

**The Effect of Environmental Cues on Sorting Behaviour**

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## Executive Summary

This report outlines the research experiment conducted by three psychology students from the University of British Columbia and their findings on environmental cues and the effects they pose towards sorting behaviours. The study was sanctioned by the Zero Waste Project at UBC and was designed to answer the following questions—*How is sorting behaviour impacted by having stand-alone garbage cans inside, or just outside, large auditoriums? And is there a benefit to having a poster where the garbage was asking people to recycle?* The research was conducted using a 2 x 2 between-subjects factorial design, participants were randomly assigned to one of four conditions; each consisting of a different combination of environmental cues. Sorting behaviour was operationalized by the participants disposal of the experiment's designated material, as collected in the Sort it Out bin. The research findings indicate certain benefits to having environmentally prompting cues in place of garbage cans in auditoriums, as supported by the data collected on sorting behaviours of the participants. Further studies need be conducted before determining conclusive results; until then the Zero Waste Project will continue to promote environmentally sustainable initiatives to reach UBC's greener goals.

**Project Title:**

The Effect of Environmental Cues on Sorting Behaviour

**Research Question:**

How is sorting behaviour impacted by having stand-alone garbage cans inside, or just outside, large auditoriums?

Is there a benefit to having a poster where the garbage was asking people to recycle?

**Hypothesis:**

If the visual cue of a written reminder and/or a poster that promote environmental sustainability have a positive effect on sorting behaviour, then we will observe more accurate sorting behaviour in conditions with a poster and/or a reminder.

**Methods:**

**Participants:** One hundred fifty-eight students (103 females, 55 males, mean age= 22 years) University of British Columbia students participated in the study. Four trials were conducted using separate sections of Psychology classes located in the Buchanan A building.

**Conditions:** To test our hypothesis, we conducted a study in which classes were each randomly assigned to one of the four conditions. In all classrooms used, a stand alone garbage can is normally placed at the exit of the room but for the study the garbage cans were removed from the classrooms. For the first condition a poster (see Appendix A) was placed where the stand-alone garbage used to appear. In addition, a questionnaire with a reminder to recycle was handed out to the class (see Appendix B, figure B2). The second condition involved the distribution of a questionnaire with a reminder to recycle. In the third condition, a poster was placed where the stand-alone garbage was and this condition also was subject to a questionnaire, however it had no reminder to recycle (see Appendix B, figure B1). As with the third condition, the fourth condition was given the same questionnaire with no reminder to recycle and there was also no poster. The questionnaires with no reminder to recycle were distributed as a control to ensure internal consistency among trials.

**Measures:** To see where and how many boxes were disposed, Sort it Out bins were inspected after the participants left the classroom. The proper place to accurately dispose of the Smartie boxes is the paper bin in the Sort-It-Out Station. The sorting bins were then checked to determine how many Smartie boxes were found in each of the different bins and the number of boxes found was then recorded. Prior to conducting the study, each Sort it Out bin was checked to ensure there were no previously disposed of Smartie boxes inside. Furthermore, the questionnaires from the students were collected following the class. The only relevant information on the questionnaire was the student's age and gender. The other questions and responses were insignificant as they were simply used as a tactic to ensure that all students opened their boxes and therefore had to dispose of them after class.

**Procedure:** Smarties boxes and questionnaires were placed at the front of every classroom. Participation in this study was voluntary, therefore by taking a box of Smarties and questionnaire, the participants agreed to consent and written consent was not required. Students that did choose to participate were asked to take a box of Smarties, fill out the questionnaire and subsequently, to return the questionnaires to the front following the end of the lecture.

Questionnaires were then gathered at the end of class, before the Sort-It-Out station was examined. Prior to each examination of the Sort-It-Out station, all garbage bags inside the station were removed to ensure data from previous classes did not get mixed. Smartie boxes were then removed from each of the separate compartments of the station and counted.

### **Results:**

As shown by the descriptive statistics in figure C4 (see appendix C), all conditions found more boxes in the recycling than in the garbage but it was only in the 'poster and reminder' condition that recycling behaviour significantly improved. Additionally, we conducted two separate repeated measures analysis of variance (ANOVA) with two between-subjects factors: presence of a poster (poster vs. no poster) and presence of a written reminder (reminder vs. no reminder). The first ANOVA test was conducted using the data from all of the Smartie boxes that were distributed. As shown in table C2 (appendix C), the interaction between the poster and the reminder factors showed a significant effect on the recycling response, with a p-value of 0.00759. However, the poster factor alone had the most significant effect, with a p-value of 0.00044. On its own, the reminder factor did not demonstrate a significant effect on the recycling response with a p-value of 0.53399. The second test was conducted using only the data from the Smartie boxes that were subsequently found in either the recycling or the garbage bins. The unaccounted for boxes were omitted from the data. This was done to help eliminate the limitation of the lack of Smartie boxes that were returned. However, as seen in table C3 (appendix C) none of the factors demonstrated a significant p-value.

### **Discussion:**

In the study reported above, we found data that suggests there is a benefit to having an environmental sustainability poster in auditoriums, in place of garbage cans, however the ANOVA showed that our specific results were inconclusive. Although the initial ANOVA showed a significant effect for two of the factors -poster and the interaction between poster and reminder- the results from the second ANOVA were insignificant. We feel that the results from the second ANOVA are more relevant to our data set, seeing as how most of the data in the first ANOVA was inconclusive (meaning that we never found the Smartie boxes). However, the descriptive statistics show an interesting pattern (see figure C4, appendix C). The ratio of Smartie boxes found in the recycling compared to in the garbage is much higher in the poster condition, than any other condition. We believe this is suggestive of a true benefit of the poster on recycling behaviour, however much more data needs to be collected before this can be proved.

The multitude of limitations that were encountered undermines the ANOVA results that may have been significant. The most detrimental challenge was that of the lack of returned Smartie boxes. In three of the trials, the amount of boxes found in the bins (and subsequently counted as recycled or thrown out) was less than half the amount that was taken. This means that over 50% of the data in these three trials was absent. This is a huge limitation because the location of where these boxes ended up could completely undermine or strengthen the results of our study.

Another important limitation is that the Smartie boxes do not clearly label whether they are recyclable and if so, which type of recyclable it is. This is important because in one of our trials we found the same amount of boxes disposed in the wrong recycling bin as we did in the garbage. This is shown in the data table C1 (see appendix C).

Due to the challenge of finding professors that were willing to allow their classes to be tested, our trials were run from two separate classrooms. We were able to get neighbouring classrooms on the same floor of Buchanan, but the participant's access and view of the recycling bins differed between the two classes. The image D1 (appendix D) shows the view from one of the exit doors from classroom A101, and the yellow star on the left indicates the exit from classroom A102. This minor difference might have had a big impact on the results, as classroom A102 is closer to another exit from the Buchanan building, which would bypass the recycling station altogether. Not only do these two classrooms have different accessibility to the bins but they also are different sized lecture halls. This resulted in our trials having uneven numbers of participants.

The sample that we chose poorly reflects the larger population, therefore the external validity of our study is quite low. Our sample consisted of UBC students registered in Psychology classes and the majority of our participants were female. Psychology students are usually overtly aware when participating in an experiment and this may have led to demand characteristics. Psychology students are also a poor representation of people at UBC because Psychology is only one of a multitude of faculties. For example, had we tested Environmental Studies students, we might have seen a higher percentage of recycled boxes. However, since our data was inconclusive anyways, the generalizability of our study is not very critical. Future studies should take into account the lack of generalizability that our study was subject to, and attempt to test a more generalizable sample.

Although inconclusive, our study is very relevant to current issues of environmental sustainability. The data found here does not provide direct evidence for the effectiveness of visual cues on improving recycling behaviours, but it does provide future researchers with a direction in which to push their studies. The Sort-It-Out posters are cost-efficient and potentially a very effective tool for increasing the amount of recycling that goes on at UBC.

### **Recommendations**

In the past few years, UBC has developed a Zero Waste Action plan that aims to eliminate garbage from landfills. According to the UBC Waste Audit in 2010, 17.5% of the material found in UBC garbage was recyclable. Only by testing different strategies can an effective way to increase recycling behaviour be found. In this case the use of a 'Sort it out' poster and a written reminder were used and although this study did not provide conclusive results, it can be used as stepping stone to create the strategies needed to achieve the Zero Waste Action plan.

The objective of our study was to force individuals to rethink where they are disposing of their waste. The results of the study suggest that by removing the stand-alone garbage bins and prompting individuals with a visual cue ('Sort it Out poster) and a written reminder (Questionnaire) students sorting behaviour is positively affected. If UBC was to implement the removal of stand alone garbage bins and provide students with visual and written reminders to recycle, students may be encouraged to divert away from garbage bins and redirect them to a 'Sort it Out' bin. This redirection of behaviour could help UBC achieve their goal of increasing diversion rates by 70 per cent by 2016.

In addition to the vast amount of recyclable material found in garbages, the 2010 UBC Waste Audit also discovered that 54.7% of the material found in garbages was organic materials. In 2015 Metro Vancouver plans to ban organic materials from the garbage stream. Thus, UBC must develop ways that promote accurate disposal of these types of materials. Thus, we

recommend that UBC conduct a future study, but instead of Smartie boxes, using organics and food scraps as the primary material of interest.

One of the limitations of this study was the lack of data returned and therefore the lack of data that could be accounted for. Thus, we propose that future studies could test sorting behaviours on all of the bins to ensure that higher volumes of materials are disposed of. The findings from this study found higher levels of sorting behaviour in conditions that solely had the 'Sort it Out' poster. Therefore, it may also be interesting to test why the 'Sort it Out' poster was more effective than the pairing of the 'Sort it Out' poster and the questionnaire with a reminder. Further studies could test whether recycling behaviour was prompted exclusively by the 'Sort it Out' poster or by visual cues in general.

Appendix A  
Sort it Out Campaign Poster

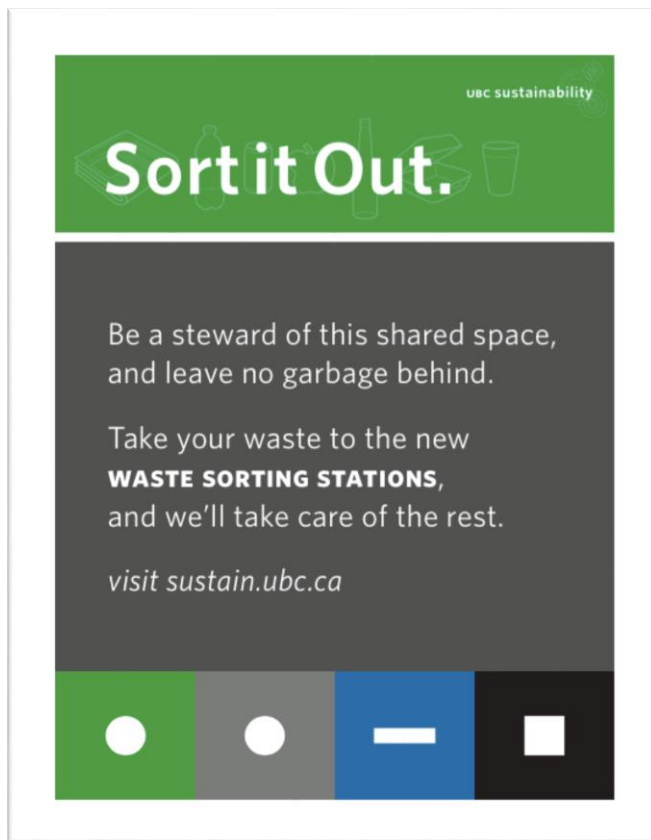


Figure A1. — Sort It Out Poster





Appendix C  
Data and Statistics

	Total Number of Experimental Trials Conducted— 4				Categorical Disposal Within the "Sort it Out" Recycling Station			Total Number of Disposed Smartie Boxes
	Number of Enrolled Students in Section	Number of Smartie Boxes Distributed	Number of Completed Questionnaires Submitted	Number of Boxes Disposed in Food Scraps	Number of Boxes Disposed in Recyclable Containers	Number of Boxes Disposed in Paper	Number of Boxes Disposed in Garbage	
Section 1— Poster & Questionnaire With a Written Reminder	83	34	31	0	0	16	3	19
Section 2— No Poster & Questionnaire With a Written Reminder	131	75	39	0	0	14	11	25
Section 3— Poster & Questionnaire Without a Written Reminder	97	31	18	0	0	9	6	15
Section 4— No Poster & Questionnaire Without a Written Reminder	64	18	12	0	2	4	2	8
<b>Total</b>	<b>375</b>	<b>158</b>	<b>100</b>	<b>0</b>	<b>2</b>	<b>43</b>	<b>22</b>	

Table C1. — Data Collection Table

Factors	P-Value
Poster Only	0.00044
Poster and Reminder	0.00759
Reminder Only	0.53399

Table C2. — First ANOVA

Factors	P-Value
Poster Only	0.16589
Poster and Reminder	0.12899
Reminder Only	0.57522

Table C3. — Second ANOVA

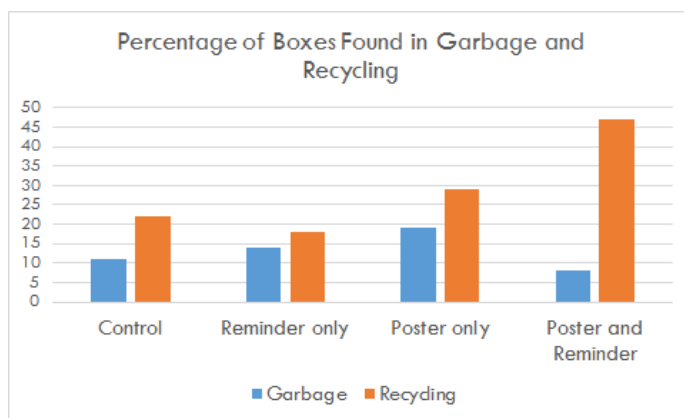
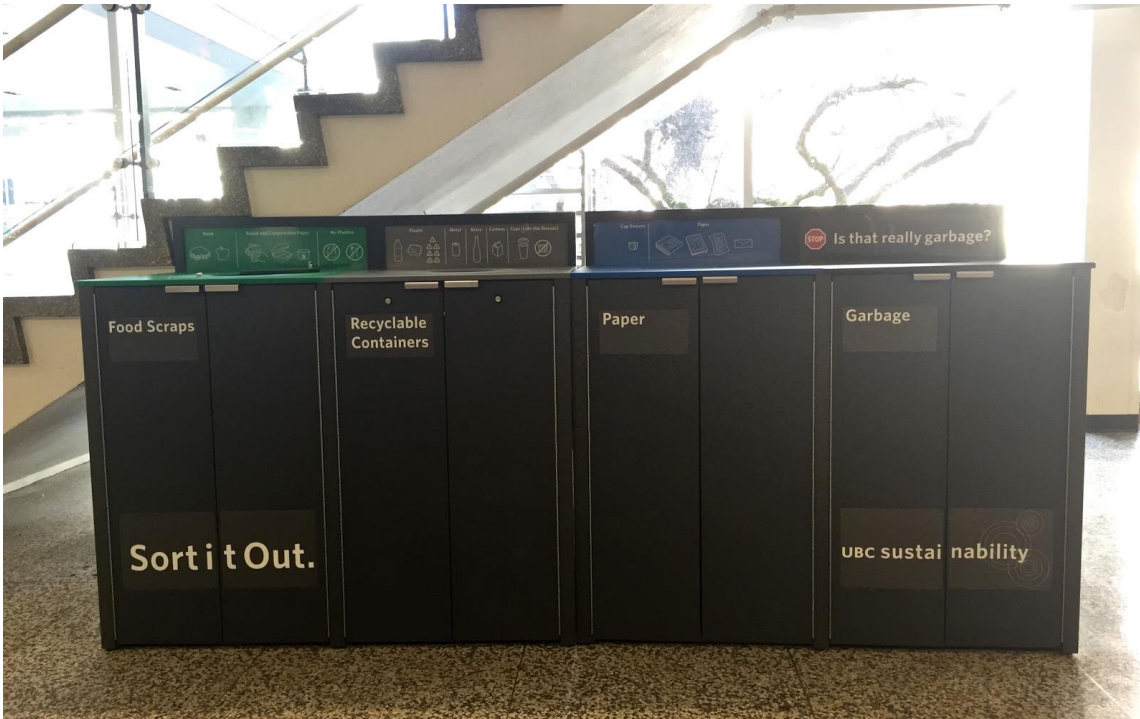


Figure C4. — Descriptive Statistics Figure

Appendix D  
Sorting Station



*Figure D1.* — Panoramic view. The “Sort it Out” station in relation to the auditorium entrance.



*Figure D2.* — “Sort it Out” station used for the study. Located on the 1<sup>st</sup> floor of Buchanan A.