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Choose to reuse! The effect of action-close reminders on pro-environmental behavior☆

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ABSTRACT

In this study, we examine whether reminders are able to overcome limited attention and effectively promote pro-environmental behavior. We conducted a natural field experiment with customers of a Swiss agricultural association that delivers weekly food boxes with vegetables in plastic bags. Treated customers received weekly reminders highlighting the option to return the plastic bags for reuse. Reminders were provided either as a flyer added to the food box or as a sticker directly attached to one of the plastic bags. We find that the flyer and sticker reminders are similarly effective in reducing plastic waste during the intervention period. Importantly, customers are most likely to return those plastic bags marked with an action-close sticker reminder that raises attention at the time of the desired behavioral change. This study provides insights into the attentional mechanisms underlying reminder effects and highlights action-closeness as an opportunity to effectively implement reminders in practice.

1. Introduction

Plastic waste has become a major environmental issue for humanity (UNEP, 2018). By 2015, approximately 6300 million metric tons of plastic waste had been generated, 12% of which had been incinerated, 79% had accumulated in landfills and the environment, and only around 9% had been recycled (Geyer et al., 2017). Packaging dominates this flow of plastic waste (Dahlbo et al., 2018). In fact, plastic packaging is often discarded after the first use and accounts for nearly 50% of all plastic waste globally (UNEP, 2018). Environmentally friendly alternatives to wasting plastic are source reduction, product reuse, and recycling (Stein, 1992; Hopewell et al., 2009). Plastic bags, for example, can be reused several times, and the simple action of reuse yields significant environmental benefits (Bisinella et al., 2018). However, reducing the burden of plastic waste by product reuse requires behavioral change (MacArthur, 2017).

Even if most people have an intention to behave in an environmentally friendly way, they often fail to do so in their daily lives. One explanation for this discrepancy between intention and action is limited attention. Limited attention refers to decision makers'

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cognitive constraints in paying attention to the full set of information, actions, and their implications (e.g., Kahneman, 1973; Pashler, 1998; Falkinger, 2008; Dean et al., 2017; Ericson, 2017). Individuals with limited attention have a tendency to ignore less salient aspects of their behavior (Kahneman et al., 1982; Bordalo et al., 2012; Tiefenbeck et al., 2018). This implies that information about the desired behavior is often only partially processed if it has low salience (DellaVigna, 2009).

In this study, we examine whether reminders, and especially action-close reminders, can reduce limited attention and therefore, enhance pro-environmental behavior by reusing plastic bags. Reminders can bridge the attentional gap between intention and action, as they bring essential implications of behavior to the top of the mind and refocus attention on the desired behavior (Borgstede and Andersson, 2010; Bordalo et al., 2012; Szilagyi and Adams, 2012; Karlan et al., 2016). Action-close reminders, further, intend to catch decision markers' attention in the situation and at the time of the desired behavioral change (Luyben, 1980; Jacobs and Bailey, 1982; Krendl et al., 1992; Werner et al., 1998; Shearer et al., 2017). Therefore, action-close reminders may effectively overcome limited attention and promote pro-environmental behavior.

We conducted a randomized controlled trial with 287 customers of a Swiss agricultural association that offers subscriptions to weekly food boxes. The vegetables in the food boxes are often in plastic bags.[1] Customers have the option, and are encouraged, to return the plastic bags to the association for reuse. Before this study, however, return rates were very low (16.7%). As an intervention with the objective to increase customers' use of the return option, we added weekly reminders to the food boxes. Reminders were provided either as a flyer that was added to the food box or as a sticker that was attached directly to one of the plastic bags in the food box. Both types of reminders were designed to shift attention on the return option for plastic bags. Therefore, we expect that the flyer and the sticker reminder increase customers' return rates for the plastic bags in comparison to a control group with no reminder.

The sticker reminder worked as an action-close reminder for plastic bags that were directly marked with the sticker. Customers noticed the sticker reminder when they held the marked plastic bag in their hands and decided whether to reuse or discard it, i.e, the reminder raised attention at the time and in the situation of decision-making. For unmarked bags, however, the flyer and sticker reminders constituted conventional, action-distant reminders.[2] Customers did not necessarily notice these conventional reminders when they decided whether to reuse or discard any of the unmarked plastic bags. Therefore, in both treatments conventional reminders are seen as more distant to action and less salient in the situation of decision-making. Thus, we hypothesize that customers are more likely to return a plastic bag marked with an action-close sticker reminder than an unmarked plastic bag.

Overall, we find a statistically significant and quantitatively large effect for the flyer and sticker reminders on plastic waste reduction. The overall treatment effect for both reminders is similar in size. Specifically, relative to the pre-intervention period, the increase in the return rates for plastic bags during the intervention is, on average, 83% higher in the reminder treatments than in the control group. In addition, our results reveal that both reminder types can increase return behavior on the extensive and intensive margin. Both reminders are especially effective for customers who returned at least one plastic bag in the pre-intervention period, although both types of reminders also positively affect customers who did not return plastic bags in the past. Further, the impacts of the flyer and sticker reminders are stable during the five-week intervention period, indicating that repeated reminders do not lose their effectiveness. However, the reminder effects decrease in the post-intervention period. In line with the hypotheses, we further find that a reminder's proximity to action statistically significantly improves the reminder's effectiveness. The probability of returning a bag with an action-close sticker reminder is about 58% higher than the probability of returning an unmarked bag in the sticker treatment and about 41% higher than in the flyer treatment. With respect to unmarked bags, the flyer and sticker reminders constituted conventional reminders and there is no statistically significant difference between treatment groups.

To the best of our knowledge, we are the first to investigate the role of a reminder's proximity to action in comparison to conventional, action-distant reminders. Previous studies focused solely on the effect of point-of-decision prompts to encourage desired behavior without comparing their impact to that of conventional reminders (Luyben, 1980; Werner et al., 1998; Russell et al., 1999; Sussman and Gifford, 2012; Allais et al., 2017; Shearer et al., 2017). Austin et al. (1993), as an exception, show that sign prompts improve recycling behavior when they are close to the point of decision. Together with the visual reminder, however, Austin et al. (1993) also vary the positioning of receptacles, and thus, the effort associated with the recycling activity. In contrast, we directly compare the effectiveness of action-close and conventional reminders. By showing that a reminder's proximity to action is important by itself, we provide new evidence that reminders issued at the time and in the situation of taking action can bridge limited attention more effectively than conventional, action-distant reminders.

In addition to extending behavioral research on reminder effects,[3] this paper adds to a growing number of field experiments that test the efficacy of nudging to enhance pro-environmental behavior. Reduced individual showering times (Tiefenbeck et al., 2018), lower paper (Egebark and Ekström, 2016) and meat consumption (Kurz, 2018), general household energy savings (Schultz et al., 2007; Allcott, 2011; Werner et al., 2012; Allcott and Rogers, 2014), and recycling (Shearer et al., 2017) are only a few examples.

[1] Plastic packaging is necessary because of hygienic and handling reasons. Many vegetables are wet or covered with dirt and thus, must be separated from others, or they are loose, and plastic bags help to keep them together.

[2] Note that unmarked bags were present in the sticker and the flyer treatment. In the sticker treatment, each food box contained one plastic bag with a directly attached sticker reminder (marked bags), while all other bags did not have attached sticker reminders (unmarked bags). In the flyer treatment and the control group, there were only unmarked bags.

[3] The effect of reminders on behavior has been studied in various areas. For example, in the context of gym attendance (Calzolari and Nardotto, 2017; Muller and Habla, 2018), charitable giving (Sonntag and Zizzo, 2015; Damgaard and Gravert, 2018), adherence to medical treatments (Altmann and Traxler, 2014), monthly savings (Karlan et al., 2016), rule compliance at the library (Apesteguia et al., 2013), electricity consumption (Allcott and Rogers, 2014; Gilbert and Zivin, 2014), and education (Castleman and Page, 2015; Himmler et al., 2019).

Our paper contributes to this literature by examining the effectiveness of reminders in a new environmental setting, namely, in the area of plastic waste reduction through reuse.

Our results provide important implications for the implementation of reminders in practice. First, the results suggest reminders are an effective, low-cost, and easy-to-implement option to decrease inattention and thus, encourage pro-environmental behavior at least in the short term. Sustainable behavioral change, therefore, may not require complex informational messaging or feedback, and there are potentially large environmentally gains to be made from small interventions. Second, reminders should optimally be issued at the time and in the situation when the action takes place to promote the desired behavior that is not at the top of people's mind.

The remainder of the paper is structured as follows. Section 2 presents a theoretical framework for the underlying mechanisms of the reminder effects. Section 3 outlines the field setting, the experimental design, and the sample characteristics and randomization checks. Section 4 lays out the experimental results, and Section 5 concludes.

2. Theoretical framework

We use the simple model of inattention from DellaVigna (2009) to investigate the mechanisms by which reminders may change behavior. In this model, the value of a good consists of two components: a visible component (v) that is easily known and remembered by the decision maker and an opaque component (o) that requires more effort and attention to be noticed. The true value of good V is determined by the sum of two components v and o, $V = v + o$. Assuming limited attention, the decision maker perceives the value as $\hat{V} = v + (1-\theta)o$, where $\theta \in [0,1]$ indicates the degree of inattention. Thus, $(1-\theta)$ can be interpretated as the degree to which an individual processes information about opaque possibility o.

In our setting, we presume that customers fail to consider the value of plastic bags inherent to the option to return for reuse, because the information about this option is provided when the contract is signed and customers may forget about it. We define v as the value of a plastic bag after its first use and o as the value of a plastic bag if it is returned and reused.[4] Because for most people, such plastic bags have no further obvious purpose after their first use and are usually discarded, we assume that $v = 0$.[5] As the customers in our setting have an above-average awareness of environmental issues, we presume that o is positive. Accordingly, we assume that with full attention ($\theta = 0$) plastic bags would be returned for reuse. Depending on the degree of inattention ($\theta > 0$), the perceived value of the plastic bag to the customers, $\hat{V} = (1-\theta)o$, may not be high enough for customers to return the plastic bag for reuse. Two factors influence the degree of inattention in the model: the salience $s \in [0,1]$ of o and the number of competing stimuli N : $\theta = \theta(s, N)$. Based on psychological evidence, DellaVigna (2009) assumes that inattention θ is declining in salience s and increasing in competing stimuli N: $\theta'_s < 0$ and $\theta'_N > 0$.

In this paper, we first examine how limited attention affects decision making when the opaque value o of a plastic bag becomes more salient through reminders. As we manipulate the salience of the return option for reuse, we test for limited attention by checking whether the derivative $\partial\hat{V}/\partial s = -\theta'_s o$ differs from zero (e.g., Chetty et al., 2009). Therefore, if our two types of reminders are able to increase the salience of the opaque purpose o, and thus, reduce inattention, the perceived value $\hat{V}$ increases. As we are not able to observe $\hat{V}$, we assume that if people return more plastic bags for reuse, the perceived value $\hat{V}$ increases. Second, we investigate the differential effects of action-close and conventional, action-distant reminders. In doing so, we draw on research showing that the temporal difference between receiving the reminder and taking action matters because individuals tend to forget and attention decays over time (Ericson, 2011; Taubinsky, 2013; Ericson, 2017). We suggest that action-close reminders, which in our setting were attached directly to one of the plastic bags, are more salient at the time of action. The model by DellaVigna (2009) indirectly captures the temporal differences between receiving a reminder and taking action through the number of competing stimuli N. The more time elapses between receiving a reminder and the actual moment of action, the more likely it is that additional, new stimuli N attract attention. This leads to an increase in inattention θ to the opaque value o and diminishes the positive salience effect of a reminder. If the reminder is attached directly to the plastic bag, it catches the decision maker's attention at the time of action, leaving little room for competing stimuli N. Therefore, we expect that action-close reminders are most effective for the return decisions on marked bags, i.e., the marginal effect on the return probability should be greater for marked plastic bags than for unmarked plastic bags. For unmarked bags, we expect that return decisions after receiving the flyer or sticker reminder depend on the decay of attention. As the decay of attention function is not known ex ante, it is unclear whether the sticker treatment will have a greater overall treatment effect than the flyer treatment.

[4] An alternative explanation for reminder effects in our setting may be that the costs of return (i.e., time-consuming cleaning and the effort to return the plastic bags) are more salient than the environmental benefits associated with the option to return for reuse. In this case, v would be defined as the costs of return and o as the value of behaving environmentally friendly by returning the plastic bags. However, a post-experimental survey shows that time-consuming cleaning is not a decisive reason for discarding plastic bags, and customers do not associate high costs with the option to return for reuse. Therefore, we focus on "forgetting" as the explanation for the reminder effects.

[5] The pre-intervention average return rate is 16.7%. However, note that v may be positive if customers have an obvious alternative use of the bags, for example, as a storage or carrier bag. In this case, the implications of the model still apply.

3. Field experiment

3.1. Field setting

We conducted the field experiment in cooperation with a Swiss agricultural association that offers weekly assortments of organic farm products. These food boxes can be bought through an annual subscription that is available for three different types (meat, vegetarian, or vegan) and in two sizes (large and small). The food boxes contain regional, organic, and seasonal vegetables, and depending on the food box type, eggs, meat, or other farm products. The annual subscription includes 48 deliveries and four (self-determined) holiday weeks per year during which the delivery is suspended. In terms of distribution, the food boxes are labeled with the customer's name and are delivered every week to 11 depots in the city of Bern. Customers can then pick up their food boxes from one of these depots.

There are several reasons why about 60% of the items are wrapped in plastic bags. For example, the vegetables in the food box are not pre-cleaned and thus, often are covered with dirt (e.g., carrots or potatoes) or in need of preparation for other reasons (e.g., small insects). Plastic bags are also used to separate wet and/or loose vegetables (e.g., fresh salad, baby spinach) from other items. For the partner association, reusing these plastic bags in the delivery process is one of the most sustainable and financially viable packaging options.[6] Therefore, next to the request to return the food box, new subscribers are explicitly encouraged to return the plastic bags in their boxes to the depots for reuse for other deliveries. Although we expect that food boxes subscribers share a common intention to behave in an environmentally friendly way, the return rate for the plastic bags before the intervention was very low (16.7%). To understand why the return option is rarely used, we conducted a small post-experimental survey to elaborate two other common alternatives regarding the handling of plastic bags: throwing the plastic bags away and reusing them in other ways (see Appendix C for details on the post-experimental survey). We found that reusing plastic bags in other ways is a plausible option for some of the respondents. However, due to careful randomization (see Section 3.2), the differences caused by this factor should be, on average, the same in all treatment groups; i.e. the treatment effects should be independent of alternative uses. In addition, the results of the post-experimental survey indicate that hygienic reasons, bad habits, and time-consuming cleaning play only a minor role in the decision not to return the plastic bags.

3.2. Experimental design and procedure

We designed a field experiment to examine whether simple reminders, and in particular action-close reminders, can encourage customers to return plastic bags for reuse. We used a between-subject design with two experimental treatments and a control group. In the control group, no reminder was in place. In the flyer treatment, a conventional flyer was added to the food box, reminding customers to return the plastic bags for reuse.[7] In the sticker treatment, the reminder was directly attached to one of the plastic bags (see Fig. 1). To avoid confounds due to potential differences in handling plastic bags with different contents, the plastic bag that received the sticker was randomly selected each week among the bags in the food box. The provision of only one reminder per delivery week in each treatment ensures the comparability of the experimental groups and at the same time, allow for an evaluation of the action-closeness effect. The reminders in both experimental treatments were equal in terms of content, layout, and size.[8] Both types of reminders contained the following information: "Please return the plastic bags. They can be reused". The reuse symbol was used to support the written information (see Fig. A.1 in Appendix A).

Customers were randomly assigned to the flyer treatment, sticker treatment, or control group. To ensure equal distribution in terms of depots' geographical locations and food box types, we stratified the sample according to the depots, box types, and box sizes. The intervention took place for five delivery weeks from October 18 until November 15, 2017. During this period, treated customers received weekly reminders either in the form of a flyer or in the form of a sticker attached to one of their plastic bags. Beyond the intervention period, we tracked customers' return behavior for two delivery weeks before (pre-intervention period) and four delivery weeks after (post-intervention period) the intervention. Thus, plastic bags were tracked for 11 weeks in total, between October 4 and December 20, 2017.[9] The timeline of the experiment is illustrated in Fig. 2.

The main challenge during the data collection process was to track the number of returned plastic bags at the individual level. Therefore, we tagged every plastic bag with an almost invisible ID label, indicating a unique identification number for the customer and the current delivery week (see Fig. A.2 in Appendix A). This procedure allowed us to gather individual customer data on the number of plastic bags delivered and returned for each week. To avoid confounds, the plastic bags that were returned during the experiment were not reused directly but collected by the experimenters and reintroduced by the organization after the end of the study.

[6] Research similarly suggests that plastic bags can be reused several times and have less environmental impact than, for instance, organic cotton bags. Organic cotton bags have to be used at least 149 times to offset their climate impact; this is compared to 43 times for regular paper bags and once for low-density polyethylene (LDPE) plastic bags (Bisinella et al., 2018).

[7] The flyers were not attached directly to the food boxes but put inside so customers in the depots could not see them from the outside. We do not assume confounding effects from personal communication, as customers pick up their boxes at individual times and in semi-public places, such as staircases or storage rooms, where they usually do not linger.

[8] Several studies indicate that simplicity, noticeability, and clarity may improve the effectiveness of visual reminders (e.g., Kline and Beitel, 2016). Furthermore, research suggests that adding a picture that emphasizes the message may support its impact (e.g. Werner et al., 1998; Roberts et al., 2009). We took these factors into account during the design process.

[9] Customers did not always return the empty food boxes and the corresponding plastic bags from the previous week when they picked up their new food boxes. Because time of the delivery and the time of the return of the plastic bags may fall more than one week apart, we counted the returns for an additional four weeks after the post-intervention period, until January 10, 2018. On average, the plastic bags were returned 1.9 weeks after delivery.

Fig. 1. Reminder treatments.

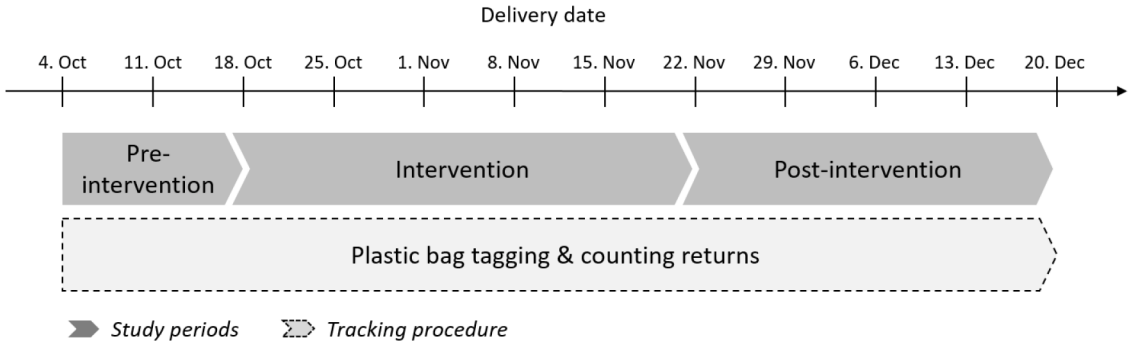

Fig. 2. Timeline of the experiment.

3.3. Outcome measures

To investigate and compare the effects of the flyer and sticker reminders in general, we employ the return rate per customer as our main outcome measure (see Sections 4.1–4.3). This variable is calculated using the number of returned plastic bags from each delivery week divided by the total number of delivered bags per week.[10] To evaluate the effect of a reminder's proximity to action, we compare the probability of return for plastic bags marked with action-close sticker reminders to the probability of return for bags without attached sticker reminders in the flyer and the sticker treatments. The comparison of marked plastic bags (i.e., bags with a sticker reminder attached) in the sticker treatment with plastic bags in the flyer treatment allows us to identify the superior effect of action-close compared to conventional reminders. The comparison of marked and unmarked plastic bags within the sticker treatment further permits us to explore the effect of action-close reminders to those decision situations where no action-close reminder is present. Our main dependent variable in these analyses is a dummy variable indicating whether the plastic bag was returned for reuse or not (see Section 4.4). In addition to the outcome measures, we use data on whether the food box itself was returned or not, the delivery week, and the customers' food box types, sizes, and depots as control variables.

[10] Note that we analyze the returned plastic bags per delivery week, irrespectively of the time of their return. This allows us to clearly attribute the plastic bag observations to the pre-, during-, or post-intervention period.

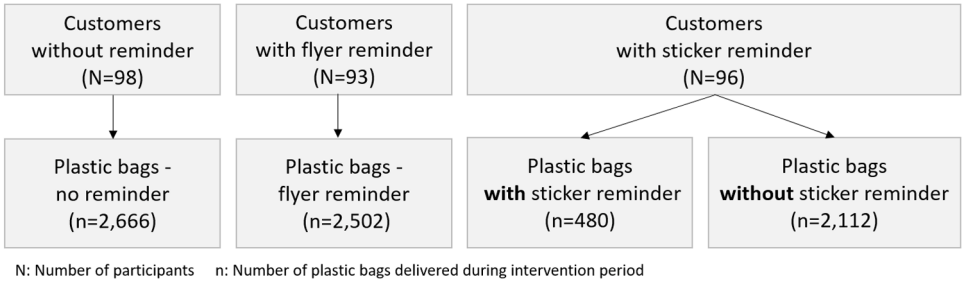

Fig. 3. Levels of analysis.

Table 1
Sample characteristics and randomization checks.

	Sample n = 287	Control n = 98	Flyer n = 93	Sticker n = 96	*p*-value
Small box	0.92	0.95	0.90	0.92	0.436
Big box	0.08	0.05	0.1	0.09	0.436
Meat box	0.30	0.32	0.30	0.28	0.867
Veggie box	0.49	0.47	0.51	0.50	0.865
Vegan box	0.21	0.21	0.19	0.22	0.903
Depot 1	0.13	0.15	0.13	0.10	0.601
Depot 2	0.05	0.04	0.05	0.05	0.903
Depot 3	0.04	0.02	0.05	0.04	0.499
Depot 4	0.04	0.04	0.05	0.03	0.745
Depot 5	0.02	0.02	0.02	0.02	0.999
Depot 6	0.11	0.09	0.13	0.10	0.705
Depot 7	0.15	0.16	0.14	0.16	0.900
Depot 8	0.01	0.01	0.01	0.01	0.999
Depot 9	0.13	0.13	0.13	0.14	0.992
Depot 10	0.12	0.11	0.10	0.15	0.569
Depot 11	0.20	0.21	0.18	0.20	0.862
Holiday weeks (intervention)	0.43	0.54	0.44	0.31	0.132
	(0.82)	(0.94)	(0.81)	(0.65)	
Food boxes returned (intervention)	6.51	6.83	6.65	6.06	0.174
	(2.94)	(2.55)	(2.79)	(3.4)	
Return rate (pre-intervention)	0.17	0.14	0.18	0.18	0.540
	(0.25)	(0.25)	(0.23)	(0.26)	

Notes: The table reports means and standard deviations for continuous variables and percentage frequencies for categorical variables for the full sample and for each treatment group individually. Standard deviations are given in parentheses. For categorical variables, the *p*-value in the last column was obtained from a $\tilde{\chi}^2$-test across all groups. For continuous variables, the *p*-value was obtained from an *F*-test.

3.4. Sample characteristics and randomization checks

337 customers of the agricultural association participated in our experiment. The return rate for plastic bags in the pre-intervention period could not be observed for 50 customers who were on holiday in either of the pre-intervention weeks.[11] As the return rate in the pre-intervention period is essential for our analyses (see Section 4.1), we consider the remaining 287 customers as our final sample.[12] Out of these 287 customers, 93 received flyer reminders, 96 received sticker reminders, and 98 received no reminders. Food boxes contained on average 5.2 plastic bags with a standard deviation of 1.16. This leads to a total of 7760 plastic bag observations in our final data set. Fig. 3 shows the number of observations on both the individual- and bag-level of analysis.

Table 1 further provides the observed customer characteristics and the average return rates in the pre-intervention period for the whole study sample and for each treatment group separately. Consistent with the randomization procedure, the average customer does not differ in terms of observed characteristics across treatments. In the pre-intervention period, customers from the experimental groups returned slightly more plastic bags than those in the control group (18% in each reminder group versus 14% in the control group). However, according to the *F*-test, this difference is not significant. Since a balanced pre-intervention return rate is crucial for our analyses, we additionally conduct a pairwise comparison. The two-sided t-tests, however, do not reject the null hypothesis of an equal mean for the treatments and the control group ($p = 0.378$ flyer vs. control, $p = 0.317$ sticker vs. control, $p = 0.864$ sticker vs. flyer).

[11] Holiday weeks during the intervention period were treated as missing observations for the respective customers.
[12] The results for the total sample are robust and available upon request.

Table 2
Average return rates over periods.

	Pre-intervention n = 287	Intervention n = 287	Post-intervention n = 286
Control (n = 98)	0.14	0.14	0.12
	(0.25)	(0.23)	(0.20)
Flyer (n = 93)	0.18	0.33***	0.26***
	(0.23)	(0.29)	(0.27)
Sticker (n = 96)	0.18	0.32***	0.22***
	(0.26)	(0.29)	(0.25)
p (flyer vs. control)	0.378	<0.001	<0.001
p (sticker vs. control)	0.317	<0.001	0.003

Notes: The table shows the average return rate across treatments in the pre-, post-, and intervention periods. Standard errors are reported in parentheses. The lower sample size in the post-intervention period is due to one customer who unsubscribed during the intervention. The *p*-values report the results of two-sided t-tests for unrelated samples.

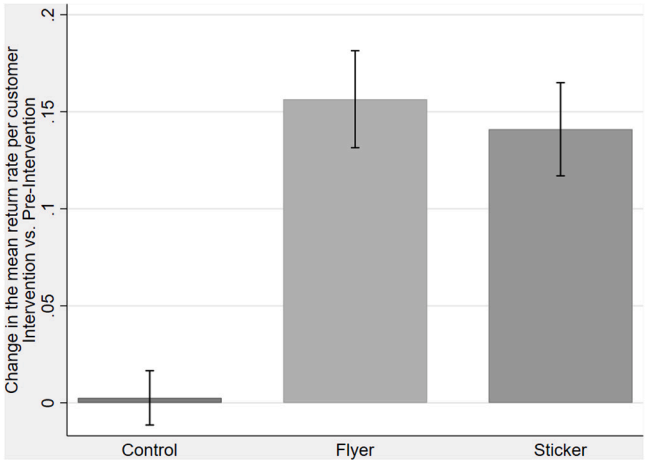

Fig. 4. Mean differences in return rates. *Notes:* Each bar indicates the change in mean return rates. The error bars represent the mean ± the standard error of the mean.

4. Results

4.1. The impact of reminders on return behavior

To analyze the effect of reminders on return behavior, we compare the return rates across treatments in the pre-, post- and intervention periods. Table 2 reports the average return rates for each treatment group in each period. While there are no significant differences across treatments before the intervention, we observe statistically significantly higher return rates in the flyer and sticker treatments than in the control group during the intervention period. This also applies for the post-intervention period. Fig. 4 displays the mean differences in return rates between the intervention and pre-intervention periods. The graph shows that the mean return rate in the control group does not change over the periods, whereas we observe a sharp increase in the flyer and sticker reminder treatments. The standard error bars indicate statistically significant differences between both experimental treatments and the control group, but not between the flyer and sticker treatments.

In addition, we use the following difference-in-difference regression model to analyze the reminder effects:

$$y_{i,t} = \beta_0 + \beta_1 Flyer_i + \beta_2 Sticker_i + \beta_3 Intervention_t + \beta_4 Flyer_i * Intervention_t + \beta_5 Sticker_i * Intervention_t + \epsilon_{i,t}, \quad (1)$$

where $y_{i,t}$ is the return rate of customer i in period t. We consider two treatment dummy variables: the $Flyer_i$ dummy and the $Sticker_i$ dummy. Both treatment dummies are 0 for the control group and take on the value 1 if the customer is assigned to the flyer or the sticker treatment, respectively. We also include the common time effect $Intervention_t$, which is 1 for the intervention period and 0 for the pre-intervention period. Our main coefficients of interest are the interaction terms between the intervention period dummy and the treatment dummies. These interaction terms indicate the differences in the pre- and intervention period return rates between the reminder treatments and the control group. In all model specifications, standard errors are clustered on the customer level.

Table 3
Difference-in-Difference regression: Return rate per customer, probability of returning at least one bag, and return rate per customer conditional on returning.

	Return rate 1	Return rate 2	Prob. of returning 3	Prob. of returning 4	Return rate cond. 5	Return rate cond. 6
Flyer	0.031	0.032	0.490***	0.493***	−0.102*	−0.110**
	(0.035)	(0.035)	(0.185)	(0.185)	(0.054)	(0.053)
Sticker	0.037	0.040	0.476***	0.484***	−0.087	−0.089
	(0.037)	(0.037)	(0.184)	(0.185)	(0.057)	(0.057)
Intervention	−0.000	−0.068**	0.270***	0.057	−0.106**	−0.179***
	(0.014)	(0.026)	(0.098)	(0.150)	(0.041)	(0.051)
Flyer ×	0.157***	0.161***	0.443***	0.469***	0.195***	0.207***
Intervention	(0.025)	(0.025)	(0.168)	(0.170)	(0.054)	(0.053)
Sticker ×	0.141***	0.154***	0.517***	0.570***	0.158***	0.174***
Intervention	(0.024)	(0.025)	(0.171)	(0.175)	(0.052)	(0.053)
Boxes		0.029***		0.088*		0.028**
returned		(0.010)		(0.048)		(0.012)
Constant	0.144***	0.098***	−0.450***	−0.591***	0.442***	0.401***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Observations	574	574	574	574	319	319
Clients	287	287	287	287	194	194
R^2/Pseudo R^2	0.086	0.106	0.091	0.096	0.025	0.049

Notes: Specifications 1 and 2 present results of a difference-in-difference OLS regression with the plastic bag return rate per customer as the dependent variable. Specifications 3 and 4 report the estimate of a difference-in-difference probit regression on the likelihood of returning at least one bag. Specifications 5 and 6 present results of a difference-in-difference OLS regression with the plastic bag return rate per customer conditional on returning at least one bag as the dependent variable. Robust standard errors clustered on the individual level are in parentheses. *Flyer* and *Sticker* are dummy variables equal to 1 for customers in the flyer or sticker treatment, respectively, and 0 otherwise. The dummy variable *Intervention* is 1 for the intervention period and 0 for the pre-intervention period. Specifications 2, 4, and 6 further include the number of returned food boxes. *, **, and *** document significance at the 10%, 5%, and 1% levels.

Specifications 1 and 2 of Table 3 present the estimated coefficients of Model (1). In line with the descriptive statistics, Specification 1 confirms the large and significant reminder effects. More specifically, the coefficients of the interaction terms between the intervention period dummy and the flyer or sticker dummy are of similar magnitude and statistically significant. Compared to the control group, the differential change over periods is 16 percentage points for the flyer treatment and 14 percentage points for the sticker treatment. This is equal to a relative increase in the return rates of 83% in the flyer treatment and 78% in the sticker treatment. These reminder effects are similar to or higher than those detected in previous work (Werner et al., 1998; Osbaldiston and Schott, 2012; Sussman et al., 2013; Altmann and Traxler, 2014; Calzolari and Nardotto, 2017). The results further suggest that the sticker and flyer reminders are similarly effective in promoting return behavior. In fact, we cannot reject the null hypothesis that the flyer and the sticker treatments have the same impact on customers' return rates ($p = 0.801$, Wald test). In Specification 2, we additionally control for the number of returned food boxes per customer i in period t. As customers usually return all packaging materials together, it is not surprising that we observe a positive and statistically significant association between returned food boxes and returned plastic bags. Importantly, the inclusion of this variable does not alter the treatment effects.[13]

With regards to extensive margin effects, Fig. 5 shows that the share of customers returning at least one bag is larger in the reminder treatments than in the control group, both in the intervention period and in the pre-intervention period. In addition, Fig. 5 indicates that there is an increase in the percentage of people who returned at least one bag during the intervention period compared to the pre-intervention period. Importantly, this increase is statistically significant for both reminder treatments ($\tilde{\chi}^2$-test; $p < 0.001$ for both reminder treatments) but not for the control group ($\tilde{\chi}^2$-test; $p = 0.141$). The descriptive statistics are confirmed by Specifications 3 and 4 of Table 3 which report the estimates of a difference-in-difference probit regression model on the probability of returning at least one bag. The results show that both types of reminders significantly increase a customer's likelihood of returning at least one plastic bag compared to the control group. The predictive margins for the interaction terms are 43% for the control group, 77% for flyer treatment, and 79% for sticker treatment. Specification 4 shows that the treatment effects are similar in sign and magnitude when including the number of food boxes returned. On the intensive margin, Specifications 5 and 6 show a statistically significant increase in the return rate, conditional on returning at least one bag, for customers in the flyer (19.5 percentage points) and the sticker treatments (17 percentage points) compared to the control group. These findings suggest that significant positive impact of reminders on return rates can be explained by a combination of extensive and intensive margin effects.

[13] Considering the week of delivery in a difference-in-difference model with random effects for customers has no major bearing on the outcomes (see Table B.1, Appendix B). As Table B.2 in Appendix B further shows, the results stay robust when looking at the absolute number of plastic bags returned during the intervention period in a Poisson regression model. Additional random effects regressions reveal that considering the week of return (in addition to the week of delivery) has no major impact. These results are available on request.

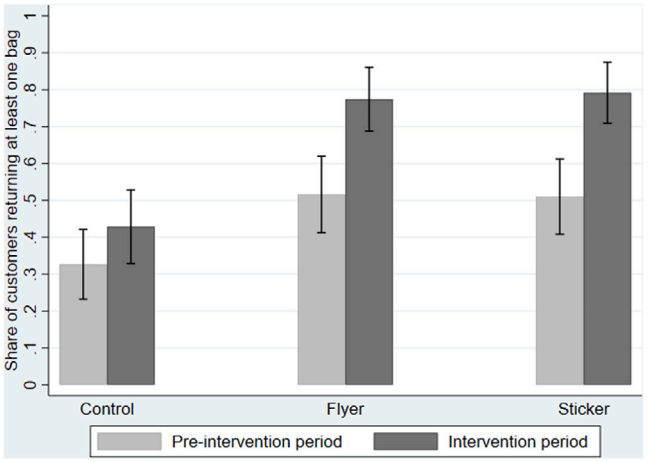

Fig. 5. Share of customers returning at least one plastic bag. *Notes:* The figure shows the share of customers returning at least one plastic bag during vs. pre-intervention period for treatments with error bars.

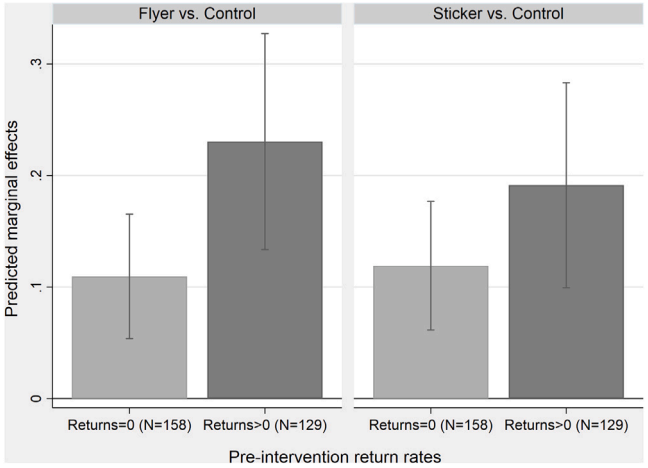

Fig. 6. Mean differences in return rates for subgroups and treatments. *Notes:* Each bar indicates the predicted change in return rate during vs. pre-intervention for subgroups and treatments. Subgroup "Return = 0" refers to customers who did not return any plastic bags and subgroup "Return > 0" refers to customers who returned at least one bag. The error bars represent the 95% confidence interval.

4.2. Reminder effects over subgroups

Previous studies have found that reminder effects are not uniform among the population and that reactions to reminders are related to the behavior before the intervention (e.g., Apesteguia et al., 2013; Altmann and Traxler, 2014; Calzolari and Nardotto, 2017; Damgaard et al., 2018). We therefore investigate whether the response to the reminders differs across customers who returned at least one plastic bag (45%) and those who did not return any bags (55%) in the pre-intervention period. To analyze a potential difference between these subgroups, we include an interaction term in the difference-in-difference Model (1). The term $Group_i$ takes the value of 1 if customer i returned at least one plastic bag in the pre-intervention period, and 0 otherwise:

$$\begin{aligned} y_{i,t} = {} & \beta_0 + \beta_1 Flyer_i + \beta_2 Sticker_i + \beta_3 Intervention_t \\ & + \beta_4 Flyer_i * Intervention_t * Group_i + \beta_5 Sticker_i * Intervention_t * Group_i + \epsilon_{i,t}. \end{aligned} \tag{2}$$

Fig. 6 provides the estimated marginal effects of Model (2) per treatment and subgroup (see Table B.3 in Appendix B for the estimates of the regression analysis). Both subgroups show statistically significant higher return rates in the flyer and sticker treatments than in the control group. Interestingly, we observe a stronger effect for customers who returned at least one bag in the pre-intervention period. During the intervention, their return rates increased by 23 percentage points in the flyer treatment and 19 percentage points in the sticker treatment, compared to the control group. Among the customers who did not return a bag in the pre-intervention period, return rates increased by 11 percentage points in the flyer treatment and 12 percentage points in

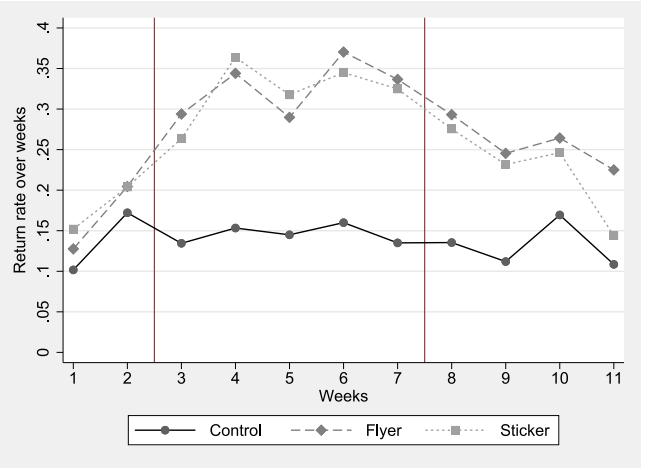

Fig. 7. Return rates per treatment over weeks.

the sticker treatment in comparison to the control group. The descriptive statistics also show that 32% of this group started to return bags for reuse during the interventions. The differences in the reminder effects between the two subgroups are statistically significant in the flyer treatment ($p = 0.034$) but not in the sticker treatment ($p = 0.191$). The finding that reminders are particularly effective for individuals who have, to some extent, already implemented the desired behavior is in line with the results of Damgaard et al. (2018) and presumably supported by two factors: First, we expect that customers who have already been more committed in the pre-intervention period are more willing to implement environmentally friendly actions and thus, are more receptive to the reminder information. Second, the majority of these engaged customers still had a lot of room to increase their return rates. These factors may explain why our results differ from previous studies indicating that reminders are more effective for less engaged individuals (Apesteguia et al., 2013; Calzolari and Nardotto, 2017).

4.3. Reminder effects over time

In the following, we are interested in the development of the reminder effects over time. Fig. 7 provides descriptive evidence for the return rates over the delivery weeks. During the intervention period (weeks 3–7; situated between the two vertical lines), customers reacted strongly to the reminders, with a peak return rate of 40% in the flyer treatment and 38% in the sticker treatment in week 6.

To further examine this time trend, we estimate the reminder effects during the intervention period with the following random effects model:

$$\begin{aligned} y_{i,t} &= \beta_0 + \beta_1 Flyer_i + \beta_2 Sticker_i + \beta_3 Week_t \\ &\quad + \beta Flyer_{i,t} * Week_t + \beta Sticker_{i,t} * Week_t + \nu_i + \epsilon_{i,t}, \end{aligned} \tag{3}$$

where $y_{i,t}$ is the return rate for plastic bags that were delivered to customer i in week t. The predictors $Flyer_i$ and $Sticker_i$ are binary variables, showing customers' assignments to the flyer or sticker treatment. To capture the time trend in return behavior, we include the variable $Week_t$ (continuous, ranging from 3 to 7) and the corresponding interactions with the treatment dummies. The term ν_i indicates random, customer-specific deviations from the average, and $\epsilon_{i,t}$ is the random error term. Table 4 provides the estimates of Model (3).

The coefficient estimates for the flyer and sticker treatments are statistically significant and are of remarkable magnitude. These observed reminder effects do not differ from each other (Wald test $p = 0.953$). Note that the treatment coefficients represent the reminder effect in the first week of the intervention period. The interactions of the treatment dummies and the intervention weeks are positive but small in size and not statistically significant. This confirms the temporal stability of the reminder effects during the intervention. As Specification 2 shows, both treatment coefficients slightly drop in size but stay significant at the 5% level when depot-fixed effects were included, and the pre-intervention return rate and the type, size, and number of returned food boxes were controlled for. These time-related results suggest that reminders, regardless of their form, have a positive effect on pro-environmental behavior not only once but also when they are repeatedly applied.[14] In other words, we found no evidence for an attenuation of the reminder effect: The impact of the reminders was stable over the five-week intervention period. This is congruent with previous findings in environmental (Allcott and Rogers, 2014; Tiefenbeck et al., 2018) and non-environmental contexts (Kast et al., 2012; Apesteguia et al., 2013; Altmann and Traxler, 2014; Calzolari and Nardotto, 2017).

[14] The results remain robust when the absolute number of plastic bags is regressed in a Poisson version of Model (3) (see Table B.4 in Appendix B).

Table 4
Random effects regression: Return rate per customer and delivery week.

	1	2
Flyer	0.151**	0.117**
	(0.063)	(0.055)
Sticker	0.147***	0.117**
	(0.056)	(0.047)
Week	0.003	0.003
	(0.006)	(0.006)
Flyer × Week	0.007	0.007
	(0.010)	(0.010)
Sticker × Week	0.006	0.006
	(0.009)	(0.009)
Boxes returned		0.045**
		(0.019)
Return rate pre-intervention		0.800***
		(0.046)
Big box		0.052
		(0.038)
Meat box		0.047*
		(0.026)
Veggie box		0.059**
		(0.024)
Constant	0.131***	−0.080*
	(0.038)	(0.046)
FE Depot	No	Yes
N	1390	1390
Customers	287	287
sd (customers)	0.251	0.147
R^2 overall	0.066	0.447
Wald Chi^2	35.33	635.48
Rho	0.602	0.342

Notes: Specifications 1 and 2 present results of a random effects model with random effects for customers. Robust standard errors clustered on the individual level are in parentheses. The dependent variable is the return rate per customer and delivery week. $Flyer$ and $Sticker$ are dummy variables equal to 1 for customers in the flyer or sticker treatment, respectively, and 0 otherwise. The variable $Week$ is continuous, ranging from 3 to 7, and represents the delivery week in the intervention period. In Specification 2, the control variables include the number of boxes returned, the return rate in the pre-intervention period, dummy variables for the box sizes (small boxes used as a reference) and the box types (vegan boxes used as a reference), and fixed effects (FE) for depots. *, **, and *** document significance at the 10%, 5%, and 1% levels.

We further investigate the post-intervention effects of the reminder treatments by applying a difference-in-difference model, similar to Model (1) (see Fig. A.3 in Appendix A for a graphical illustration and Table B.5 in Appendix B for the estimates of the regression analysis). Specifications 1 and 2 of Table B.5 show that, in comparison to the pre-intervention period, the flyer and sticker reminders have a statistically significant positive effect on the return rates in the post-intervention period. Nevertheless, Specifications 3 and 4 reveal that the post-intervention reminder effects are statistically significantly lower than those observed during the intervention period. This is particularly the case for the sticker reminders, for which we observe a decrease of 8.9 percentage points (see Specification 4).[15] Taken together, these results suggest that once we stop enclosing reminders, the impact of both treatments decreases over time. This indicated decay is consistent with existing literature, showing that consumers are very slow in taking up new habits based on reminders (Kast et al., 2012; Sussman and Gifford, 2012; Calzolari and Nardotto, 2017; Allais et al., 2017).

4.4. The impact of the reminders' proximity to action on return behavior

In this section, we provide an in-depth analysis of whether a reminder's proximity to action has an effect on return behavior. In our setting, the sticker reminder worked as an action-close reminder for plastic bags with a reminder directly attached, catching customers' attention when they decide to discard or return the plastic bag. For unmarked bags, however, the flyer and sticker

[15] Table B.6 in Appendix B supports these results with separate estimates for each week of the post-intervention period. The flyer reminder effect seems to be slightly more persistent over the post-intervention period than the sticker reminder effect. However, except for the last week, we cannot reject the null hypothesis of identical effects at conventional significance levels.

Table 5
Random effects logit regression: Odds that a plastic bag is returned.

	Model (4a)			Model (4b)			Model (4c)		
	1	2	3	4	5	6	7	8	9
Action-close	14.670***	12.023***	19.381***	2.410**	2.240***	5.103**	3.191***	3.179***	4.966***
	(7.090)	(3.989)	(13.650)	(0.875)	(0.595)	(3.259)	(0.467)	(0.461)	(2.704)
Boxes returned		1.058	1.057		1.092*	1.092*		1.003	1.003
		(0.057)	(0.056)		(0.053)	(0.053)		(0.053)	(0.052)
Return rate pre-intervention		188.537***	173.836***		103.817***	101.155***		280.545***	253.220***
		(112.295)	(103.139)		(61.579)	(59.688)		(173.210)	(154.014)
Big box		1.120	1.122		1.802*	1.810*		1.095	1.088
		(0.663)	(0.655)		(0.607)	(0.608)		(0.573)	(0.561)
Meat box		1.901	1.841		2.144**	2.099**		2.916**	2.830**
		(0.856)	(0.817)		(0.800)	(0.779)		(1.271)	(1.207)
Veggie box		1.399	1.411		1.961*	1.975*		1.836	1.866
		(0.539)	(0.536)		(0.687)	(0.688)		(0.716)	(0.719)
Week			1.097			1.164**			1.087
			(0.080)			(0.077)			(0.066)
Action-close × Week			0.895			0.844			0.903
			(0.109)			(0.097)			(0.085)
Constant	0.027***	0.010***	0.009***	0.171***	0.021***	0.014***	0.092***	0.006***	0.007***
	(0.012)	(0.007)	(0.007)	(0.053)	(0.014)	(0.010)	(0.034)	(0.004)	(0.005)
FE Depot	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
FE Delivery week	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
N	2081	2076	2076	2108	2108	2108	1920	1892	1892
Customers	143	142	142	144	144	144	75	74	74
sd (customers)	2.396	1.339	1.316	1.901	1.150	1.144	2.200	1.031	1.011
Wald Chi^2	43.25	159.2	138.09	17.77	113.61	113.68	92.99	30124	29441
Rho	0.636	0.353	0.345	0.523	0.287	0.285	0.595	0.244	0.237

Notes: Specifications 1–9 present the results of a logistic regression with random effects for customers. Robust standard errors clustered on the individual level are in parentheses. Estimates are presented in odds ratios. The dependent variable is a dummy variable indicating whether the plastic bag was returned or not. The dummy variable *Action-close* is 1 if the plastic bag had a sticker reminder attached and 0 for unmarked bags in the control group (Specifications 1–3), the flyer treatment (Specifications 4–6), and the sticker treatment (Specifications 7–9). In Specifications 2, 5, and 8, the control variables include the number of boxes returned, the return rate in the pre-intervention period, and dummy variables for the box sizes (small boxes as a reference) and the box types (vegan boxes as a reference). We also use fixed effects (FE) for the depots and delivery weeks. Specifications 3, 6, and 9 include the week variable as a continuous measure for the weeks of the intervention period (ranging from 3–7). *, **, and *** document significance at the 10%, 5%, and 1% levels.

reminders constituted conventional, action-distant reminders. To investigate the question of whether a plastic bag with an action-close sticker reminder is more likely to be returned than an unmarked bag, we apply the following logistic regression models:

$$\ln\left(\frac{P(y_{b,i})}{1-P(y_{b,i})}\right) = \beta_0 + \beta_1 ActionCloseC_b + \delta_w + \nu_i + \epsilon_{b,i}, \tag{4a}$$

$$\ln\left(\frac{P(y_{b,i})}{1-P(y_{b,i})}\right) = \beta_0 + \beta_1 ActionCloseF_b + \delta_w + \nu_i + \epsilon_{b,i}, \tag{4b}$$

$$\ln\left(\frac{P(y_{b,i})}{1-P(y_{b,i})}\right) = \beta_0 + \beta_1 ActionCloseS_b + \delta_w + \nu_i + \epsilon_{b,i}, \tag{4c}$$

where $y_{b,i}$ is a dummy variable indicating whether plastic bag b delivered to customer i has been returned or not. Because we want to differentiate the direct effect of the action-close sticker reminder, we confine our analysis to those bags with a sticker attached in the sticker treatment and use the unmarked bags of the control group (Model (4a)), the flyer treatment (Model (4b)), and the sticker treatment (Model (4c)) as the comparison group. Accordingly, the indicators $ActionCloseC_b$, $ActionCloseF_b$, and $ActionCloseS_b$ are binary variables, taking the value 1 if plastic bag b had a sticker reminder attached (action-close reminder) and 0 for all unmarked bags from the control group, the flyer treatment, and the sticker treatment, respectively. In our analyses, we further include fixed effects for the delivery weeks (δ_w).[16] As before, the term ν_i indicates random effects at the customer level, and $\epsilon_{b,i}$ captures any other unmodeled effects.

Table 5 reports the estimated odds ratios of Models (4a), (4b), and (4c) for the intervention period. The dummy variable *Action-close* is 1 if the plastic bag had a sticker reminder attached and 0 for unmarked bags in the control group (Model (4a), Specifications 1–3), the flyer treatment (Model (4b), Specifications 4–6), and the sticker treatment (Model (4a), Specifications 7–9). The results show a strong positive and statistically significant effect of the action-close reminder on the probability that a plastic bag is returned.

[16] The outcomes are hardly affected if we do not control for the week of delivery. Results are available upon request.

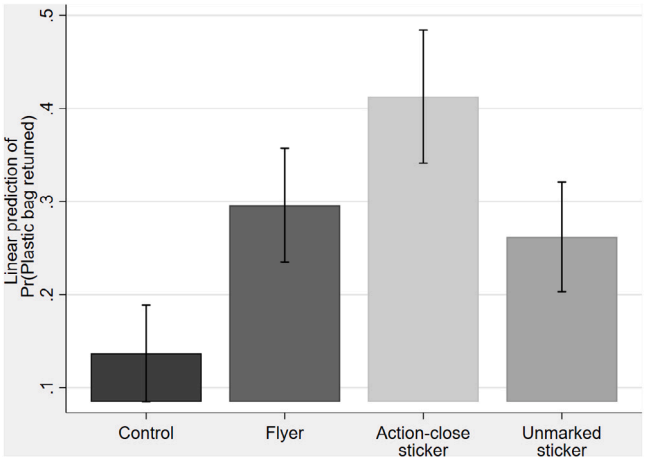

Fig. 8. Action-closeness effect. *Notes:* Predicted probabilities that a plastic bag is returned, based on the logistic regression models (4a), (4b), and (4c). The error bars report the 95% confidence intervals.

In Specification 1, the odds ratio of the action-close reminder indicates that the odds of returning are 14.7 times higher for bags with a sticker reminder attached than for bags in the control group. Specification 4 suggests that the odds of returning bags with an action-close reminder are 2.4 times higher than for bags in the flyer treatment. Adding the set of control variables in Specifications 2 and 5 further supports these findings. In Specifications 3 and 6, we additionally test the time effect by including the week variable as a continuous measure for the week of the intervention period (ranging from 3 to 7). The interactions of the week variable and the dummy indicators $ActionCloseC_b$ and $ActionCloseF_b$ are not statistically significant, confirming the stability of the action-closeness effect over time.[17] The action-closeness effect is also supported by the estimates of Model (4c), where we compare the return rates for plastic bags with and without sticker reminders within the sticker treatment. Specification 9, for example, shows that the odds for returning a bag with a sticker attached are almost 5 times higher than the odds for returning an unmarked bag in the sticker treatment.[18]

Fig. 8 illustrates the predicted probabilities for returning a plastic bag with and without a sticker reminder in Specifications 1, 4, and 7. Whereas the probability for returning a bag with a sticker reminder attached is about 41%, the probability for returning an unmarked bag is 14% in the control group, 29% in the flyer treatment, and 26% in the sticker treatment. Using an action-close instead of a conventional reminder, therefore, increases the probability that a plastic bag is returned for reuse by 12 percentage points (compared to a flyer reminder) or 15 percentage points (compared to an action-distant sticker reminder on another plastic bag). This equals a relative increase of 41% (compared to a flyer reminder) or 58% (compared to a distant sticker reminder).[19] We also find a strong effect of action-closeness in comparison to the control group, where the difference in probability is approximately 27 percentage points or 190%.[20] These results are in line with the theoretical framework of inattention and suggest that a higher degree of salience at the time of action enhances the effectiveness of a reminder.

Thus far, we focused on the effect of an action-close sticker reminder on return behavior. Now, we investigate the effect of action-distant reminders on unmarked plastic bags. Therefore, we compare the probabilities for returning plastic bags without a sticker attached across the experimental treatments and omit plastic bags with stickers attached from the following analyses. Table 6 presents the estimates of the following logistic regression model:

$$\ln\left(\frac{P(y_{ns,i})}{1-P(y_{ns,i})}\right) = \beta_0 + \beta_1 Flyer_i + \beta_2 Sticker_i + \nu_i + \epsilon_{ns,i}. \tag{5}$$

The dummy variable $y_{ns,i}$ indicates whether the unmarked plastic bag ns delivered to customer i has been returned or not. The indicators $Flyer_i$ and $Sticker_i$ are binary variables indicating the assignment of customer i to the flyer or sticker treatment, respectively. The term ν_i represents customer-specific random effects, and $\epsilon_{ns,i}$ is the random error term. We additionally use fixed effects to control for the delivery weeks. Table 6 displays the estimated odds ratios of Model (5). Both reminder treatments have a

[17] Step-by-step inclusion of control variables shows that these results are robust. Regressions available upon request.

[18] We find similar and slightly stronger results when we add random effects for the delivery weeks in a mixed-effects regression model (see Table B.7 in Appendix B).

[19] The effects were calculated using the predicted marginal means of Specification 4 in Model (4b) and Specification 7 in Model (4c).

[20] The effect was calculated using the predicted marginal means of Model (4a), Specification 1.

Table 6
Random effects logit regression: Odds that an unmarked bag is returned.

	1	2	3
Flyer	5.634***	4.692***	3.388**
	(2.582)	(1.394)	(1.899)
Sticker	3.661***	2.953***	3.063**
	(1.702)	(0.852)	(1.693)
Boxes returned		1.104**	1.103**
		(0.051)	(0.051)
Baseline return rate		342.328***	325.474***
		(158.825)	(150.076)
Big box		2.078**	2.084**
		(0.747)	(0.742)
Meat box		2.117**	2.049**
		(0.699)	(0.672)
Veggie box		1.892**	1.911**
		(0.577)	(0.579)
Week			1.099
			(0.081)
Flyer × Week			1.063
			(0.106)
Sticker × Week			0.993
			(0.095)
Constant	0.025***	0.003***	0.003***
	(0.010)	(0.002)	(0.002)
FE Depot	No	Yes	Yes
FE Delivery week	Yes	Yes	No
N	4984	4923	4923
Customers	212	209	209
sd (customers)	2.417	1.312	1.302
Wald Chi^2	52.5	234.20	215.41
Rho	0.640	0.344	0.340

Notes: Specifications 1–3 present the results of a logistic regression with random effects for customers. Robust standard errors clustered on the individual level are in parentheses. Estimates are presented in odds ratios. The dependent variable is a dummy variable indicating whether a plastic bag without a sticker attached was returned or not. The dummy variables $Flyer$ and $Sticker$ indicate the assignment of a customer to the flyer or sticker treatment, respectively. In Specifications 2 and 3, the control variables include the return rate in the pre-intervention period, the number of boxes returned, and dummy variables for box sizes (small boxes used as a reference) and box types (vegan boxes used as a reference). We also include fixed effects (FE) for depots. In Specifications 1 and 2, we consider fixed effects for the delivery weeks, whereas Specification 3 includes the week variable as a continuous measure for the weeks of the intervention period (ranging from 3–7). *, **, and *** document significance at the 10%, 5%, and 1% levels.

positive and statistically significant effect on the return probability of unmarked plastic bags compared to the control group. A Wald test suggests that there is no statistically significant difference between the sticker treatment and the flyer treatment with respect to unmarked bags ($p = 0.293$).

In sum, although plastic bags marked with a sticker reminder are more likely to be returned for reuse than unmarked bags in either of the treatment groups, the overall return rates of the two reminder treatments do not systematically differ. A possible explanation for this finding could be a combined effect of attentional decline and the treatment difference in the timing of receiving the reminder messages.[21] Our theoretical framework suggests that after receiving the last reminder message, the decay of attention has a similar effect on the return decision of unmarked bags. However, in the flyer treatment, customers receive the reminder message directly when they empty the food box, i.e, early on. In contrast, in the sticker treatment, customers may not see the reminder message before they empty the plastic bag with the sticker and the sticker reminder may fail to affect the return decisions of unmarked bags before customers emptied the plastic bag with the sticker. In consequence, the overall return rates do not systematically differ between treatments although the sticker reminder is highly salient and effective for marked bags.

5. Discussion and conclusion

In this paper, we investigate the effect of reminders on pro-environmental behavior as measured by food box customers' propensity to return plastic bags for reuse. Our results show that weekly flyer and sticker reminders increase the return rates for

[21] We thank an anonymous referee for this suggestion.

plastic bags by 83% relative to a control in which no reminders were present. In line with our theoretical framework, we explain the positive treatment effects by the ability of reminders to increase the salience of the return option, thus drawing customers' attention to it and inducing the desired behavior (Borgstede and Andersson, 2010; Karlan et al., 2016; Calzolari and Nardotto, 2017). The present results further show that reminders provoke the strongest reactions for customers who have already returned plastic bags before the intervention, although both types of reminders also positively affect customers who did not return plastic bags in the past. Interestingly, the reminder effects unfold from the beginning of the intervention and persist over the entire intervention period. However, the effects of both reminder treatments decrease during the post-intervention period when reminders were no longer handed out. These dynamics suggest that, in the long run, the reminder effects will vanish, and the return rates will revert to baseline levels. Although there is much evidence documenting the difficulty of changing human behavior in the long term (e.g., Kast et al., 2012; Sussman and Gifford, 2012; Calzolari and Nardotto, 2017), our results show that this is also the case for people such as subscribers for ecological food boxes, who are motivated to behave environmentally friendly and who, thus, are already sensitized to the desired behavior. By contrasting the return rate for plastic bags that were marked with an action-close sticker reminder and unmarked plastic bags, we find that the increase in salience through action-closeness has a strong effect on the return rates for marked plastic bags. The probability of returning a bag with a sticker reminder is about 41%, while for unmarked bags it is, on average, about 29% in the flyer treatment, 26% in the sticker treatment, and 14% in the control group. The overall treatment effects for the flyer and sticker treatments are similar in size. Taken together, our results support limited attention as an explanation for reminder effects and suggest that especially action-closeness may help to overcome the attentional hurdle for considering the reuse option and translate pro-environmental intentions into action.

The results are in line with existing reminder interventions in other studies on pro-environmental behavior (Austin et al., 1993; Houghton, 1993; Sussman and Gifford, 2012; Sussman et al., 2013; Shearer et al., 2017). In a similar experiment, the findings of Austin et al. (1993) indicate that recycling behavior can be effectively encouraged if visual prompts and recycling containers are in close proximity to a recycling decision. Our study adds to this literature by using individual-level data and a design in which only the reminder's proximity to action is manipulated. The reminder effects detected in our study are also notable from a practical perspective. In our setting, a weekly flyer reminder leads to approximately 300 additional plastic bags returned per week. Such a behavioral change would imply that around 16,000 additional plastic bags are returned by the customers of the food box provider over the course of a year. With respect to the sticker intervention, marking every plastic bag with a sticker reminder would result in a significant reduction in plastic waste with approximately 25,000 additional plastic bags being reused instead of discarded per year. This, of course, assumes that reminders are used regularly, and the magnitude of the effect persists over time.

Some limitations inherent to our setting raise open questions and provide opportunities for future research. First, there are alternative explanations why reminders effectively increased the return rates. For example, rather than forgetting about the option to return plastic bags, customers may have focused on the immediate costs of returning plastic bags for reuse (i.e., time-consuming cleaning and the effort to return the plastic bags). However, this contrasts the results of the post-experimental survey data showing that customers do not associate high costs with returning plastic bags. As another explanation participants could have perceived plastic bags with a sticker reminder attached as different, perhaps more valuable or important than unmarked bags. However, the sticker and flyer reminders were identical with respect to size and layout and neither reminder extended the usage or purpose of the plastic bags or was inherently valuable for the customers. The post-experimental survey further indicates that the message on the plastic bag was not associated with a higher perceived value of the plastic bag. Second, as several studies call for research on the long-term effects of behavioral interventions (e.g., Steg and Vlek, 2009; Croson and Treich, 2014; Damgaard and Gravert, 2018), we may also question whether the effect of repeated reminders lasts longer than the five-week intervention period. It could be argued that the treatment effect would gradually decline as reminders that are received repeatedly may receive less attention. Otherwise, one could also conceive that receiving repeated reminders over a longer period of time would be better suited to create a habit effect. To address this issue, it would be interesting to conduct a similar experiment over a longer period of time. Third, another important question is to what extent similarly large reminder effects could be expected in alternative settings and with different samples. The particular subject pool of this study possibly limits the potential to generalize the findings. Customers of regionally produced, organic food boxes are expected to have an above-average awareness of environmental issues, which possibly reinforced the reminder effects in our analyses.[22] Fourth, it might be worth to investigate whether improved pro-environmental behavior in one area (e.g., reusing plastic bags) has the power to spill over into other environmental decisions (Daneshvary et al., 2016; Dolan and Galizzi, 2015). Finally, it would be interesting to understand the potential interaction effects of reminders with other motivational factors, such as commitment contracts (e.g., Can et al., 2003), financial incentives (e.g., Volpp et al., 2009; Charness and Gneezy, 2009), or information (e.g., Apesteguia et al., 2013; Altmann and Traxler, 2014; Raifman et al., 2014) on behavioral change. Such interactions may exploit the benefits of reminders in addressing consumers' limited attention and possibly support pro-environmental behavior in the long term.

Appendix A. Additional figures

See Figs. A.1–A.3.

[22] Schultz (2014) shows that recycling prompts work most effectively for individuals with favorable attitudes toward recycling.

"Please return the plastic bags. They can be reused."

Fig. A.1. Reminder message. "Please return the plastic bags. They can be reused".

Fig. A.2. Plastic bag labeling. *Notes:* The labeling procedure worked as follows. We affixed a tag with multiple transparent ID labels to each of the boxes, before they were filled. From this tag, the ID labels could be peeled and quickly attached to the plastic bags of the corresponding customer when the vegetables were put inside.

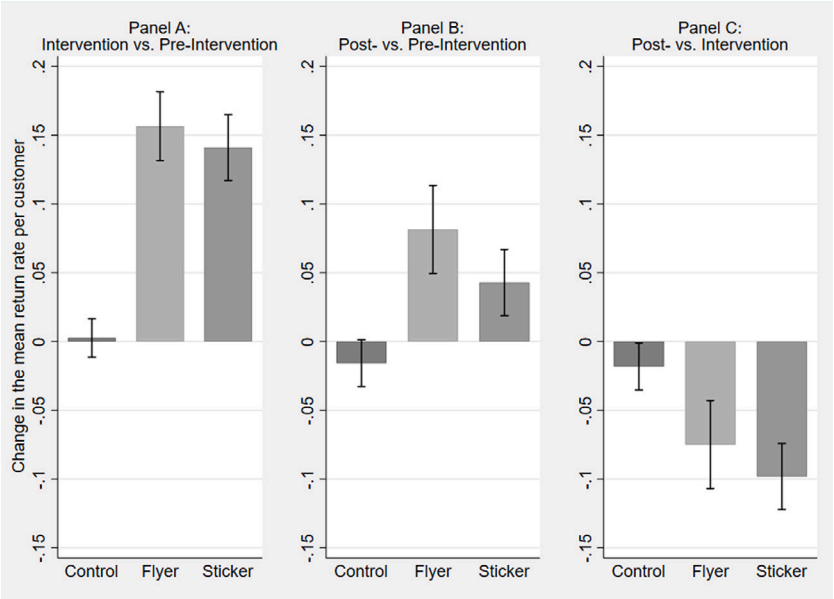

Fig. A.3. Mean differences in return rates in the post-intervention period. *Notes:* Each bar indicates the change in mean return rates. The error bars represent the mean ± the standard error of the mean.

Appendix B. Additional regression analyses

See Tables B.1–B.6.

Table B.1
Difference-in-difference random effects regression: Return rate per week.

	1	2
Flyer	0.033	0.035
	(0.033)	(0.034)
Sticker	0.043	0.046
	(0.035)	(0.035)
Intervention	0.010	0.011
	(0.014)	(0.014)
Flyer × Intervention	0.150***	0.149***
	(0.027)	(0.027)
Sticker × Intervention	0.135***	0.137***
	(0.025)	(0.025)
Boxes returned		0.039**
		(0.017)
Constant	0.100***	0.133***
	(0.029)	(0.024)
N	1949	1949
Customers	287	287
sd (customers)	0.233	0.230
R^2 overall	0.072	0.080
Wald Chi^2	103.4	118.33
Rho	0.559	0.553

Notes: The table displays the results of a difference-in-difference regression with random effects for customers. Robust standard errors clustered on the individual level are in parentheses. The dependent variable is the plastic bag return rate per customer per delivery week. $Flyer$ ($Sticker$) is a dummy variable equal to 1 for customers in the flyer (sticker) treatment and 0 otherwise. The dummy variable $Intervention$ is 1 for the intervention period and 0 for the pre-intervention period. Specification 2 further includes the number of returned food boxes. *, **, and *** document significance at the 10%, 5%, and 1% levels.

Table B.2
Poisson regression: Plastic bags returned during the intervention.

	1	2
Flyer	0.832***	0.818***
	(0.182)	(0.179)
Sticker	0.788***	0.807***
	(0.185)	(0.182)
Plastic bags delivered	0.036**	0.054*
	(0.017)	(0.029)
Boxes returned		0.113***
		(0.042)
Big box		0.084
		(0.213)
Meat box		0.378
		(0.244)
Veggie box		0.383**
		(0.178)
Constant	−0.930	0.387
	(0.782)	(0.447)
FE Depot	No	Yes
N	287	287
Pseudo R^2	0.079	0.124

Notes: The table reports the results of a Poisson regression with robust standard in parentheses. The dependent variable is the number of plastic bags returned per customer during the intervention period. $Flyer$ ($Sticker$) is a dummy variable equal to 1 for customers in the flyer (sticker) treatment and 0 otherwise. $Plastic\ bags\ delivered$ indicates the number of plastic bags a customer received during the intervention period. Specification 2 further includes control variables for the number of boxes returned, dummy variables for the box sizes (small boxes as a reference) and the box types (vegan boxes as a reference), and fixed effects (FE) for depots. *, **, and *** document significance at the 10%, 5%, and 1% levels.

Table B.3
Difference-in-difference regression for subgroups: Return rate per customer.

	1	2
Flyer	−0.000	0.006
	(0.000)	(0.003)
Sticker	−0.000	0.004
	(0.000)	(0.003)
Intervention	0.026***	−0.018
	(0.008)	(0.020)
Flyer × Intervention	0.109***	0.119***
	(0.028)	(0.029)
Sticker × Intervention	0.119***	0.131***
	(0.029)	(0.030)
Engaged subgroup	0.442***	0.446***
	(0.043)	(0.043)
Flyer × Engaged subgroup	−0.102*	−0.113**
	(0.054)	(0.054)
Sticker × Engaged subgroup	−0.087	−0.092
	(0.057)	(0.057)
Intervention × Engaged subgroup	−0.081**	−0.079**
	(0.037)	(0.037)
Flyer × Intervention × Engaged subgroup	0.121**	0.108*
	(0.057)	(0.056)
Sticker × Intervention × Engaged subgroup	0.072	0.064
	(0.055)	(0.055)
Boxes returned		0.019**
		(0.008)
N	574	574
Customers	287	287
R^2	0.540	0.548

Notes: Specifications 1 and 2 present results of a difference-in-difference regression, including an interaction with subgroups. Robust standard errors clustered on the individual level are in parentheses. The dependent variable is the plastic bag return rate per customer. $Flyer$ and $Sticker$ are dummy variables equal to 1 for customers in the flyer or sticker treatment, respectively, and 0 otherwise. The dummy variable $Intervention$ is 1 for the intervention period and 0 for the pre-intervention period. The dummy variable $Engagedsubgroup$ is 1 for customers with a positive return rate in the pre-intervention period and 0 for customers with zero returns. Specification 2 further includes the number of returned food boxes. *, **, and *** document significance at the 10%, 5%, and 1% levels.

Table B.4
Random effects Poisson regression: Plastic bags returned over time.

	1	2
Flyer	0.864***	1.126***
	(0.314)	(0.287)
Sticker	0.809***	1.033***
	(0.313)	(0.288)
Delivery week	0.043	0.020
	(0.038)	(0.038)
Flyer × Delivery week	−0.002	−0.004
	(0.046)	(0.046)
Sticker × Delivery week	−0.001	−0.005
	(0.046)	(0.046)
Plastic bags delivered		0.234***
		(0.022)
Baseline returns		0.347***
		(0.031)
Boxes returned		0.164*
		(0.088)
Big box		0.317
		(0.242)
Meat box		0.556***
		(0.197)
Veggie box		0.626***
		(0.178)
Constant	−0.537**	−3.253***
	(0.244)	(0.352)
ln(α)	0.639***	−0.105
	(0.106)	(0.135)
FE Depot	No	Yes
N	1390	1390
Customers	287	287
Wald Chi^2	27.12	306.33

Notes: The table reports the results of a Poisson regression with random effects for customers. Robust standard errors clustered on the individual level are in parentheses. The dependent variable is the number of plastic bags returned per customer per delivery week. $Flyer$ ($Sticker$) is a dummy variable equal to 1 for customers in the flyer (sticker) treatment and 0 otherwise. $Plastic\ bags\ delivered$ indicates the number of plastic bags a customer received during the intervention period. Specification 2 includes control variables for the number of boxes returned, dummy variables for the box sizes (small boxes as a reference) and the box types (vegan boxes as a reference), and fixed effects (FE) for depots. *, **, and *** document significance at the 10%, 5%, and 1% levels.

Table B.5
Post-intervention difference-in-difference regression.

	Pre vs. Post		Intervention vs. Post	
	1	2	3	4
Flyer	0.035	0.037	0.189***	0.195***
	(0.035)	(0.035)	(0.038)	(0.037)
Sticker	0.041	0.044	0.179***	0.195***
	(0.037)	(0.037)	(0.038)	(0.038)
Post-intervention	−0.016	−0.047**	−0.018	0.015
	(0.016)	(0.021)	(0.013)	(0.016)
Flyer × Post-intervention	0.097***	0.096***	−0.057**	−0.063**
	(0.032)	(0.032)	(0.027)	(0.026)
Sticker × Post-intervention	0.059**	0.062**	−0.080***	−0.089***
	(0.024)	(0.025)	(0.020)	(0.020)
Boxes returned		0.026**		0.028***
		(0.010)		(0.008)
Constant	0.140***	0.100***	0.143***	0.031
	(0.025)	(0.029)	(0.023)	(0.039)
N	572	572	572	572
Customers	286	286	286	286
R^2	0.034	0.048	0.089	0.116

Notes: Specifications 1–4 present the results of a difference-in-difference regression with robust standard errors clustered on the individual level in parentheses. The dependent variable is the return rate per customer. The dummy variables *Flyer* and *Sticker* indicate the assignment of a customer to the flyer or sticker treatment, respectively. In Specifications 1 and 2, the dummy variable *Post-intervention* is 1 for the post-intervention period and 0 for the pre-intervention period. In Specifications 3 and 4, the dummy variable *Post-intervention* is 1 for the post-intervention period and 0 for the intervention period. Specifications 2 and 4 further include the number of returned food boxes. *, **, and *** document significance at the 10%, 5%, and 1% levels.

Table B.6
Regressions per post-intervention week: Return rate per customer.

	Week 8	Week 9	Week 10	Week 11
Flyer	0.158***	0.133***	0.095*	0.116***
	(0.045)	(0.040)	(0.051)	(0.043)
Sticker	0.140***	0.120***	0.077	0.035
	(0.041)	(0.038)	(0.051)	(0.039)
Customers	278	282	262	262
R^2	0.052	0.045	0.014	0.030

Notes: We have missing observations for some customers in the separated delivery weeks due to holidays. Robust standard errors in parentheses.* $p < 0.10$,** $p < 0.05$,*** $p < 0.01$

Table B.7
Multilevel logistic regression: Odds that a plastic bag is returned.

	1	2	3	4	5	6
Action-close	19.838***	39.797***	2.684**	6.992**	4.012***	8.194***
	(10.832)	(36.441)	(1.102)	(5.317)	(0.741)	(5.404)
Week		1.125		1.187**		1.105
		(0.100)		(0.080)		(0.093)
Action-close × Week		0.871		0.826		0.868
		(0.126)		(0.105)		(0.109)
Constant	0.025***	0.014***	0.200***	0.085***	0.106***	0.064***
	(0.011)	(0.009)	(0.058)	(0.038)	(0.036)	(0.35)
N	2081	2081	2108	2108	1920	1920
Customers	143	143	144	144	75	75
var (customers)	7.022	7.009	4.542	4.517	6.387	6.403
var (weeks)	1.254	1.220	1.144	1.060	1.892	1.890
Wald Chi^2	29.94	31.34	5.78	12.13	56.51	57.85

Notes: Specifications 1–6 present the results of a logistic regression with random effects for customers and for delivery weeks (three levels). Robust standard errors are clustered on the customer level and are reported in parentheses. Estimates are presented in odds ratios. The dependent variable is a dummy variable indicating whether the plastic bag was returned or not. The dummy variable *Action-close* is 1 if the plastic bag had a sticker reminder attached and 0 for unmarked bags in the control group (Specifications 1–2), the flyer treatment (Specifications 3–4), and the sticker treatment (Specifications 5–6). Specifications 2, 4, and 6, include the week variable as a continuous measure for the weeks of the intervention period (ranging from 3–7). *, **, and *** document significance at the 10%, 5%, and 1% levels.

Appendix C. Post-experimental survey

We conducted a short post-experimental survey to gather more information on the handling of the plastic bags and reasons why reminders have an effect. The survey was conducted in October 2020 via an online questionnaire. Food box subscribers were invited to participate in the survey through two different channels. For two weeks, an invitation and the link to the survey were included on the homepage of the food box provider. In addition, an invitation flyer with an QR code leading to the questionnaire was added to the food boxes in three depots. Out of about 330 food box subscribers, 48 individuals followed the invitation link, and 47 participants completed the survey. This led to a participation rate of about 14%. Note that the respondents did not necessarily participate in the experiment, as the invitation to the survey was addressed to all food box subscribers at the time of October 2020, i.e., also to those who newly subscribed in the period between the experiment and the survey. Further note that the survey was conducted during the Covid-19 pandemic, and respondents were asked to relate their answers regarding the handling of plastic bags to the time before the Covid-19 pandemic. The food box provider also specified that the survey should not take longer than three minutes. This information and a statement informing respondents that participation was voluntary and that we ensured their confidentiality and anonymity were provided to the respondents on the first page.

First, participants were presented statements about plausible alternative behaviors for handling the plastic bags. These behaviors represent alternatives to the desired behavior of returning the bags for reuse. Respondents could indicate on a five-point Likert scales (1 = "does not apply at all", 5 = "completely applies") how strongly the following statements applied to them: (a) I throw most of the plastic bags in the trash out of habit, (b) I reuse most of the plastic bags myself (e.g., at home), (c) I throw most of the plastic bags away for hygienic reasons, and (d) I throw most of the plastic bags away, because cleaning them is too time-consuming. Table C.1 shows the corresponding mean scores and standard deviations. Second, the survey included a question about whether plastic bags are treated at more or less the same instance in time. We asked subscribers whether they unpack all items from the plastic bags when they receive the food box or whether they store items in the plastic bags (i.e., they may receive the treatment at a later point in time). We find that only 31% of the respondents (N = 47) unpack the vegetables when they receive the food box (i.e., they receive the treatment at the same instance of time as in the flyer treatment). Finally, the survey had a question that presented respondents two pictures, one showing a plastic bag with a sticker (plastic bag A) and one showing an unmarked plastic bag (plastic bag B). Respondents were asked which plastic bag they would return with the option to choose one out of seven options that partially included a rationale for the respective choice. Table C.2 shows the corresponding frequencies.

Table C.1
Practicalities in the handling of plastic bags.

Statement	Mean	Standard deviation
I throw most of the plastic bags in the trash out of habit	2.00	1.37
I reuse most of the plastic bags myself (e.g., at home)	2.62	1.39
I throw most of the plastic bags away for hygienic reasons	1.70	1.25
I throw most of the plastic bags away, because the cleaning is too time-consuming for me	2.09	1.27

Notes: Respondents were asked to assess plausible alternative behaviors rather than returning the bags to the depots on a five-point Likert scale (1 = "does not apply at all", 5 = "completely applies").

Table C.2
Reasons for returning the plastic bags.

Statement	Absolute frequencies	Percentage frequencies
Plastic bag A, because it reminds me to return it	15	31.91
Plastic bag A, because I think this bag is more valuable	2	4.26
Plastic bag A, because I do not want to use a bag with the message "Please return the plastic bag" for other purposes	2	4.26
Plastic bags A and B	26	55.31
Plastic bag B	1	2.12
Plastic bags A and/or B, for other reasons	1	2.12
Total	47	100

Notes: Respondents were asked which plastic bag they would return: a plastic bag with a sticker reminder attached (plastic bag A) or an unmarked plastic bag (plastic bag B).

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