

Effect of Backgrounds on Waste Disposal Behaviour
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Effect of Backgrounds on Waste Disposal Behaviour
Massive Apples

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Executive summary

This study aims to promote environmental sustainability by increasing the helpfulness of the 3-D Sort-it-Out Boxes. Our study examines if changing the background of the 3-D Sort-it-Out (SIO) Boxes can increase participants' usage of recycling bins, and decrease usage of garbage bins. We created three conditions; condition one was our baseline condition, having a plain white background behind the 3D SIO Boxes; condition two had an environmentally associated colour - bright green; and on condition three, we substituted a grassy background behind the boxes. We collected observation data by watching participants to see which bins they used when disposing of waste. After that, we randomly surveyed them on how noticeable and helpful they thought the boxes were. We collected data on the three conditions over two weeks. Upon analyzing the data, we conclude that our study findings do not support our hypothesis. In other words, we do not have enough evidence to prove that having a bright green or grassy background enhances the effectiveness of the 3-D Sort-It-Out boxes.

Research Question

Does the background of the 3-D Sort-It-Out Boxes have an effect on waste disposal sorting behaviour at the AMS Nest? More specifically, does the presence of a coloured or a grassy background attract the attention of students and induce them to place their wastes in the correct disposal bin?

Hypothesis

Previous research done by Bateson et al., (2013) discovered that having images of watching eyes around a location can induce more pro-social behaviours. Additionally, they believe that the use of watching eyes has the potential to be an inexpensive method of reducing littering. Similar to how watching eyes can be used to induce pro-social behaviour, we believe that a picture of nature (grassy background) will have a comparable result. In order to gauge how much of an effect the grassy background will have on sorting behaviour when compared to the default white background, we decided to introduce another condition, a bright green background. The colour green was chosen due to its association as the colour of nature and thus, we expect the green background to have some effect on waste disposal.

Due to our interest in determining whether these two backgrounds will have an effect on both the noticeability of the Sort-It-Out Boxes as well as the frequency of different bin usage, we conducted two experiments and thus there are two different hypotheses for our research. For our first experiment, we hypothesize that compared to the control white background, both the bright green-coloured background and the grassy background will result in participants rating the Sort-It-Out Boxes as more noticeable, and more helpful. Secondly, we hypothesize that when compared to the control white background, both the bright-green coloured background and the grassy background will result in participants using the recycling bins with greater frequency and the garbage bin with lower frequency.

Participants

The participant population of our study are the UBC student body and faculty who frequent the AMS Nest. Participants were users of the disposal bin located next to the stairs and facing the Flipside fast food joint. A total of 84 participants, 46 male and 38 female, were involved in the first experiment and a total of 256 participants were involved in the second experiment. We did not track the gender of participants for the second experiment.

Conditions

In both of our studies we designed 3 different conditions. The first condition is having the plain white background for the SIO boxes (**Figure 1**). This condition is the original state that has been deployed in the NEST before any alteration and thus is used as a baseline for our studies. The second condition we designed was to change the background of the SIO boxes to bright

green (**Figure 2**) as we predict the bright color will be more visible and create a greater contrast to the items displayed. Additionally, we feel that the color green will be associated with pro-environmental attitudes, and thus prime participants to use the recycling boxes with a greater frequency. For the third condition, we changed the background of the SIO boxes to a grassy pictured (**Figure 3**) background, as we would like to see if a background that is more relatable to nature can be more effective than the plain green background.

Measures

For our first experiment, participants that used the bins were randomly selected to answer a survey. Participants were asked to report the noticeability of the boxes on the scale of one to seven, with one being not noticeable at all and seven being highly noticeable. Also on the survey, participants were asked to rate the helpfulness of the SIO boxes on a scale of one to seven, with one being not helpful at all, and seven being highly helpful. Finally, participants were asked to select their gender, with the options being: 'Male', 'Female', 'Other', and 'I'd prefer not to answer'. This gender data was taken to ensure that the results were not over-sampled from one gender. The self-reported data then underwent an ANOVA test and subsequent Tukey test to determine statistical significance. For our second study, we observed and recorded the participants' frequency of usage on each bin across conditions. We measured each participant's use of the four waste disposal bins, and gave each bin used a binary score. For example, a participant that used both the garbage and compost bins, but not the plastics or papers bins would get a score of: Users = 1, Compost = 1, Garbage = 1, Paper = 0, Plastic = 0. These results were maintained by keeping a running tally of how many participants used each bin. The statistical significance of this experiment was determined by running a chi-squared test. This test showed whether there was a difference in the frequency of bin usage across conditions. Note that data for different conditions were collected during the same period of time but on different days (12pm-2pm.)

Procedure

Our team collected the data for six weekdays, over the period of two weeks (Friday during the first week, then Monday through Friday the second week.) On the first two weekdays, we maintained the background the way it was provided for us, which is our plain white background condition. The data was collected between the timeframe of 12pm to 2pm. Two experimenters were stationed near the waste bins, one to record observations and the other to give participants a survey. The sets of data for both studies were then entered and recorded in an excel file at the end of each data collecting section. During the third and the fourth weekdays, we changed the background to bright green and repeated the procedure. On the last two weekdays, the background was changed to a grass picture and we again repeated the procedure. Note that the backgrounds were changed a half hour prior to data collection to prevent participants from seeing us and affecting their sorting behaviour.

Results

Experiment 1

For the first question of noticeability, our null hypothesis is that the grass background and bright green background are not statistically different from the plain white background. The raw data from our experiment shows that participants found the SIO bins slightly less noticeable in both the bright green and grassy backgrounds, when compared to the plain white background. See **Figure 4** for more details. Running an ANOVA on the data returned a p-value of .884. (**Figure 5**) We fail to reject the null hypothesis and conclude that there is no statistical difference between conditions. These results do not support our hypothesis, as we believed that the grass background and the bright green background would be more noticeable, but this is not suggested by the data.

For the second question regarding helpfulness, our null hypothesis was that the grass background and the bright green background were not statistically different from the plain white background. Our raw data shows that participants found the SIO bins slightly less helpful in both the bright green and grassy backgrounds, when compared to the plain white background. Running an ANOVA on the data returned a p-value of .005. We reject the null hypothesis and conclude that there is a statistical difference between the conditions, and looked further via a Tukey test for more information. Upon running a Tukey test, Conditions one and two were found to be statistically different, having an absolute difference greater than the honestly significant difference (HSD). See **Figure 6** for more detail. These results are not in support of our hypothesis. We believed that the grassy and bright green backgrounds would be rated as more helpful, but the grass had no statistical effect; and the bright green background was rated as less helpful to a statistically significant degree.

Experiment 2

The raw data for our second experiment showed slightly less usage of the garbage bin in the bright green ($r = 0.281$) and grassy condition ($r = 0.254$) when compared to the plain white background in our experiment ($r = 0.372$). Additionally, the raw data showed that paper and compost bins were used slightly more in the bright green ($r = 0.750$) and grassy condition ($r = 0.718$) when compared to the plain white background ($r = 0.603$) in our experiment. The plastics bin showed ambiguous results. See **Figure 7** for more detail. We ran a chi-squared test to see if the usage of each type of bin changed across conditions. We found that for compost there was no statistical difference across conditions (**Figure 8**). This was also true for garbage (**Figure 9**) and papers (**Figure 10**), while the participants of our study exhibited marginally more sustainable behaviour (using recycling more and garbage less) for both green conditions, this result was too small to be statistically significant. For these conditions, we fail to reject the null hypothesis that the results are not statistically different.

Finally, regarding the usage of the plastics bin, our chi-squared showed that there was a statistical difference between conditions. We reran the chi-squared for each pair of conditions, and found that condition two (bright green background) was statistically different than the other two conditions. However, this result showed that the plastics bin was used less than across other conditions (**Figure 11**). These results again do not support our hypothesis.

Discussion

Our overall research question was to determine whether the background of the 3-D Sort-It-Out bins would be able to attract the attention of students and induce them to place their wastes in the correct bins. We wanted to test if using either a plain green background or a grassy background was enough to subconsciously prime our participants into performing more eco-friendly behaviors. However, the study results suggest that there is no statistical difference between conditions and they do not support our hypothesis. While sustainable behaviour was slightly more predominant in our experiment, the results were not significant enough to suggest that the sustainable behaviour pattern had any significance.

Although our results do not support our hypothesis, we believe that more testing should be done in the future. One of the most important, and perhaps the most influential limitation to our study result was the time limit we had on our data collection. We were unable to collect enough data to get a significant sample size that we can use to generalize across all results. Additionally, the time constraints prevented us from collecting data more consistently across time periods. We initially decided to use one week to test each condition. However, towards the end, we had to split multiple days in the week to test different conditions. There could be different variability in data collection on different days of the week, which could have affected our data. The characteristic of our study population could also be a potential limitation to external validity. The UBC nest was designed with sustainability as its core feature and as such, could be frequented by individuals who are more prone to lean towards pro-environmental behaviors than an outside population.

In addition, it is important to mention that our data for experiment one was produced through a self-reported survey. There were no measurements on the amount of thoughts or efforts that the study participants have put into answering the survey questions. Also, our observation data was generated by recording the usage frequency for each recycling bin, and did not necessarily indicate the effectiveness of the sorting behaviour.

As mentioned earlier, our main limitation was the time limit. We needed a longer time period to achieve more consistent data collection periods and be able to allocate the same amount of time to each of our conditions. From our previous survey response, we noticed that the backgrounds used were not very noticeable. When re-running this experiment, we could consider increasing the size of the background area or brightening the tone of the background to increase

noticeability. Additionally, to prevent any confusion, we would want to remove the backgrounds on the garbage bin to further enforce the difference between the three recycling bins and the one garbage bin. Finally, it would be ideal to re-run this experiment in buildings that are not designed to promote sustainable behaviors. This allow us to more accurately pinpoint the source of the influence on participants' pro-environmental behaviours.

Recommendation

As the goal of UBC sustainability is to “commit, integrate, demonstrate and inspire”, our study focused on adding value and contributing to the environment by trying to integrate the effectiveness of the usage of recycling bins on UBC campus (“Home UBC sustainability” n.d.).

As we mentioned above, our study result does not support our hypothesis. However, we still believe that adding an environmental cue background to the 3-D Sort-It-Out box will have positive effects when it comes to promoting sustainability behaviours, which in this case is recycling waste material. We recommend that our UBC client conduct future study to minimize our current limitations, in order to further investigate this question. Here are three suggestions on how to achieve better waste management.

First, we recommend our UBC client try out different environmental background cues. As mentioned above, the environmental-cued background we used in this study was grass background. A different background, such as an ocean or forest, as well as their associated colour, might yield different and hopefully, more positive results.

Secondly, we recommend our UBC client to run the survey in a longer time period, in addition to different time period during the semester. We conducted our survey during exam weeks and as a result, our participants' answer to the survey questions, and our observation data might be influenced by both internal and/or external psychological and/or environmental factors resulting from the stress of exam seasons. Running the study for a longer time period will allow more data collection, which will yield more conclusive result.

Finally, it is important to mention that our survey questions were designed to be straightforward and easy to understand. As a result of the simplicity, the survey may have induced interviewer bias. In other words, our study participants could have easily guessed our research questions and deliberately responded favourably to the questions asked. Thus, we recommend our UBC clients to redesign the survey questions, and to make the research questions more difficult to guess to minimize interviewer bias.

Appendices

Figure 1



Figure 2



Figure 3



Figure 4

Survey Results			
Average Score	Condition 1	Condition 2	Condition 3
Q1	4.48	4.20	4.29
Q2	5.39	3.90	5.13

Figure 5

Anova: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
condition 1	23	103	4.478261	2.988142		
condition 2	30	126	4.2	4.855172		
condition 3	31	133	4.290323	4.346237		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1.026153743	2	0.513077	0.123348	0.884122	3.109311
Within Groups	336.9262272	81	4.159583			
Total	337.952381	83				

Figure 6

SUMMARY						
Groups	Count	Sum	Average	Variance		
condition 1	23	124	5.391304	2.158103		
condition 2	30	117	3.9	4.782759		
condition 3	31	159	5.129032	2.382796		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	35.5759634	2	17.78798	5.591922	0.00531	3.109311
Within Groups	257.6621318	81	3.181014			
Total	293.2380952	83				
TUKEY TEST						
		num df	3.4			
Comparison	Absolute Difference	Critical Range	Results			
1 to 2	1.491304348	1.264237182	statistically different			
2 to 3	1.229032258	1.264237182	not statistically different			
1 to 3	0.26227209	1.264237182	not statistically different			

Figure 7

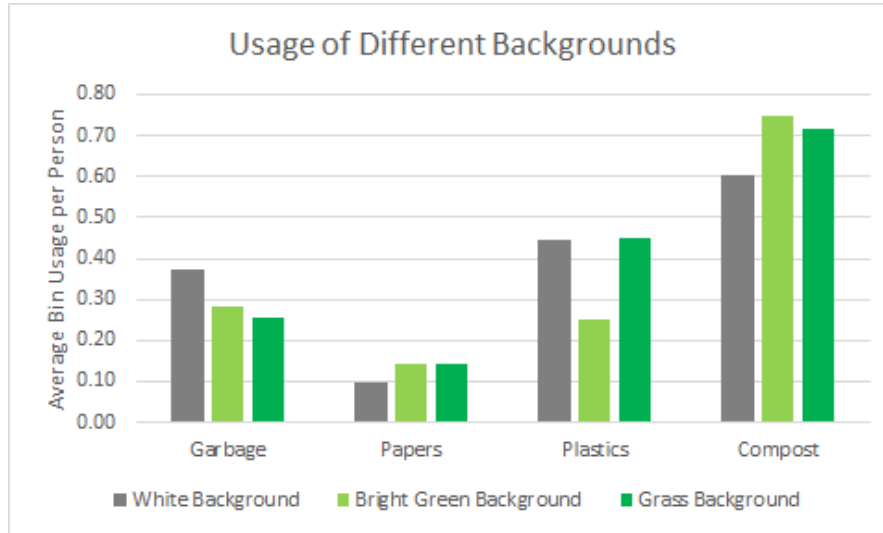


Figure 8

Compost					
Actual Values	Condition 1	Condition 2	Condition 3	Total	Joint Prob.
Used compost	73	48	51	172	0.671875
Didn't use compost	48	16	20	84	0.328125
Total	121	64	71	256	1
				Chi-Test	0.080184194
Expected Values	Condition 1	Condition 2	Condition 3	1v2	0.046014853
Used compost	81.296875	43	47.703125	1v3	0.070343518
Didn't use compost	39.703125	21	23.296875	2v3	0.116312465

Figure 9

Garbage					
Actual Values	condition 1	condition 2	condition 3	Total	Joint Prob.
used garbage	45	18	18	81	0.3164063
didn't use garbage	76	46	53	175	0.6835938
total	121	64	71	256	1
				chi test	0.1839064
Expected Values	Condition 1	Condition 2	Condition 3	1v2	0.1261045
Used compost	38.2851563	20.25	22.4648438	1v3	0.0068807
Didn't use compost	82.7148438	43.75	48.5351563	2v3	0.1970879

Figure 10

Papers						
Actual Values	condition 1	condition 2	condition 3	total	jpb	
used papers	12	9	10	31	0.121094	
didn't use bottlespapers	109	55	61	225	0.878906	
total	121	64	71	256	1	
Expected Values	Condition 1	Condition 2	Condition 3	Chi-Test	0.595737	
Used compost	14.6523438	7.75	8.59765625			
Didn't use compost	106.347656	56.25	62.4023438			

Figure 11

Bottles						
Actual Values	condition 1	condition 2	condition 3	total	Joint Prob.	
used bottles	54	16	32	102	0.3984375	
didn't use bottles	67	48	39	154	0.6015625	
total	121	64	71	256	1	
				chi test	0.0197604	
Expected Values	Condition 1	Condition 2	Condition 3	1v2	0.0088323	
Used compost	48.2109375	25.5	28.2890625	1v3	0.9525546	
Didn't use compost	72.7890625	38.5	42.7109375	2v3	0.0149928	

References

Bateson, M., Callow, L., Holmes, J. R., Maximilian L Redmond Roche, & Nettle, D. (2013). Do images of watching eyes induce behaviour that is more pro-social or more normative? A field experiment on littering: E82055. *PLoS One*, 8(12) doi:10.1371/journal.pone.0082055

Home UBC sustainability. (n.d.). Retrieved April 04, 2017, from <https://sustain.ubc.ca/>