JOURNAL OF APPLIED SOCIAL PSYCHOLOGY

Journal of Applied Social Psychology 2013, 43, pp. 24–34

The effectiveness of models and prompts on waste diversion: a field experiment on composting by cafeteria patrons

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Acknowledgments: Kiyuri Naicker, the volunteers who acted as models, the Victoria Public Interest Research Group (VIPRG), and the University of Victoria Student Society are acknowledged.

doi: 10.1111/j.1559-1816.2012.00978.x

Abstract

This study investigated whether or not visual prompts and human models influence compost-supportive behavior by individuals in a cafeteria setting. Waste disposal behavior of cafeteria patrons was observed ($N = 1{,}060$) after the introduction of (1) pro-composting signs, and (2) models who demonstrated appropriate composting behavior. Ideal composting significantly increased relative to the baseline with the introduction of the signs (from 12.5% to 20.5%). A further increase (to 42%) was observed when two (but not one) individuals modeled the behavior, and this increase was sustained even after the models were removed. Informational and normative influences may explain the increase in composting. This study further supports the use of prompts and models as a strategy for encouraging pro-environmental behaviors.

Introduction

The impact of human behavior on the planet's resources, ecosystems, and climate is ever increasing, and waste production is a large part of this problem. Most of the world's municipal waste ends up in landfills (Clean Air Council, 2006; European Commission, 2005; United Nations Statistics Division, 2011), resulting in damage to much valuable habitat and arable land; in addition, dangerous greenhouse gases like carbon dioxide and methane are produced as a by-product of waste decomposition (Doorn & Barlaz, 1995). The problem is compounding as the amount of municipal waste increases (United Nations Statistics Division, 2010). A significant proportion of this waste is organic but does not decompose in landfills because they are designed to prevent this decomposition in order to avoid the leeching of toxic chemicals into the soil. Despite available infrastructure for composting and recycling, most waste could still be diverted more efficiently.

Composting

Many pro-environmental waste management behaviors are currently practiced by individuals as part of their daily routines (e.g., reusing or recycling goods). Composting of food and food-related items in public eateries is one method of waste diversion that individuals can do to make an effective contribution to waste diversion. By reducing the amount of organic waste that ends up in landfills, the amount of methane and leachate formulation is reduced (United States Environmental Protection Agency, 2008). In addition, composting has the potential to reduce greenhouse gas emissions (Favoino & Hogg, 2008) while creating a marketable soil supplement that has several advantages over commonly used chemical fertilizers (Bulluck, 2002). Thus, composting may help to mitigate climate change, reduce the pressure on existing landfills (and the need to create new ones), and improve agricultural soil quality. However, composting will only work if individuals adopt the behavior—a process that can be informed by social psychology research. Although "composting" may sometimes refer to the process of converting organic matter to compost, or fertilizing a garden using compost, in this paper we use the term "composting" to refer to the behavior of putting organic waste (food and food-related waste) into a compost bin.

Like many pro-environmental behaviors, the impact of composting at an individual level may be small, but can be very large if performed by a large number of people. However, several psychological barriers may prevent individuals from composting, one of which concerns the composting behavior of others. If people believe that many others are engaging in the behavior, then they may be more likely to perform it. This occurs not only because their actions appear more efficacious, but possibly also because there is social pressure to conform. Behavior models may be used to simulate this

process, and signs are also a frequently used method of encouraging the adoption of a desired action.

Signs

Signs can provide viewers with practical information, persuasive information, and behavioral cues for decision making (Geller, 1989). Five characteristics of effective visual prompts have been described: (1) the target behavior is relatively convenient to engage in; (2) the desirable or undesirable behavior is specified in precise terms; (3) convenient alternative desirable behaviors are indicated when avoidance of an undesired behavior is targeted (e.g., disposing of bottles in a recycling bin rather than the garbage); (4) the message is delivered in close proximity to opportunities for engaging in the target behavior (e.g., as in point-of-purchase advertising); and (5) the message is stated in polite language that does not threaten an individual's perceived freedom (Geller, Winett, & Everett, 1982). Using these principles, point-of-decision signs have been created that effectively encourage polystyrene recycling, litter cleanup after eating in cafeterias (Craig & Leland, 1983; Dixon, Knott, Rowsell, & Sheldon, 1992; Werner, Rhodes, & Partain, 1998), and other behaviors (e.g., Baltes & Hayward, 1976; Geller, Witmer, & Orebaugh, 1976; Johnson, Sholcosky, Gabello, Ragni, & Ogonosky, 2003).

In one particularly relevant study, tabletop signs were used in a university cafeteria to reduce littering (Durdan, Reeder, & Hecht, 1985). The signs were equally effective in reducing litter whether they had a specific message ("Place your tray and dishes in the tray holders along the west wall") or a nonspecific message ("Clear your own table"). This finding is important because it used an identical sign-placement procedure (i.e., tabletop signs) to that employed by the current study.

Although signs and prompts are effective at mobilizing pro-environmental behavior, several authors have called for the use of subtle modeling or demonstration to increase such behavior (e.g., Geller, 1995; Lutzenheiser, 1993). These techniques, known as human antecedent methods, can have the effect of encouraging that behavior in the observers (e.g., Guéguen, 2007; Rosenthal & Marx, 1979).

Models

The phenomenon of learning through observation is well established (Bandura, 1977) and has been shown to occur in both humans and nonhumans (e.g., Thorhallsdottir, Provenza, & Balph, 1990). Several field studies have investigated the influence of subtle modeling techniques on the behavior of others. Typically, confederates demonstrate the target behavior in front of bystanders and then observe whether those bystanders also engage in the behavior. These techniques have been used to encourage bystanders to sign a petition (Bégin, 1978), eat more crackers in an experimental setting (Rosenthal & Marx, 1979), tip bakery employees (Guéguen, 2007), reduce or increase litter in public places (Cialdini, Reno, & Kallgren, 1990), and pick up campsite litter (Wagstaff & Wilson, 1988).

Models and signs

A combination of models and signs was used to increase the frequency of certain behaviors by bystanders in two studies. In one, signs and models were used to encourage students in an elevator to turn down the volume of their portable music players (Ferrari & Chan, 1991). This study consisted of two experiments: The first successfully used signs to reduce the level of audible music coming from portable music players in the elevator (from between 76% and 85% down to 59%), and the second successfully used models (one asked another to turn down the volume) to encourage other passengers to turn down their headsets (29% did). The signs were removed during the second study. However, the researchers did not employ the typical modeling procedure of confederate models who simply engaged in the behavior. Instead, the confederate model engaged in the behavior only after being prompted by the second confederate to "turn it down." Hence, onlookers may have been affected by the action of the model turning down his or her headset, or the onlookers may have turned down their headsets to avoid being reprimanded by others. The authors did not report any inferential statistics, significance tests, or effect sizes to strengthen their claim that the interventions were effective.

In the second study, on water conservation in gym showers, the sign-and-model behavioral intervention was also successfully employed (Aronson & O'Leary, 1982–83). The study took place in four phases over 5 weeks. In the baseline phase, a small sign was placed in a men's locker room communal shower with the instructions "Conserve Water: 1.Wet Down 2.Water Off 3.Soap 4.Rinse," and 6% of students followed the instructions. In the second phase, the sign was made more salient and, although 93% of students saw the sign, only 19%–20% followed the directions. During the third phase, in addition to this conspicuously placed sign, a confederate stood in the shower and demonstrated the prescribed behavior in view of other showering students. These interventions prompted 49% of individuals to perform the behavior. In the fourth phase, two students were used instead of one and 67% of the students complied with the instructions.

Models who are perceived to be attractive and similar to the observer are most effective (Kelly, 1965) if they are salient (Cialdini et al., 1990; Kallgren, Reno, & Cialdini, 2000). If models are famous or influential, their persuasiveness also increases (Rogers, 2003). Four important aspects of the model in the Aronson and O'Leary (1982–83) study were that he was salient, observable, not intrusive, and an average male using the showers like everyone else. Therefore, the model

represented an acceptable reference group, and was unlikely to induce reactance, which could reduce conformity.

Assuming the models in the Aronson and O'Leary study were effective, observers may have experienced the modeled behavior as instructions to "turn off the water while you are soaping up." However, models who speak these instructions may be even more effective: They are both more salient and provide descriptive information that would further aid compliance. Additionally, information about a new behavior or a new concept is traditionally disseminated through language and communication channels. In diffusion of innovation theory (Rogers, 2003), personal communication is most important at the stage in which an individual is first convinced to adopt an innovation.

Models and signs to encourage composting

The current study used Aronson and O'Leary's sign-and-model approach to increase another type of pro-environmental behavior—composting by cafeteria patrons. In this setting, diners were given the opportunity to sort their unconsumed food and associated material into a compost container separate from a container for noncompostable waste.

Based on the aforementioned considerations, we tested three hypotheses:

Hypothesis 1. The percentage of cafeteria patrons who composted their food waste will significantly increase from a baseline condition following the introduction of informative signs.

Hypothesis 2. The percentage of patrons who composted their food waste will further increase following the introduction of a model who made no verbal contact with participants.

Hypothesis 3. The percentage of patrons who composted their food waste will increase again following the introduction of two models who engaged in a simple verbal exchange about composting.

Method

Design and setting

This was a naturalistic observation study conducted in the same location under four systematically varied conditions, which were followed by a postmanipulation observation period. The study was conducted in a student-run cafeteria of a mid-sized Canadian university (approximately 18,000 full- and part-time students). The room was large, but rarely filled to capacity. It contained an estimated 25 tables, where students, visitors, and staff came to sit, eat, socialize, or do homework. Although food could not be purchased in the room, it was often purchased in the food court immediately outside the door and brought in to eat, or diners would bring their own food from home. This room was one of several places where food court customers could eat, and within the room there was only one waste disposal area.

Prior to the study, cafeteria patrons recycled their bottles and cans and disposed of everything else in the garbage bin after finishing their meals; composting of organic waste (such as food, napkins, and paper cups) was not possible. Consequently, organic waste comprised a large proportion of the total waste produced. For the purposes of this study, a bin for collecting compostable waste was placed next to the garbage and recycling bins.

Patrons were discreetly observed while they disposed of their potentially compostable waste at lunch (12 noon to 2 PM) on weekdays. In total, observations occurred over 21 days on all weekdays except Fridays (when the cafeteria was booked for an unrelated event). The number of observations recorded per day ranged from 27 to 77 ($M = 51.48$, $SD = 14.42$).

Participants

The participants ($N = 1{,}060$) were patrons of the cafeteria with potentially compostable waste; *all* cafeteria patrons were included in our observations as long as they approached the waste disposal area carrying trash to be discarded. These included an approximately equal number of males ($n = 582$, 54.9%) and females ($n = 476$, 44.9%); the gender of two participants (.2%) was not recorded. Most participants appeared to be students, but some were employees.

Outcome measures

Compost categories were determined based on factors known to influence composting behavior, such as how-to knowledge (Edgerton, McKechnie, & Dunleavy, 2009). Specifically, because an industrial composter was used, participants could compost items they would not necessarily know were compostable (such as napkins or chopsticks). Even diners who were familiar with composting may have had to learn that unusual items could be composted. Therefore, we created a category for unusual items and partial composting as well as noncomposting and ideal composting. Thus, four categories were created: noncomposters, partial composters, "unusual item" noncomposters, and ideal composters. Based on preliminary observations, these categories appeared to accurately distinguish diners.

Noncomposters had *usual* compostable items but did not dispose of any of them in the compost bin (e.g., they put orange peels in the garbage). Unusual item noncomposters only had *unusual*, yet still compostable items (e.g., napkins), but did not dispose of them in the compost bin. The unusual item noncomposter category was considered

Table 1 Frequency of Composting Behavior Categories Across All Five Phases

Category of composter	Definition	Percent (*n*)
Noncomposters	Patron had a "usual"[1] item and disposed of it in the garbage.	20.5 (217)
Partial composters	Patron disposed of some compostable items in the garbage (and others in the compost).	6.9 (73)
"Unusual item" noncomposters	Patron only had an "unusual"[2] item and disposed of it in the garbage.	47.6 (505)
Ideal composters	Patron correctly disposed of all compostable items they had.	25.0 (265)
Total		100 (1060)

[1] "Usual" items are objects that are compostable in any household composting unit, such as orange peels or apple cores.

[2] "Unusual items" are items that are not normally compostable with household compost units but can be composted in this case because an industrial composter was used. These include items such as napkins and chopsticks. An unusual item noncomposter did not compost appropriately, but only had unusual items to dispose of.

distinct from the noncomposters because their behavior may or may not have reflected a lack of knowledge about industrial composters.

Partial composters appropriately composted some, but not all, compostable items (e.g., composting an apple core, but throwing a napkin in the garbage). These participants appeared to make an effort to compost, but possibly lacked the knowledge to do so correctly.

Finally, ideal composters performed perfectly by composting everything they could (i.e., usual and unusual items). Noncompostable garbage placed in the compost bin was recorded as a composting mistake. The primary outcome measure was the percentage of ideal composters, and the secondary outcome measure was the percentage of noncomposters. A description of each compost category and its frequency of occurrence can be found in Table 1.

Observers

Observers sat at a table approximately 15′ away from the waste disposal bins in a slightly raised eating area with a laptop into which they entered data for the study. This procedure allowed each observer to maintain a clear view of waste disposal behaviors while appearing to others as students working on a computer-based assignment. To achieve high interobserver reliability, three raters trained together for two sessions prior to the start of the study to recognize the compost categories previously described. Throughout the duration of the study, observations were recorded by only one observer. On the last day of the study, an exit survey assessed whether diners had noticed the observers.

Procedure

Following the procedure delineated by Aronson and O'Leary (1982–83), the study included four phases: baseline, signage, one-behavior model, and two-behavior models. Each phase lasted for 1 week, with 4 days of observation. In addition, a 5-day postmodel observation phase was added.

Phase 1: baseline

An upgraded waste station was introduced in the cafeteria two days prior to the beginning of the study, which included a compost bin and a standard informational sign. The sign, like other waste station signs at the university, simply listed acceptable and unacceptable compost items, as shown in Figure 1.

Phase 2: improved signage

An improved sign was placed above the compost bin as shown in Figure 1, and tabletop signs were placed throughout the venue. These signs cued patrons to compost their organic waste in the bin. The tabletop signs were laminated 8.5″x11″ pieces of paper folded into three sections, with different messages on each side. Each of the three messages began with "Please Compost Your Leftovers," and then followed with a series of region-specific garbage-related facts, a small picture, and a final point about why composting is good for the environment (see Figure 2).

The poster placed over the bin provided clear and specific information about what should be composted and what should not, with pictures of typical items used by cafeteria patrons. These signs followed Geller et al.'s (1982) suggestions for the construction of an effective visual prompt. However, the tabletop signs did not specify a specific behavior, because they were not point-of-decision signs; previous research has reported that the specificity of tabletop signs in this type of setting is not associated with a significant difference in behavior (Durdan et al., 1985).

Sign development

In the process of creating the signs, a small survey ($n = 12$) was conducted among undergraduate students from an upper-level environmental psychology seminar. Although small, this convenience sample of individuals was able to provide useful preliminary feedback as to the practical effectiveness of the signs. Students generally perceived the signs to be quite effective but a few comments and suggestions from

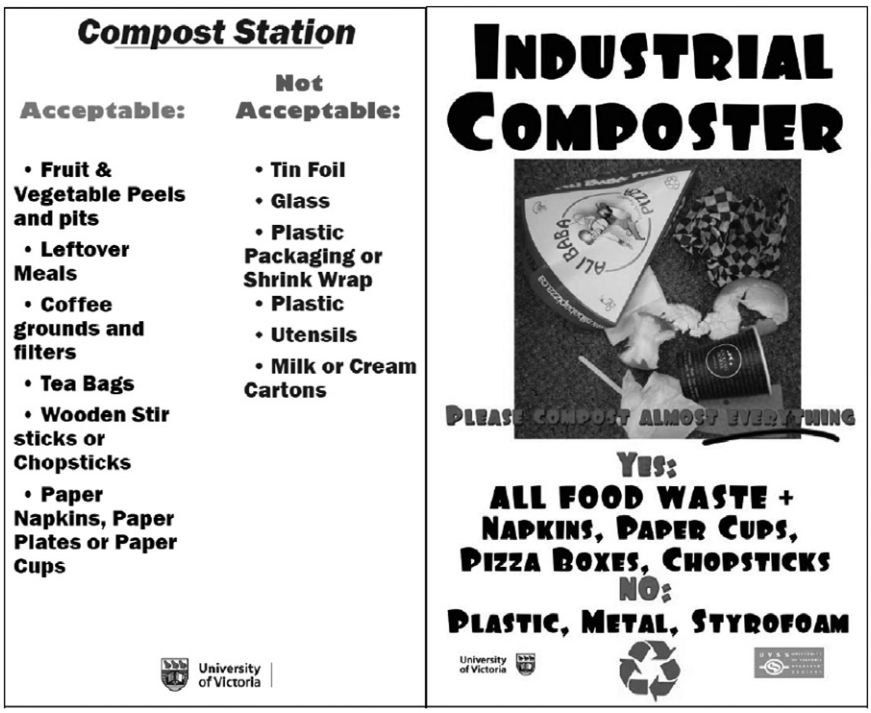

Figure 1 Standard (left) and upgraded (right) sign over compost bin.

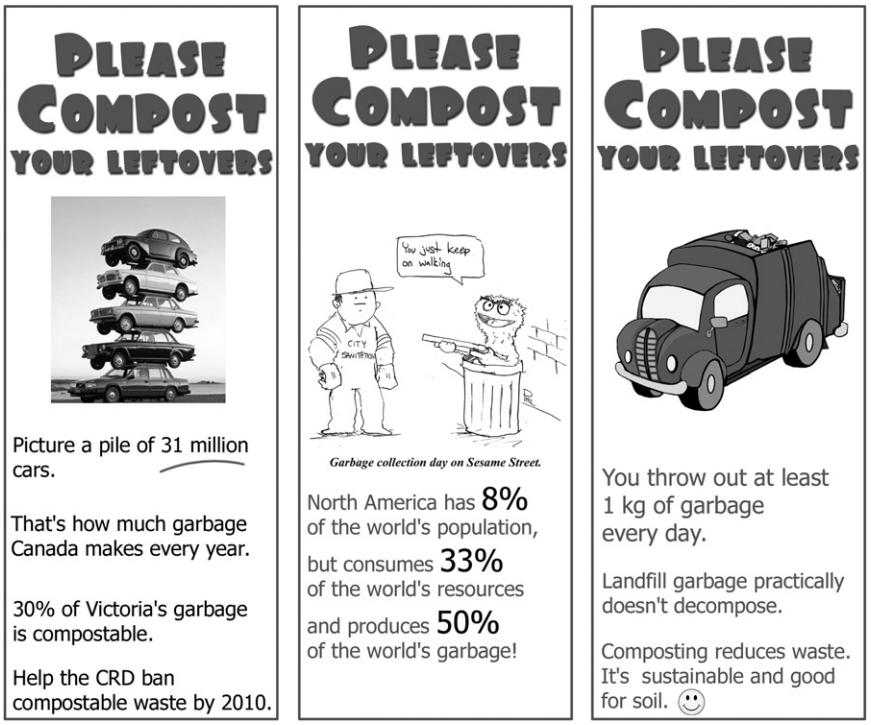

Figure 2 Tabletop sign.

participants were nevertheless used to improve the signs further. For instance, a more readable font was selected, and information on the signs was changed to emphasize local issues (see Figure 2). In addition, the poster to be placed over the compost bin was altered based on observations of common composting oversights by the cafeteria patrons. Specifically, pictures of pizza boxes, napkins, and paper cups (observed to be the most commonly misdisposed items) were added to this sign.

Manipulation check

On the second day of Phase 2, a brief survey was conducted to ascertain whether or not patrons exiting the cafeteria had seen the signs. Of the 27 patrons interviewed, 21 reported they saw at least one sign, and all of them indicated they believed composting was important. This was revealed in comments such as: "the purpose of composting is to reduce waste, increase sustainability, and improve resource management," and "to make my garden grow better." Only a brief survey was conducted because we were interested in getting a general sense of the procedure's effectiveness through qualitative information rather than inferential testing.

Phase 3: one behavior model

Ten confederates were recruited to act as models. Student models were chosen because they were most similar to typical cafeteria patrons in terms of age and other general characteristics. They represented several ethnicities and both genders (six females and four males). Multiple confederates were used rather than one to reduce suspicion among regular diners that they were not ordinary patrons.

In this phase, a confederate model sat at a table close to the garbage and compost bins, and composted organic material in front of unsuspecting patrons without making verbal or visual contact with them. When the model noticed a patron or group of patrons approaching the area, he or she pretended to have finished eating, and approached the compost bin just before the patron arrived. While in view of the waiting patron(s), the model carefully examined the sign above the compost bin and separated his or her compostable and noncompostable waste into the appropriate bins. After composting, the model refilled his or her plate with dining-related waste in a room adjacent to the cafeteria and sat down again. The waste on the plate included one usual item (e.g., pizza crust), one unusual item (e.g., wax paper wrapper), and one item of garbage (e.g., plastic cup).

Models worked in shifts of approximately 1 hour, after which a new model would arrive and assume his or her place. The models were encouraged to bring reading material to the cafeteria to avoid drawing attention to themselves. Diners tended to engage in activities such as socializing or doing school work while eating and therefore paid little attention to what was going on at other tables. The room was very large, the compost bin was in the corner of the room, and there were many diners throughout the day, thereby reducing the possibility a model would be recognized. The diners gave no indication of noticing the model repeatedly returning to the table (e.g., they did not look at the model while seated). However, diners' possible suspicions about the models were not directly measured and therefore this may be a limitation of the procedure.

The observers recorded whether or not the patrons composted after observing the model. However, if the confederate was out of the room refilling his or her plate, patrons could not view the modeled behavior and so the behavior of these patrons was not recorded. In accordance with the Aronson and O'Leary study, the signs were not removed during this phase.

Phase 4: two behavior models

In the following week, a two-model condition was implemented. Two confederates modeled composting behavior together by approaching the waste disposal area at the same time ahead of cafeteria diners. While diners moved toward the waste disposal area, they witnessed the two models examining the sign above the compost bin, and one asking the other if he or she thought it would be okay to compost a certain unusual item (e.g., a napkin or wax paper wrapper). Then the two models would each appropriately dispose of their waste and leave the cafeteria.

Phase 5: postmodel phase

The final phase of the study was a postmodel condition—the signs remained, but the behavior was no longer modeled (i.e., a return to Phase 2). This observation phase lasted for 5 days, and was included to assess whether the target behavior persisted over time.

Exit interview

To ascertain whether patrons were aware of the observers, and the study's purpose, an exit survey was conducted for patrons leaving the cafeteria on the last day of the study. Patrons were asked whether they had (a) seen the observers, and (b) suspected they had been observed. There were 3 out of the 25 respondents (12%) who said they had noticed the observers, but none accurately guessed what the observers were actually doing. Given the near-unanimous results of the survey, we are confident a larger sample would reveal comparable findings.

Results

Data cleaning

Only diners who had potentially compostable waste were included because those without compostable waste did not

have an opportunity to compost appropriately and therefore the effectiveness of the intervention would be unknown based on their behavior. Diners who did not have compostable waste (i.e., only had items to be disposed in the garbage bin) were excluded, even if they disposed of their waste in the compost bin (i.e., a composting mistake, $n = 12$). Similarly, nine other participants were excluded because they only had napkins to discard and they disposed of them in the "mixed paper" recycling bin. Clean napkins *could* be disposed in the paper recycling bin, and therefore these participants were considered not to have compostable waste. After these exclusions, 1,060 observations remained for analysis.[1]

Interobserver reliability

A chi-square test revealed that throughout the study, the three raters did not differ significantly in the frequency with which they observed each type of composting behavior, $\chi^2(6) = 8.94$, $p = .18$. Frequencies recorded by the three raters were not significantly different for observation of noncomposting, $\chi^2(2) = 1.52$, $p = .47$; partial composting, $\chi^2(2) = 5.52$, $p = .06$; unusual-item noncomposting, $\chi^2(2) = 2.65$, $p = .27$; or ideal composting, $\chi^2(2) = 1.62$, $p = .44$. To further validate this, inter-observer reliability was calculated, after the fact, using 86 additional observations. Between each pair of observers, the percent of overall agreement ranged from 73% to 80%, and the free-marginal multirater kappa (Randolph, 2005) ranged from .64 to .74. Among all three observers, the percent of overall agreement was 73%, and the free-marginal multirater kappa was .67, indicating acceptable reliability.

Frequencies

The frequencies for the four compost categories were computed, and can be seen in Table 1. The most common behavior across all phases ($n = 505$, 48%) was unusual item noncomposting (when a diner only had unusual compostable items, such as napkins, and disposed of them in the garbage).

Types of composting behavior by study phase

The differences in composting behavior categories were examined in relation to the phase of the study. An omnibus chi-square test revealed that compost behavior differed significantly between phases, $\chi^2(12) = 69.32$, $p < .001$, indicating that the various manipulations were effective.

Four chi-square analyses were computed to determine the change with study phase for each of the four types of composting behavior, based on our a priori hypotheses.[2] The frequency of noncomposting (disposing of "usual" compostable items in the trash) did not depend on study phase, $\chi^2(4) = 3.98$, $p = .41$, and remained approximately 21% in all phases (see Table 1). However, the frequency of partial composting and unusual item noncomposting changed significantly with study phase, $\chi^2(4) = 12.06$, $p = .02$, and $\chi^2(4) = 39.94$, $p < .001$, respectively. Unusual item noncomposting decreased from 59% in Phase 1 to 38% in Phase 4, and partial composting peaked at 12% in Phase 3.

The effect of study phase on ideal composting behavior is of particular interest. Study phase was significantly associated with ideal composting, $\chi^2(4) = 50.24$, $p < .001$. Comparisons between each study phase and ideal composting behavior showed that the number of ideal composters increased with each manipulation (12.5%, 20.5%, 24.5%, 42.0%; see Figure 3). From the baseline to the sign phase, the change of 12.5% to 20.5% was significant, $\chi^2(1) = 5.61$, $p = .02$, $\Phi = .11$. The frequency of ideal composting in the sign phase (20.5%) and the one-model condition (24.5%), however, did not differ significantly, $\chi^2(1) = 1.03$, $p = .3$. When ideal composting behavior was modeled by two individuals, the percentage of patrons who displayed ideal composting (42%) *did* increase significantly over the one-model condition, $\chi^2(1) = 10.25$, $p = .001$, $\Phi = .18$. This suggests that although one model did not seem to contribute to ideal composting behavior over and above the signs, the presence of two models made ideal composting behavior 70% more likely than with one model. These results support the first and third hypotheses.

Somewhat surprisingly, ideal composting rates for the two-model condition did not significantly differ from the post-model condition, $\chi^2(1) = 2.39$, $p = .12$, demonstrating that composting behavior did not decrease when the models were removed.

Time-related factors

With each additional manipulation (signs, models), the increase in ideal composting rates could be attributed to study phase or factors related to the passage of time, such as history or maturation effects (e.g., Campbell & Stanley, 1963). Although such factors could not be entirely ruled out within the current study paradigm, a chi-square test of ideal composting rates *within* each phase (day-by-day) has the potential to rule out the effect of phase, thus supporting the

[1]A second analysis was conducted with diners who committed composting mistakes included as noncomposters and diners who disposed of napkins in the mixed paper recycling bin as unusual item noncomposters. The addition of these 21 diners did not significantly change any of the results from the primary analyses.

[2]The probability of Type I errors may have increased due to conducting multiple chi-square tests. However, the findings were sufficiently robust that had a conservative Bonferroni correction been applied to the alpha level (0.05/4 = .013), identical results would have been found, except for the effect of improved signs in Phase 2, which would have been borderline significant, $p = .02$.

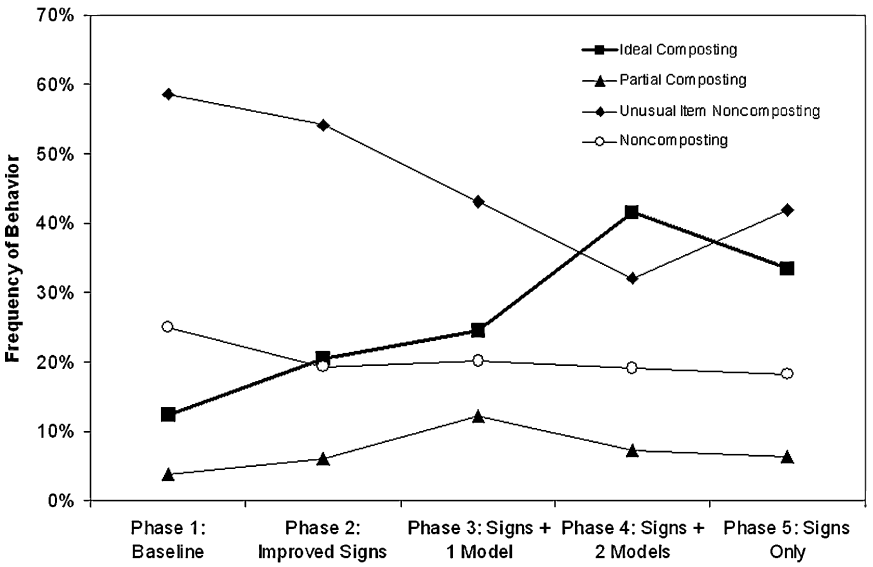

Figure 3 Percentage of composters of each category by study phase.

presence of these influences. The test revealed that ideal composting behavior did not increase over days within any single phase of the study, $\chi^2(3) = 2.02$, $p = .57$, $\chi^2(3) = 2.49$, $p = .48$, $\chi^2(3) = 1.27$, $p = .73$, $\chi^2(3) = 3.84$, $p = .28$, with the exception of the postmodel phase, $\chi^2(3) = 12.37$, $p = .02$. In this phase, the change was neither an upward nor downward trend; rather, it fluctuated and was strongly influenced by the outlying effect of 1 day with unusually high levels of ideal composting. Additionally, ideal composting behavior did not differ according to day of the week, $\chi^2(9) = 4.06$, $p = .91$.

Discussion

Ideal composting of food and food-related items

The main focus of this study was to determine whether a relatively unstudied pro-environmental behavior (composting) can be increased in a population that was not previously performing the behavior. Hence, the primary outcome variable was the frequency of ideal composting (both usual items, such as food articles, and unusual items, such as napkins). Given that the percentage of ideal composters increased with each phase of the study—except during the postmodel phase—the method employed appears to be effective for introducing or increasing this form of pro-environmental behavior. A day-by-day analysis within each phase revealed that time-related factors were unlikely to be solely responsible for the increase in ideal composting.

Signs

The addition of signs on tables in the cafeteria, and a more persuasive and informative sign over the compost bin itself, significantly increased the percentage of ideal composting. Therefore, the relatively inexpensive step of using signs to increase composting behavior can be effective. However, the increase in composting rates may be attributed to either the tabletop signs or the improved bin sign. A survey of diners exiting the cafeteria revealed that 78% (21 of 27) saw the signs. If the signs were made even more salient, and this percentage increased, then perhaps the frequency of ideal composting would increase as well.

Models

Although the frequency of ideal composting increased from the sign-only condition to the single-model condition, this increase was not significant. However, patrons who witnessed two models composting, and discussing whether an unusual item was compostable, were 70% more likely to compost perfectly than those who witnessed a single model compost. Observation of a verbal interaction is an important part of childrens' learning through intention participation (Rogoff, Paradise, Arauz, Correa-Chávez, & Angelillo, 2003), and a second model may have made the composting behavior more salient. Focus theory (Cialdini, Kallgren, & Reno, 1991) suggests that interventions which are more salient will be more effective. The key differences between the one- and two-model phases of the study were that two models were more salient than one and that two models were able to verbally interact. The presence of a second model and the verbal interaction between them appeared to make composting by onlookers more likely.

Two social influence explanations for the effectiveness of the two-model condition may be applied to this study—informational (i.e., the participant learned how to compost)

and normative (i.e., the participant learned that composting is the social norm) (Deutsch & Gerard, 1955). Presumably, both explanations were involved in the adoption of the new behavior. In support of the informational explanation, models seem to provide onlookers with information about how to compost correctly, which enables a behavior that was previously difficult to understand. This is congruent with research on practical knowledge of pro-environmental behavior, in which individuals who chose to participate in a curbside composting program possessed significantly more *how-to* knowledge than did nonparticipants (Edgerton et al., 2009). In earlier phases of the current study, cafeteria patrons may simply have been unsure about what could be composted and what could not, and two models effectively conveyed this information to them.

The normative explanation is that individuals behaved in accordance with a composting norm. Norms provide information about how to behave, or what is considered acceptable behavior (e.g., Cialdini, 1993). These may be *personal*, in which acceptability is determined internally (e.g., Hopper & Nielsen, 1991; Stern, 2000), or *social*, in which acceptability is determined by the external normative environment (e.g., Cialdini et al., 1990; Reno, Cialdini, & Kallgren, 1993). In the present study, a pro-composting personal norm may have existed, as evidenced by responses to a brief survey; cafeteria patrons ($n = 26$, 96%) reported they understood the value and importance of composting. However, a strong social norm may also have been introduced by the presence of signs and models.

Two types of social norms have been distinguished: injunctive (what individuals think others approve or disapprove of) and descriptive (what individuals think is actually happening) (Cialdini et al., 1990). The strongest conformity is likely achieved when injunctive and descriptive norms are aligned (Cialdini, 2003). Possibly, signs describing the importance of composting activated an injunctive norm, and models' composting may have activated a descriptive norm. In witnessing two models compost, diners may have inferred that "everyone" was composting and the implicit pressure to conform was increased.

Continued composting

A particularly interesting finding was that during the 5 days of postmodel observation, the percentage of ideal composting reached a plateau rather than declining. Furthermore, the postmodel phase had the same prompts as the sign phase, but a significantly higher percentage of ideal composting, suggesting that the manipulations had a lasting effect.

One possible concern is that patrons who regularly frequented the cafeteria may have noticed that they were being observed and elected to compost for that reason. However, a survey conducted on the last day of the study revealed that none of the patrons exiting the cafeteria ($n = 27$, 100%) reported suspecting their compost behavior was being observed.

Another explanation is that the "population" of the cafeteria learned and adopted the new behavior in a relatively permanent way. This adoption may have occurred for any of three reasons. First, the behavior was learned and adopted by diners who frequent the cafeteria regularly, meaning that observational learning occurred among these individuals (Bandura, 1977). Second, these diners became models themselves, and may have then diffused the proper composting behavior within their social network (Rogers, 2003). This may result when pressures from a group with which one identifies, or aspires to join, are effective in altering one's behavior and attitudes (Kelly, 1965). Third, as mentioned previously, a composting norm may have developed in this cafeteria setting. Should this be the case, results suggest that the behavior may, in fact, continue to grow and be adopted by more individuals as they observe it and become models themselves, eventually passing a "tipping point," after which the behavior is adopted by most people.

Noncomposting behavior

Non-composting is the act of failing to compost an obviously compostable item such as a piece of food (i.e., a usual item). The rate of noncomposting remained approximately 21% throughout the study and did not fluctuate significantly in response to any manipulation. Therefore, each manipulation (signs, one model, two models) appeared to increase ideal composting by reducing the number of imperfect composters rather than by reducing the number of noncomposters.

A small segment of the population may believe that pro-environmental behaviors are not useful, and therefore choose not to perform such behaviors (McKenzie-Mohr & Smith, 1999). In other words, some people choose not to compost because they do not see its value. Signs and models are effective in delivering information about how to compost and about the norm of composting, but these prompts may not be enough to engage this segment of the population. Although all cafeteria patrons who were interviewed answered "yes" to the question "do you think composting is important," this response may have been influenced by social desirability, and a deeper feeling in some that composting is not important was not revealed.

Composting mistakes

A composting mistake was recorded when a noncompostable item was placed in the compost bin. These mistakes are an important concern for most composting facilities because they result in contamination of the compost and can destroy composting equipment. We were encouraged by the observation that only 12 cafeteria patrons (of 1,081) made a mistake.

This demonstrates that composting may be feasible for cafeterias that wish to implement it.

General discussion

The current study is the first to replicate and extend the findings of Aronson and O'Leary (1982–83), but using a new pro-environmental behavior and adding a follow-up component. The two primary findings of this study were (1) the frequency of ideal composting increased significantly with the addition of improved signs and multiple models, and (2) the frequency of noncomposters (i.e., people who disposed of "usual" items like food in the garbage) was not affected by the use of signs or models. In addition, ideal composting behavior persisted for a week even after the models were removed.

The current study also has several limitations; most importantly, determining whether the observations were independent of one another was difficult. For example, some subjects may have been exposed to only one or several days of signs or models. Therefore, despite a clear increase in the number of ideal composting-related observations in each phase, ascertaining whether models, signs, or both together caused this improvement was difficult. Another potential limitation is that the sample drawn from a university cafeteria may not generalize to the population as a whole. Finally, during the poststudy reliability check, interobserver agreement could have been artificially inflated because the three raters were aware that their observations were being compared with one another.

The strength of the current study design lies in its practicality and ecological validity. It describes a method shown to be effective in increasing two types of pro-environmental behaviors (composting and water conservation) in real-life situations. Both this study and Aronson and O'Leary's (1982–83) shower room study were based on naturalistic observation as opposed to attitudes or laboratory simulations. Given the efficacy of this method, future research capable of explaining the distinct role of each intervention component can be designed.

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