Sort it with a Smile: Interactive Waste-Sorting and its Effects on Sorting Behavior

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Final Report:

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Team Dynamite

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Summary

We wanted to investigate if the presence of a waste-tracking "game, titled the Bin-Fun Game, influenced the sorting behavior of people throwing out waste at the AMS Nest's waste-sorting stations. We believed that the presence of the Bin-Fun Game might increase a person's awareness of the act of sorting their waste, and could lead to more accurate sorting, therefore reducing contamination of improperly sorted items. Our study participants consisted of all staff, student, faculty, and visitors who frequented the AMS Nest. It was conducted over a 5 day baseline condition and an 8 day intervention condition using an experimental bin where the game was set up that was measured against a control bin with no game. We measured the contaminants (i.e. incorrectly sorted waste) of both bins as well as the weight, and used a 2-by-2 ANOVA between subjects design to test our results. However, we did not find results to support any of our hypothesis. This leads us to believe that there may be other, more effective ways to encourage better sorting behavior among frequenters of the Nest.

Research Question

Does the presence of a "bin-fun" style waste-sorting station affect sorting behaviour at the AMS Nest? This type of waste sorting station was created by attaching a computer monitor to the waste sorting station, which counted how much waste was thrown into the bins each day. It also displayed a fact about waste disposal every time a piece of waste was thrown into one of the bins, for example, the fact that Styrofoam is a non-recyclable material.

Hypothesis

Previous research has found that contextual factors can have a significant impact on recycling behaviour. For example, Wu, DiGiacomo and Kingstone (2013) found that students in the environmentally friendly CIRS building in UBC were more likely to accurately sort their rubbish than students in the old Student Union Building. This was mainly attributed to the presence of pro-environmental contextual cues, such as persuasive signs that explain where the food comes from and the use of compostable eating utensils in the cafe, which are believed to increase attention to recycling behaviour. However, Gamba and Oskamp (1994) found that the most significant predictor of accurate recycling was relevant recycling knowledge, suggesting that attentional cues alone may not be sufficient for increasing waste-sorting accuracy. The importance of education for accurate waste-sorting behaviour was highlighted by Goldenhar and Connel (1993), which found that there were higher levels of recycling among students when they received educational feedback. This feedback took the form of a poster on the inside door of the waste disposal unit, which displayed recycling myths about the environmental impact of paper recycling and product packaging, as well as the impact of recycling on energy savings and air and water pollution.

Considering this correlation between environmental knowledge and recycling accuracy, our hypothesis predicts that the educational feedback provided by the Bin Fun game will increase a person's recycling knowledge, which should lead to a more accurate sorting of waste at the Bin Fun game waste sorting station.

Participants

Our participant population is the UBC student body, faculty, and visitors that frequent the AMS Nest. Participants were not assigned to any of the conditions. However, we conducted a brief observation of 7 random participants using the Bin-Fun Game which we coded for engagement.

Conditions

Our experiment collected data from 2 sets of waste-sorting bins located in the AMS Nest. The bins were identical in appearance, with both being sorted based on the waste-categories garbage, food scraps, paper, and recyclable containers. However, in our experimental condition, the presence of the "Bin-Fun Game" was the only difference. This "game" was a computer monitor also divided into the different sorting categories (see Appendix B). For each category, a cartoon figure based on the type of waste sorted into that category (e.g. a cartoon figure of a straw for garbage) would jump up and down once waste had been deposited into the bin and give a tip on what kind of waste went where. The experimental bin was located on the Lower Level of the Nest connecting to the Old Sub, and the control bin was located on the Second floor of the Nest in an area that students studied and ate lunch in. We deemed these bins to be in comparably trafficked areas by brief observation. Our experiment, which was conducted over a period of 13 days during days when classes were held (Monday to Friday), consisted of 4 conditions: experimental baseline, control baseline, experimental intervention, and control intervention. In the experimental and control baseline condition, data was collected over a period of 5 days from the experimental and control waste-sorting bins before the Bin-Fun Game was implemented. In the experimental and control intervention conditions, data was collected from the bins after the Bin-Fun Game was implemented for a period of 8 days.

Measures

Participants sorting behaviors were assessed on two measures: weight of the bins in kilograms and contamination percentage (%). To ensure less variability due to differences in the Nest traffic hours, we collected our data every day of the week at 5:00 pm. By using a weighting scale, we weighted the four different waste types of the experimental and control sorting stations. The contamination levels of the bins were estimated by visually counting the number of contaminants. We used a long stick to be able to estimate the contamination level of the bottom of the bins.

Additionally, in order to have a broader perspective on how the participants interacted with the game, we observed people throwing their waste in the experimental sorting station for an hour time period. In total, seven people used the sorting station during the observations. Two of them showed no engagement and did not look at the bins. There was one person that seemed to be moderately interested in the game and looked at the bins for less than 5 seconds. Four people showed a significant engagement with the bins and looked at the sorting station during 5 seconds or more. These results suggest that the minimal difference observable between the experimental bin and the control bin sorting behaviors may not be due to a lack of interest or the inattention of the participants.

Procedure

The weight of each bin was calculated using the weighing scale in the back of the old student union building.The amount of contamination in each bin was estimated using observational methods. We used a long wooden stick to sift through the contents of the bin and estimate the percentage of incorrectly sorted rubbish in each bin .We recorded this data on an excel spreadsheet in order to conduct a statistic analysis after the experiment.

This method of data collection was used to access the experimental bin before the bin-fun game was implemented (experimental baseline condition) and the control bin (control baseline condition) for five days. Once the game was implemented, we used the same method of data collection for the experimental bin (experimental intervention condition) and the control bin (control intervention condition) for eight days.

Results

The descriptive statistics for both weight and contamination by bin type, station and period are summarised in tables 1 & 2. Employing a two by two between subjects ANOVA design, the data were analysed for both directionality and significance. Specifically, we sought to measure the effect of station and period on weight along with the effect of station and period on contamination for each bin type.

The results of the ANOVA (summarised in Appendix E, Table 3) demonstrated single marginally significant effect ($p = 0.07$) of station on weight in the food bin (more food was composted in the experimental condition relative to the control condition). However, this effect was diminished to the point of insignificance in calculations including both stations and period (interaction) or period alone. No other significant results were found irrespective of dependent variable (p-values ranged from $p = 0.28$ to $p = 0.98$).

Discussion

As our results indicate, there was no significant difference between the control and experimental bins. This was across both periods, and so we suppose that the bin fun game had little effect on sorting behaviors. Our initial assumption was that a lack of engagement with the game caused the lackluster results. The game was set up in an area more used as an exit from the Nest and so we reasoned that people disposing of trash at these bins were on the way out already, and were not paying attention to it. Naturalistic observations of people throwing their waste in the experimental station suggest that some participants paid attention to the game. Out of 7 people using the sorting station, 4 of them looked at the game for more than 5 seconds. Therefore, we suggest that a lack of attention might not explain the insignificant results. Rather, we propose that the lack of a significant difference was possibly due to the bin fun game itself being ineffective at teaching accurate sorting behavior, mainly due to the fact that messages were displayed too late, only showing once garbage was already thrown into the bin. Secondly, the messages displayed might not be enough proactive, as they only gave general tips on sorting waste. Arguably, this was due to practical concerns, as it is technically difficult to have the game analyse every piece of waste thrown in and display a message relevant to that material. However, the observation cannot be seen as entirely representative of the overall effect on the student body. Regardless, more effective messages will be proposed in the recommendations section.

However, there were several factors that may have influenced our results. Firstly, both our control and experimental bins were subject to low traffic. The control bin was placed on the second floor of the Nest, with a relatively low student presence at any given time. Additionally, to get to the experimental bins, one would have to pass bins already in the center of the Nest, and so there was a high chance that participants who engaged with the game – regardless of their attention – had already disposed of a fair amount, if not all, of their garbage. Secondly, the overall length of the data collection period was only 13 days, and so it can be said that not enough data was collected to note any significant effect. For these two reasons, it can be argued that our data was not truly representative of the game's effects on waste sorting behavior.

Recommendations

Firstly, to make the messages more effective, and still keep the game practical in its design, the messages could describe accurate sorting behavior in a normative context (i.e. as information about how most people behave in a given situation). Research by Goldstein, Cialdini, and Griskevicius found that descriptive norms resulted in roughly 75% of guests who participated in hotel conservation programs reusing their towels (Goldstein, Cialdini, and Griskevicius, 2008). In a related experiment, they found that descriptive norms used on housekeeping door cards resulted in significantly higher towel reuse than that of cards displaying standard environmental messages (e.g. "Help save the environment by reusing towels during your stay"), despite the results being artificially suppressed via strict criterion for what towels counted as "reused" (Goldstein, Cialdini, and Griskevicius, 2008). Therefore, utilizing descriptive norms is recommended for a more pronounced effect. The messages should be kept specific to the material that should be disposed of in the bin (or specifically state what should not be thrown in the bin). Additionally, displays similar to those in the CIRS building bins – where physical examples of the correct materials for each bin are displayed – could also be added to better educate students on what is and is not appropriate for each bin, as the drawings can be confusing.

Secondly, practical concerns regarding the positioning of the bins should also be addressed. For the best representation of sorting behavior, both the control and experimental bins should be placed on the lower ground floor. There should also be longer periods for data recording for both the baseline and intervention conditions, so that enough data can be collected to reveal any trends.

References

Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels. *J Consum Res Journal of Consumer Research*, *35*(3), 472-482.

Wu, D.W-L, DiGiacomo, A, Kingstone, A (2013). A Sustainable Building Promotes Pro-Environmental Behaviour: An Observational Study on Food Disposal. *PLoS ONE 8*(1):e53856.doi:10.1371/journal.pone.0053856

Gamba, RJ, & Oskamp (1994). Factors Influencing Community Residents' Participation in Commingled Curbside Recycling Programs. *Environment and Behavior, 26*(5), 587-612

Goldenhar, L.M, & Connell, C.M (1993). Effects of Educational and Feedback Interventions on Recycling Knowledge, Attitudes, Beliefs and Behaviours. *Journal of Environmental Systems*, *24(*4), 321-333

Appendix A: Issues

We have encountered three problems during data collection that are worth mentioning. First, the weighting scale was defective on one occasion, therefore, we could not measure the weight and the contamination percentage on that date. Also, we have been waiting for the approval of the UBC sustainability project coordinator to use the weighting scale. This delayed the date of the game implementation. Finally, it should be noted that there could be differences in the contamination percentage found due to inter-rater reliability issues. Indeed, 5 people estimated the number of contaminants using their own standards of which items should be sorted in which type of bins.

Appendix B: The experimental sorting station

Appendix C: The control sorting station

Appendix D: Observational measures

When observing the 7 participants who used the Bin-Fun game in our observational period, we coded engagement on a scale of not engaged, somewhat engaged, and very engaged. No engagement was coded as participants who were not looking at the bins at all, moderate engagement was coded as participants who were looking for up to 5 seconds and significant engagement was coded as participants that were looking at the sorting station for more than 5 seconds.

Appendix E: Tables & Figures

Table 1

Mean Weight (kg) (Standard Deviation reported in brackets)		Bin			
Stations	Period	Garbage	Paper	Container	Food
Experimental	Intervention	1.13 (1.04)	1.15 (0.64)	0.00 (1.48)	1.68 (1.57)
	Baseline	1.32 (1.55)	2.58 (2.24)	2.52 (1.80)	2.48 (3.09)
Control	Intervention	0.79 (0.85)	1.38 (1.44)	1.23 (1.46)	1.45 (0.80)
	Baseline	1.24 (3.83)	2.36 (3.21)	2.58 (1.09)	2.5 (1.58)

Table 2

Mean Contamination (%) (Standard Deviation reported in brackets)		Bin			
Stations	Period	Garbage	Paper	Container	Food
Experimental	Intervention	4.38 (29.69)	1.00 (18.42)	0.00 (10.53)	3.13 (6.05)
	Baseline	2.00 (29.54)	1.00 (6.52)	4.00 (5.70)	8.0 (14.40)
Control	Intervention	1.88 (25.34)	1.25 (4.96)	2.50 (12.11)	3.75 (10.35)
	Baseline	2.00 (31.09)	2.00 (9.52)	8.00 (11.73)	18.00 (33.09)

Table 3

		Bins											
		Garbage			Paper			Container			Food		
		F	Obtained P-Value	Df	F	Obtained P-Value	Df	F Value	Obtained P-Value	Df	F	Obtained P-Value	Df
	Stations	0.587	0.452	1	0.970	0.355	1	0.941	0.343	1	3.620	0.070	1
	Period	0.758	0.393	1	0.551	0.466	1	0.12	0.732	1	0.368	0.550	1
Weight (kg)	Interaction (Station x Period)	1.123	0.279	1	0.394	0.537	1	0.501	0.486	1	0.477	0.477	1
	Stations	0.009	0.924	1	0.318	0.579	1	0.66	0.425	1	0.066	0.800	1
	Period	0.535	0.472	1	0.580	0.812	1	0	0.9894	1	1.067	0.313	1
Contamination (%)	Interaction (Station x Period)	0.235	0.633	1	0.981	0.333	1	0.835	0.371	1	0.267	0.611	1