

Trash or Recycle? How Product Distortion Leads to Categorization Error During Disposal

Environment and Behavior
1–20

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DOI: 10.1177/0013916515577635
eab.sagepub.com



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Abstract

Much of what ends up in our landfills is recyclable material, exposing the urgent need to understand the psychological processes behind recycling behavior. Results from four studies suggest that consumers often trash well-known recyclable products due to the product being erroneously categorized as trash after it has been distorted (e.g., paper after it has been cut, torn, or crumpled). However, this categorization error can be somewhat mitigated by the presence of signage depicting the different distorted forms the recyclable product can take. Through prompting, consumers are able to correctly categorize a recyclable product when disposing of it, regardless of the level of distortion. These results provide an explanation for, and potential solution to, the issue of recyclable materials making their way into our landfills every day.

Keywords

recycling, categorization, product distortion, sustainability, public policy

According to the U.S. Environmental Protection Agency (EPA; 2012), 251 million tons of municipal solid waste (MSW) was generated in 2012, of

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which approximately one third was recycled. The prevalence of recycling bins in most municipalities, our homes, and workplaces has made recycling more accessible and easier than ever; however, while recycling rates have steadily increased over the last 30 years, more still needs to be done to ensure that the 60% of recyclable material sent to landfills is appropriately diverted to recycling plants (EPA, 2013). Moreover, one particular material, paper, is not only the most recycled product but also the most trashed product (EPA, 2012). This raises the question of what makes paper more likely to be recycled in one instance and trashed in another?

While recent research has started to examine this question (Trudel & Argo, 2013), the academic literature has largely focused on individual-level factors (De Young, 1986; Laidley, 2013; Oskamp, Harrington, Sherwood, Okuda, & Swanson, 1991; Saphores, Nixon, Ogunseitán, & Shapiro, 2006; Schultz, Oskamp, & Mainieri, 1995; Sia, Hungerford, & Tomera, 1986) and attitudes (Biswas, Licata, McKee, Pullig, & Daughtridge, 2000; Ebreo & Vining, 2001; Ojala, 2008; Tonglet, Phillips, & Read, 2003) that influence recycling behavior. Other streams of research have demonstrated effects of knowledge (Andrews, Gregoire, Rasmussen, & Witowich, 2013; Hopper & Nielson, 1991; Nyamwange, 1996; Vining & Ebreo, 1990), effort (Brothers, Krantz, & McClannahan, 1994; Ludwig, Gray, & Rowell, 1998; Reid, Luyben, Rawers, & Bailey, 1976), incentives (Geller, Chaffee, & Ingram, 1975; Luyben & Bailey, 1979), and design (Duffy & Verges, 2009) on recycling behavior. Although focusing on these aspects can be costly and produce inconsistent effects (Austin, Hatfield, Grindle, & Bailey, 1993), and when positive reinforcements, such as raffles and contests, are removed, behavior can revert to baseline levels (Witmer & Geller, 1976).

The present research seeks to provide additional insight into the psychological processes behind consumers' disposal decisions. To keep the project manageable, we limit our investigation to one product category: paper. Given that paper makes up the largest component of solid waste in our landfills (EPA, 2012), we believe that it is the logical place to start an investigation of disposal decision making. We examine the potential importance of paper's form on its categorization as trash or recycling and how that influences disposal behavior. More specifically, we investigate conditions where the same piece of paper is perceived to be more or less like trash and demonstrate how this influences disposal behavior. Across four experiments, we consistently show that consumers' decision to recycle the same product depends on whether the product is intact (i.e., whole) or distorted (i.e., crumpled, cut).

The EPA (2009) lists recycling as an actionable means of combating climate change and protecting our environment. Thus, understanding the psychology of disposal behavior is an important endeavor. Only after

understanding the psychology of disposal behavior can policy makers and social marketers provide optimal prompts before and during recycling opportunities that increase recycling rates (de Kort, McCalley, & Midden, 2008; Jacobs & Bailey, 1982) in an economical manner (Dwyer, Leeming, Cobern, Porter, & Jackson, 1993; Geller, Witmer, & Tusso, 1977). Next, we review the relevant literature and then present the results of four experiments that provide support for our conceptualized process of disposal behavior.

Conceptual Development

Consumers use categories and categorical representations to classify, interpret, and understand the world around them (Barsalou, 1982, 1983, 1985; Loken & Ward, 1990; Noseworthy & Trudel, 2011). Central to categorization research is the notion that categories are assumed to have a graded structure (Barsalou, 1985), such that people categorize a product based on how representative or typical it is of a category. Conceptually, graded structure can be thought of as a continuum of category representativeness with the most typical category members at one end of the continuum and the least typical at the opposite end. When a product is encountered, it is evaluated in terms of how similar it is to the prototypical category members of the same category. The product is then eventually classified on this continuum of category representativeness. At a certain level of similarity, and thus inclusiveness, consumers naturally and spontaneously react to the categorization process, which then predictably influences decision making, as categories optimally function to provide maximum information with minimal cognitive effort. Unfortunately, as is the case with recyclables and trash, errors in categorization can occur when *versions* of the same product can fall at different ends of the graded structure continuum. As in the decision to purchase products (e.g., Loken & Ward, 1990), we believe that categorization forms the basis of the psychological process behind consumers' disposal decisions. An intact piece of paper is categorized as "recyclable" but the same distorted piece of paper is categorized as "trash" calling into question the notion of single category beliefs that has been so widely held in psychology (Barsalou, 1982, 1983, 1985; Loken & Ward, 1990).

Trudel and Argo (2013) found that consumers' decision to recycle or trash a product often depends on whether or not the product has been distorted. The degree of distortion "is a function of the amount of physical dissimilarity between the original product and the 'new' product" (Trudel & Argo, 2013, p. 633). Specifically, the authors found that when products are distorted and physically changed during the consumption process, they are more likely to be trashed. For instance, in one experiment, consumers were much more

likely to trash an $8\frac{1}{2}'' \times 11''$ sheet of paper that had been cut into smaller pieces than when the paper remained undistorted. It appears as though the same product (i.e., paper) may have different categorical representations in memory depending on the degree of distortion. In the design literature, prototypical distortion is said to occur when an existing design is altered to increase the perceived distance between the new product and a prototypical product (e.g., Hutchinson & Alba, 1991; Veryzer & Hutchinson, 1998). Our conceptual explanation is that a piece of paper that has been cut into smaller pieces is more prototypical of garbage or trash and is automatically categorized as trash because of the alterations to its size and form. Small pieces of paper fall on the trash end of the graded continuum of disposal category representativeness, while an undistorted $8\frac{1}{2}'' \times 11''$ sheet of paper is automatically categorized as recyclable because it is more prototypical to what recyclable paper should be.

Following the intuition that categories are constructed through experience, it is likely that consumers categorize smaller pieces of paper as trash because of the ease with which instances of throwing small pieces of paper in the trash can be brought to mind. Instances of throwing small, useless pieces of paper such as gum wrappers are easily retrieved from memory and form prototypical categorical representations of trash. Empirically, Trudel and Argo (2013) showed that size and form distortion also influence the perceived usefulness of a product and that usefulness is a category-defining attribute for recyclables and trash. Products that are perceived to be more useful are more typical of recyclables, whereas products that are perceived to be useless are more typical of trash. As a demonstration of the categorical representations of trash and recycling, Trudel and Argo (2013) found that participants only trashed the paper when it was sufficiently small enough in the end. Even after the paper had been distorted by cutting it into smaller pieces, if the end product was large enough and still perceived to be useful, it continued to be classified as recyclable and disposed of accordingly.

Overview of Studies

The current research presents four empirical studies investigating disposal behavior that replicate and extend Trudel and Argo's (2013) study. In all four studies, we employ clean paper, a material that consumers are practiced at recycling, and show conditions where the same product or material is treated differently during disposal. The impact of product distortion on disposal behavior when product quantity and integrity is maintained is not intuitively apparent. On one hand, it is possible that different representations of the same-sized recyclable product could yield similar behaviors. That is, the

decision to recycle could be independent of distortion as long as the quantity (e.g., total area, volume, weight, and amount) of the product is held constant. The paper is still paper! Therefore, it would seem reasonable to expect that consumers would recycle a piece of paper independent of whether it is a whole sheet (e.g., $8\frac{1}{2}'' \times 11''$) or whether it is a whole sheet that has been cut into smaller pieces or crumpled into a ball. As the total mass of the paper is the same, the impact on the environment is also the same in both cases, and only the distortion of the paper's form is affected, consumers may be equally likely to recycle different representations of the same product. However, because usefulness is a category-defining attribute for the disposal category, cutting a full sheet of paper into smaller pieces or crumpling it into a ball may have a significant effect on the paper's perceived usefulness and likely lead it to be recycled less often than a full sheet of paper that has not been distorted (Trudel & Argo, 2013). We extend the findings of Trudel and Argo by showing that the impact of product distortion on recycling is due most likely to the categorization of a recyclable product as "trash."

In Study 1, we show that product distortion and size influences categorization and intentions to recycle. In Study 2, we show that cutting a piece of paper into smaller pieces makes the same product less likely to be recycled. In Study 3, we show that product distortion, crumpling an $8\frac{1}{2}'' \times 11''$ sheet of paper into a ball, also makes the same product less likely to be recycled. In Study 4, we provided a simple visual prompt, whereby a recycling sign that depicts the different forms of paper (e.g., crumpled, torn) drastically increases the recycling rate of distorted paper.

Study 1—Inconsistent Categorization of Paper

Participants

Upon entering the lab, 150 undergraduate participants were randomly assigned to one of three between-subjects conditions: full sheet ($8\frac{1}{2}'' \times 11''$ sheet of paper), crumpled sheet ($8\frac{1}{2}'' \times 11''$ sheet of paper crumpled into a ball), and a small sheet ($2'' \times 4''$ small sheet of paper).

Procedure

Participants entered the lab and seated themselves at a computer terminal. On their desk next to their keyboard was either a full sheet of paper, a crumpled sheet of paper, or a small sheet of paper according to their randomly assigned conditions. Dividers separated participants, so that they could not see one another. Participants were then given a short questionnaire that asked five

Table 1. Likelihood of Behaviors and Opinions Across Paper Forms.

Measures	Full sheet		Crumpled sheet		Small sheet	
	M	SD	M	SD	M	SD
Likely to trash	3.32	1.39	4.10***	1.07	4.02**	1.00
Likely to recycle	3.46	1.18	2.84**	1.22	2.52***	1.18
Intentions to recycle	3.07	1.11	2.37***	1.06	2.25***	0.95
Categorize like trash	1.80	1.13	3.80***	1.25	3.30***	1.07
Effort to recycle	2.52	1.18	2.54	1.16	2.24	0.98
Impact on landfill	3.18	1.21	3.14	1.07	2.78	1.23

Note. Scores range from 1 to 5.

*** $p < .01$. ** $p < .001$, using full sheet as the comparison group.

questions in random order: (a) How likely are you to throw the piece of paper into the trash? (1 = not at all likely; 5 = very likely). (b) How likely are you to throw the piece of paper in the recycling bin? (1 = not at all likely; 5 = very likely). (c) How much is the paper like trash? (1 = not at all like trash; 5 = exactly like trash). (d) How much effort would you exert to recycle this piece of paper? (1 = no effort at all; 5 = a tremendous amount of effort). (e) What impact on landfill use would disposing the piece of paper in the trash have? (1 = minimal; 5 = substantial). After finishing the questionnaire, participants were thanked and asked to complete another unrelated study.

Results and Discussion

The results from Study 1 are shown in Table 1. We combined the likely to trash (reverse coded) and the likely to recycle items to form a reliable intention to recycle index ($\alpha = .737$). One-way ANOVA revealed a main effect of distortion condition on the intentions to recycle index, $F(2, 147) = 9.81$; $p < .001$. Participants had significantly higher intentions to recycle a full sheet of paper ($M = 3.07$) in comparison with a full sheet of paper that was crumpled into a ball ($M = 2.37$; $p = .001$) or a small 2" \times 4" piece of paper ($M = 2.25$; $p < .001$). The third question, our categorization question, assessed how typical the paper was of trash. Consistent with our categorization thesis, the results also revealed differences in typicality, $F(2, 147) = 40.94$; $p < .001$. A full sheet of paper was perceived to be less typical of trash ($M = 1.80$) in comparison with a crumpled sheet ($M = 3.80$; $p < .001$) and also in comparison with a small piece of paper ($M = 3.30$; $p < .001$). The data did not reveal differences in how much effort the participant would exert to recycle the paper ($p = .32$) or on the perceived impact on the landfill ($p = .18$).

The results show that product distortion influences intentions to recycle and the degree to which a product is considered typical of trash. Crumpled paper and smaller pieces of paper were considered to be more like trash than a maintained whole sheet of paper. Perceptions of effort and impact on landfill were ruled out as alternative explanations. These results provide initial support for our hypothesis that distorted products are less likely to be recycled because consumers are incorrectly categorizing them as “trash.” However, research has found that the presence of pro-environmental attitudes does not always predict pro-environmental behavior (Corral-Verdugo, 1996; Davies, Foxall, & Pallister, 2002; Grob, 1995; Hungerford & Volk, 1990; Posch, 1993; Rajecki, 1982). To ensure that we are not observing the same attitude–behavior gap found in prior work, in the studies that follow, we further test our theory and predictions using actual disposal behavior. Together with Study 1, the following experiments help unravel the reasons why the same product may be recycled in one instance and trashed in the next.

Study 2—Inconsistent Disposal of Cut Paper

Participants

Upon entering the lab, 200 participants were assigned to one of four conditions in a 2 (Paper: Distorted vs. Maintained) \times 2 (Distance: Near vs. Far) between-subjects design based on the session they attended. All participants in an individual session were given the same instructions, which differed from the other sessions depending on the condition assigned. Participants were run in groups of 10 to 16. Participants signed up to perform a series of five unrelated studies. The first study was a product (scissors) evaluation study and then four other studies conducted by other researchers.

Procedure

In all four conditions, participants were given a pair of scissors and an 8½" \times 11" sheet of paper. The sheet of paper provided a product description and the scissor's specifications. In the Maintained condition, participants were given scissors and asked to assess whether or not they liked the product based on its aesthetic components. In the Distorted condition, participants were told that they had to assess whether or not they liked the product based on its functionality and instructed to cut their 8½" \times 11" sheet of paper into eight equal pieces, leaving them with eight small pieces to dispose of after the studies (i.e., same mass as a full sheet, but different composition). Dotted lines were

provided on the back of the paper to ensure that all participants ended up with eight equally sized pieces of paper. In the distance conditions, we manipulated the placement of the recycling bin relative to the trash can. As physical distance has been shown to influence consumers' motivation to recycle (e.g., González-Torre & Adenso-Díaz, 2005), we wanted to include this factor and replicate this prior work to show that the distorted/maintained influence on disposal behavior is consistent with previous research. In the near condition, next to the exit were two identical white flip-top bins, one labeled "Trash" and the other labeled "Recycling." Thus, little effort was required to recycle. In the far condition, the trash can was still placed next to the exit but the recycling bin was placed 10 feet away from the exit making participants go out of their way and exert more effort to recycle. The bins were identical in every way except signage. The flip-top lids on the bins prevented participants from seeing into the bins prior to disposal.

After finishing the final study, the research assistant thanked the participants for their time and reminded them to "dispose of all paper on the way out." Finishing times were naturally staggered as participants took between 30 minutes and 1 hour to complete the series of studies, thus limiting social influence. Once all participants had left, the research assistant counted the number of sheets in each condition that were recycled versus thrown in the trash which was used as the dependent variable.

Results and Discussion

The recycle data across experimental conditions are shown in Figure 1. A binary logistic regression model was used with disposal behavior as the dependent variable (coded 1 = recycled, 0 = trashed) and with paper size (coded 1 = 8 pieces; 0 = full sheet), effort (coded 1 = far; 0 = near exit), and their interaction term as independent variables. The results revealed simple effects of distortion ($\beta_{\text{exp}} = .18$, $\chi^2 = 14.10$, $p < .001$) and of distance ($\beta_{\text{exp}} = 3.30$, $\chi^2 = 6.55$, $p = .011$) as significant predictors of recycling behavior. Participants were significantly more likely to recycle the paper if it was not distorted. Participants were also significantly more likely to recycle the paper if the recycling bin was near as compared with when it was farther away. The interaction proved to be unreliable ($p > .25$).

Finishing times, and therefore departure times, were naturally staggered as participants took between 30 minutes and 1 hour to complete the series of studies, thus minimizing the possibility of social influence. However, as a check to ensure against any unobserved contagion effects that may have resulted from our block design, we performed an additional regression

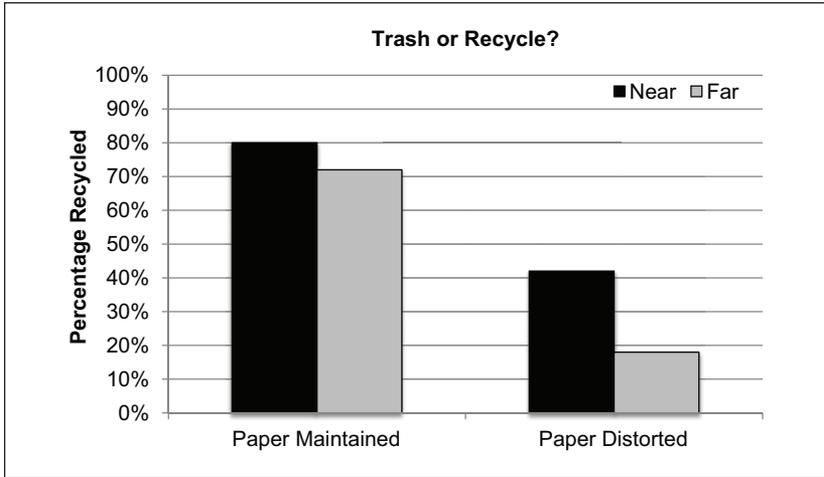


Figure 1. Cutting paper decreases recycling rates.

analysis to examine potential differences across sessions within the same condition or the influence of the number of participants per session. The new model included distortion, proximity, and their interaction term, as well as session and number of participants per session as covariates, with disposal behavior as the dependent variable. The main effect of distortion ($\beta_{\text{exp}} = 1.73$, $\chi^2 = 5.68$, $p = .017$) and proximity ($\beta_{\text{exp}} = -1.16$, $\chi^2 = 6.01$, $p = .014$) remained significant, but both session ($p = .57$) and number of participants per session ($p = .99$) were found to have no significant influence on disposal behavior. The distortion by proximity interaction remained not significant ($p = .27$). Because this further rules out the possibility of any contagion effects, we have excluded these factors (i.e., session, number of participants) from subsequent studies.

The results show that the impact of product distortion on disposal behavior is significant even when product quantity is held constant. Once a full sheet of paper is cut into smaller parts, each part exhibits its own individual properties making it more similar to trash and increasing the likelihood that it gets treated as such. In Study 1, we established that distorted paper is considered to be more typical of trash, and now in Study 2 we show that product distortion causes consumers to trash a well-known recyclable object. In the next study, we examine the impact of a different type of product distortion: crumpling the paper into a ball without actually cutting the paper. Here, the product itself remains whole, but it takes on a different form.

Study 3—Inconsistent Disposal of Crumpled Paper

Participants

Upon entering the lab, 130 participants were assigned to one of two between-subjects conditions (Paper: Distorted vs. Maintained) based on the session they attended. All participants in an individual session were given the same instructions, which differed from the other sessions depending on the condition assigned. Participants were run in groups of 7 to 16. Participants were told that they would be completing a series of four unrelated studies, the first being a memorization study.

Procedure

All participants were given an $8\frac{1}{2}'' \times 11''$ sheet of paper with a 3-digit number printed on it and given 15 seconds to study the number and memorize it. The 3-digit number was used as an identifier. Participants in the Distorted condition were asked to crumple their paper into a ball after the 15 second memorization period, whereas those in the Maintained condition were asked to flip the paper over so that they could not see the number. Participants then completed a series of unrelated studies and were instructed to “dispose of all paper on the way out.” Next to the exit was a white flip-top bin labeled “Trash.” Ten feet away was an identical white flip-top bin labeled “Recycling.” Finishing times were naturally staggered as participants took between 20 and 45 minutes to complete the series of studies, thus limiting social influence. Once all participants had left, the research assistant counted the number of sheets in each condition that were recycled versus thrown in the trash which was used as the dependent variable.

Results and Discussion

Four participants left with paper in hand leaving 126 data points. A binary logistic regression with disposal behavior as the dependent variable (coded 1 = recycled; 0 = trashed) and distortion condition (coded 0 = maintained; 1 = distorted) as the lone predictor variable revealed a significant effect of distortion condition on disposal behavior ($\beta_{\text{exp}} = 40.46$, $\chi^2 = 44.28$, $p < .001$). As shown in Figure 2, participants recycled the full sheet of paper (Maintained = 77.4%) significantly more compared with when it was crumpled into a ball and distorted (Distorted = 7.8%).

The results again show that form distortion has a significant effect on consumers' disposal behavior. In Study 3, the impact on the environment was held constant, and only the distortion of the paper's form was altered, and yet

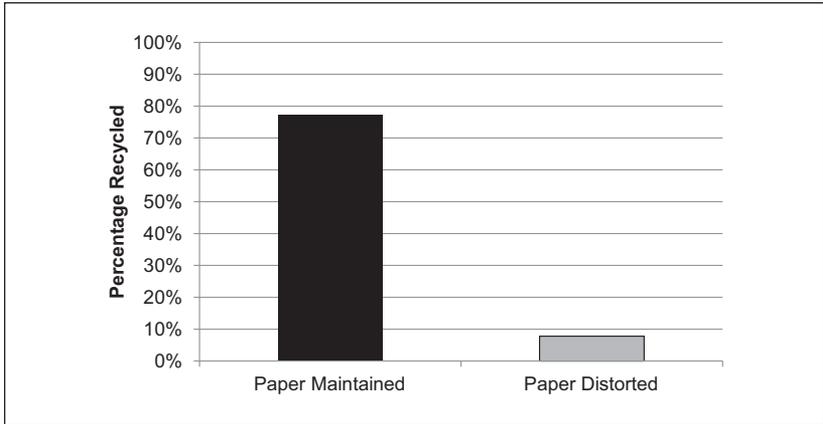


Figure 2. Crumpling paper decreases recycling rates.

consumers were more likely to trash the distorted paper. This directly extends the findings of Trudel and Argo (2013), where we show that even when the product size is maintained (i.e., the product remains in one piece), it is still more likely to be incorrectly treated as trash when the paper is simply crumpled. In the studies by Trudel and Argo, the size of the paper always decreased with distortion. When deciding to trash or recycle the paper, we believe that consumers evaluate the product in terms of how similar it is to other products that represent each disposal category in memory. That is, categorization forms the basis of the psychological process behind consumers' judgments and subsequent disposal decisions. This argument is consistent with the categorization data obtained from Study 1, where the crumpled paper was perceived to be much more typical of trash than an intact whole sheet of paper. Consequently, the crumpled paper was treated similarly to the cut paper in Study 2, as it was more likely to be treated as trash. Given that consumers consider distorted paper to be trash, the next study aims to test a potential visual prompt that overrides this incorrect categorization by explicitly depicting crumpled and cut paper as being recyclable. These findings will have the potential to inform public policy on methods to influence behavior change to increase recycling rates.

Study 4—Visual Recycling Prompt

Participants

Upon entering the lab, 129 participants were assigned to one of four conditions in a 2 (Paper: Distorted vs. Maintained) \times 2 (Visual prompt: Present vs.

Absent) between-subjects design based on the session they attended. All participants in an individual session were given the same instructions, which differed from the other sessions depending on the condition assigned. Participants were run in groups of 15 to 20 and were told that they would be completing a series of six unrelated studies.

Procedure

As they entered the lab, participants were handed an 8½" × 11" piece of paper with a unique code (e.g., VL8095) written in the top left-hand corner. After sitting at individual computer stations, participants were required to enter this code into a text box at the beginning of the first study. Those in the Distorted condition were told to crumple the paper into a ball after they had entered the code. Those in the Maintained condition were simply asked to place the paper off to the side after entering the code.

Participants then completed a series of unrelated studies and were instructed to "dispose of all paper on the way out." Outside the computer laboratory were the same two identical white flip-top bins labeled "Trash" and "Recycling" used in our previous studies, separated by 4 feet. In the visual prompt conditions, we manipulated the presence (i.e., placed over the existing recycling sign) or absence (i.e., only the existing recycling sign is used) of a purposely designed recycling sign (see Figure 3). This sign depicts recyclable paper that has been distorted (e.g., crumpled, cut) with the aim to override the participants' categorization of distorted paper as useless trash and increase recycling rates. This follows a similar operationalization used by Werner, Rhodes, and Partain (1998) who found that schema-sensitive signs were successful at teaching consumers to keep contaminants such as food out of the recycle bin. Schema sensitivity has also been shown to influence categorization processes and decision making (Nosworthy & Trudel, 2011). Participants exited at different periods due to the variation in completion times of the studies, minimizing the potential for any social influence. Once all participants had left, the research assistant counted the number of sheets in each condition that were recycled versus thrown in the trash which was used as the dependent variable.

Results and Discussion

A binary logistic regression model was used with disposal behavior as the dependent variable (coded 1 = recycled; 0 = trashed) and with distortion (contrast coded 1 = distorted; -1 = maintained), signage (contrast coded 1 = present; -1 = absent), and their interaction as independent variables. The



Figure 3. Visual prompt designed to correct categorization error.

main effect of distortion on disposal behavior was significant ($\beta_{\text{exp}} = -.822$, $\chi^2 = 16.632$, $p < .001$), whereas the main effect of signage on disposal behavior was marginally significant ($\beta_{\text{exp}} = .360$, $\chi^2 = 3.192$, $p = .074$). The interaction between distortion and signage was also marginally significant ($\beta_{\text{exp}} = .375$, $\chi^2 = 3.462$, $p = .063$). A planned comparison using cross-tabulation revealed that those in the Maintained condition did not differ in the rate of recycling when the sign was present (64.7%) compared with absent (65.4%; $p = .956$), whereas those in the Distorted condition showed a significant increase in recycling behavior when the sign was present (42.9%) compared with when the sign was absent (14.7%; $p = .010$; see Figure 4).

From the first three studies, we found that the impact of product distortion on recycling intentions and behavior is significant even when product quantity is held constant, possibly due to the categorization of distorted paper as trash. To combat this, in Study 4 we manipulated the presence of a sign depicting different forms of paper that can be recycled. The presence of this simple sign drastically increased the recycling rates of distorted paper. The recycle bin is clearly labeled in both conditions; however, it was only when the sign depicted distorted paper as being recyclable were the recycling rates positively influenced.

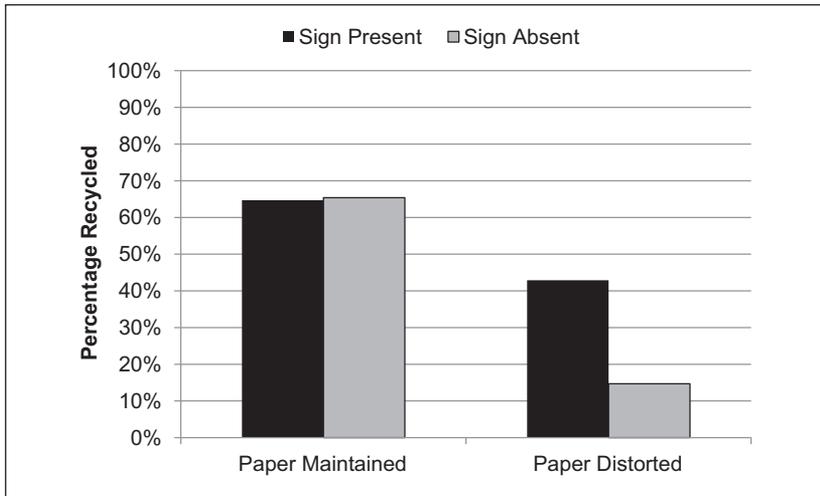


Figure 4. Visual prompt increases recycling rates of distorted paper.

General Discussion

Given the significant amount of waste that is ending up in our landfills, we examine conditions under which consumers dispose of a well-known recyclable product in the trash (vs. recycle bin). Specifically, the results show if the consumption process distorts paper sufficiently from its original form (i.e., paper is cut or crumpled), consumers categorize it as trash, and in turn are more likely to throw it in the trash (as opposed to recycle it). It is important to note that three of the four studies presented in this article examine real behaviors in actual product disposal situations. Even controlling for total mass and effort required, product distortion caused participants to incorrectly categorize and trash a well-known recyclable product.

Our experiments were performed using participants from a recognized “green” school (Princeton Review, 2014; STARS, 2013), meaning that the differences in recycling behavior may be even greater in the general public whose pro-recycling attitudes may not be as favorable. Furthermore, in our experiments we used a product that was well known to be recyclable, and controlled for effort by providing easily accessible and clearly labeled recycling bins next to the trash can. Despite this, we still show differential recycling rates. Simply being in close proximity to recycling receptacles or knowing whether the substance a product is made of is recyclable is not enough to ensure that product is recycled when disposed of. Understanding

how the product in its various forms is categorized (i.e., trash vs. recyclable) is critical to understanding recycling behavior.

Applications

The findings of these studies have important implications for public policy and pro-environmental interventions. As discussed in Chen and Tung (2009), policy makers must understand consumers' recycling attitudes and perceptions of barriers to successfully implement recycling programs. By uncovering the basis of the psychological process behind consumers' disposal decisions, we can be more effective at influencing subsequent behavior. We have shown that how products are treated during disposal is influenced by how distorted the product is and how the product is subsequently categorized. The visual prompt in Study 4 was designed to encourage recycling behavior by overriding/correcting consumers' erroneous categorization of distorted paper as trash. Even though previous research has claimed that signs alone may not be effective at increasing recycling compliance (Andrews et al., 2013; Duffy & Verges, 2009), we have shown that if the message on the sign addresses an underlying psychological process then this method becomes more feasible. Therefore, campaigns designed to educate consumers on how to recycle could include the different forms that a product can take. As categorization processes are determined through experience and typicality, we believe that over time these errors in categorization can be overcome by making the recycling of distorted products more typical. From the meta-analysis by Osbaldiston and Schott (2012), we can see that prompts that remind consumers are highly effective at promoting pro-environmental behaviors. Such information can be distributed to the population through mail-based drives, school education campaigns, or via stickers placed on public and private recycling bins. Although this was not explicitly tested, using pictorial representations rather than words/lists could be more effective as those with low literary skills, such as children or illiterate consumers, can still be educated. Educating people about environmental concerns (Owens, 2000) and highlighting acceptable conduct using materials such as brochures, prizes, or placement of containers are effective motivators of sustainable behavior; however, behaviors can revert to the baseline after the removal of these materials (Bagozzi & Dabholkar, 1994). This reveals that changing consumers' beliefs (i.e., the correct categorization of distorted products) could be much more effective at increasing recycling behavior than traditional methods. By understanding the psychological processes behind disposal decisions, we can design more optimal interventions rather than relying on assumptions of potential behavior.

Limitations and Future Research

Although our theory was supported and we uncovered a simple, easily implementable, and cost-effective method to increase recycling rates of distorted products, this research was not without its limitations.

We were very careful in designing our experiments to eliminate any demand effects and observe true disposal behavior. However, given that these studies were performed within a laboratory setting, the situations may not be reflective of the many varied situations that consumers recycle. During disposal, consumers may often be under significant cognitive load and subsequently may not be fully paying attention to their actions. However, this is a justifiable trade-off when attempting to isolate and uncover a specific psychological process. We attempted, where possible, to create a situation that mimics the real world by placing the bins in a naturally obvious place outside of the laboratory when the participants would have believed the experiment to be “finished.” Future research could test similar interventions on actual bins placed in high-traffic areas when consumers are often disposing of multiple objects (some recyclable and some not) to increase the ecological validity.

The simple signage we proposed is far from universal solution. Given the abundance of recyclable products in modern society, showing them all in their different forms would result in cluttered and hard to understand signs. Furthermore, these studies are limited in that they only look at one particular recyclable material: paper. However, paper is very well-known recyclable material (Planet Ark, 2014), and we purposely used paper to control for knowledge which, as discussed previously, has a significant influence on disposal behavior. Future research can examine the impact of distortion on other recyclable materials such as aluminum and plastic, which are important to examine as, unlike paper, they may not be biodegradable and can potentially choke up waterways. However, the aim of these studies was to test our theory regarding product distortion and show that this bias can be interrupted and reversed. Future research could test possible mediators that we proposed but failed to fully test, such as ease of retrieval or uselessness.

Another question that may merit investigation is whether or not the impact of product distortion is domain specific? Or could learning and correctly categorizing one distorted product (e.g., crumpled paper) increase the likelihood that people will recycle a different distorted product (e.g., crushed aluminum cans)? Also, could these interventions be used to lower the number of contaminated objects placed incorrectly in the recycling bin? Though, incorrectly recycling soiled material such as napkins, paper towels, or plastic bags (Andrews et al., 2013) is more likely due to a lack of knowledge, rather than

a bias or categorization error. Consumers know that paper is recyclable, but they may not know that *soiled* paper is *not* recyclable. In the current study, we examined situations where consumers erroneously categorize clean material as trash, but future research could look at situations where consumers erroneously categorize *soiled* material as *recyclable*. Finally, we have argued that much of what ends up in the landfills are distorted recyclable products that have been erroneously categorized. Our results certainly suggest that this may be true; however, future research could investigate what proportion of distorted items actually ends up in our landfills. A large scale trash audit could confirm our findings and quantify the significance of the “bias” we have demonstrated here.

Conclusion

If the goal is to achieve substantial and lasting behavioral change, then we must move past studies examining attitudes. We have known for some time that measured attitudes are not always accurate predictors of subsequent behavior (Ajzen & Fishbein, 1977), and sometimes people are unaware they even have a particular attitude (Wilson & Schooler, 1991). Therefore, research in this important area should incorporate studies of real behavior to better understand the complex psychological processes behind recycling. This article is a modest attempt at just that and identifies a condition in which consumers erroneously categorize and trash a well-known recyclable product. The consistent and robust findings of this article provide an actionable way in which we might improve recycling by making consumers aware of their behavior.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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