has your UBC Department influenced your energy saving behaviors?

1	2	3	4	5
Greatly Reduced				Greatly Improved

15. To what extent peer institutions have influenced your energy saving behaviors?

1	2	3	4	5
Greatly Reduced				Greatly Improved

16. How do you feel your current approach toward energy saving practices has influenced your lab peers' energy saving behaviour?

1	2	3	4	5
Greatly Reduced				Greatly Improved

17. How do you feel your current approach toward energy saving practices has influenced your fellow lab users, students, post-docs' energy saving behaviour?

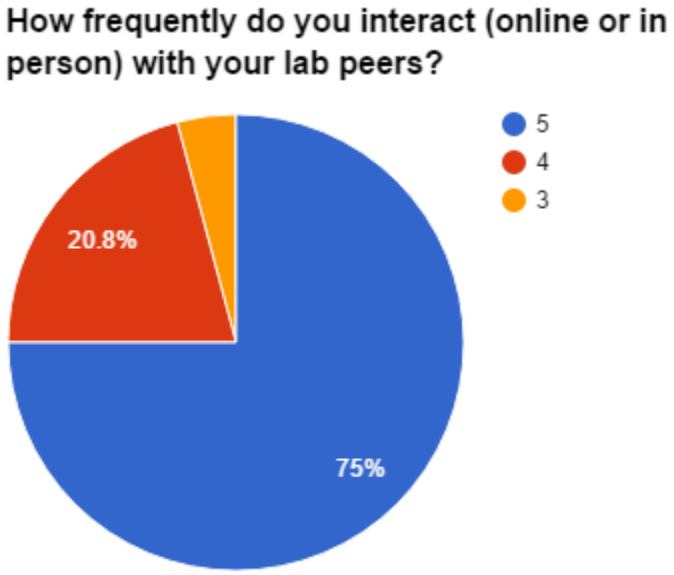
1	2	3	4	5
Greatly Reduced				Greatly Improved

18. How do you feel your current approach toward energy saving practices has influenced your lab supervisors, technicians and Principal investigators' energy saving behaviour?

1	2	3	4	5
Greatly Reduced				Greatly Improved

Appendix B: Figures

Figure 1. Frequency of interaction with lab peers



Options using scale from 1-5, where 1 = Not At All and 5 = Very Often

Figure 2. Correlations between each Peer Groups and Following Practices that Reduce Energy Consumption in the Lab

Following practices that reduce energy consumption in the lab

	r	*t*	*p*
Fellow labmates	-0.33	-1.44	0.167
Other lab users	-0.29	-1.24	0.232
Principal investigator	-0.25	-1.05	0.306
UBC department	0.436	2.00	0.062
Peer Institution	-0.22	-0.94	0.360

Appendix B: Figures

Figure 3. Multiple Regression to Control for Physical Cues in the Lab and Participants' Importance of Reducing Environmental Impact in General

Source	SS	df	MS
Model	5.51200028	3	1.83733343
Residual	4.59326288	15	.306217525
Total	10.1052632	18	.561403509

Number of obs	= 19
F(3, 15)	= 6.00
Prob > F	= 0.0068
R-squared	= 0.5455
Adj R-squared	= 0.4546
Root MSE	= .55337

reduce_enviro_pract~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dprtmnt_influence_you	.3195509	.1959297	1.63	0.124	-.0980633	.737165
physical_cues2	.5922061	.2623127	2.26	0.039	.0330999	1.151312
reduce_enviro	.3764861	.1730147	2.18	0.046	.0077141	.7452582
_cons	1.472127	.8373682	1.76	0.099	-.3126813	3.256935

Figure 4. Two-Sample T-Test between Building and Following Practices that Reduce Energy Consumption in the Lab

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
Forestry	8	4.75	.1636634	.46291	4.362998	5.137002
CEME	11	4	.2335497	.7745967	3.479619	4.520381
combined	19	4.315789	.171894	.7492686	3.954654	4.676925
diff		.75	.3086325		.0988424	1.401158

diff = mean(**Forestry**) - mean(**CEME**) t = 2.4301

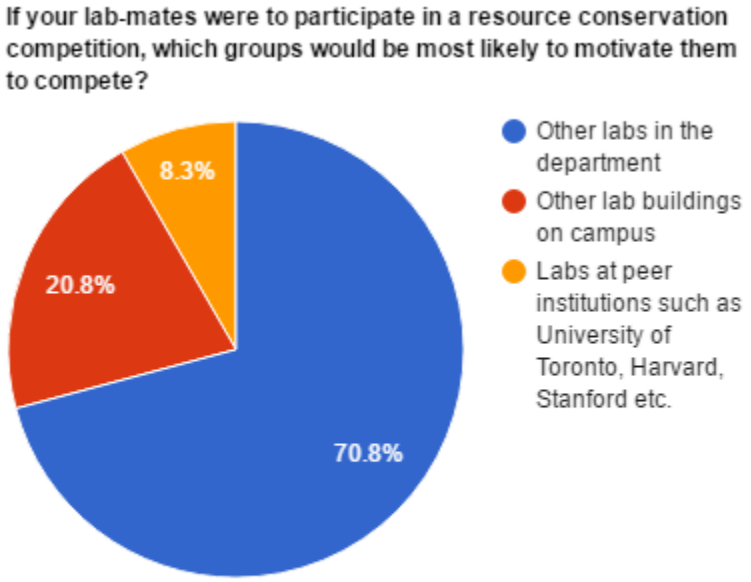
Ho: diff = 0 degrees of freedom = 17

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = **0.9868** Pr(|T| > |t|) = **0.0265** Pr(T > t) = **0.0132**

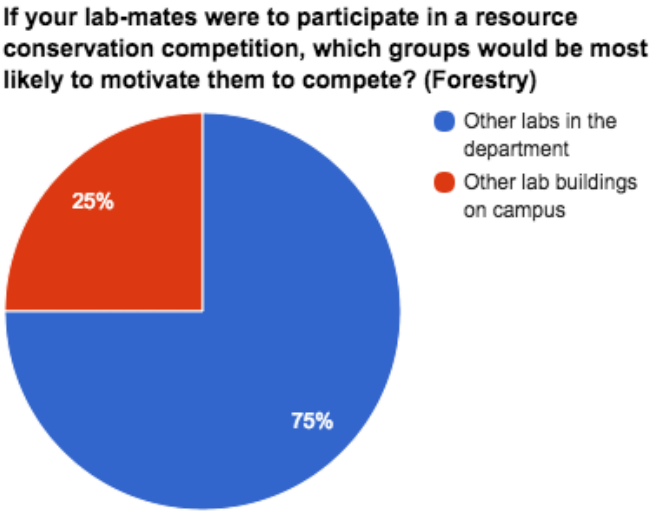
Appendix B: Figures

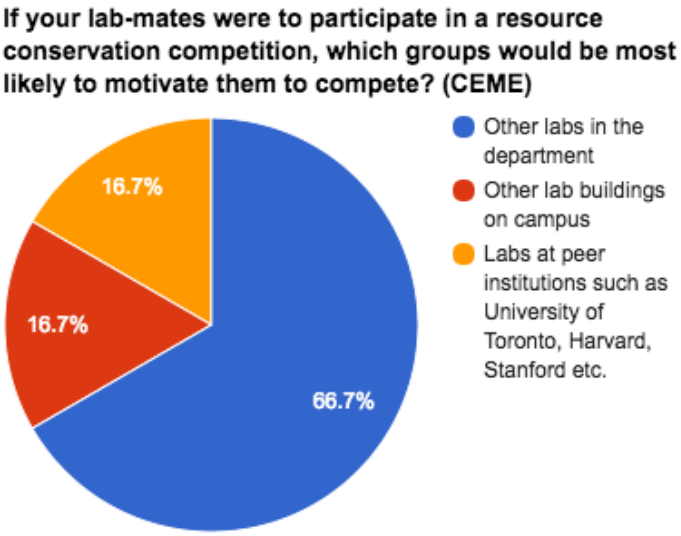
Figure 5. Motivation to Participate in a Resource Conservation Competition



Appendix B: Figures

Figure 6. Motivation to Participate in a Resource Conservation Competition between Forestry and CEME





Appendix B: Figures

Figure 7. Two-Sample T-Test between Building and Motivation to Compete in Resource Conservation Competition

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
Forestry	**12**	**1.25**	**.1305582**	**.452267**	**.9626432**	**1.537357**
CEME	**12**	**1.5**	**.2302831**	**.797724**	**.9931503**	**2.00685**
combined	**24**	**1.375**	**.1320477**	**.646899**	**1.101839**	**1.648161**
diff		**-.25**	**.2647183**		**-.7989921**	**.2989921**

diff = mean(**Forestry**) - mean(**CEME**) t = **-0.9444**

Ho: diff = 0 degrees of freedom = **22**

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = **0.1776** Pr(|T| > |t|) = **0.3552** Pr(T > t) = **0.8224**