Making Sense of Sorting

How normative feedback and information-based instruments can be used to make citizens sort waste

By Anders Adser Sørensen and Simon Birk Nielsen in collaboration with Impactually

Summary

Can the municipality of Copenhagen apply learnings from behavioral science to increase households' degree of waste recycling in order to become a CO_2-neutral city by 2025?

Since 2012, the municipality of Copenhagen has invested heavily in making it possible for its citizens to sort their waste into the most common fractions such as bio, plastic, paper, metal etc. The result has been that around 45% of household waste is sorted which roughly means that less than half of all households actively participate in waste sorting even though doing so has been made as easy as ever. As a result, the municipality has realized that for the degree of waste sorting to increase, citizens need to be further motivated to engage in waste sorting and hereby better utilize the provided infrastructure. Since monetary incentives appealing to extrinsic motivation might be troublesome to introduce in a setting where each households' waste production is not directly visible (as many people live in apartment buildings and dump their waste at certain stations), it is necessary to appeal to other motivators. We therefore chose to conduct an experiment where we exposed two yards of apartment buildings to a set of interventions meant to make individuals aware of a social norm to sort waste while seeking to invoke warm glow and promote other-regarding preferences. This was done by handing out postcards to all households with information regarding the societal benefits associated with waste sorting while attaching normative feedback stickers to all waste containers in the yards comparing the households' waste sorting effort to that of the city district.

Following 11 weeks of measurements we could conclude that our intervention had significant treatment effects leading to an increase in the level of bio waste in the treated yards in three to four weeks out of six, depending on the applied econometric model. Thus, the treated households appeared to have been positively affected by the normative feedback and the provided information.

These insights not only showcase that behavioral science can have a significant impact on individuals' sorting behavior, they can also inform the municipality's strategy on how to reach a high degree of waste sorting and achieve CO_2-neutrality.

Defining and Diagnosing the Challenge

Reaching a higher waste sorting degree among households holds great economic potential if considered in the context of a circular economy and the reuse of valuable resources. However, doing so is not necessarily an easy task. The municipality of Copenhagen has since the launch of the Resource and Waste Plan 2018 (RAP18) in 2012 sought to take on this task. RAP18 was a policy seeking to increase the waste sorting degree across the municipality from 27% in 2010 to 45% by 2018. It succeeded and did so by focusing on improving the waste management infrastructure, making it easier for citizens to engage in waste sorting. The Resource and Waste Plan 2024 (RAP24) was introduced in late 2018 to replace and improve upon RAP18. RAP24 is just as ambitious as RAP18 since its goal is for the municipality to achieve a waste sorting degree of 70% by 2024, contributing to making Copenhagen CO2-neutral by 2025. Where RAP18 focused on providing citizens with the necessary means to sort waste, RAP24 focuses on how to make citizens actually utilize these. Thus, the theme with the most funds allocated in RAP24 is labeled "Copenhageners Sort More" which covers initiatives aimed at influencing the sorting behavior of citizens. Two of these initiatives are of special interest as they directly motivated the design of our intervention and experiment. The first initiative seeks to use data as a motivator for citizens' waste sorting engagement. RAP24 reports that many citizens see the waste management system as a "black box" and have little or no knowledge about how the sorted waste is actually recycled. The second initiative seeks to ensure that knowledge regarding why one should sort waste and how to do so is anchored among citizens and actively applied on a daily basis.

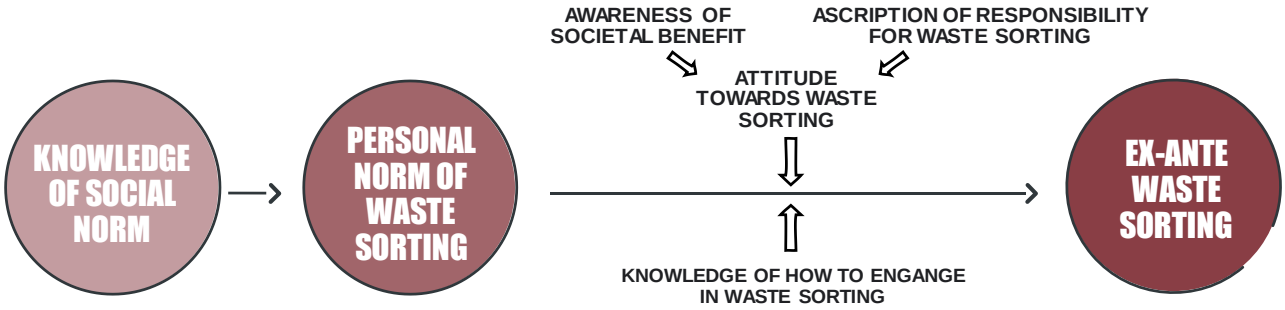
Before an intervention inspired by these two initiatives could be successfully designed and tested, we thought it useful to further study which behavioral factors could drive participation in waste sorting and which might possibly hinder it.

In and of itself, waste is the leftover material from the production of goods or the residual of households' consumption. Optimally, this material or residual has been completely exhausted of its economic value and should therefore be of little interest to economists. Efficient waste management is therefore in alignment with the overarching goal of economics as a science, i.e. the optimal allocation of scarce resources with alternative means. From a classical economic viewpoint, for a given utility-maximizing agent, the time spent on activities such as waste sorting is valued as opportunity cost of lost leisure and as an effort where the payoff is either in the distant future or entirely missing. As such, the personal marginal benefit is perceived as being significantly lower than the incurred marginal costs, alas participation in waste sorting might not take place. Following this line of thought,

introducing a monetary incentive, e.g. in the form of a tax on the amount of unsorted waste, could potentially make it rational for citizens to participate in waste sorting. However, introducing a monetary incentive could easily also have other, less desirable consequences as it might crowd out motivation or invoke unwanted behavior such as free rider problems.

Thus, we consulted behavioral economics and environmental psychology to obtain insights into non-pecuniary extrinsic and intrinsic factors which might influence an individual's decision to sort their waste. Ajzen's theory of planned behavior and Schwartz's norm activation model provided us with a framework within which to integrate these insights into one whole as depicted in the figure below.

Figure 1. The applied behavioral model



This framework allowed us to identify how social norms, warm glow, other-regarding preferences and limited attention might either promote or prevent the desired behavior. This approach led to the identification of the following three behavioral barriers which currently might prevent waste sorting among households residing in apartment buildings:

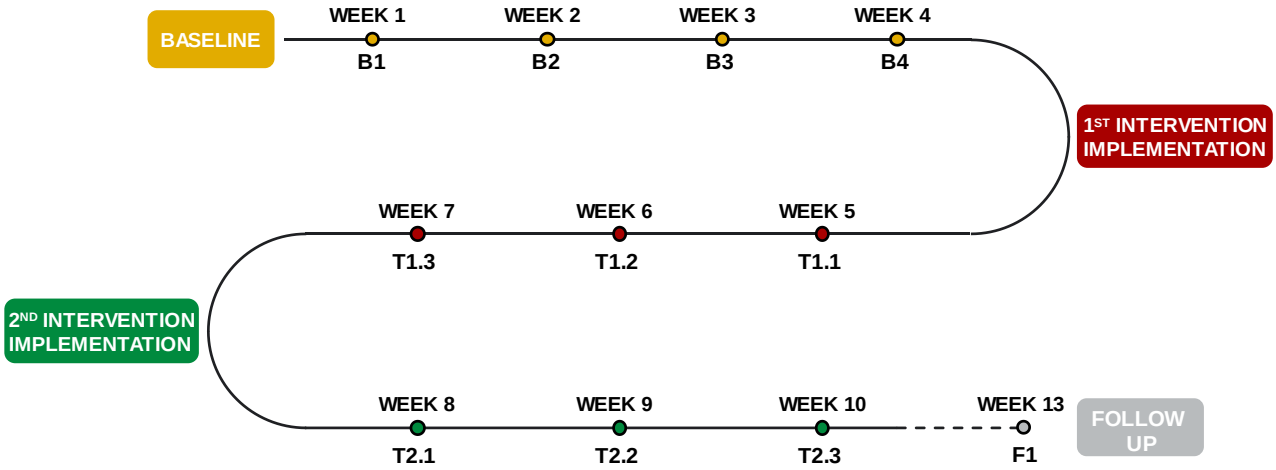
- Individuals are not aware of the prevailing social norm to sort waste and therefore might not feel any need for adherence
- Individuals are not aware of the societal benefits of waste sorting (their attitude does not reflect an awareness of consequences or an ascription of responsibility) and will therefore not obtain utility through intrinsic channels such as warm glow and other-regarding preferences when sorting waste
- Individuals do not have the necessary knowledge about how to engage in waste sorting and therefore do not believe they have the behavioral control needed to engage in waste sorting

We believe that these three barriers exist due to missing information which in turn is most likely due to the human brain's limited cognitive capacity and attention as suggested by the likes of Kahneman and Stanovich. Thus, we thought it necessary to target the barriers by providing the individuals with the right amount of information as salient as possible at the right time at the right place.

The Experimental Design and Setup

Our experiment took place over an 11-week period in five apartment building yards randomized into a treatment and control group, with two yards receiving the treatment and three serving as control. During this period of time, more than 2,000 measurements of bio and general waste were conducted. This means that more than 2,000 times, we opened a waste container, levelled out the waste to obtain a plain top layer, and measured the distance in centimeters from the top layer to the lid of the of the container using a measuring tape. The experiment had three different phases which can be seen in the timeline below.

Figure 2. The timeline of the experiment



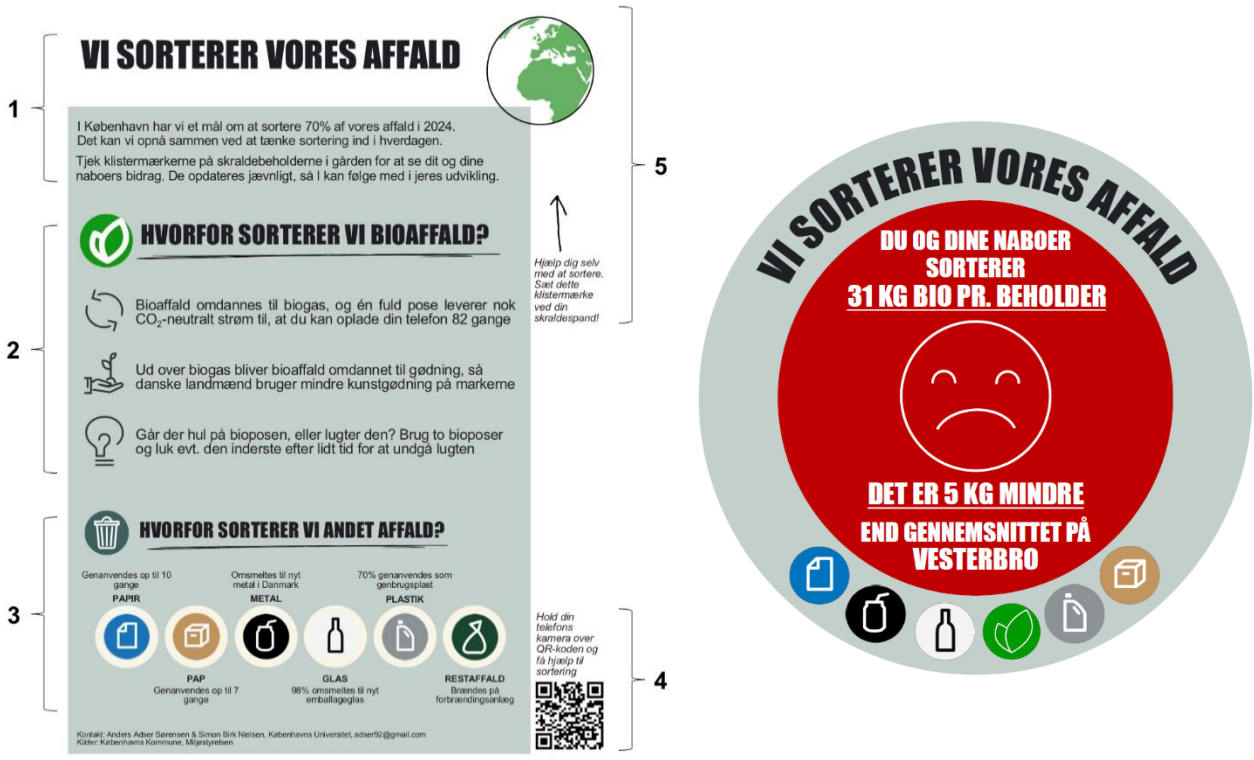
The first phase of the experiment was four weeks of baseline measurements to help us establish how invested the citizens of the different yards already were in the effort to sort waste.

The first intervention implementation took place after these four weeks and introduced the three different elements of our intervention. The first element was an information card delivered directly to all households in the treatment group through their mail slot, detailing the societal advantages of waste recycling and providing the households with a sticker they were encouraged to put up in their kitchen to remind themselves to sort waste. The second element was a poster version of the information card which was placed at visible spots at all waste sorting stations in the treatment yards. These two elements were meant to articulate the existence of a social norm to sort waste by using wording such as "we", "together", and "our". Furthermore, they provided the reader with details on

exactly how different waste fractions are being recycled and reused. They were meant to be salient in the two must critical environments where waste sorting takes place, i.e. the kitchen and the sorting stations where waste is deposited in the yards.

The third and final element was a feedback sticker attached to all waste bins in the yards providing direct normative feedback to the households on how their bio waste sorting efforts compared to the average of the city district. This element was meant to further underline the social norm to sort waste. It did so by making use of a descriptive message comparing the treatment group's sorting efforts with the local city district's efforts. It furthermore made use of an injunctive message by having a smiley and the sticker's color vary depending on this comparison. Since the sticker was placed on all waste containers in the treatment yards, they were salient every time an individual was to deposit his or her waste. The descriptive message was designed to be as simple as possible to ensure that the individual would register the message during the short amount of time it takes to deposit waste.

Figure 3. The different elements of the intervention



The third phase was an update to the feedback stickers providing households with new descriptive and injunctive messages. Where the treatment group was below the city district average during the baseline measurements, their efforts following the first intervention implementation had improved sufficiently enough to put them above the average at the time of the update.

Following three further weeks of measurements, all the intervention elements were removed from the yards. Three weeks after this, a follow-up measurement was conducted to see whether any treatment effects persisted after the removal of the intervention.

Findings and Their Applicability

Analyzing the measured levels of bio waste and general waste as well as the ratio between the two using a difference-in-difference approach, several significant treatment effects were identified. Depending on the applied econometric model, three to four of the six treatment weeks show significant treatment effects on the level of bio waste. Upon implementation of the intervention, the treatment group significantly increased their bio waste sorting degree compared to the control group. After a few weeks with no significant results, a significant increase in the bio waste sorting degree is once again observed in the last week of the experiment. This effect coincides with an update to the intervention's normative feedback component. In these two weeks, the estimated treatment effect is a respectively 15% and 29% increase compared to the baseline level of bio waste. Further robustness checks of these results indicate that the intervention specifically caused the sorting degree of bio waste to increase and that the treatment effects were not caused by a general increase in the quantity of waste.

We believe that our results can provide the municipality of Copenhagen with valuable insights into how to engage citizens in waste sorting using simple tools from behavioral economics. With the introduction of a new municipality-wide measuring system in 2020 where each waste container's weight is automatically registered when emptied, it would be possible for the municipality to implement an intervention similar to ours by using information-based instruments and normative feedback. Such feedback could compare residents' waste sorting effort in one ward to the neighboring yard, the district, or the city as a whole. There is reason to believe that doing so would be a cost-effective approach to reaching the goal of a waste sorting degree of 70% in 2024, contributing to making Copenhagen CO2-neutral by 2025.