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The warm glow of recycling can make us more wasteful

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ABSTRACT

Laudable initiatives designed to limit the environmental damage associated with consumption, such as the recycling of plastic packaging into clothing or unused bread into beer, have become increasingly popular. In three experiments, we show how such initiatives can potentially *increase* waste rather than preventing it. Specifically, we show that when presented with such options people may come to psychologically frame their waste creation as a contribution to the collective good that makes them feel good about themselves (i.e. eliciting a warm-glow effect). We argue that such potential 'wasteful contribution' effects need to be considered in assessing the true sustainability benefits of certain recycling initiatives.

1. Introduction

Given the difficulty of convincing people to make more environmentally sustainable decisions, such as avoiding food waste or single-use plastic, environmental initiatives often instead focus on limiting the environmental damage caused by wasteful and resource-intensive practices. One prominent example is the recycling of plastic (Geiger et al., 2019; United Nations Environment Programme, 2018). Recently, many recycling schemes have highlighted the recycling of waste into products for the market, such as the recycling of plastic packaging into clothing, or of food waste into biofuel or beer (Lankston, 2018; Mann, 2018). Companies and authorities often go to great lengths to make people aware of these initiatives, with taglines such as "This ... bus is powered by your waste for a more sustainable future" (BBC, 2015) or "... outerwear made entirely from discarded plastic bottles" (Lankston, 2018).

However, critics have suggested that recycling schemes may in some cases actually change matters for the worse. For example, Germany introduced a deposit-return scheme in January 2003 for recycling non-reusable plastic beverage containers. To stimulate the use of *reusable*, predominantly glass, bottles (as distinct from *recyclable* ones), the deposit is higher for single-use recyclable bottles (around 25 cents) than for reusable bottles (between 8 and 15 cents) (Oltermann, 2018). However, contrary to what was intended, Germany has witnessed strong market share gains of single use recyclable plastic bottles at the expense of reusable glass bottles. The market share of reusable bottles dropped

from around 70% in the 1990s to 56% in 2005 and 42% in 2011 (Groth, 2015). One explanation put forward is that the suggestion that the single-use plastic bottles are recycled – even if only around a quarter are actually recycled into another bottle – makes many people believe that they are doing something good for the environment by opting for single-use plastic options (Öchsner, 2010). Therefore, they may feel less obliged to avoid single-use beverage containers in the first place, making the decreased use of reusable bottles an unintended negative side effect of the bottle and can return scheme that was initially developed to benefit the environment (Groth, 2015; Oltermann, 2018).

The knowledge of laudable initiatives designed to limit the environmental damage associated with consumption thus risks making people behave in less environmentally sustainable ways than they otherwise would have. We posit that recycling aimed at turning waste into something useful may transform an act otherwise seen as wasteful into one seen as a contribution to the collective good. This leaves people feeling better about themselves than if they had simply prevented the waste in the first place, with the latter generally seen as environmentally preferable according to The Waste Hierarchy (e.g., Papargyropoulou et al., 2014).

Previous literature has shown that interventions designed to reduce environmental consequences may indeed backfire. For example, the improvement of technical efficiency, such as LED lighting, can lead to a relaxing of curtailment behaviours that offsets the energy savings that otherwise might have been achieved, the so-called rebound effect (Hertwich, 2005; Sorrell & Dimitropoulos, 2008). It has also been shown

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that the efficacy of attempts to reduce food waste in a cafeteria via an information campaign can be undermined when diners are told that their wasted food is composted to reduce methane emissions (Qi & Roe, 2017). Furthermore, consumption of products that are free of charge (such as office paper or restroom paper towels) have been shown to increase when a recycling option is provided (Catlin & Wang, 2013).

Initial empirical support for explanatory psychological mechanisms for such findings can be found in experimental behavioural studies by Sun and Trudel (2017), which show that people use more of a resource (e.g., plastic cups or gift-wrapping paper) when a recycling option is provided for their waste than when it is not. In separate, scenario-based, studies these same authors show that people imagine they would feel fewer negative emotions and more positive emotions about consuming an unnecessary amount of resources when the opportunity was provided to recycle. As such, Sun and Trudel's (2017) findings hint at psychological measures of emotional states mediating the effect of the waste option available on behavioural choices, but fall short of directly empirically testing this.

We suggest that the psychological mechanisms involved in the provision of recycling options for one's wasteful consumption can go beyond recycling merely allowing people to avoid a guilty 'cold prickle' or eliciting generic positive emotion when they throw things in the bin. Going beyond Sun and Trudel (2017), we posit that recycling schemes emphasizing that waste is turned into something useful, such as a new piece of clothing, can make people feel an actively good 'warm glow' that results from such schemes psychologically reframing the act as a positive contribution to the collective good. This is supported by recent work showing that recycling motivation can increase as a result of the positive emotions caused by consumers' knowing about the products that recycling will transform their waste into (Winterich et al., 2019). Indeed, anticipated warm glow has been shown to drive various sustainable behaviours, such as signing up for green electricity (Van der Linden, 2018; Hartmann et al., 2017; Taufik et al., 2015). However, we raise here the novel question of whether (anticipated) warm glow potentially afforded by state-of-the-art recycling schemes emphasizing the transformation of waste into something useful might also lead people to behave in an ultimately *less* sustainable way.

Importantly, while previous studies have focused on *how much* people consume of a recyclable product (Catlin & Wang, 2013; Sun & Trudel, 2017), we show that communicating such initiatives can also affect *what* product and disposal options people choose. We demonstrate that this can ultimately result in people preferring a single use product over a re-useable one (as happened when Germany introduced the recycling scheme for non-reusable beverage containers) or preferring to throw away surplus food rather than 'socially recycling' it (Donnelly et al., 2017) by preserving it for others to eat.

Our theoretical focus here is also distinct from that of the moral licensing literature (Merritt et al., 2010), which concerns how past responsible behaviours may make us feel entitled to relax our future efforts. For example, Ma et al. (2019) suggest that higher levels of (self-reported) recycling are associated with higher levels of pride in one's efforts and also higher levels of consumption. Our interest here, however, is not in how past recycling might make us feel good about ourselves in ways that compromise our future environmental actions. Rather, it is in the potential for the present act of discarding waste to be psychologically transformed by the presence of certain recycling options into an act that contributes positively to the collective good. Thereby, people convince themselves that discarding waste represents a more moral act than avoiding the generation of the waste in the first place. We tested this proposition in the context of two recycling domains: food waste (studies 1 and 2) and single-use plastics (study 3).

2. Study 1: The effect of recycling provisions on discarding food

Study 1 (approved by the ethics Institutional Review Board of the University of Groningen) examined whether people are more likely to

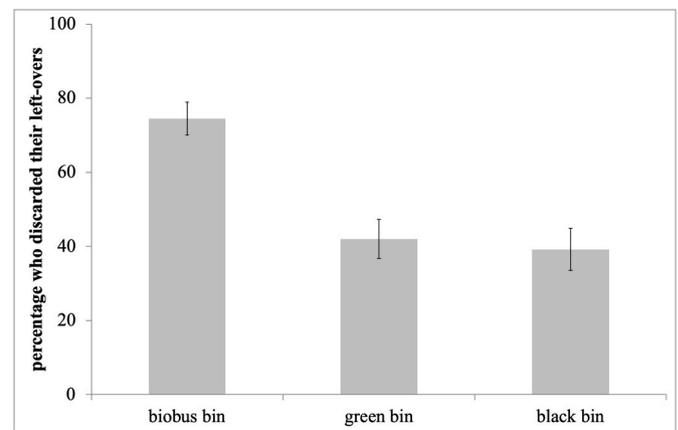


Fig. 1. Percentage of participants who discarded their leftovers when presented with the different bins.

behave in a wasteful way when convinced that the environmental damage is reduced by virtue of a recycling initiative that puts that waste to a good use. We recruited 302 participants for a 'taste test experiment' at the University of Groningen. Power analysis (G*power) suggested that to detect a small to medium effect size of 0.25 would require 248 participants, yet we slightly over-recruited in anticipation that not all participants would have waste. Participants were randomly assigned to one of the three waste disposal conditions (general waste vs. organic waste vs. bio-bus bin) and could taste as much as they wanted from a box containing 75g small biscuits (weighing 1–2g each) while watching a short movie. They were instructed that, when finished eating, they could either dispose of uneaten biscuits in a bin provided or put them in a bag and take them to a basket located on the 9th floor in a communal area where they could be consumed by others. The latter option was effortful because the elevator only went to the 8th floor. Note that this study was conducted before the COVID-19 pandemic, and thus there were no potential concerns around 'contamination' of the food.

In one condition, the bin provided was described as "the black bin that contains general waste". In the second condition it was "the green bin that contains biodegradable waste", and in the third "the green bin that contains biodegradable waste [that] will be turned into biofuel to power the local buses in a new waste recycling project". The conditions were alternated from one day to the next across the period of data collection. The leftovers (either in the bin or in the plastic bag) were weighed out of sight of participants. Five participants who left the food on the workstation were removed from the data set.

Across the three conditions, there was no significant difference in the amount of food left over to dispose of ($M_{biofuel} = 37.67$ ($SD = 23.21$; 95% CI: 33.30; 42.03; $N = 111$), $M_{blackbin} = 35.64$ ($SD = 21.53$; 95% CI: 31.14; 40.15; $N = 90$), $M_{greenbin} = 41.75$ ($SD = 20.69$; 95% CI: 37.56; 45.94; $N = 96$); $F(2, 294) = 1.90$, $p = .15$). As depicted in Fig. 1, a Chi-square test revealed that participants who had edible food left over ($N = 256$) were more likely to discard that edible food when they were told that their biodegradable waste would be turned into biofuel (74.5%) than when presented with either the green bin (42.0%) or the black bin (39.2%), $\chi^2 = 27.30$, $p < .001$, Cramer's $V = 0.327$ (pairwise comparisons: biobus vs. black bin: $\chi^2 = 21.29$, $p < .001$, Cramer's $V = 0.356$; biobus vs. green bin: $\chi^2 = 19.72$, $p < .001$, Cramer's $V = 0.329$; green vs. black bin: $\chi^2 = 0.14$, $p = .42$, Cramer's $V = 0.029$).

Study 1 showed that participants become less willing to exert effort to avoid creating unnecessary food waste when they think that waste is being transformed into a useful product. In study 2 we examined whether participants feel a warm glow by virtue of "contributing" their waste to such initiatives. We furthermore investigated whether our results may be due to people being convinced that wasting is the objectively more sustainable option when such recycling is provided.

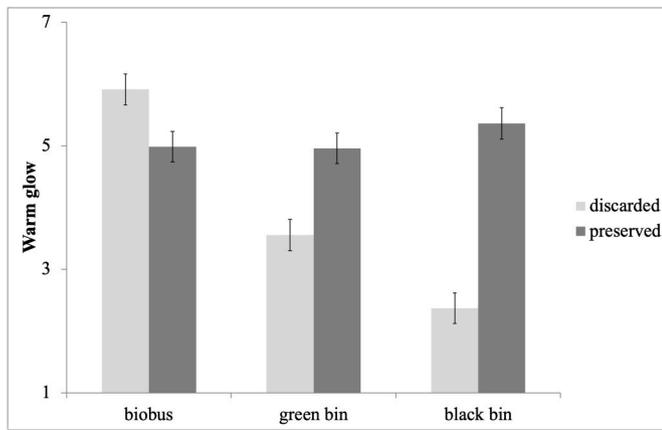


Fig. 2. The amount of imagined warm glow when choosing to discard vs. preserve the leftover food when presented with each of the three bins. Error bars denote standard errors.

3. Study 2: Recycling and warm glow

In study 2 (approved by the ethics Institutional Review Board of the University of Groningen and conducted before the COVID-19 pandemic), 209 undergraduate students ($M_{Age} = 22.09$ years, 113 women) participated in exchange for course credit or payment in a 3x2 between-subjects design with the same three waste options as in study 1 and two behaviors with respect to the food leftovers (discarding vs. preserving). Power analysis suggested that detecting a similar effect size as in study 1 (0.33) would require 188 participants, yet we slightly over-recruited in anticipation that some participants may not finalize the study.

Participants were randomly assigned to one of the six conditions and told to imagine that they participated in a study involving a taste test of small biscuits. They were told that they had not eaten all the biscuits and that there had been the option to either dispose of them in the [general waste/biodegradable waste/biobus] bin located in the cubicle or to take them up to the 9th floor in a plastic bag. They were told that they had chosen to [discard/preserve] the biscuits. We measured warm glow associated with their imagined chosen option ($\alpha = 0.93$, “How do you think you would feel about ...” 1 = negative to 7 = positive, “I would feel good about myself if I decided to ...”, “I would feel positive about my decision to ...”, 1 = strongly disagree to 7 = strongly agree; Västfjäll et al., 2015; Taufik et al., 2015; Van der Linden, 2018). We also asked to what extent participants thought that their decision to [discard/preserve] the leftovers would have been a responsible behavior

(“... seems very socially irresponsible to me (reversed)” “It was morally irresponsible of me to ... (reversed), 1 = strongly disagree to 7 = strongly agree).

An ANOVA on the measure of warm glow as a function of bin option and behavior revealed main effects of the bin option provided ($F(5, 203) = 21.84, p < .001; \eta^2 = 0.177$) and the depicted behavior ($F(5, 203) = 32.15; p < .001; \eta^2 = 0.137$), together with a significant waste option by behavior interaction ($F(5, 203) = 31.21; p < .001; \eta^2 = 0.235$). As depicted in Fig. 2, when presented with either the black general waste bin or the green organic waste bin, participants imagined lower warm glow after discarding the biscuits than preserving them (black bin: $M_{discarded} = 2.37$ ($SD_{discarded} = 1.12$; 95% CI: 1.87; 2.87; $N = 34$), $M_{preserved} = 5.36$ ($SD_{preserved} = 1.52$; 95% CI: 4.88; 5.85; $N = 36$); $F(1, 203) = 71.86; p < .001; \eta^2 = 0.261$; green bin: $M_{discarded} = 3.55$ ($SD_{discarded} = 1.84$; 95% CI: 3.06; 4.04; $N = 35$), $M_{preserved} = 4.96$ ($SD_{preserved} = 1.45$; 95% CI: 4.46; 5.46; $N = 34$); $F(1, 203) = 15.74; p < .001; \eta^2 = 0.072$). However, crucially, when participants were told that the discarded food leftovers would be turned into biofuel, the effect completely reverses. Here participants imagined higher warm glow after discarding the food than preserving it ($M_{discarded} = 5.91$ ($SD_{discarded} = 1.30$; 95% CI: 5.43; 6.40; $N = 36$), $M_{preserved} = 4.99$ ($SD_{preserved} = 1.51$; 95% CI: 4.49; 5.48; $N = 34$); $F(1, 203) = 6.91; p = .009; \eta^2 = 0.033$).

An ANOVA on the measure of responsibility as a function of bin option and behavior revealed main effects of the bin option provided ($F(5, 203) = 7.45, p = .001; \eta^2 = 0.068$) and the depicted behavior ($F(5, 203) = 51.17; p < .001; \eta^2 = 0.201$), together with a significant waste option by behavior interaction ($F(5, 203) = 5.81; p = .004; \eta^2 = 0.054$). Contrasts reveal that among participants who thought that their food leftovers would be turned into biofuel there was not a significant difference in perceived responsibility between the acts of discarding ($M = 5.03$; $SD = 1.55$; 95% CI: 4.51; 5.54) and preserving the food ($M = 5.62$; $SD = 1.27$; 95% CI: 5.09; 6.15; $F(1, 203) = 2.49; p = .117; \eta^2 = 0.012$). Whereas, participants presented with the black or the green bin viewed discarding as a less responsible behavior (black bin: $M = 3.40$; $SD = 1.42$; 95% CI: 2.89; 3.93; green bin: $M = 3.50$; $SD = 1.77$; 95% CI: 2.98; 4.02) compared to preserving (black bin: $M = 5.78$; $SD = 1.68$; 95% CI: 5.26; 6.29; $F(1, 203) = 40.48; p < .001; \eta^2 = 0.166$; green bin: $M = 5.18$; $SD = 1.63$; 95% CI: 4.65; 5.71; $F(1, 203) = 19.80; p < .001; \eta^2 = 0.089$).

The results of study 2 suggest that the warm glow induced by a recycling option may indeed lead participants to exert less effort to avoid creating waste in the first place, although they are well aware that this would be the most responsible thing to do in its absence. Extending study 2, study 3 aimed to replicate our effects with a different recycling domain and show that perceptions of warm glow mediate decisions to generate or prevent waste.

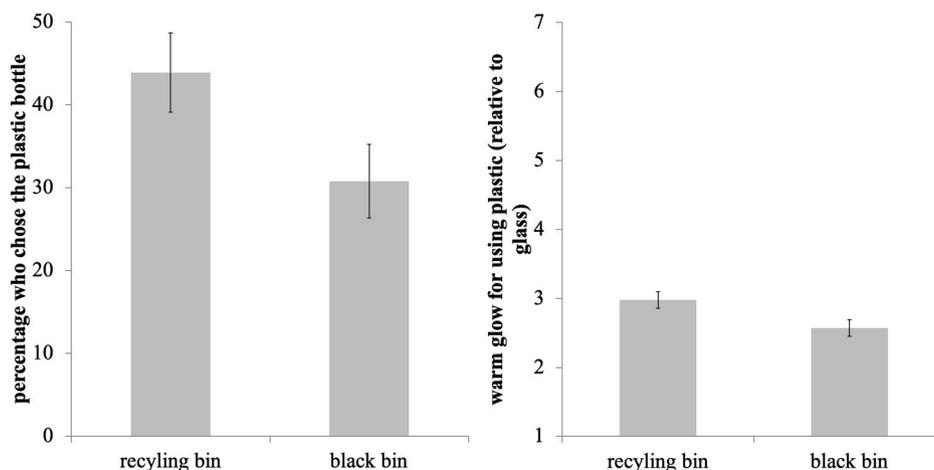


Fig. 3. Choice of plastic vs. glass vessel and warm glow for plastic (vs. glass) in each bin condition. Error bars represent standard errors.

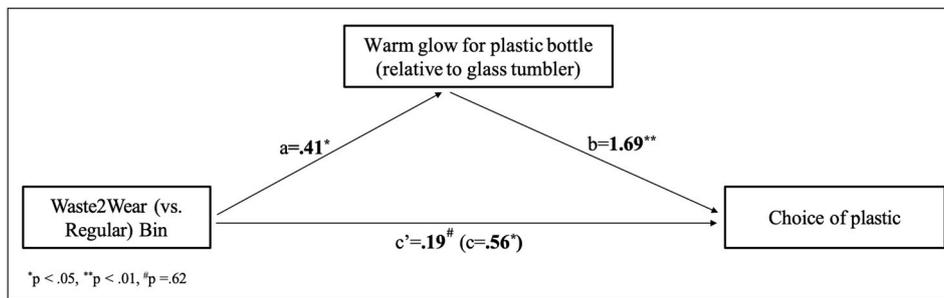


Fig. 4. The mediation model tested in study 3 (direct effect of bin type on vessel choice depicted in brackets underneath bottom path).

4. Study 3: Impact of recycling and warm glow on behavioural choices

Undergraduate students at the University of Groningen ($N = 214$, $M_{\text{Age}} = 22.46$ years, 135 women) who participated in exchange for course credit or financial compensation were told that they would have the opportunity to taste a new type of non-alcoholic beverage. A power analysis indicated 210 participants were required to detect an effect size of 0.25. Participants were informed that previous tasters reported variation in the taste of the beverage depending on whether a plastic bottle or a glass tumbler was used. They were therefore informed they could decide themselves whether to taste it from a plastic bottle or from a glass tumbler, both of which were available in their cubicle. Note that this study was also approved by the Institutional Review Board of the university and conducted before the COVID-19 pandemic. Participants were instructed, in one condition, that if they chose the plastic bottle then they should dispose of it in the black bin located in their cubicle. In a second condition they were told to use a provided recycling bin, with the plastic bottles being recycled into new pieces of clothing by the company Waste2Wear. The conditions were alternated from one day to the next. Respondents were then invited to make their choice between using a glass tumbler or a plastic bottle for the taste test, and to exit their cubicle to help themselves to a serving of the beverage from a dispenser located outside the cubicle.

After tasting the drink from the chosen drinking vessel while watching a short, unrelated movie and, if applicable, discarding the plastic bottle, participants answered questions assessing how much warm glow they imagined they would feel about the various vessel options on offer. Three items were used ($\alpha = .81$), namely: “How do you feel about the vessels you could use for the taste test?” (reversed) (1 = more positive for the plastic bottle, 4 = equally positive for both vessels to 7 = more positive for glass), “It would give me a positive feeling about myself if I would use this vessel for the taste test” (reversed) (1 = more positive for the plastic bottle, 4 = equally positive for both vessels to 7 = more positive for glass); “I would feel bad if I would use this vessel for the taste test” (1 = agree more for the plastic bottle, 4 = equal for both vessels to 7 = agree more for glass). Note that higher values denote higher warm glow for plastic relative to glass (Västfjäll et al., 2015; Taufik et al., 2015; Van der Linden, 2018).

As depicted in Fig. 3, of the participants who were presented with the option to subsequently discard the plastic bottle in the general waste ($N = 107$), 30.8% chose to taste the drink using a single-use plastic bottle (rather than a glass tumbler). When participants were told that the plastic bottles would be recycled into clothing ($N = 107$), this proportion significantly increased to 43.9% ($\chi^2 = 3.91$, $p = .048$, Cramer's $V = 0.135$). As Fig. 3 also depicts, participants (overall) felt less positively towards the plastic bottle than the glass tumbler, with both conditions being below the scale midpoint of 4. However, an ANOVA on the measure of warm glow as a function of waste option (black vs. recycling bin) revealed that participants reported feeling significantly higher glow for using the plastic bottle when they were provided with the recycling bin ($M = 2.98$, $SD = 1.24$; 95% CI: 2.74; 3.22) compared to when they

were provided with the black bin ($M = 2.57$ ($SD = 1.22$; 95% CI: 2.34; 2.81), $F(1, 213) = 5.77$; $p = .017$, Cohen's $d = 0.33$). A mediation analysis using PROCESS Model 4 (Hayes, 2017) revealed a significant indirect effect of which bin was available in the cubicle on participants' choice of the plastic bottle vs. the glass via perceptions of warm glow regarding choosing plastic (vs. glass) ($a \times b = 0.69$; 95% CI: 0.15; 1.39, see Fig. 4), supporting the notion that the higher likelihood of choosing the plastic bottle in the recycling condition was indeed driven by higher warm glow that it induced.

5. Discussion

Across three studies we show that the effect of making people aware of initiatives designed to limit the environmental damage of their consumption can go beyond hampering attempts to reduce waste (Qi & Roe, 2017) or increasing the quantity of recyclable products consumed (Catlin & Wang, 2013; Sun & Trudel, 2017). We show that communicating such initiatives can actually cause people to be more likely to unnecessarily discard products, or to choose a single use product over a re-useable one, because the presence of the initiative makes people feel actively better about creating waste compared to avoiding its creation. In study 1, participants were almost twice as likely to discard perfectly edible food instead of exerting effort to preserve it when they were provided with the option of putting leftover food in a bin that would see it being used to make biofuel to power the local bus – relative to when they were provided with either a regular ‘general waste’ bin or a bin simply labelled as ‘organic waste’. In study 3, participants were 50% more likely to choose a single-use plastic bottle for a drink instead of a glass tumbler when they were told that the plastic would be recycled to make clothes. Thus, we demonstrate that telling people about ostensibly positive environmental initiatives to limit the damage caused by their wasteful behaviour can make them more likely to engage in that behaviour.

Moreover, studies 2 and 3 provide a candidate psychological mechanism for this somewhat perverse effect. Namely, that people come to think of the wasteful behaviour as a relatively less bad thing to do and feel a greater sense of warm glow from making that choice than if they acted in an ultimately less-wasteful way. We also demonstrate that respondents are well aware that acting in a less-wasteful way is the more responsible thing to do, but that these perceptions become (erroneously) disrupted when the recycling option offered is advertised as leading to the creation of societally beneficial new products.

Previous literature has thus far seen warm glow as a way to stimulate sustainable behaviour (Van der Linden, 2018; Hartmann et al., 2017). We add to this literature by cautioning that the warm glow elicited by the prospect of contributing to a laudable environmental initiative, such as recycling of plastic bottles into a piece of clothing, can risk stimulating ultimately less sustainable behaviour such as generating more waste. We leave it for future research to examine whether this may extend to other contexts.

This suggestion has clear implications for (communication of) environmental policy. One should exclusively focus on encouraging people

to avoid generating waste in the first instance. This is not to say that governments and businesses should stop initiatives such as turning organic waste into biofuel or used plastic bottles into clothes. However, they may be well advised to avoid the current (admittedly intuitive) practice of making people aware of such “good outcomes” for their waste, or at least be aware that increases in wasteful behaviour could be a potential negative side effect.

Author statement

Jenny van Doorn: Conceptualization, Methodology, Investigation, Formal analysis, Writing
 Tim Kurz: Conceptualization, Methodology, Formal analysis, Writing.

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