

It Matters a Hole Lot

Perceptual Affordances of Waste Containers Influence Recycling Compliance

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This article examines whether specialized lids on waste receptacles affect recycling compliance in public settings. Thirty waste receptacles were assigned to a *lids-present* and *lids-absent* condition, and the number of recyclable items found in recycling and waste bins served as the dependent measure. Results indicated the presence of specialized recycling container lids increased the beverage-recycling rate by 34%, which suggests that perceptual affordances of specialized container lids improve recycling compliance. Possible underlying mechanisms and implications for institutions seeking to promote recycling as an environmentally responsible behavior are discussed.

Keywords: *perceptual affordances; public recycling; recycling; waste receptacles*

According to the U.S. Environmental Protection Agency (EPA; 2008), 52% of Americans recycle paper products, 31% recycle plastic bottles, and 45% recycle aluminum cans. Although much of this recycling occurs at home through curbside recycling programs, people also dispose recyclables in public settings (e.g., work, transit, leisure). Many public and private institutions provide separate receptacles for depositing recyclables and trash. Just because public institutions provide receptacles does not ensure their use; people may simply throw recyclables into trash receptacles. When individuals habitually neglect to recycle, institutions must either

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commit staff to separate recyclables from waste, or eliminate recycling programs altogether. Therefore, an important goal for environmental research is to design waste receptacles that increase recycling compliance in public settings. The present study investigates whether using specialized lids on waste receptacles affects recycling behaviors.

Prior research on recycling compliance has largely taken an endogenous approach to examine how people's values, beliefs, and attitudes affect recycling compliance (e.g., Barr, 2007; Ewing, 2001; Guagnano, Stern, & Dietz, 1995; Schultz, Oskamp, & Manieri, 1995). Yet, internal attitudes and beliefs are only part of the story as people live in external environments that exert powerful influences on behavior (Todd & Gigerenzer, 2007). Several studies have investigated how the placement and proximity of recycling receptacles and prompts affect recycling compliance (Austin, Hatfield, Grindle, & Bailey, 1993; Brothers, Krantz, & McClannahan, 1994; Luyben & Bailey, 1979; Reid, Luyben, Rawers, & Bailey, 1976). These studies found increased compliance when prompts appeared closer to bins and when bins were placed closer to users. Surprisingly, however, few studies have examined whether the physical features of the receptacles influence recycling compliance. Understanding these design elements may help to improve public recycling programs.

According to the ecological approach to perception (e.g., Gibson, 1979), objects provide unique affordances for particular actions. Affordances refer to object properties that provide salient cues for use (Norman, 2002). For example, hanging strings afford pulling, whereas affixed buttons afford pushing. Some objects have well-designed affordances that provide clear cues for action. Other objects have poorly designed affordances that provide unclear or confusing cues for action. Most environments contain objects that vary in the quality of the affordances they provide such as doors that either clearly or ambiguously afford pushing or pulling.

Similarly, public waste receptacles vary in their perceptual affordances, which may influence recycling compliance rates. Well-designed waste receptacles should afford recycling in two ways. First, trash and recycling receptacles should be clearly distinguishable to support correct waste disposal. Second, these receptacles should reduce cognitive and motor demands for recycling. Improving these affordances should decrease the amount of contaminants that enter the recycling stream and decrease the amount of recyclables that enter the general waste stream.

Often, the only perceptual feature differentiating recycling and trash receptacles is a printed label or symbol indicating the material appropriate for the receptacle. Although some studies have found that posting signs above recycling bins increased recycling compliance (e.g., Werner, Rhodes, & Partain,

1998), labels alone may not provide effective affordances. First, people may simply ignore labels, especially if those labels are not prominently displayed on receptacles. Second, labels may fade or tear over time, particularly in outdoor settings. Finally, not every user is a native speaker of the language in which the labels are printed. These limitations may result in decreased recycling compliance because discarding waste (whether trash or recyclable) into trashcans may be considered a default response (Gigerenzer, 2008).

To address these limitations, manufacturers and institutions have designed specialized lids for waste receptacles. For instance, one type of lid consists of a small hole for disposing recyclable bottles, whereas another type of lid consists of a narrow slit for disposing wastepaper. These lids ostensibly serve as barriers to discourage individuals from placing contaminants into recycling bins. These lids alter the receptacles' perceptual salience which could increase recycling compliance. Alternatively, specialized lids could decrease recycling compliance because they raise task demands for recycling. Placing an object through a small hole or narrow slit requires guided action and cognitive effort not required when simply discarding recyclables into recycling containers having wide openings. Because prior research has not empirically tested these competing hypotheses, it is currently unknown whether the perceptual affordances of specialized container lids influence recycling behaviors.

Study

The purpose of this study was to examine the utility of specialized lids on public recycling. If specialized lids provide salient cues for recycling, then people should be more likely to recycle and less likely to discard recyclables into trashcans. If, however, specialized lids increase task demands on recycling, people should be more likely to discard recyclables into trashcans. Of course, a third possibility is that these specialized lids will not affect the recycling rate. If so, the proportion of recyclables placed into waste bins should be roughly equal regardless of the presence (or absence) of specialized container lids.

Method

Design and Materials

Ten waste stations were observed in a five-story academic building. Each station consisted of three container types: commingled glass/

Figure 1
Image of Lid Conditions (Absent, Present)



aluminum/plastic (GAP), paper, and trash. We tested the utility of these container lids in two conditions (Figure 1). In the lids-present condition, specialized container lids were placed on top of waste bins. Trash containers had standard flap lids; GAP containers had flap lids with a 6-inch hole at the center; and paper containers had single lids with 2-inch wide narrow slits on both edges. In the lids-absent condition, specialized lids were removed from the receptacles. Two stations were located on each floor on opposite ends of the hallway (approximately 100 feet apart), which were randomly assigned to lid conditions. We also randomized the order of the three receptacles at each station to ensure that common spatial alignment provided no useful cues for discrimination. Assignment to lid condition was counterbalanced midpoint of the investigation.

Procedure

We counted the number of GAP items placed into each container for one month¹. We also noted any non-GAP items deposited in GAP containers. Observations took place twice each workweek after business hours. Once counted, we removed GAP items from the building, thus eliminating the possibility of double counting.

Results

The number of discarded GAP items in each type of receptacle served as the dependent measure. We first considered whether people deposited GAP items into GAP bins at above chance levels. If people treated each receptacle as a trashcan, there should be an equal proportion of GAP items

Table 1
Proportion of GAP Items Observed in Each Type
of Waste Receptacles

Condition	Trash	GAP	Paper	$\chi^2(2)$
Lids-present	.07	.92	.005	286.03***
Lids-absent	.35	.57	.08	71.48***

Note: GAP = glass/aluminum/plastic.

*** $p < .0001$.

across the three types of receptacles. To determine if people recycled GAP items in both lid conditions, we collapsed data across all stations and observation periods and then submitted those data to a chi-square goodness of fit test. As shown in Table 1, GAP recycling compliance was above chance in both conditions. This result suggests that people are likely to recycle GAP items regardless of the presence or absence of specialized lids.

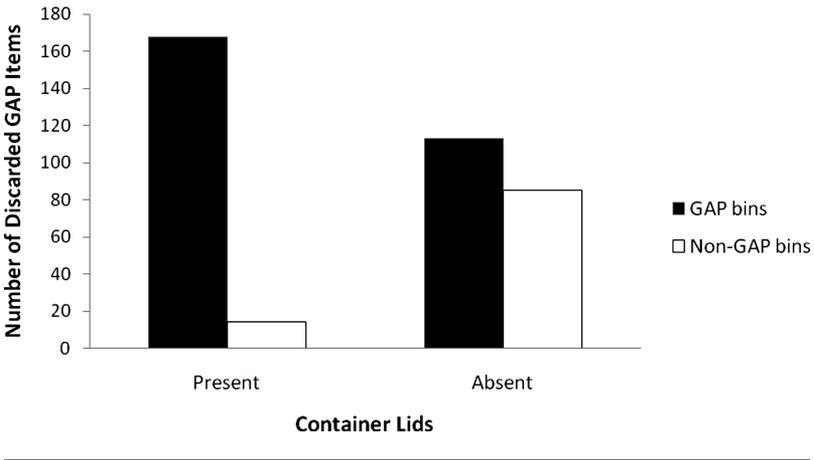
The main question was whether recycling compliance rates change due to the presence or absence of specialized container lids. Prior to analysis, the number of GAP items discarded into waste bins was organized into two groups according to bin type: GAP items correctly deposited GAP receptacles and GAP items incorrectly deposited in either paper or trash receptacles. Data were then submitted to a 2 (container lid: present, absent) \times 2 (bin type: GAP, non-GAP) chi-square test of independence. As shown in Figure 2, results indicated greater recycling compliance in the lid-present condition (92%) than in the lid-absent condition (57%), $\chi^2(1, N = 380) = 61.12, p < .0001$.

The second question we addressed was whether specialized lids reduce the amount of trash deposited into recycling bins. We recorded the number of cases in which GAP recycling bins contained nonrecyclable waste across lid conditions. In the lid-absent condition, the majority of GAP recycling bins (97.5%) contained at least one piece of nonrecyclable trash. However, in the lid-present condition, only one GAP recycling bin (2.5%) contained nonrecyclable trash. These results were highly significant, $\chi^2(1, N = 80) = 72.2, p < .001$.

Discussion

The purpose of this study was to determine whether specialized lids influence recycling behaviors. The use of specialized container lids increased recycling compliance rate by 34% and reduced the amount of contaminants entering the recycling stream by 95%. This finding suggests

Figure 2
Number of GAP Items Discarded Into Receptacles
by Lid Condition and Bin Type



that using specialized lids did not simply deter people from discarding trash into recycling containers; but rather, using these lids dissuaded people from discarding recyclables into trashcans. Although the methods used in this study cannot address underlying psychological factors that produce this increase, there are several possible explanations of how this perceptual affordance might alter behavior.

One possibility is that although most people intend to recycle, they fail to do so because of limited cognitive processing during the act of disposing of waste. Performance deficits (e.g., cognitive bottlenecks) arise when people engage in two simultaneous tasks (Spence & Read, 2003; Strayer & Johnson, 2001). It is possible that people are commonly engaged in another task (i.e., conversation, dialing a phone, leafing through papers) while disposing waste. In such dual-task situations, people may exhibit higher thresholds for distinguishing waste containers when the only discriminating feature is a label. Specialized lids may therefore lower detection thresholds by increasing the salience of recycling bins to promote compliance.

A second possibility involves adaptive cognition (Gigerenzer, 2000). Because public recycling programs have become commonplace, recycling containers with specialized lids are frequently encountered in public settings. People may have developed a simplified heuristic for handling waste

(e.g., Gigerenzer, 2008). That is, any receptacle without a specialized lid is for discarding trash, whereas any receptacle with a specialized lid is for discarding recyclables. Thus when faced with recycling containers lacking specialized lids, people may appeal to a default heuristic for handling waste and may subsequently deposit their recyclables in the trash.

A final possibility concerns social norms. Recycling is regarded as a socially desirable practice (Ewing, 2001), and people may be motivated to comply with this norm. In this context, using specialized lids may activate both descriptive and prescriptive norms, which reflects perceptions of frequently occurring behaviors (e.g., Cialdini, 2003). Consistent with prior findings relating normative factors to anti-littering campaigns (Cialdini, Reno, & Kallgren, 1990) and energy conservation (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007), the current findings suggest that specialized lids tacitly remind individuals to comply with this social norm. In addition, this relatively simple affordance provides a salient cue at the time of the desired action unlike public service announcements and other proenvironmental messages not always present when recycling ought to occur. Thus specialized lids may enhance prorecycling social norms that yield effective behavioral results in public settings.

Although the mechanism underlying these findings remains for future investigations, these results can be useful for institutions starting or improving recycling programs. First, well-designed receptacles can reduce the amount of general waste produced by an institution and reduce the cost of waste disposal. Every cubic foot of recyclables is one less cubic foot of trash and in most communities the disposal cost of recyclables is less than the disposal cost of general waste (Beukering, 2001; Hershkowitz, 1998). Second, well-designed receptacles allow the public to accurately separate recyclables from waste, which reduces staff resources for sorting waste materials. Finally, well-designed receptacles do not require large financial investments. Although recycling bins with specialized lids are commercially available, few tools are needed to cut small holes into inexpensive plastic trashcan lids. In fact, the containers used in the present study are such converted trashcans.

To conclude, the present study offers a simple, yet important insight: Something that is nothing—a hole—can dramatically increase environmentally responsible behaviors. That such a subtle affordance of the physical environment substantially increases recycling compliance reinforces the argument that external environments tacitly exert a powerful influence over behavior (Todd & Gigerenzer, 2007). Future studies on the structure of environments that promote proenvironmental behaviors may be an important step toward a sustainable future.

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