Signage with a Nudge: A Quasi-Experiment of Waste Disposal Behavior using Sensor Data

A Campus Climate Lab Project Report

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Abstract

Recent years have seen an unprecedented rise in climate technology as a solution to campus waste, now a top contributor to landfill in the United States. However, technological solutions alone are limited in attaining zero waste status, as waste disposal is primarily driven by the behavior of individuals. Ultimately, the engagement of students and faculty is vital to reach a true zero waste and zero contamination status that many organizations strive to achieve. We offer a novel, effective signage framework that draws from social psychology and live waste intelligence. We design trash bin signage that invoke ideas of loss aversion, material self-interest, and reputation against the backdrop of in-group/out-group competition.

Our plan is to continue this project for another funding cycle. During this time, we will use the signage as treatments (or interventions) in a group-randomized quasi-experiments at the CDS building on campus that is newly equipped with trash can sensors. Our aim is to offer a behaviorally designed signage framework that can be adapted by different groups and organizations in the community and beyond. We hope to improve existing understanding of the types of messages that are most effective in translating awareness to action.

Milestones

Previously, we used data science–covariate balancing by propensity score matching–in order to choose those floors at the CDS building which contain trash bins that are the most comparable for our experiment. Our data source is Spare-It's trash can sensor database. Covariate balancing is needed to check and only select those bins that have comparable weights across categories, and comparable contribution to indirect

emissions (as these variables can be proxies for individual waste disposal behavior, we want to ensure that behaviors are comparable by proxy). The plot below shows the improvement of our key variables before and after such selection process. We identified Floor 6 to be our Control floor, and will select six others, each of which will have one of our posters as a Treatment. Having determined our floors, the following are next steps in implementing the experiment:

1. Put up posters at the CDS for three months.
2. Collect data on waste sorting behavior, with a focus on variables contamination and co2eq.
3. Analyze which posters were successful in reducing contamination, if any.

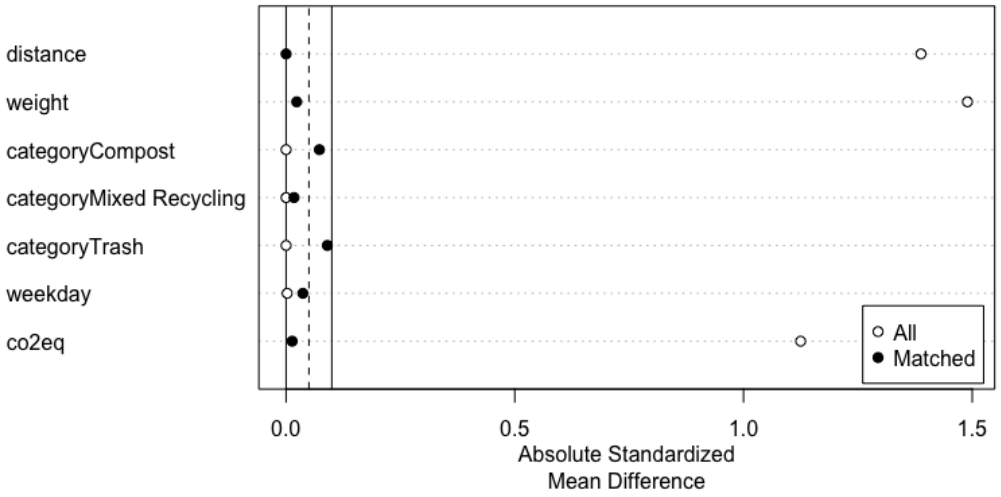

Figure 1: Covariate Balance Before and After Matching

We have reached out to the Institutional Review Board (IRB) for approval on human subjects study. This is with the end goal of submitting our work for publication at a peer-reviewed journal.

We did a test run of putting up several posters across two floors, as a start. This was in order to simulate our eventual launch of the experiment after IRB approval. However, we have realized that putting up a single poster requires eight poster clips, and takes about ten minutes each. We came to the conclusion that we need additional members who are willing to work with us in launching the experiment as well as capable of conducting follow-up analyses.

We have added a new member to our team, Yvette Rabada (IQS Barcelona), who is a biomedical engineering Ph.D. student interested in the intersection between environmental impact and nanomedicine. Yvette will help significantly in launching the experiment after IRB approval and in statistical analysis of resulting data.

In the spring semester, we aim to receive IRB approval and finally conduct a month-long behavioral experiment.

Contribution

This project contributes to BU's Climate Action Plan goal of net carbon neutrality by building its first-ever quantitative sustainability analysis pipeline for all BU buildings to understand and reduce indirect emissions from waste disposal. Using novel live waste intelligence data collected from the CDS, our project will push BU's new CDS building toward TRUE Zero Waste Certification and contribute to BU's Zero Waste Plan goals.

Collaborators

1. Sarah Healey, TRUE advisor and Zero Waste Manager
2. Christopher DeVits, Director of Administration of the CDS

Data: Signage with a Nudge

Loss to economic self-interest	Loss to self health
	

Streamlining information	Loss to group reputation/ social desirability bias
Items covered in food or grease CANNOT be recycled. even paper or plastic 	**Built-in sensors at all CDS bins are monitoring if trash is sorted correctly.** Every item counts in bringing us closer to No. 1! 

Trust in the process	Control (Message expected NOT to change behavior)