Ballot Butts: Nudging towards Pro Environmental Behaviour

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ABSTRACT

This study explores the effectiveness of a nudge-based intervention, to reduce cigarette butt littering on a student campus. Using the principles of nudge theory, particularly the EAST framework, we designed a ballot box, allowing smokers to "vote" by disposing of their cigarette butts. Observations conducted before and after the intervention revealed a statistically significant increase in proper disposal, supporting the claim that nudges can positively influence environmental behavior. However, the study also highlights several limitations, including varying participant demographics and the challenge of isolating the factors driving behavioral change.

KEYWORDS

nudging, environmental behaviour, gamification, littering

1 INTRODUCTION

1.1. Increasing Need for Innovative Solutions

With the increasingly dire consequences of climate change, the urgency to address the environmental degradation has never been greater. Among the myriad of issues contributing to this escalating problem, littering—particularly the improper disposal of cigarette butts—stands out as a significant, yet often overlooked, contributor. In 2019, of the estimated 6 trillion cigarettes, only a third were properly disposed of [1]. Cigarette butts (CBs) are composed of tightly packed microfiber bundles of cellulose acetate. Cellulose acetate is cellulose treated with acetic acid, which heavily impedes the biodegradability of CBs. During their decades-long degradation period, CBs pose a double threat. The first is plastic pollution, as cellulose acetate is classified as a 'bio-plastic' with the second being the release of toxins that build up through the process of smoking [1]. The effects typically result from leaching, causing damage to aquatic life and contaminating waterways, while the consequences in terrestrial environments range from ingestion of butts, buildup of toxic chemicals, and soil contamination [1, 2, 3]. As such, finding ways to encourage proper disposal of CBs is crucial for reducing environmental harm.

1.2. Nudge Theory

One promising line of research in reducing littering is the nudge theory, first proposed by Thaler and Sunstein in their work *Nudge: Improving Decisions About Health, Wealth, and Happiness.* In their words, a nudge is "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" [4]. A nudge replaced their previous idea of paternalism, which similarly influences "choices of selected parties in a way that will make them better off" [5]. Several studies have found that nudges, in their various forms, can indeed be effective in reducing littering [6, 7, 8]. For example, a study on Chinese workers found that it is possible to reduce littering on the factory floor by 20% by placing golden coins, which are culturally and religiously significant, on the factory floor, thus changing it from a place that can be littered, to a place that should not be littered [8]. There are various forms of nudges and can be roughly divided into sizing (e.g. changing portion sizes in restaurants to reduce food waste), priming (e.g. footprints leading towards a bin), proximity (e.g. having a bin close by), presentation (e.g., designing eco-friendly devices as more aesthetic), labelling and improving the functional design [7]. Due to their diversity, usefulness and cost efficiency, nudges could help mitigate the environmental impact of CBs.

1.3. Theoretical framework

Our research was inspired and partly supported by the Green Nudge project[1]. This study specifically targeted the smoking behaviours of the student population from various faculties in the area of Kardeljeva ploščad in Ljubljana, aiming to assess how the design of bins could influence proper disposal habits of the CBs.

Information Society 2024, 7–11 October 2024, Ljubljana, Slovenia

[1] The Green Nudge project ("UL za trajnostno družbo – ULTRA"), financed by the EU - NextGenerationEU, and Republic of Slovenia, Ministry of Higher Education, Science and Innovation.

In our pilot study we implemented the nudging principles in the context of pro-environmental behavior. During our research design and nudge implementation process we relied heavily on the ideas from The Little Book of Green Nudges [9], where we utilized their five recommended steps of nudge implementation and their EAST framework, designed to make a nudge Easy, Attractive, Social and Timely. We based our nudge on the findings of Rifkin and colleagues [10], where they found out that behavior, such as tipping in a bar, can be influenced by "dueling preferences". If a behavior is presented as a choice between two options, preference for dogs versus cats, it gives people the opportunity to self-express themselves through a behavior that is not directly connected with the preference. In a similar fashion we have designed a cigarette voting box, where people could cast a vote with their CBs. The previously mentioned study was also a basis for a pilot study by Gay and colleagues [11], where they compared the impact of different cigarette bins on polluting behavior. They found that a "dual preference" voting box, like ours, was the most efficient in reducing the pollution of the environment with CBs.

Figure 1: The ballot box for CB's
The prompts on the box are: morning shower (slo. *tuširanje zjutraj)* and evening shower (slo. *tuširanje zvečer*). The box is made from a repurposed mail box and is standing on a metal pole. Surrounding the box is a picture depicting two smokers. The bin was made by our colleagues at the Academy of Fine Arts.

Existing studies addressing cigarette butt littering through behavioural experiments indicate that 63% of such littering is driven by individual motivations, such as a lack of awareness about environmental impacts and the availability of ash receptacles [12]. Other contributing factors include convenience (e.g., the distance to bins) and habitual behaviour [13], some research highlights a correlation between an area's cleanliness and the likelihood of littering, with certain demographics, like younger individuals and men, being more prone to littering [14]. While the design of ballot bins is often consistent across studies, the specific environments, demographics, and timelines vary. Research demonstrates that these bins can be an effective, low-cost solution for reducing cigarette butt litter, particularly in more homogeneous settings like school campuses. However, their effectiveness may diminish in more diverse public spaces [14]. Given the many variables influencing these outcomes, researchers recommend further experiments to optimize these interventions in different settings [12, 13, 14].

2 METHODS

Our preliminary study into the effectiveness of cigarette disposal through the use of ballot bins was conducted on a student campus in Ljubljana, Slovenia during the spring and summer of 2024. After initially observing the campus area, we decided to target the behavior of throwing CBs on the ground. There were several 'hotspots' of discarded cigarette butts, but we were particularly intrigued by the large number of butts thrown around bins. What intrigued us was the fact that despite there being a clear area for throwing away their cigarettes, smokers still did not opt for this choice. As such, we focused on a popular smoking area of the Faculty of Social Sciences at the University of Ljubljana. During the span of six months, we conducted two sets of observations, totalling seven observations: one set of observations before our intervention and one after. The first four observations were carried out in April 2024 and observed a popular smoking spot for students and faculty next to an existing bin. With the exception of the first observation, which was done in a group by all researchers, all were done individually over the course of two hours. During these observations, we collected data on the total number of CBs thrown in the bin or improperly discarded. We also took into account other factors such as time of day, weather and any other factors we deemed important like the number of people smoking together outside, or any other factors, which might have influenced the final number. The second set of observations was done during July, this time with the nudge (the ballot box) placed next to the bin in a popular smoking spot. The ballot box can be seen in **Figure 1**.

3 RESULTS

Our descriptive results are presented in the table below (see **Table 1**), where we calculated the mean value of CBs either in the bin or on the ground before and after the implementation of our green nudge.

Table 1: Littering behaviour observations before and after intervention with CB's thrown in the bin and on the ground

Observations	Condition	CB's in bin		CB's ground	
		M	*SD*	*M*	*SD*
1	before	21	6.38	12.25	5.74
2	after	17	17.35	4.3	2.52

In order to determine if there is a statistical difference between the proportion of CBs in the bin versus on the ground based on the condition, we conducted a two-proportion Z-test. Based on

the statistical analysis we found that there was a statistically higher proportion of CBs thrown into the bin versus on the ground after the implementation of our cigarette voting box, compared with the proportions before its implementation, $z = 0.165$, $p = 0.0495$.

4 DISCUSSION

Based on our results we can confirm our hypothesis that our nudge would increase the proportion of CBs thrown into the bin versus on the ground thus reducing the pollution of the environment surrounding the student campus with CBs, which is in line with the findings by Gay and colleagues [11]. Although our results do indicate a change in the proportions, conclusions should be taken with caution, since the frequency of smokers present before and after the implementation of the nudge varied vastly and could have had a big impact on the results of our analysis.

Additionally, it is difficult to determine exactly what nudged the participants' behaviour, which opens a broader question of nudge validity. Specifically, for our nudge, there could have been a number of factors influencing their behaviour. Some of these factors include 1) proximity; simply having more available bins could have decreased the number of CBs thrown on the ground, 2) novelty; the nudge gained attention by simply being a new structure in a familiar environment, 3) presentation; the ballot box is more attractive than a conventional bin, which is why participants would decide for it. While these factors do not negate the effectiveness of the nudge, the difficulty in pinpointing the determining factor could influence the design and implementation of nudges. For example, if novelty is the determining factor, a green arrow pointing towards a bin could have the same effect as a costly ballot box. There is also a possibility that our nudge was not clear enough and thus resulted in some people not engaging with it. The communication materials were designed with a tone that was perhaps too playful and light-hearted, which may not have resonated well with the student population of smokers, who might have responded better to more straightforward and direct messages. This lack of clarity could have had an overall impact on the efficacy of our nudge as suggested by Sunstein [15].

4.1. Limitations

One key limitation of our study is the comparability of pre- and post-intervention data. Before the intervention, data was collected during the ongoing academic term with a larger, consistent student population. Post-intervention data, however, was gathered after the exam period, when fewer students were present. Moreover, the population mainly consisted of foreign students attending summer school. The study of Chinese workers by Wu and Paluck mentioned in section 1.2. urges that cultural context must be taken into account when designing a nudge. They state that nudges "must recognize motivations and subjective interpretations within a particular context" [8]. Thus, without the proper consideration of the cultural background of foreign students, it seems highly unlikely that our nudge, designed for Slovene students of the Faculty of Social Sciences, had an equal effect on foreign students attending summer school.

4.2. Future directions

While our pilot study provides valuable insights into the effectiveness of nudging towards pro-environmental behaviour, future research could address the small sample size in this study by employing a larger, more diverse population to improve the generalizability of the findings. Additionally, observing the population within a shorter timeframe would improve the validity of our results. Further studies could also include an interview before implementing a green nudge, using polling to determine the general environmental attitude, and after the green nudge, to ascertain the factors influencing their decision-making process.

In conclusion, our study has shown that nudges can be successfully employed to influence non-environmental behaviours by combining behavioural insights from nudge theory and gamification concepts (see [16] for a study combining gamification and nudging). Specifically, a ballot box could be used in short term settings, like open-air concerts and other events, where littering poses an issue. However, further research is needed to expand upon the factors underlying non-environmental decisions.

ACKNOWLEDGMENTS

This pilot research study was partly supported by The Green Nudge project ("UL za trajnostno družbo – ULTRA") - European Union - NextGenerationEU, and Republic of Slovenia, Ministry of Higher Education, Science and Innovation.

The authors also wish to express their gratitude to the development team at the Academy of Fine Arts, who created the ballot box.

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