



How do Probabilistic Rewards Influence Personal Mug Use?

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Executive Summary

Introduction

Single-use disposable cups made or lined with plastic pose a significant environmental threat (Triantafillopoulos & Koukoulas, 2020; Foteinis, 2020). While previous research has found that surcharges on single-use plastic items can affect SUDC consumption and incentivise the use of personal (i.e., reusable) mugs (Sidhu et al., 2018; Poortinga et al., 2019), efforts to deploy such interventions on a population level have been ineffective (Vancouver City Council, 2023). The failure of surcharges on a broader scale underscores the need for novel interventions that incentivise personal mug use. Based on economic theories of gamification, the present study aimed to determine whether probabilistic rewards influence the use of personal mugs.

Research Question

How do probabilistic rewards influence the use of personal mugs?

Methods

Sales data was collected from two cafés on a Canadian university campus. One cafe (intervention café) implemented a 1 in 10 chance of winning free coffee for customers with personal mugs, while the other (neutral café) did not.

Results

At the neutral café sales made with personal mugs decreased between both control periods and the study period. At the intervention café there was a modest increase in sales in personal mugs between one of the control periods and the study period.

Recommendations

We propose that Loafe continue to implement the 1 in 10 chance of winning a free coffee for personal mug users with some slight alterations. Firstly, to address the issue of a lack of awareness of the intervention, we recommend 1) a longer intervention period, and 2) a more aggressive marketing campaign. Second, we recommend incorporating the raffle tracking system into the POS in order to limit the attentional demands placed on staff at the cafés. For the UBC Social Ecological Economic Development Studies (SEEDS) program we recommend continued partnerships with Loafe and other on-campus businesses. Moreover, based on existing gamification, we recommend future partnered studies incorporate some form of points system in order to encourage competition between customers.

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Introduction

Over the past several years, consumer demand for single use items such as Single-Use Disposable Cups (SUDCs) has been steadily increasing (Grand View Research, 2021; Statista, 2020). In Vancouver, British Columbia, 2.6 million SUDCs are disposed of each week and make up nearly half of the contents of public waste bins (City of Vancouver, 2018). On a global level, distribution of SUDCs in 2020 exceeded 118 billion units (iMarc, 2020). According to one estimate, carbon-like emissions stemming from the UK's annual SUDC consumption alone are comparable to those released in the manufacturing process of over 11 thousand multi-passenger vehicles (Foteinis, 2020). Additionally, although SUDCs are made primarily of recyclable material, less than 1% of these cups are actually recycled worldwide (Triantafillopoulos & Koukoulas, 2020). The remaining cups end up in landfills, or as pollutants to soil or oceans (Foteinis, 2020; Schnurr et al., 2018). Furthermore, by switching to personal reusable mugs, it is estimated that nations could reduce global emissions by over 5Mt of CO₂ equivalents annually (Foteinis, 2020).

Current State of SUDC Interventions

Given the environmental impact of SUDCs, researchers have begun searching for interventions that incentivise personal mug use as an alternative to SUDC's. Thus far, the most promising of these interventions has been surcharges placed on single-use plastic items (Sidhu et al., 2018; Poortinga & Whittaker, 2018; Poortinga, et al., 2019). However, evidence from these studies is mixed: One study from a Canadian university that replaced its 15-cent discount on sales made in personal mugs with a surcharge of 25-cents for SUDC's found that, on average, participating locations experienced a 29% drop in SUDC consumption compared to previous years (Sidhu et al., 2018). A similar study in the UK introduced SUDC surcharges at several university and non-university affiliated cafés and found that while some sites witnessed a 12% increase in personal mug use, others saw no change or even a decrease (Poortinga & Whittaker, 2018). Furthermore, in an extensive review of the literature examining the effects of SUDC surcharges, Poortinga et al. (2019) found changes in sales with personal mugs ranging from 3.6-42%. Underscoring this dramatic range of findings may be the additional measures taken by many of the more successful partnered locations in these studies such as the distribution of free personal mugs to customers (Poortinga & Whittaker, 2018).

Despite the evidence for the effectiveness of surcharge interventions on university campuses, population level attempts at implementing SUDC surcharges have largely been unsuccessful (Vancouver City Council, 2023). The city of Vancouver's now repealed 25-cent charge on plastic items provides a striking example of this lack of success (City of Vancouver, 2023). The surcharge, implemented in January of 2022 (Brown & Judd, 2022), was active for less than 2 years before being repealed due to lack of efficacy (Vancouver City Council, 2023). Such a failure calls into question the generalizability of previous findings with respect to surcharge interventions and underscores the need for novel interventions that can reduce SUDC consumption.

Gamification

Gamification involves applying elements of game design such as points, challenges, and rewards (Jefferies, 2022) to a non-game setting (Deterding et al., 2011). Over the past several years, gamification has received considerable attention among both the scholarly (Hamari et al., 2014) and the corporate world (see McDonalds, 2024; Harris, 2021) due to its ability to foster behavioral change (Mitchell et al., 2017). One key element of gamification is the introduction of probabilistic rewards (i.e., lotteries) to marketing campaigns to increase consumer interest. A successful example of this form of gamification is McDonald's annual Monopoly event, which gives customers a chance of winning prizes (e.g., free food) with each purchase made at participating locations (McDonalds, 2024). In 2013, at one location this promotional event was so successful that it raised 3rd quarter profits by over 5% in the span of a month (Money Watch, 2013). Similar probabilistic reward events can now also be found at other major chain businesses such as Starbucks (Starbucks, 2023) and Tim Hortons (Harris, 2021). The success of these events supports the efficacy of gamified probabilistic reward interventions in driving consumer habits.

The Current Study

Despite the success of gamification in marketing, research has yet to be conducted on its effectiveness in encouraging personal mug use. In order to address this gap in the literature, the present study sought to answer the question: How do probabilistic rewards influence the use of personal mugs? Drawing on the previous successes of gamified interventions, we hypothesized that, 1) at the neutral café sales with personal mugs would remain constant between conditions, and 2) at the intervention café more people would use reusable mugs instead of SUDCs when offered a chance to win a free coffee.

Methods

Participants

Sales data was collected from two cafés under the same name and management, in separate areas of the University of British Columbia (UBC) campus. Participants in this study were customers who purchased beverages at the partnered café's locations during March 6-31st 2023, February 1-28th 2024, and March 4-29th, 2024. Only sales registered as "to-go" were eligible for observation. This excluded customers who consumed their beverages in-store using the cafés' mugs. Based on a between-groups comparison power analysis conducted in G*Power 3.1 (Faul et al., 2007), with a minimum effect size of 0.20, an alpha of 0.05, and power = .80, this study required at least 387 total observations (to-go sales). A total of 28,676 observations were recorded. Although no further demographic information about participants was collected, customers from these coffee shops typically consist of university students as well as some faculty, staff, and alumni.

Procedure

Between March 5-29th 2024, one of the café's (i.e., the intervention café) implemented a probabilistic reward system, whereby 1 in every 10 customers who purchased their coffee in a personal mug were rewarded with a free coffee or the equivalent in store credit (\$3.40). During this time, the other café (i.e., the neutral café) made no changes to their sales protocol and continued to levy a 25-cent surcharge on SUDCs. Customers were informed of this intervention through social media as well as posters at the intervention café and around campus (See Appendix). At both cafés, each time a to-go beverage sale was made employees logged the sale on their point of sale (POS) system. At the intervention café only, staff also tracked personal mug sales and rewards on a physical sheet provided to them by the researchers (See Appendix). When a customer with a mug made a sale, the staff would mark this sale on the sheet. This sheet provided an additional measure of sales with personal mugs. At the end of data collection, there were pronounced discrepancies between the number of sales with personal mugs reported on the POS and the raffle tracking system. For consistency's sake between both cafés, only POS data was reported in the results. At both cafés, POS data was also collected for March 6-31st 2023 and February 1-28th 2024 to serve as two separate baselines (i.e., control conditions) for pre-intervention sales.

Measures

All beverage sales were tracked using the partnered café's point of sale (POS) software, through which staff differentiate between to-go sales in personal mugs and sales in SUDCs via digital buttons. In addition to the POS, at the intervention café, raffle tracking sheets were used to track the raffle and the number of free coffees distributed (see appendix). Each sheet contains 90 checkboxes (i.e., sales made in personal mugs) with 10 mug icons (i.e., winning sales) spaced out.

Conditions

At each café, the control conditions were baseline data from March 2023, and February 2024. The experimental conditions for each café were sales data from March 2024. The independent variable was the data collection period, while the dependent variable was the ratio of sales in personal mugs to total to-go sales.

Results

The total number of to-go sales made at each café reported on the POS along with sales made in personal mugs can be found in Table 1. To determine whether there were significant differences in sales with personal mugs between control and experimental conditions at each café, we conducted four between-groups 2x2 chi-squared analyses using online tools (Chi-Square Test Calculator, 2023; Cramer's V Calculator, 2023). All assumptions were met.

The first chi-squared analysis compared sales data for the months of March 2023 and March 2024 at the neutral café. Inconsistent with our hypothesis, there was a significant decrease in sales with personal mugs, $X^2(1) = 80.53$, $p < .001$, $v = 0.03$. The second chi-squared analysis compared sales data for the months of February 2024 and March 2024 at the neutral café. Inconsistent with our hypothesis, there was a significant decrease in sales made with personal mugs, $X^2(1) = 9.59$, $p = .002$, $v = 0.09$.

The third chi-squared analysis compared sales data for the months of March 2023 and March 2024 at the intervention café. Inconsistent with our hypothesis, there was no significant difference in sales made with personal mugs, $X^2(1) = 1.82$, $p = .18$, $v = 0.01$. The fourth chi-squared analysis compared sales data for the months of February 2024 and March 2024 at the intervention café. Consistent with our hypothesis, there was a significant increase in sales made in personal mugs, $X^2(1) = 11.12$, $p < .001$, $v = 0.03$.

Discussion

This study examined whether a probabilistic reward system would increase the use of personal mugs at a university café. Inconsistent with our hypotheses, at the neutral café the number of sales made with personal mugs decreased between both baseline months and the month of March 2024. At the intervention café, inconsistent with our hypotheses, the number of sales made in personal mugs did not differ significantly between March of 2023 and March of 2024. However, consistent with our hypotheses, there was a significant increase in sales made with personal mugs between February and March of 2024. Our results provide evidence that probabilistic reward interventions serve as a potential avenue through which the incentivization of sustainable behavior such as personal mug use is possible.

Personal mug use at the neutral café provides insight into the efficacy of surcharges over the long term. Over the past year before our intervention was implemented, at both cafés there was a 25-cent surcharge on SUDCs. During this time, cafés witnessed a decrease in the number of sales made with personal mugs. This is consistent with the inefficacy of surcharge interventions in the city of Vancouver more broadly (Vancouver City Council, 2023). Furthermore, our results indicate that the current surcharge placed on SUDCs may be offering diminishing returns. These diminishing returns could be the result of customers beginning to factor the minor cost of single-use plastic items into the cost of to-go coffee. Another factor driving the decrease in personal mug use may be the increasing consumer demand for convenience (Bronnenberg, 2018; Heo et al., 2020). Whereas customers purchasing to-go coffee may already be in a rush, personal mug use requires active planning and maintenance (Heo et al., 2020). Together these factors may act as barriers to the uptake of personal mugs among café customers.

One explanation for the modest effects of the probabilistic reward may be that this current intervention may not have created a strong enough incentive for personal mug use. One study examining gamification-based interventions produced a significant increase in environmentally sustainable behaviors through the incorporation of a point system, badges, and trophies awarded to participants for sustainable behaviors (Mulcahy et al., 2021). Furthermore, previous discussions of gamification posit *sociality* and *competition* as core elements of gamification (Huber & Hilty, 2014). In the present study, perhaps the incorporation of a points system to introduce a competitive social element to the reward system could have produced a stronger effect on consumer behaviors. In other words, the limited introduction of gamified elements into our intervention may serve to explain its small effects.

However, while the effects of the current intervention on personal mug use were indeed modest, they should be understood in the context of the recent downtrend in personal mug use at the partnered cafés. As noted above, at the neutral café, personal mug use decreased across all measured periods. However, at the intervention café, although personal mug use decreased between March of 2023 and February of 2024, during the intervention period personal mug use rose to levels similar to that of March 2023. This increase in sales with personal mugs is consistent with Khaneman and Tversky's (1968) *probability-weighting function*. This function suggests that individuals tend to *overweight* the probability of events that have a less than 40% chance of occurrence, which likely extended to the 1 in 10 chance of winning a free coffee (Khaneman & Tversky, 1968). In addition, a key feature of our intervention is the immediacy of

the reward provided to customers with personal mugs. In animal models, immediate, rather than delayed, reinforcement (i.e., reward) has been found to be more effective in producing desired behaviors (Snyckerski et al., 2005). Altogether, both these elements of the probabilistic reward system may have contributed to its effectiveness.

Our results also provide support for “happy climate” initiatives (Zhao, 2023) as strategies for climate-oriented behavioural change. Happy climate initiatives refer to interventions wherein an incentivised behavior is rewarding for both the individual and the environment (Zhao, 2023; CBC, 2023). These reward-oriented initiatives have many advantages when compared to traditional climate actions, such as not requiring individuals to even believe in climate change (CBC, 2023). Regarding the current study, previous research indicates that games of chance can generate happiness through the potential for reward (Burger et al., 2020). Therefore, not only was the current intervention beneficial for the environment, but its ability to generate happiness among consumers may have driven personal mug use regardless of consumers beliefs about climate change.

Strengths and Limitations

This study was the first of its kind to examine the effects of a gamified probabilistic reward intervention on personal mug use. Given the high traffic at both café locations, we achieved a considerable sample size, affording us high statistical power. In addition, the use of an intervention and neutral café on the same campus provided us with assurance that fluctuations in sales at one location were not simply due to seasonal changes in student consumption of coffee. Furthermore, the use of historical data from March 2023 and February 2024 provided us with two separate baseline conditions for both cafés and gave us insight into changes in personal mug sales before the intervention was implemented. Together, these factors strengthen the findings of the present study.

Despite these strengths, this study also suffered from several limitations. Firstly, because we did not collect demographic information about participants, we were unable to determine whether increases in sales could be attributed to a) increased sales among consumers who already use personal mugs, and b) consumers from the neutral café simply shifting their business to the intervention café given their close proximity. Secondly, there may have been a general lack of awareness of the intervention due to minimal advertising and the brief length of our study. Thus, our lower capacity for widespread marketing compared to that of larger chain businesses may have contributed to our modest results. Thirdly, one challenge we encountered during data collection was a discrepancy between personal mug use logged on the POS system and number of sales marked on the raffle tracking sheets. Overall, the POS indicated less personal mug use than the tracking sheets, suggesting that there may have in fact been more sales in personal mugs than were recorded in the present study. Finally, this study took place in a university setting. Previous research indicates that younger samples (such as university students) tend to be more concerned about climate change than older populations (Boluda-Verdu et al., 2022), which impacts the generalizability of our findings.

To conclude, this study provides preliminary support for the efficacy of probabilistic-reward systems in increasing consumer use of personal mugs. Furthermore, with some modifications,

subsequent initiatives implemented on a larger scale could prove useful for increasing personal mug use at the community level.

Recommendations

Based on the modest effect of the probabilistic reward on personal mug use, we propose that Loafe continue to implement the 1 in 10 chance of winning a free coffee for personal mug users – with some slight alterations. Firstly, to address the issue of a lack of awareness of the intervention, we recommend 1) a longer intervention period, and 2) a more aggressive marketing campaign. One simple in-store method could be the implementation of a large visually salient board that displays the number of daily or weekly coffee winners. Additionally, more extensive social media advertising on platforms targeted towards the greater UBC community, as opposed to solely the cafe's social media accounts may be worthwhile. Second, we recommend incorporating the raffle tracking system into the POS in order to limit the attentional demands placed on staff at the cafés. This will likely limit the number of sale logging errors made and eliminate the potential for discrepancies such as the one observed in this study between the POS data and the raffle tracking sheets.

For the UBC Social Ecological Economic Development Studies (SEEDS) program we recommend continued partnerships with Loafe and other on-campus businesses. Through the current project, Loafe has demonstrated a strong interest in collaborative initiatives with the student body and SEEDS more broadly. Thus, SEEDS is well positioned to conduct future partnered research initiatives. Moreover, based on existing gamification literature (see Huber & Hilty, 2014; Mulcahy et al., 2021), we recommend future partnered studies incorporate some form of points system in order to encourage competition between customers. This competition could work in tandem with the reward itself to drive consumers' personal mug use.

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Appendices

Table 1: Descriptive Statistics

| Data Period | Sales in Reusable Mugs | To-Go Sales | Mugs/Total Sales |
|------------------------------|------------------------|-------------|------------------|
| | <i>N</i> | <i>N</i> | <i>N</i> |
| March 6-31st, 2023 | | | |
| Neutral Café | 223 | 4382 | 0.05 |
| Intervention Café | 390 | 4562 | 0.09 |
| February 1-29th, 2024 | | | |
| Neutral Café | 107 | 4234 | 0.03 |
| Intervention Café | 319 | 5296 | 0.06 |
| March 4th-29th, 2024 | | | |
| Neutral Café | 71 | 4515 | 0.02 |
| Intervention Café | 441 | 5687 | 0.08 |

Figure 1: Sales in Personal Mugs Over Time

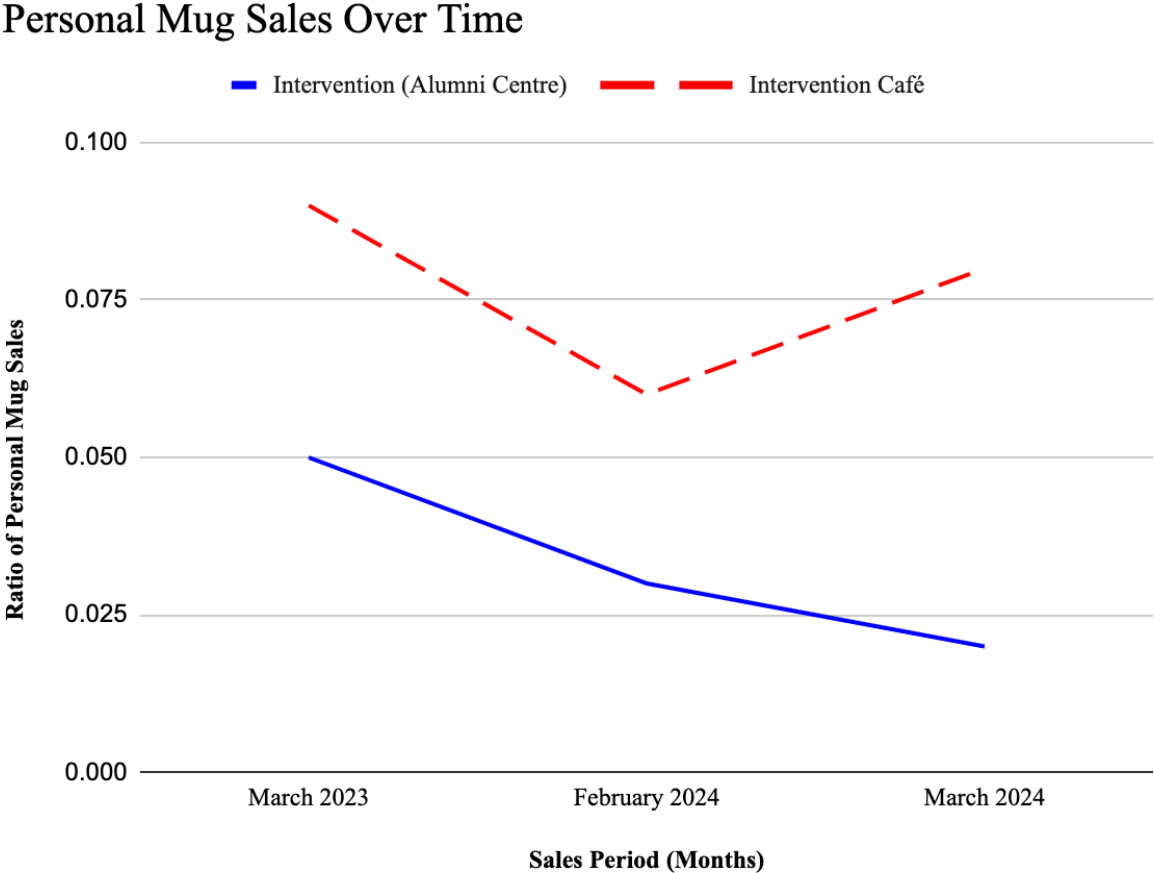


Figure 2: Advertisement Poster



AVAILABLE @ LOAFE-ALUMNI CENTER, MARCH 4-29

* 12oz drip coffee OR store credit!

