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Research Article

Free riding or discounted riding? How the framing of a bike share offer impacts offer-redemption

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Abstract: We report the results of an experiment to increase use of a municipal bike sharing system. Two distinct groups – those who had newly moved close to a bike station (N=3,500) and those who lived in the vicinity of a newly built bike station (N=7,000) – were randomly assigned to receive one of two versions of a postcard offering free rides. In the first version, the offer is framed in terms of what recipients get for "free". In the second, the same offer is framed in terms of its discount value: $12 off. We find no overall difference in redemption of the offer between postcard frames but for those with a new bike dock in their vicinity the "free" message is significantly more effective. We also note new movers are almost four times as likely to redeem the offer than those with a new dock in their vicinity. As a result of the study the city transportation bureau's marketing team have used the "free" frame on subsequent materials and continue to target new movers.

Keywords: Transport, Cycling, Behavioral economics, Social marketing

Supplements: Open data, Open materials

Cities around the world are investing in bike share systems. The goal is to promote cycling over other modes of transport to reduce congestion, improve public health, and improve air quality. 35 million bike share rides were taken in 2017 in the US, a 25% increase on the previous year (NACTO, 2018). While the growth in bikeshare journeys is impressive there is still a long way to go before cycling meaningfully displaces other journey modes. There are many barriers to riding for the first time. For example, users may not be sure how to access or use the bikes, they may have concerns about whether they will feel safe, or they may simply never get round to trying it out. While there are certainly barriers associated with using bike share schemes regularly, some barriers (such as not knowing how to access the bikes) disappear once the first ride has been taken. As such, for new and expanding bike share initiatives, nudging people to take their first ride is considered an important component in building the user base of these systems.

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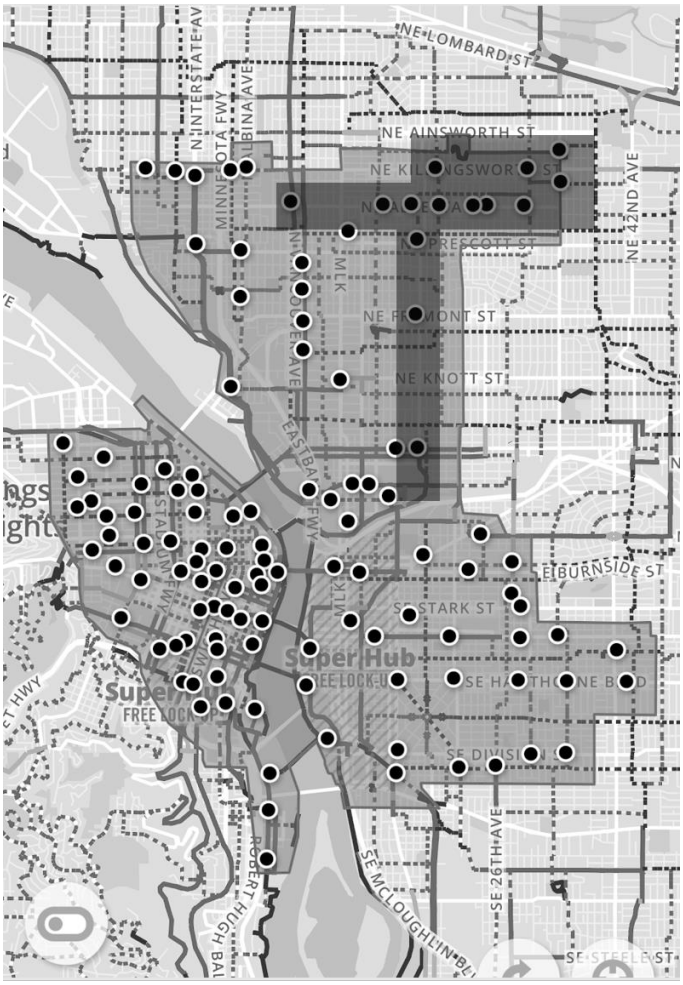
Study Context

The city of Portland, Oregon, launched its bike sharing initiative in July 2016 with 1,000 bikes and 100 hubs (see Figure 1). Following early success, it expanded in 2017. To try and attract new members, staff in the City's Bureau of Transportation designed an offer to allow residents, notably those living in areas where the system had newly expanded and those who had just moved to an area with nearby bike stations, to try the bike share. For both groups, "nearby" is defined as living within two blocks of a corridor with a new bike station, specifically NE Alberta Street, NE Killingsworth Street, and NE 15th Avenue. We do not know the average distance residents lived from a new bike station, but the maximum distance is half a mile.

I was part of a research team partnered with the City's Budget Office. The goal of this partnership

Figure 1
Map of the Bike Share Stations
(the darkest grey areas correspond to where our offers were mailed)



was to embed more robust evaluation methods and behavioral science into the day-to-day operations of the City. For this particular project, we worked with staff in the City's Transportation Bureau. Using the offer that the Transportation staff had designed, we created two different ways of expressing the corresponding discount. The goal was to test whether varying the presentation of the offer affected take-up (the rate at which the offer code was redeemed) by residents.

Literature Review

Our engagement with the Transportation Bureau was designed to enhance existing ways of working. As such, our choice to work on optimizing a social marketing campaign to encourage use of the bike share was pragmatic rather than theory-driven. As an inherently individualistic approach (Raftopoulou & Hogg, 2010, Strengers & Maller, 2014) social marketing, enhanced by behavioral economics, does not address the systemic or institutional barriers that promote some modes of transport over others (see Marsden, Mullen, Bache, Bartle, & Flinders, 2014); other tools of policymaking are used by the bureau to work on those issues.

While the literature review fits this individualistic approach, we also use Social Practice Theory (Shove, Pantzar, & Watson, 2012) to consider what would be needed to drive longer-term changes in transport use at a population level.

The (Behavioral) Economics of Monetary Discounts

Free vs $12

There is a rich literature on gift giving (see Mauss, 1967, Cialdini, 1985, and Waldfogel, 1993), with a growing body of evidence on gifts as a means to drive business transactions (Maréchal & Thöni, 2018). Per Chandran & Morwitz (2006), there is evidence that free promotions are more attractive to consumers than equivalent-value promotions framed in terms of monetary discount. Situated within the broader behavioral economics literature that shows we make decisions using available reference points (Kahneman, 1979), the dominant explanation is that, in the absence of references to monetary value, the quality of a free-framed promotion is assessed independent of the price point (Diamond, 1990). This makes the fact and content of an offer more focal than it might be if it were more readily comparable to classic market-value.

Related theories posit that monetary discounts activate the decision-frameworks we use in market domains, whereas offering something for free activates the equivalent frameworks for social transactions (McGraw & Tetlock, 2005). As negotiation of offers is different in these two spheres, discounts and free offers are accepted at different rates with free-framed offers preferred.

In sum, there is compelling evidence that zero pricing is treated differently to equivalent discounts (Shampanier, Mazar, & Ariely, 2007), although we are not aware of evidence that demonstrates this in the domain of transport behavior. Previous studies are also somewhat underpowered, meaning this large-sample experiment can add something by virtue of its scale.

Trying new things, forming new habits

One-off or Temporary Behavior Change

Research states that changes in context can make new behaviors more likely (Verplanken & Aarts, 1999). In particular, moving residence can be a powerful force for disruption, creating a temporary window in which changes to regular activity may be more appealing (Wood, W., Tam, L., & Witt, M. G., 2005).

While a temporary openness to trying new activities might make a new resident more likely to try the bike share than someone who has not moved, it is unlikely to lead to longer-term habit change. Indeed, in the case of transport behaviors, one experiment presenting hypothetical journeys and transportation options showed that respondents with strong pre-existing habits sought out less information and used simpler decision processes for choosing a mode of transport (Verplanken, Aarts, & Van Knippenberg, 1997). This suggests that transportation habits trump other considerations, notably utility, even in unfamiliar journeys (which may increase when one moves house).

Longer-term or Habitual Behavior Change

Social Practice Theory (SPT) offers a richer insight into why transportation habits, that is longer term patterns of usage, may be difficult to change and why endeavors to do so must extend beyond individualistic intervention. There are two main points for consideration in this framework; the elements of a practice (such as cycling) and the linkages of that practice to other practices (such as driving) (Kurz, Gardner, Verplanken, & Abraham, 2015).

Per Shove et al. (2012), the three elements required to produce sustained behavior change are materials, competence, and meaning. Although not focused on bike share use, Spotswood, Chatterton, Tapp, & Williams (2015)'s analysis of how these elements are constructed by cyclists provides clues as to what might be deficient to ensure longer-term behavior change in this context. The findings suggest that first-time bike share use might develop some of the required levels of materials and competence to support the practice of riding longer-term but would not be likely sufficient to create the meaning or association required to sustain a practice. Specifically, the materials required to use a bike share are a membership, the bike itself, and road features, such as cycles lanes to keep the rider safe. The necessary competences (including perceived competence) can largely be confirmed through the first ride, assuming the rider has ridden a bike before. Meaning, on the other hand, is revealed to be highly complex. Cycling was associated with danger, with stress, with being 'cool', with being for lower-status workers, with going against the right of motorists to rule the road, and with being "unusual or niche". It is this last association that might provide the largest barriers to continued use of the bike share: if the practice of bike sharing is not perceived as usual then it will fail to recruit new practitioners.

Our hypotheses flow from the theory as follows:

Figure 2
Postcard Version A: Free Frame

Figure 3
Postcard Version B: Discount Frame

Hypothesis 1. ***Behavioral economics****: Free-framed promotions will out-perform those framed as a monetary discount;*

Hypothesis 2. ***Openness to new things post-moving house:*** *Those who have newly moved house will take up the offer more often that those with new infrastructure in their vicinity (noting this part is not a controlled experiment);*

Hypothesis 3. ***Social marketing:*** *Overall offer redemption rates will be low in terms of absolute numbers as transport behaviors are difficult to change and the marketing is not targeted;*

Hypothesis 4. ***Social practice theory:*** *There will be no long-lasting effects from this social marketing intervention.*

The Intervention

The offer from the city was as follows: by using a code when setting up a membership profile, new riders would receive a $12 credit. This could be used to buy: a full day pass (valued at $12); four single rides; or towards an annual membership ($144 in total). The value of the offer was funded from the Bureau of Transportation's budget.

In partnership with the Bureau of Transportation staff, we designed two postcards to communicate this offer. The postcards were identical except for the framing, as shown in Figures 2 and 3. The full postcards can be seen in Appendix B. To distinguish both the postcard frame and the sub-group, we used four different promotional codes.

The identification of recipients, randomization, mailing, and collection of outcome data (whether the discount codes were redeemed) were managed by the Bureau of Transportation staff. We, the research team, supported by providing information on necessary sample size, providing the randomization code, and analyzing the results based on the outcome data.

Method

This was a two-arm randomized controlled trial (n=10,500), randomized at the household level, and stratified by two types of household; those in the vicinity of a newly built bike station (n=7,000), and households with a new resident located near a bike dock (n=3,500). Randomization was conducted using Microsoft excel on the City premises: each household was assigned to one of the two treatment arms using =randbetween(0,1). The resulting assignments were then copied and pasted as values (to ensure they did not recalculate).

With this sample, we were powered to detect small effect sizes. Given that this is the first study of

its kind, in all our power calculations we assumed power of .8 and an alpha of .05, and we varied the baseline proportion from 0 to .0.05.

For all our analysis we use a binary logistic regression model, using the Intention to Treat (ITT) population. For our primary and secondary analyses (which differ based on the sample analyzed) the model is as follows:

$$logit(Y_i) = \alpha + \beta_1 T_{1i} + \beta_2 T_{2i} + u_i$$

Where:

Y_i is our outcome measure; a binary variable taking the value of one (1) if the participant takes up the offer and (0) otherwise.

α is the constant.

β_1 is the coefficient on T_{1i}, which measures the effect of receiving the free-frame offer (coded 1) and is our primary coefficient of interest.

T_{1i} is a binary variable equals 1 if a participant received the free-framed offer, so that the discount-offer (coded 0) is omitted.

u_i is the error term.

We also separately estimate take-up between these two household types using the same underlying model. In this instance:

Y_i takes the value of one (1) if the participant takes up the offer and (0) otherwise.

α is the constant.

β_1 is the coefficient on T_{1i}, which measures the effect of having recently moved near a bike dock (coded 1) and is our primary coefficient of interest.

T_{1i} is a binary variable equals 1 if a participant recently moved, so those with a new bike dock near them (coded 0) are omitted.

u_i is the error term.

Lastly, we will look at follow-up data three months after the intervention to assess whether those who received the offer became regular riders. Since we have no control group (that is, everyone in our trial received an offer postcard), we cannot use this data to conclude anything about the impacts of social marketing. We expect the samples to be too small to give anything other than descriptive statistics at this stage.

Figure 4
Main Results

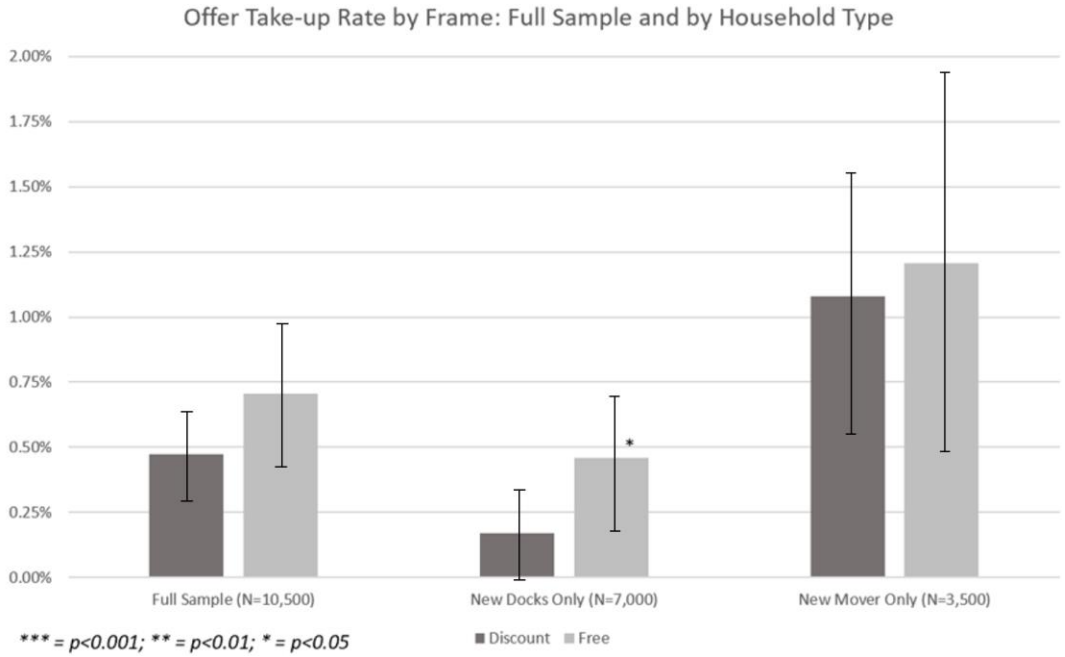
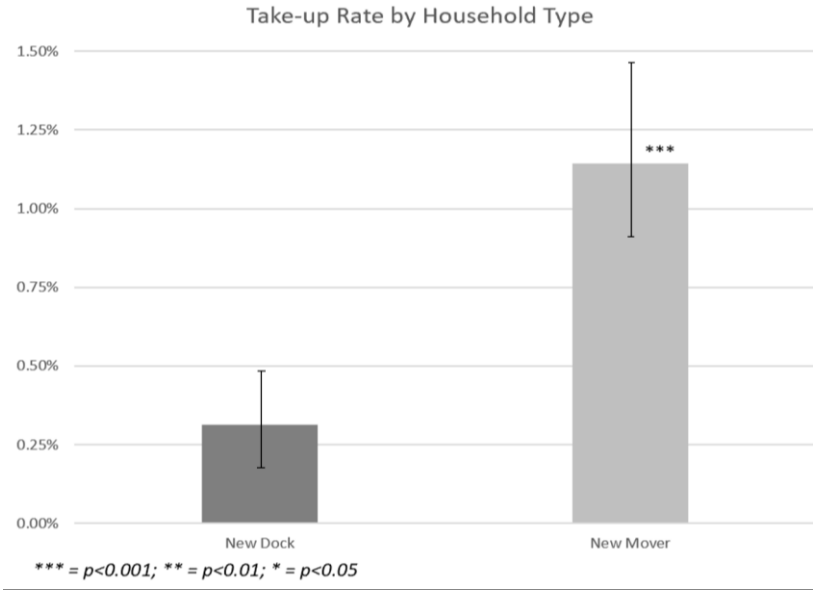


Figure 5
New Movers vs New Docks



Results

Randomization occurred on city premises and so we cannot include demographic summary statistics but given the large samples, we can assume randomization created two groups that are balanced on all key demographic, and other, variables.

Figure 4 shows the main findings of the study. For the full sample, there was no significant difference in take-up between the two offer-frames, although the free-framed offer was redeemed more often (p=0.123). We also failed to detect a difference between the two offer-frames for the 3,500 new movers in our sample (p=0.729). However, for the 7,000 households in an area where a new bike dock had been installed, the free-frame drove significantly higher take-up than the discount frame (0.46%, 0.17%), p = 0.0389. The odds ratio is 2.688 (95% CI = [1.104,7.499]).

Finally, as shown in figure 5, we found that those who had recently moved house were almost four times more likely to take up the offer than those who had not (1.14%, 0.31%), p<0.001. The odds ratio is 3.67 (95% CI = [2.198, 6.279]).

Lastly, we looked at continued use of the bike share by those who redeemed an offer code. While there was some level of repeat ridership the majority of those who redeemed the offer did not covert to regular riders.

Discussion and Conclusion

Link Between Findings and Current Literature

For the full sample, our primary hypothesis (that the free-frame offer would be taken-up at higher rates) must be rejected. However, for those with a new dock nearby, the free-frame offer was more than twice as effective as the discount-frame. For new movers, the frame made no difference, although – per our secondary hypothesis – members of this group were almost four times as likely as those with a new dock nearby to take-up the offer.

These results suggest that framing of an offer can have marginal effects on those whose access to new modes of transport has improved. It also contributes to the literature assessing the relative merits of framing an offer as free vs discounted. More cautiously – since the causal link is weak – we might posit that life-events, such as moving, may meaningfully change underlying motivation to try new things, like bike-share. For the new movers, this motivation may have been sufficiently high that the framing of the offer did not play into the decision of whether to take it up. Besides the recent move, other circumstantial factors for this sample might also weaken the mechanism typically used to explain why free-framed promotions are more attractive than discounts. For example: movers may share more characteristics with bike share users than the average resident; or, unless

funded by another party, those who have moved house may be cash-poor meaning they find monetary offers more appealing. Although other differences between the two sub-groups could also explain this differential effect, we consider this a compelling contribution to the literature on a matter that is difficult to test experimentally (since random assignment of house movement is unusual).

Limitations

The study has three key limitations. First, because we do not have further demographic characteristics on households, we cannot do a more in-depth analysis on the heterogeneous impacts. While we can have some level of confidence that the large sample and randomization mean these factors will be balanced, we cannot be certain. Second, the practical decision to use a single promotional code for each treatment group means we cannot guard against spillovers from code-sharing. Lastly, assuming bike share pricing isn't known to everyone, there are extra search costs to find out the value of $12 off, we cannot disentangle this mechanism from the effect of an offer being framed as "free".

Broader Significance of Findings

While we see statistically significant differences on some of our key tests, overall take-up of the offer is low with just 0.59% of the sample redeeming the offer. Indeed, three months after the trial concluded, the cost of the campaign was not covered by the revenue from new customers, although this calculation does not consider other benefits to the city, such as reduced congestion, lowered emissions, or better public health, associated with any level of take-up. If everyone had received the most effective postcard, a conservative estimate suggests there would be 72 new riders overall. This low take-up rate is in line with expectations for both transport behaviors and direct marketing, especially given that other barriers to access will exist for many recipients (Bauman, Rissel, Garrard, Ker, Speidel, & Fishman, 2008).

However, these results do form a strong case that municipal governments, and many others who already send mail to those who have moved house, should consider using these interactions as an opportunity to drive take-up of other city services, especially those that require a one-off behavior or where a social practice approach reveals that an old habit can be replaced since it was linked exclusively to the former residence. Lower cost communications methods, such as email or online advertising, could also be tested in the future, notably to try and get those who have ridden once to ride again.

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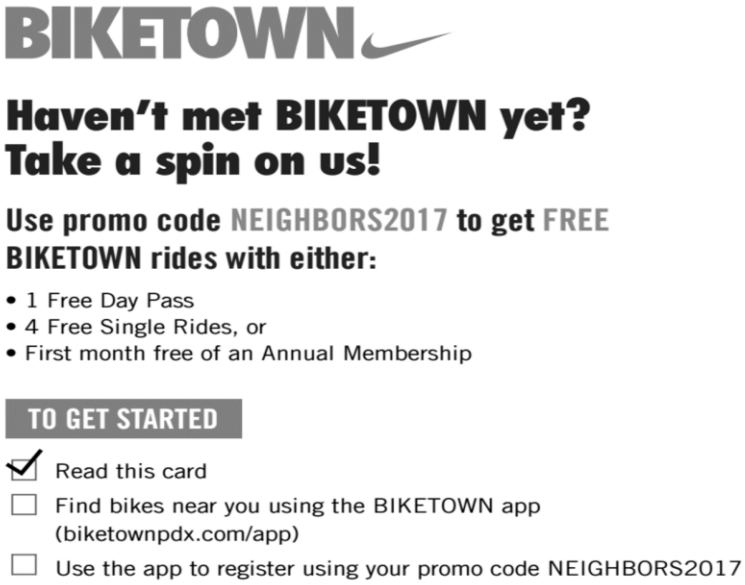
Appendix A:
Glossary of terms

Term	Definition
BIKETOWN	The city of Portland's bike share initiative
New movers	Those people in our sample who had newly moved to the one of the areas with a new dock installed.
New dock	A newly installed BIKETOWN collection/ drop-off station
The offer	Our intervention: the social marketing post-card variants mailed out by the city
Free frame	The variant of the postcard in which the offer is expressed in terms of "free" rides.
Discount Frame	The variant of the postcard in which the offer is expressed in terms of a $12 discount on rides.
The offer code	Each variant of the postcard (Free frame (new movers); Free frame (new dock); discount frame (new movers); discount frame (new dock)) had its own redemption code so we could track offers redeemed to the postcard received.
Take-up of the offer/ redemption of the offer	The act of redeeming the code provided on the offer against one of the possible purchases (a day pass, four single rides, an annual pass)

Appendix B:
Intervention details

Full Copy: Postcard A (Free Frame)



Full Copy: Postcard B (Discount Frame)