Working title: Nudging to reduce littering in waste disposal areas – A field experiment in Austria's community houses

Trial Information

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Location:	Field experiment in Vienna/Austria
Status:	Before data collection
Trial start:	2020-06-30
Trial end:	2020-09-30
Intervention:	July to September 2020
Keywords:	littering, nudging, field experiment, watching eyes, nature effect, injunctive norm

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Abstract

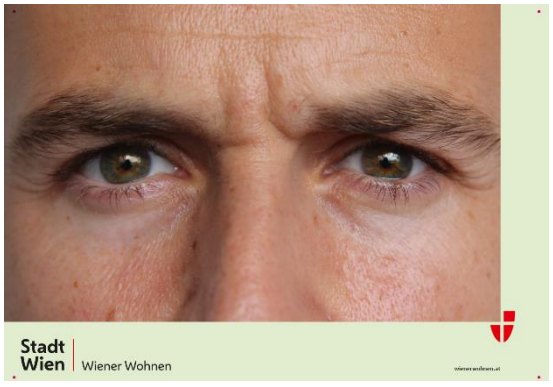
This field experiment tests an intervention to reduce littering in waste disposal areas in community houses in Vienna/Austria. Community houses differ in size from about 20 apartments in some houses to over 2000 apartments in other houses. The inhabitants take away their garbage bags in shared waste disposal areas. Waste disposal areas in community houses are often littered. This problem causes monetary costs for cleaning personnel as well as psychological costs for residents who feel disturbed by litter in this area. In this study, we test instruments to reduce littering in these waste disposal areas in a cost-effective way. We test four different nudges in this study. Currently, there is little evidence on how best to engage inhabitants of those community houses to preserve cleanliness in the shared waste disposal areas. In a randomized controlled trial, we test four interventions in around 560 waste disposal areas in over 90 different community houses. In a control group, there will be no poster and everything as is. The interventions are posters that will be placed above the garbage containers. Besides two classical nudges that work with pictures of landscapes or watching eyes and on a more subconscious level (system 1), there will be two posters focusing on raising awareness for the injunctive norm and the negative monetary consequences of littering (system 2). Our outcome variable is the tidiness/messiness of the waste disposal areas. We shoot pictures three times; before, shortly after hanging up the posters and after a couple of weeks. This way, we have a proxy on messiness at the baseline level, short-term effects, and long-time effects of the different interventions. The four treatments allow as to compare not only the intervention group to the control group but also make comparisons concerning effectiveness across different interventions.

Background

Waste disposal areas in community houses are often littered. This problem causes monetary costs for cleaning personnel as well as psychological costs for residents who feel disturbed by litter in this area. A cost-effective way to reduce littering may be to use nudging instruments. We test four different interventions in this study.

The waste disposal areas differ in their location. Some are located indoors and some are located outdoors. Furthermore, there are (fake) cameras installed in some but not all waste disposal areas. The community differ in size, i.e., they vary in the number of apartments, residents, waste disposal areas, and sizes of waste containers.

Interventions



1. Watching Eyes: Literature has shown the positive effect of a pair of watching eyes on prosocial behavior in various contexts. Inappropriate handling of personal waste (e.g., littering) in the field can be reduced by installing posters of human watching eyes. Especially where few natural observers pass by, the watching eyes induce a strong corrective effect on antisocial behavior. The mechanism works independently of an accompanying text which is why we use only a

visual prompt in our intervention. The dark eyes employ an authoritarian, strict, and observative look as laid out by previous research.

2. Nature poster: Exposure to beautiful nature can lead to prosocial and environmentally sustainable behavior. Literature defines beautiful nature as depicting water, the sky, natural bright colors, and a landscape without any trace of human involvement. Our intervention consists of a photograph of a nature reserve meeting these criteria.

3. Piktogramm/Infographics: Prompts might remind people of what is the desired behavior at the point of action. Non-verbal prompts that only employ visual communication are not very common in anti-littering research but often used in practice. The intervention consists of two illustrations that showcase desirable behavior as performed by two characters (left) and the consequences of undesirable behavior (right). The order was chosen according to perceptual attention, the displayed people serve as role models. In other contexts (Handwashing), bright and colorful infographics have been proven successful to facilitate behavioral intentions which is why our intervention employs colorful illustrations. The design is in line with the corporate identity of the social housing company. As the improper disposal of cardboard boxes is an issue in Viennese social housing, a second panel illustrates the consequences of proper (separating packaging, folding) and improper cardboard box disposal.

4. Slogan: According to previous research, monetary motives can play a role in littering behavior. Gaining money by behaving properly might incentivize people to dispose of their trash well. A positive frame ("do xyz") should work better than a negative one ("don't do xyz") according to literature. This intervention specifies the number of utility costs that can be saved as an average household by keeping the waste disposal areas clean. It features a landscape-orientation A1 poster with the line "A clean waste disposal area brings you up to 170€ a year.". As the social housing company uses the honorific approach in their communications, we

also employ the polite form. The amount was computed based on an average flat size of 60 m^2 and using the largest difference in utility costs between two social housing areas. It serves as an approximation.

5. Control group: In the control group the waste disposal area is left as is.

All interventions employ the corporate design of the social housing company with regards to the colors used and layout. All posters are in landscape orientation and are installed visible above the waste containers and paper bank respectively in the waste disposal areas.

Research Questions

1. Can our interventions increase people's compliance to keep waste disposal areas clean?
2. Which intervention is most effective?

Experimental Design

Recruitment and Randomization Method

The service agent for the community homes provided us with a list of 98 community houses. We randomize the treatments within community houses. We assign a unique number to each waste disposal area that identifies the community house and the specific waste disposal area. In the list, we sort the waste disposal areas by community houses and assign the treatment randomly. For this, we use a random number generator by the software excel between 1 and 5 whereas each number identifies one of the four treatment groups or the control group. We stratify by outdoor or indoor waste disposal area since we suspect that the effectiveness of the interventions may be heterogeneous across the two conditions. To ensure a balanced sample concerning treatment allocation, we kept updating the randomization until a distribution test (chi2) signaled that treatment conditions are assigned randomly across indoor and outdoor waste disposal areas.

Research Strategy

Sampling

Sampling Frame

What is the eligible population for the study?

We collect data on the level of cleanliness in waste disposal rooms. Therefore, we do not know the participants and do not get in touch with them personally. We only observe the result of their behavior in the waste disposal areas in the community houses. The participants are all residents in the sampled community houses who use the waste disposal areas.

What is the expected sample for the study?

The expected sample size are around 450 waste disposal rooms in about 95 different community houses. We assign 5 treatments (including the control group) randomly to the rooms within houses. This way, we have 90 observations per treatment group.

Fieldwork

Time schedule

1. Baseline Measure: Beginning of July 2020
2. Installing intervention: Middle of July 2020
3. Measure short-term: Middle of July 2020 (about 1 day after installation)
4. Measure long-term: Beginning of September 2020 (about 6 weeks after installation)

Data Collection and processing

Data will be collected during July and September 2020. In each community house, we make pictures from the waste disposal areas on two consecutive days. The first data collection serves as a baseline measurement for cleanliness in each waste disposal room. Afterward, the interventions will be installed. The second measurement will be shortly after the installation. The last measurement will take place after eight weeks.

The research assistants take pictures from the same angle each time and send them with a timestamp to the service center of the community houses. The pictures of the waste disposal rooms do not contain any personal information but only capture the ground of the room. The pictures will be stored on a cloud. The researchers have access to the pictures. Assistants will rate the pictures for their cleanliness on a scale from 1 to 7.

Empirical Analysis

Balancing Checks

How will you check balance between treatment and control groups?

Balancing checks may include the following variables. We expect that the variance is equal in the treatment groups and the control group. We run regressions on the following variables with the treatment groups as an independent variable to check if treatments are balanced for the following variables:

- Baseline floor_rating (cleanliness level)
- Outdoor vs. indoor waste disposal area

How will you check balance between attritors and non-attritors?

The data collection focuses on pictures of the waste disposal areas. Hence, we are independent of residents' cooperation and there should not be any attrition.

However, there may be vandalism and posters may get stolen. When research assistants notice a missing poster in the first measurement period, we will replace the poster as soon as possible. The poster will not be replaced at a later point of time of the intervention period. The research assistants will take note of missing posters at the second measurement. This allows us to take the effect of vandalism into account (see heterogeneous treatment effects).

Treatment Effects

Main Effects

How will you estimate the (causal) effect of the offer of the treatment?

To answer the main research questions, i.e., if the intervention increases cleanliness, we use the following outcome variable:

Outcome variable: floor_rating

Description of the outcome variable: Independent research assistants rate the floor pictures of the waste disposal areas (the treatment is not visible on the picture); the rating is based on perception from 1 to 7 whereas 1 indicates a sparkling clean floor and 7 a complete mess. With the numbers in between the research assistants can grade based on a pre-defined categorization. We employ two independent research assistants and take the average of the two floor ratings for the analysis.

Baseline cleanliness (variable floor_rating):

- We rate the cleanliness M_t of each waste disposal area i on two consecutive days before installing the interventions (t0, t1) and take the average: $M_{B,i} = \frac{\sum_{t=0}^{1} M_{t,i}}{2}$
- $M_{B,i}$ is the average baseline messiness level in waste disposal area i

Short term effects:

- We rate the cleanliness M_t of each waste disposal area i on two consecutive days after about a day (t2, t3) and take the average: $M_{s,i} = \frac{\sum_{t=2}^{3} M_{t,i}}{2}$
- $M_{s,i}$ is the average short-term messiness level in waste disposal area i

Long term effects:

- We rate the cleanliness of each waste disposal area M_t on two consecutive days after six weeks (t4, t5) and take the average: $M_{l,i} = \frac{\sum_{t=4}^{5} M_{t,i}}{2}$
- $M_{l,i}$ is the average long-term messiness level in waste disposal area i

Treatment effect short-term:

$$M_{s,i} = \beta_0 + \beta_T T_i + \beta_Z Z_i + \beta_B M_{B,i} + \varepsilon_i$$

Treatment effect long-term:

$$M_{l,i} = \beta_0 + \beta_T T_i + \beta_Z Z_i + \beta_B M_{B,i} + \varepsilon_i$$

Standard errors are clustered by community houses.

Missing values

When a research assistant misses to take a picture or the picture does not have an ID or a proper time stamp, we take the rating of the other picture for the main analysis.

What controls will you include in your specification?

Covariates Zi:

Level of waste disposal area

- Camera installed (yes/no, indicator variable)
- Bulky waste (yes/no, indicator variable)
- Full waste container (yes/no, indicator variable)
- Trash in front of the waste disposal area (yes/no, indicator variable)

Level of community houses

- Container volume per resident
- Number of garbage collections per week
- Cleaning service (indicator variables for different service providers)
- Waste collection at the same time as data collection (yes/no, indicator variable)*

How will you estimate the (causal) effect of the receipt of the treatment?

Nudging works subconsciously. The interventions in the waste disposal areas are rather large and hard to overlook. We assume that the majority of residents receive the treatment in a waste disposal area.

Potential pooling of data

We will check if our more traditional nudging treatments (landscape and watching eyes) and the injunctive norm treatments (slogan and pictogram), respectively, are significantly different concerning the effect on floor-rating. If those are not significantly different, we may pool these treatments for the analysis.

Adaption of econometric analysis depending on the data structure

Depending on the distribution of the floor_rating, we may have to adapt our econometric strategy. For example, if the floor_rating contains a lot of ones (“sparkling clean”) in the baseline measure, we may exclude these waste disposal areas for the analysis and focus on the waste disposal areas in which we have the necessary prerequisite of dirty waste disposal areas to observe an improvement over time.

Mechanisms

We conducted a pre-test to find out more about the potential effectiveness of the interventions as well as the mechanisms.

We test for the following motives via an online-survey with 360 people:

1. Feeling of being controlled
2. Money saving motive
3. Awareness of injunctive norm
4. Preserving nature / environment
5. Perception of being individually addressed
6. Joy by the intervention
7. Preference for cleanliness

Heterogeneous Effects

We check for heterogeneous effects for the following variables X_i:

- Indoor vs. outdoor waste disposal areas
- Waste collection at the same time as data collection (yes/no, indicator variable)*

Only for long-term effects:

- Poster had been taken down at one point of time (vandalism), 1=vandalism, 0=no vandalism

*explanation: The time schedule for the data collection is optimized based on the waste collection in the community houses. Although the waste collection is scheduled in a regular rhythm across the week, waste collection days and frequency differs across community houses. We cannot exclude that data and waste collection fall on the same week day. However, this will be an exception. Since that may slightly bias results, we will check for heterogeneous effects and control for this variable.

How will you estimate the heterogeneous effects of the offer of the treatment?

$$Y_i = \beta_0 + \beta_T T_i + \beta_X X_i + \beta_{XT} X_i T_i + \beta_Z Z_i + \varepsilon_i$$

What controls will you include in your specification?

Same as before, see above Zi.

How will you account for clustering in your data?

Use of standard errors clustered by community house.