The Effect of Contamination-Specific Tags on Residence Organic Disposal Bins

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April 06, 2017

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AELVZ

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Executive Summary

We wanted to investigate if the presence of contamination-specific tags on organic disposal bins influence the sorting behavior of people throwing waste in the organic bins at the Thunderbird Residence Area. We believed, that putting two styles of stickers might increase a person's awareness, therefore lead to a reduction in contamination rate in organic disposal bins. By contamination, we specify plastic. Our study participants consisted of all Thunderbird residence (mainly upper year and graduate student), and we assumed only Thunderbird residence use the organic disposal bins. It was conducted over a 4-week with baseline condition, manually dividing the location of the containers into the experimental condition which received the stickers against a control condition with no stickers under any circumstances. We used two types of stickers, the "Thank you" sticker (positive sticker) and the "no plastic" sticker (negative sticker). we measured the contaminants of all the bins as well as the fullness of the bins by volume and used ANOVA-tukey test and t test to analyze the result. We found the result to support our hypothesis. This significance shows that there is a decrease in contamination in the disposal bins. Of course, this is contingent on the parameter and measurements restrictions that were imposed on us.

Research Question

Does the presence of contamination-specific tags on residence waste station affect food scraps contamination rates?

Hypothesis

We predict placing contamination tags with either positive or negative sticker (see Appendix a) on organic waste bins should result in a decrease in contaminant rate of plastics.

Participants

Our participant population is residents of UBC Thunderbird Residence Area, which is mainly composed of upper-level undergraduate students and graduate students. Since the waste stations are outside of the residence buildings; however, we cannot rule out the possibility that people nearby may be involved as well.

Conditions

Our experiment collected data from five blocks (see Appendix b) at the Thunderbird Residence. Each block has it's own waste station, with identical organic bins along with the same graphic demonstration poster (see Appendix a). We randomly assigned each block to either the control condition or experiment condition with one exception. The garbage bins for block two were placed outside away from the waste station, thus if we placed the stickers on the garbage bin, there would be no signs indicating what should go into each bins and sticker would be placed on the bin itself rather than on the wall. With environmental restrictions, we assigned block two to

be a controlled group. The other group that were assigned to the control group was block three. The control groups are aimed to identify the contamination rate without stickers, and so did not receive a sticker under any circumstances.

The rest three blocks are labeled as the experimental group. For each category of the experimental group a sticker was pasted depending upon the contamination rate of the previous week, heavily contaminated group received a “no plastic” sticker (negative sticker), and lightly contaminated group receive a “Thank you for keeping plastic out” sticker (positive sticker). The experiment bin locations are location one, four and five (see Appendix B).

Measures

Considering the limitation on the assessment tools, participants sorting behavior in five different locations (see Appendix b) were assessed on two primary measures: contamination percentage (%) and the fullness of the food scrap bin by height. Therefore, making it number of contaminants on one percent of the fullness of the bin. To ensure less variability due to differences in the traffic hours, we collected the data on every Sunday of the week at 4.30 pm, as we believe weekends has the maximum amount of garbage. The contamination level of the bins was estimated by visually counting the number of contaminants using a long stick. Additionally, the measuring tape was used to measure the height of fullness in different experimental and control stations. The percent of the fullness of the bin was measured by height, by dividing the height of the wastes to divide the height of the bin.

Moreover, due to the focus of the research, only plastics are considered as contaminants. The cutoff line for heavy contamination and light contamination was determined by the baseline data collected initially in the first week, with no stickers applied. The average was 8.6 contaminants for one percent of fullness, so we set the cutoff line at four contaminants per percent of fullness. For bins that exceeded the cutoff line of contamination, they would receive the negative sticker. For bins that did not exceed the cutoff line of contamination, they would receive the positive sticker. We changed the stickers on Tuesdays every week after the garbage collection to mimic the indirect interaction between the janitor and the residents.

Procedure

The objective of the study was to determine whether putting contamination tags on residence waste station affect the behavior of people in sorting the waste into food scrap bins. The initial steps involved calculating the number of contaminants in the bin by observational method i.e. visually inspecting the bins. We used a long stick to sift through the contents of the bins and estimate the percentage of incorrectly sorted plastic in food scrap bins. The height of the bins was also calculated by the measuring tape to assess the fullness. We recorded this data on an excel spreadsheet to conduct a statistic analysis after the experiment.

Our experiment was conducted over a period of four weeks including the baseline week. The baseline data was collected a week before implementing the stickers. We collected data on

Sunday afternoons, as it was the nearest day to garbage collection after proposal approval, at five different locations at Thunderbird Residence. We wanted to remain constant as much as possible, so we collected data every Sunday at 4:30 pm. This method of data collection was used to assess the initial contamination rate in the experimental bin before the stickers were implemented. Once the stickers were implemented, we placed the appropriate stickers every Tuesday after the garbage collection based on previous week's data.

Results

We administered two tests to analyze our data, the prior being the Anova tukey test, to examine the impact of "no plastic" sticker and "thank you" sticker separately with the control condition, and then we administered an Independent Sample t test to examine the impact of both the stickers together which means stickers versus control condition.

The total data set for Anova tukey test are shown below (see Appendix c table 5 and 6). The descriptive statistics include the number of contaminants, fullness and ratio of contaminants per percent of fullness of the bin. Employing an ANOVA tukey test including three conditions (thank you sticker, no plastic sticker and the control group). Due to the between group design, the degree of freedom for fullness, ratio and contaminants is two; which is same for all. The F value for fullness, ratio and contaminants with respect to between group is 2.067,1.136 and .002 respectively. The p values for fullness is 0.138, for ratio it was 0.330 and for contaminants it is 0.375 respectively. Therefore, none of them demonstrated significance effect as all the p values are greater than 0.05 which implies it is not significant and no other significant results were found in this test.

However, during the Anova test we find our control group data points are a lot more than the other two conditions separately, which may underestimate the effect of the stickers, so we combined two stickers together to see whether the stickers overall have an impact or not. Therefore, we conducted the Independent Sample t test(see Appendix c Table 2, 3 and 4) with "Thank you" and "no plastic" sticker under one condition in contrast with the control condition. Also, since this study is a between-groups study due to the fact that it is impossible to determine who used the sorting stations at certain days and certain times, it would be beneficial to see if there were significant results between conditions for various days of the week. The result come out slightly different from the Anova test, with significance for fullness, contaminants and the ratio shown as 0.002, 0.048, and 0.085 respectively, the p value for fullness and contaminants is less than 0.05 which indicates there is a marginal significance.The F value for fullness, contaminants and ratio with respect to equal variances assumed was 11.210,4.122 and 3.103 respectively. The degree of freedom for fullness, ratio and contaminants with respect to equal variances assumed was 11.210,4.122 and 3.103 respectively. Whereas, the mean for fullness with respect to control and sticker condition are 51.24 and 67.62 respectively. The Mean for contaminants with respect to control and sticker condition are 3.56 and 2.88 respectively. Additionally, the mean for ratio with respect to control and sticker condition are 8.62 and 4.75 respectively. Coming to the standard deviation for fullness with respect to control and sticker condition are 51.24 and 67.62 respectively. Standard Deviation for contaminants with respect to control and sticker condition are 2.836 and 1.967 respectively. Standard deviation for Ratio with

respect to control and sticker condition are 10.337 and 3.779 respectively. The data shows a marginal impact on bins fullness and contamination ratio.The results of Independent Sample t test found marginal significance as the p value was less than 0.05 proving it to be significant.

Discussions

As our results from the ANOVA Tukey test indicate either "no plastic" sticker or "thank you" sticker separately has a significant impact on people's sorting behavior, or say does not affect the contamination rate. However, after we adjust the number of control data and experimental data by combining the stickers together to conduct a T test it showed a marginal significance, as the bins with stickers show a higher level of fullness and a lower level of contamination rate, with p value for fullness and contaminants being 0.002, 0.048 which is less than 0.05 showing marginal significance effect. Therefore our hypothesis is marginally supported by the T test.

However, there were several factors that may have influenced our results. Firstly, both our control and experimental bins were subject to different locations that meant different traffic. One of the control bin location had two extra bins compared to other locations. Additionally, as the bins were outside the residence there is a high chance of participants from nearby (who do not live at thunderbird) to dispose a fair amount of garbage in the bins. Secondly, the overall length of the data collection period was only three weeks, and so it can be said that not enough data was collected to note any significant effect. The sample size was pretty small. For these reasons, it can be argued that our data was not truly representative of the effect of contamination stickers on contamination rate in organic bins.Also, we believe with a large sample size and a better balance between the control data and experimental data, the result will show a favor to our hypothesis. Moreover, due to the measuring limitations; we were unable to grasp the exact number of contaminants in the bins, for example: plastics that is wrapped inside of the bags. Therefore, there is possible margin of error.

Also, throughout our data collection, we noticed the amount of garbage disposed in Thunderbird Residences often exceed the amount the various garbage bins allows. Many items and bags were disposed on the ground by the waste stations. The untidiness of the station may indicate that other residences do not follow the sorting guidelines and thus the participant does not need to follow either.

Even though there are some limits to our study, overall we believe our data suggests that the indirect interaction between the janitor and the residences through the anti-contamination stickers helps reduce the contamination rate in food scrap bins. Thus, we believe that further studies on the effect of the anti-contamination sticker. Qualitative measure can also be conducted in the future; for example, a brief survey to record to effectiveness of the stickers placed in our experimental condition, the participants could be asked if the presence of the stickers aided them in their sorting decision making process for the organic bins and their answers can be recorded with the help of a straightforward nominal scale consisting of two options: yes or no.

Recommendations for the client

In order to make the messages more effective, the stickers could be combined with a psychological phenomenon aptly demonstrated by Melissa Bateson and Daniel Nettle at Newcastle University. The phenomenon demonstrates that the mere illusion of being watched, even by an eye on a poster, is significant enough to alter people's behavior. People become more self conscious and tend to behave in a more socially acceptable way. By combining this phenomenon with the stickers; there may be an increase in efficiency in reducing contaminants. Of course, this is still due to further research and study.

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.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 contaminants is not appropriate for organic bin. It catches more attention. Moreover, it can also be analyzed if putting the stickers directly on the bin has more effect rather than pasting it on the walls.

Lastly, practical concerns regarding the positioning of the bins should also be addressed. For the best representation of sorting behavior, the surrounding environment of waste station should be considered. Also, 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

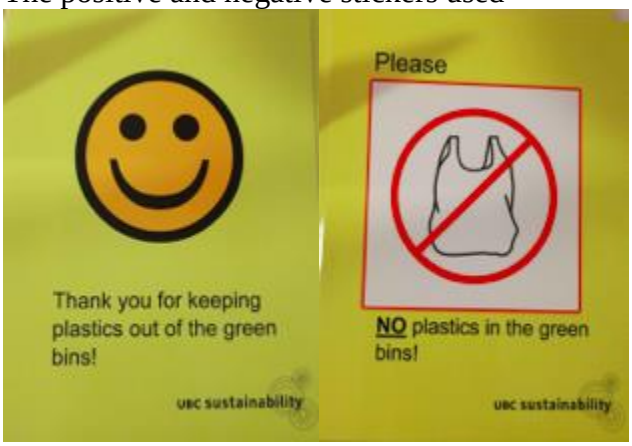
Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels. *J Consum Res Journal of Consumer Research*, 35(3), 472-482

Bateson, M., Nettle, D. & Roberts, G.(2006). Cues of being watched enhance cooperation in a real-world setting. *Biology Letters*, 2, 412–414

Appendix

Appendix a

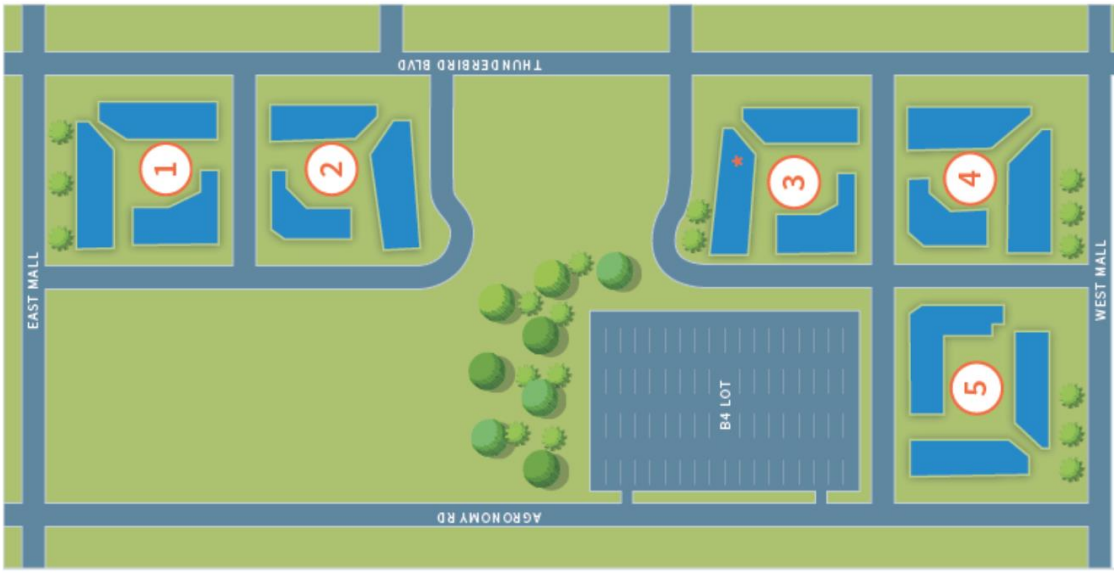
The positive and negative stickers used



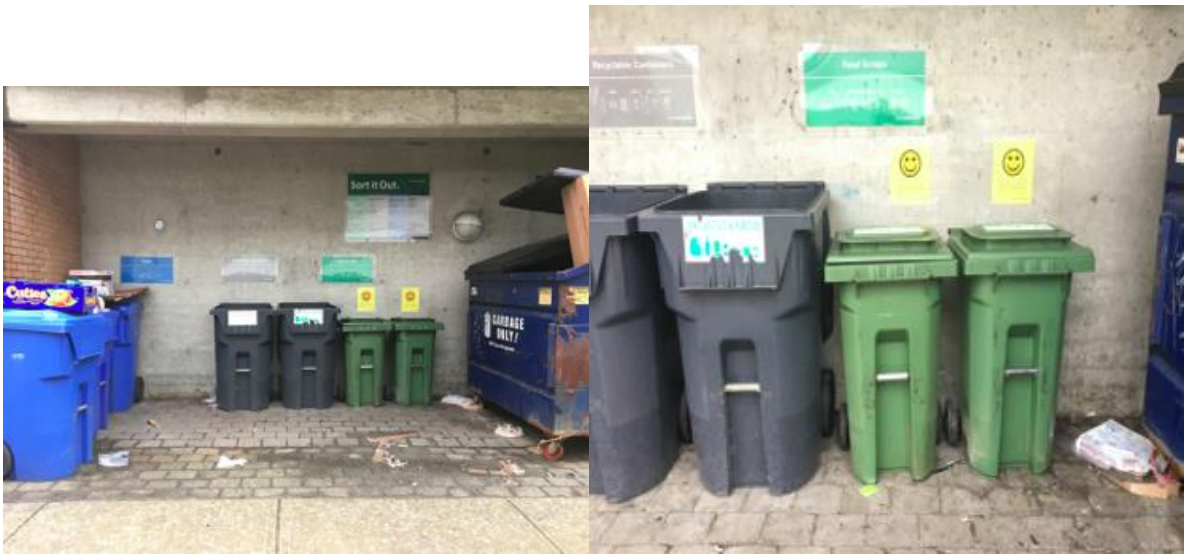
Positive Sticker Negative Sticker

Appendix b

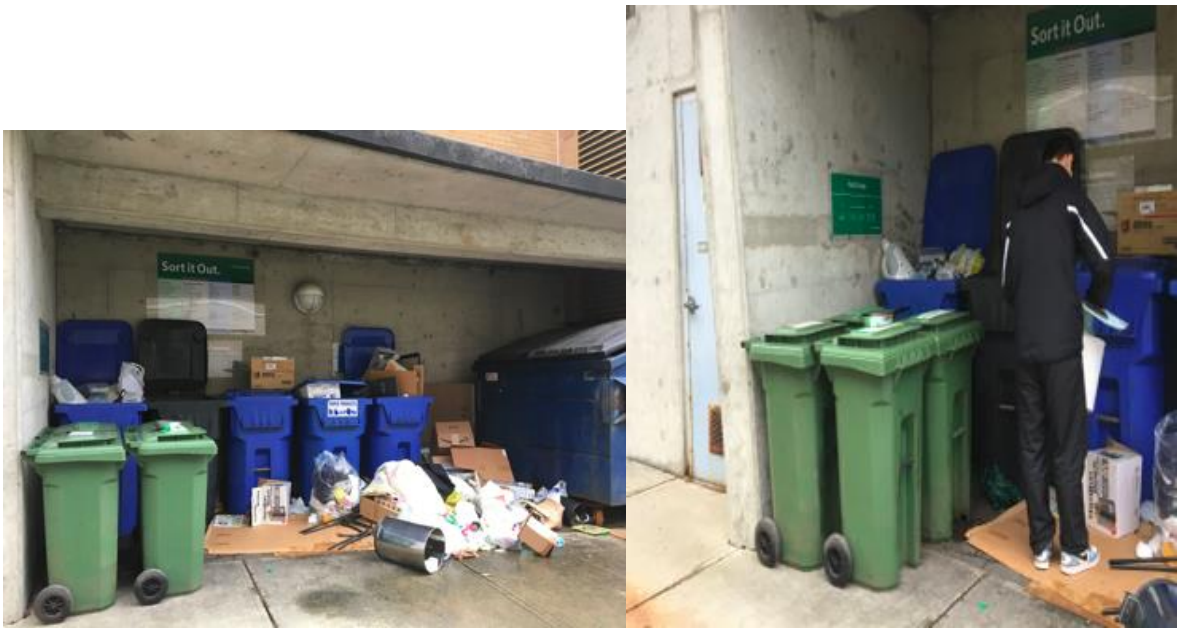
It includes the map of Thunderbird residence and the five different locations where the data was collected



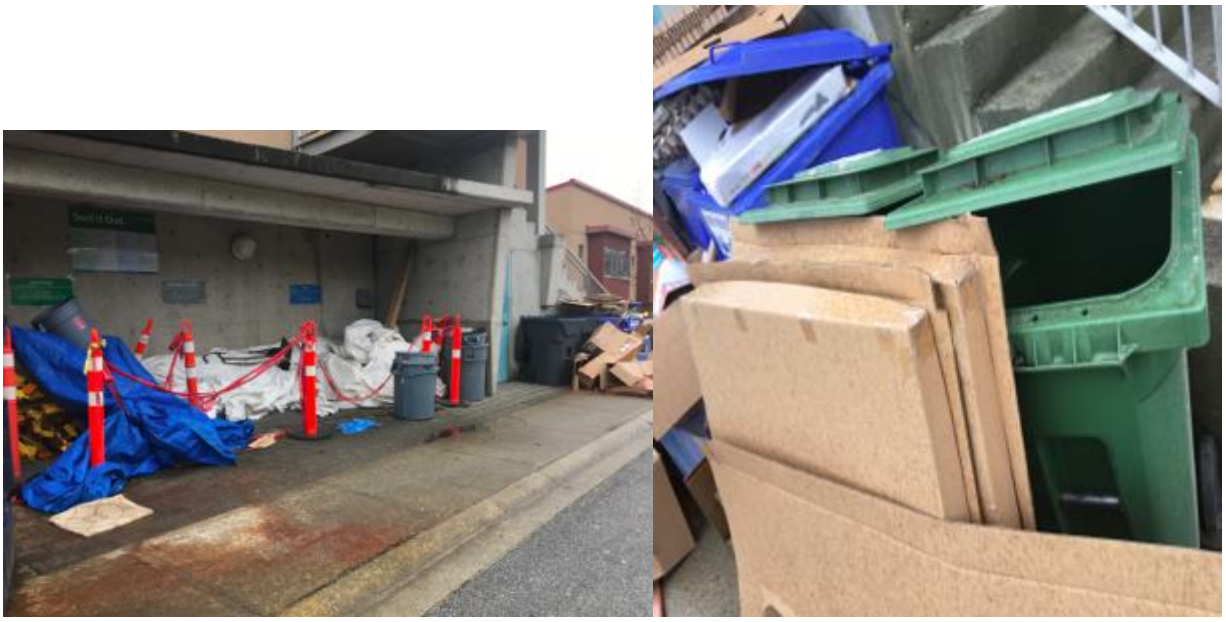
Location 1- Experimental Condition(with stickers)



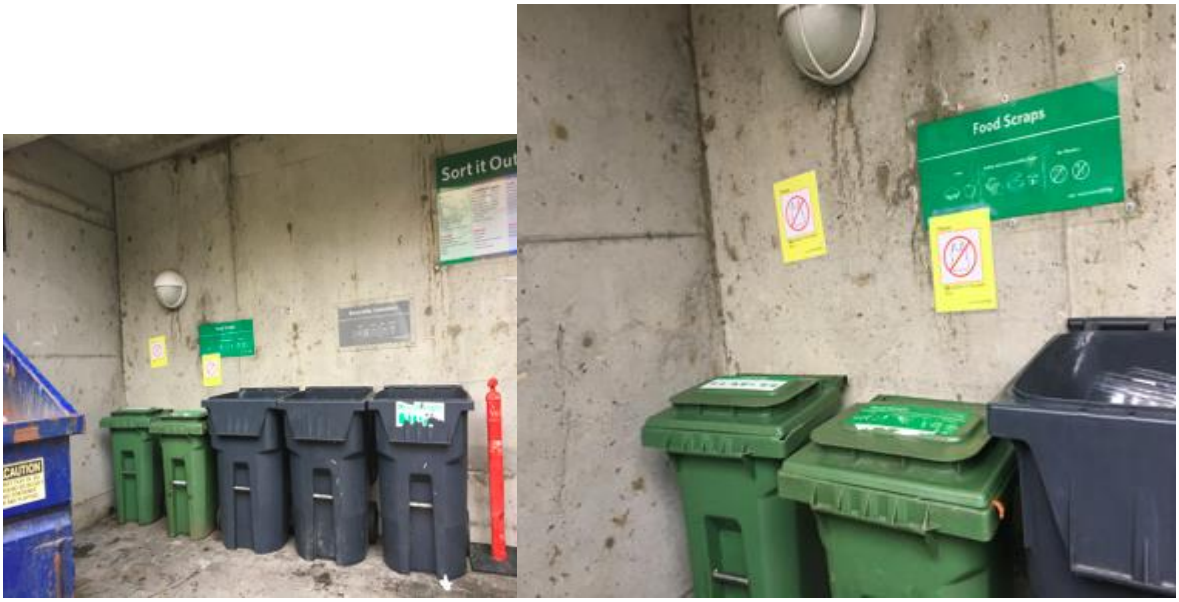
Location 2- Control Condition(with no stickers)



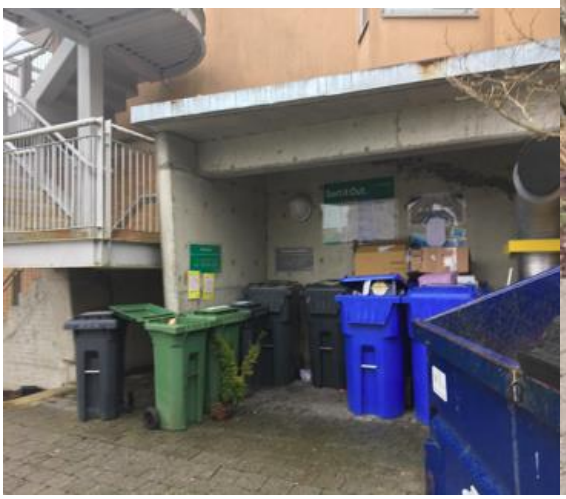
Location 3- Control Condition(with no stickers)

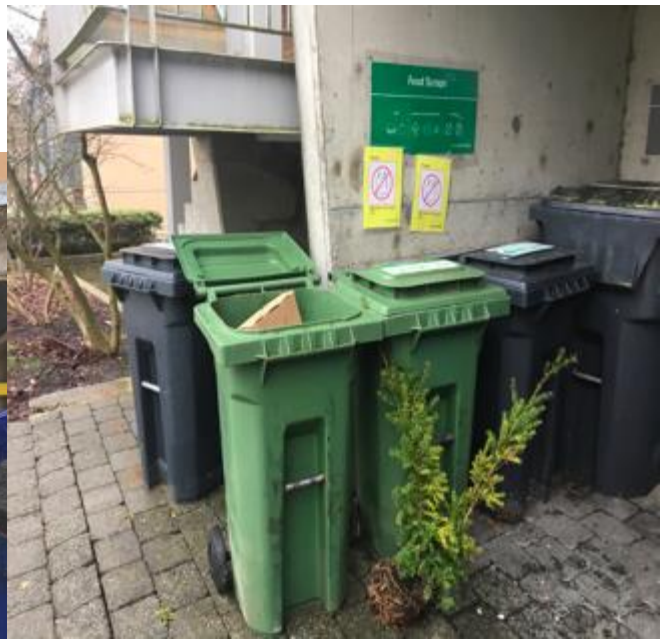


Location 4- Experimental Condition(with Stickers)



Location 5- Location 4- Experimental Condition(with Stickers)





Appendix c
Tables

Table 1-

Date	Location	Bin	Height Bin is filled up to	% full	# of contiminants	contiminants : fullness of bin	receive a thank you sticker	
		1	35	100.00%	8	8		
	1	2	22	62.86%	5	7.954545455	control	
		3	18.5	52.86%	2	3.783783784		
		4	24	68.57%	3	4.375		
		5	0	0.00%	0			
	2	6	0	0.00%	0	0	control	
		7	10	28.57%	3	10.5		
	3	8	8	22.86%	6	26.25	control	
		9	31.5	90.00%	4	4.444444444		
	4	10	12	34.29%	2	5.833333333	control	
BASELINE - March 12		11	25	71.43%	6	8.4		
	5	12	22	62.86%	6	9.545454545	control	
		1	27	77.14%	2	2.592592593		
	1	2	17	48.57%	2	4.117647059	no plastic	
		3	29.5	84.29%	2	2.372881356		
		4	4	11.43%	1	8.75		
		5	10	28.57%	1	3.5		
	2	6	0	0.00%	0	0	control	
		7	13	37.14%	3	8.076923077		
	3	8	19	54.29%	7	12.89473684	control	
		9	32	91.43%	8	8.75	no plastic	
	4	10	32	91.43%	4	4.375	sticker	
		11	21	60.00%	4	6.666666667	no plastic	
March 19	5	12	25	71.43%	3	4.2	sticker	
		1	26	74.29%	0	0	thank you	
	1	2	20	57.14%	2	3.5	sticker	
		3	29	82.86%	10	12.06896552		
		4	30	85.71%	7	8.166666667		
		5	10	28.57%	2	7		
	2	6	9	25.71%	2	7.777777778	control	
		7	3	8.57%	4	46.66666667		
	3	8	0.5	1.43%	0	0	control	
		9	20	57.14%	2	3.5		
	4	10	33	94.29%	4	4.242424242	no plastic	
		11	18	51.43%	0	0		
March 26	5	12	31	88.57%	4	4.516129032	no plastic	
		1	22	62.86%	2	3.181818182		
	1	2	15	42.86%	5	11.66666667	thank you	
		3	35	100.00%	4	4		
		4	33	94.29%	1	1.060606061	control	
		5	6	17.14%	6	35		
	2	6	35	100.00%	9	9	control	
		7	32	91.43%	1	1.09375		
	3	8	32	91.43%	2	2.1875	control	
		9	29	82.86%	2	2.413793103	thank you	
	4	10	11	31.43%	2	6.363636364	sticker	
		11	35	100.00%	1	1		
April 2	5	12	12	34.29%	5	14.58333333	thank you	

Table 2

Independent t test

Group Statistics

	stickers	N	Mean	Std. Deviation	Std. Error Mean
fullness	control	30	51.2387	35.42846	6.46832
	stickers	18	67.6200	21.24568	5.00766
contaminants	control	30	3.5667	2.83675	.51792
	stickers	18	2.8889	1.96705	.46364
ratio	control	30	8.623	10.3379	1.8874
	stickers	18	4.759	3.7796	.8909

Table 3

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
fullness	Equal variances assumed	11.210	.002	-1.775	46	.083	-16.38133	9.22856	-34.95746	2.19479
	Equal variances not assumed			-2.003	45.995	.051	-16.38133	8.18021	-32.84729	.08462
contaminants	Equal variances assumed	4.122	.048	.891	46	.377	.67778	.76030	-.85263	2.20818
	Equal variances not assumed			.975	44.907	.335	.67778	.69512	-.72235	2.07791
ratio	Equal variances assumed	3.103	.085	1.520	46	.135	3.8640	2.5413	-1.2514	8.9794
	Equal variances not assumed			1.851	39.976	.072	3.8640	2.0871	-.3543	8.0823

Table 4

		N	Mean	Std. Deviation
fullness	control	30	51.2387	35.42846
	thank you	10	61.1440	22.42397
	no plastic	8	75.7150	17.74550
	Total	48	57.3817	31.65387
ratio	control	30	8.623	10.3379
	thank you	10	4.942	4.6896
	no plastic	8	4.531	2.5120
	Total	48	7.174	8.6419
contaminants	control	30	3.5667	2.83675
	thank you	10	2.3000	1.56702
	no plastic	8	3.6250	2.26385
	Total	48	3.3125	2.54455

Table 5-

Anova tukey test

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
fullness	Between Groups	3962.534	2	1981.267	2.067	.138
	Within Groups	43129.929	45	958.443		
	Total	47092.463	47			
ratio	Between Groups	168.718	2	84.359	1.136	.330
	Within Groups	3341.379	45	74.253		
	Total	3510.098	47			
contaminants	Between Groups	12.971	2	6.485	1.002	.375
	Within Groups	291.342	45	6.474		
	Total	304.313	47			

Table 6

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) conditions	(J) conditions	Mean Difference (I-J)	Std. Error	Sig.
fullness	control	thank you	-9.90533	11.30453	.658
		no plastic	-24.47633	12.31883	.127
	thank you	control	9.90533	11.30453	.658
		no plastic	-14.57100	14.68501	.586
	no plastic	control	24.47633	12.31883	.127
		thank you	14.57100	14.68501	.586
ratio	control	thank you	3.6815	3.1465	.477
		no plastic	4.0922	3.4288	.463
	thank you	control	-3.6815	3.1465	.477
		no plastic	.4107	4.0874	.994
	no plastic	control	-4.0922	3.4288	.463
		thank you	-.4107	4.0874	.994
contaminants	control	thank you	1.26667	.92910	.368
		no plastic	-.05833	1.01247	.998
	thank you	control	-1.26667	.92910	.368
		no plastic	-1.32500	1.20694	.520
	no plastic	control	.05833	1.01247	.998
		thank you	1.32500	1.20694	.520