Title	Psychological interventional approach for reduce resource consumption : Reducing plastic bag usage at supermarkets
Author(s)	Ohtomo, Shoji; OHNUMA, Susumu
Citation	Resources, Conservation and Recycling, 84, 57-65 https://doi.org/10.1016/j.resconrec.2013.12.014
Issue Date	2014-03
Doc URL	http://hdl.handle.net/2115/56092
Type	article (author version)
File Information	RECYCL.pdf

[Instructions for use](#)

Psychological interventional approach for reduce resource consumption: reducing plastic bag usage at supermarkets

Shoji Ohtomo^a and Susumu Ohnuma^b

^a Department of Psychology, Faculty of Human Sciences, Konan Women's University, 6-2-23, Morikita-machi, Higashinada-ku, Kobe, 6580001, Japan

^b Department of Behavioral Science, Graduate School of Letters, Hokkaido University, North 10 West 7, Kita-ku, Sapporo, 0600810, Japan

Corresponding author at: Department of Psychology, Faculty of Human Sciences, Konan Women's University, 6-2-23, Morikita-machi, Higashinada-ku, Kobe, 6580001, Japan. Tel: +81-78-413-3021.

E-mail: s.ohtomo@konan-wu.ac.jp (S. Ohtomo).

Psychological intervention to reduce resource consumption: reducing plastic bag usage at supermarkets

Abstract

A field study was conducted to investigate the reduction of plastic bag usage at supermarkets. Many behaviors leading to potential damage to the environment may be unintentional. This study applied a dual motivation model to plastic bag usage and examined the effects of an intervention aimed at promoting pro-environmental behavior. A voice prompt intervention was implemented in Japanese supermarkets. In the first (control) week, shoppers were given free plastic bags by the cashier. In the second (intervention) week, cashiers asked shoppers whether they wanted plastic bags. We collected observational and questionnaire measures of variables that predicted free plastic bag usage during the intervention. The results supported a dual motivation model of behavioral change. The voice prompt decreased the usage of plastic bags by both discouraging unintentional usage and encouraging an intentional reduction in usage. Possibilities for interventions designed both to attenuate unintentional motivation and to promote intentional motivation are considered.

Keywords: behavioral change, behavioral intention, behavioral willingness, plastic bag usage, voice prompt.

1. Introduction

“Think Globally, Act Locally” is one of the most famous slogans in environmental activism. Because local activity is necessary to reduce carbon dioxide emissions, an interventional approach (e.g., Bamberg et al., 2003; Heath and Gifford, 2002) is one of the recommended strategies for encouraging individuals to engage in pro-environmental behaviors in their everyday life. Reduction of the usage of plastic bags is an effective pro-environmental behavior that relatively few people engage in, despite the small effort required to do so (e.g., Ayalon et al., 2009; Convery et al., 2007; Funaki, 2006). In particular, most Japanese supermarkets provide free plastic bags for shoppers to carry their purchases, and consumers use these bags excessively. According to one estimate (Funaki, 2006), 302 thousand tons of plastic, (i.e., 44 billion plastic bags), that is 24 kg (i.e., 360 plastic bags) per person, are consumed every year in Japan. Another study (Eco-Design Forum for Civic Society, 2010) estimated that one person not using plastic bags for a single year would reduce carbon dioxide emissions by 18.9 kg. Therefore, reducing the usage of plastic bags is considered one of the most simple and effective resource reduction behaviors that everyone can perform on a daily basis.

A few people strive to reduce their usage of free plastic bags. Although most people in Japan are environmentally concerned and have some reusable plastic bags, they often use free plastic bags at supermarkets. Funaki (2006) revealed that approximately 30% of plastic bags in households, obtained for free while shopping, are disposed without being used at all, and there are five plastic bags in disposed wastes on average. According to the estimate of the Global Warming White

Paper (2013), over 300 plastic bags per person are consumed every year. Usage of free plastic bags at supermarkets is a repetitive type of behavior in daily life, which is acknowledged as a habit (Aarts and Dijksterhuis, 2000; Ouellette and Wood, 1998). The habituation of free plastic bag use induced an inconsistency between people's environmental concern and their actual behavior. Through repetition of behavior in the same context (e.g., regular supermarket), plastic bag usage is likely to become a habitual behavior that is activated automatically. People who have formed a habit behave automatically by reacting habitually in the same behavioral setting, without further consideration of other available alternatives (Danner et al., 2008; Neal et al., 2011). Thus, habitual behavior is elicited automatically by a response to the behavioral context regardless of environmental concerns, as long as the behavioral context is stable.

Although there have been some field experiments aimed at promoting environment-friendly behavior, particularly in relation to travel mode choice and water and energy conservation (Bamberg et al., 2003; Heath and Gifford, 2002; Verplanken et al., 1998), only a few field studies have focused on and measured habits for promoting resource reduction behaviors. Knussen and Yule (2008) investigated the role of recycling habits in the disposal of household waste. They suggested that the lack of a recycling habit was an obstacle to behavioral change. Therefore, the purpose of this study was to conduct a field study to intervene in the behavioral context that induced habitual behavior and to clarify psychosocial determinants of environmentally friendly behavior.

2. Theoretical framework

The theory of planned behavior (TPB: Ajzen, 1991; Ajzen and Madden, 1986) has been one of most frequently cited models, in many domains of social science, for understanding some psychosocial determinants of human social behavior (Nosek et al., 2010). The TPB postulates that human actions are a result of consciously controlled or deliberative decision-making. According to the TPB, an attitude does not directly determine behavior, but does so only indirectly via a behavioral intention, which is a deliberative motivation. The TPB also stresses the importance of social influences in the behavioral decision. In addition to the influence of attitude, the behavioral intention is also determined by perceived behavior control (PBC), which reflects the extent to which an individual feels it to be easy or difficult to perform the behavior in a given situation.

A subjective norm is viewed as a third factor influencing behavioral intention. In the framework of TPB, a subjective norm is conceptualized as a social pressure derived from the expectations of important reference persons or groups regarding whether a behavior should or should not be performed.

The TPB has been successfully applied to examine the psychosocial determinants of resource reduction behaviors. For example, a study by Thøgersen (1994) suggested the utility of the TPB framework to reveal the motivational process of recycling behavior. Tonglet et al. (2004a) applied TPB to identify the determinants of recycling behavior in a local curbside recycling scheme, and suggested that attitude and past recycling behavior were the important determinants of intention. Moreover, Tonglet et al. (2004b) showed that different factors are involved in waste minimization and recycling behaviors. Knussen et al. (2004) also examined recycling behavior using the TPB framework. They reported that the relationship between perceived behavioral control and behavioral intention was weaker for people who

perceived that they lacked facilities for recycling.

However, recent studies have suggested the framework of TPB has a limited ability to predict behavior, because the TPB model is premised on deliberative or intentional decisions (Gerrard et al., 2008). In a meta-analysis of studies applying the TPB to environmental behavior, Bamberg and Möser (2007) reported that behavioral intention (i.e., the proximal antecedent of behavior) explained only 27%, on average, of the variance in environmental behavior. In addition, the results of a meta-analysis of intervention studies based on the TPB framework indicated that changes in intention engendered fewer changes in behavior (Webb and Sheeran, 2006). These findings suggest that the inconsistency between behavioral intention and actual behavior might be caused by a “habitual reaction” or a “non-intentional route to behavior,” regardless of behavioral intention.

In an effort to improve the predictive power of TPB, the prototype model examines behavior in terms of not only intentional motivation but also unintentional motivation (Gibbons et al., 1998; Gibbons et al., 2009). The prototype model assumes that two types of motivation are involved in social behavior. The first is behavioral intention (Ajzen, 1991; I intend to do an action), which is conscious deliberation leading to intended behavior (similar to TPB). The second is behavioral willingness (Gibbons et al., 1998; a given situation elicits an action), which is a reaction to a situation leading to unintended or unplanned behavior. Behavioral willingness is considered as the unintentional motivation that is elicited by circumstances conducive to impulsive or spontaneous behavior, regardless of the individual’s intention (Gerrard et al., 2008; Gibbons et al., 2006). The dual-process perspective of this model is able to predict both intended behaviors based on a conscious motivation, and unintended behaviors based on a spontaneous reaction to a given context (Gibbons et al., 2009). The prototype model has been found to be effective where the behaviors are determined not only by intention, but also by unintended behavioral willingness,

particularly in predicting socially undesirable behaviors such as risky sexual activity (Gibbons et al., 1998; Thornton et al., 2002) and use of substances such as alcohol, tobacco, and drugs (Gerrard et al., 2002; Gibbons et al., 2004).

Ohtomo and Hirose (2007) extended the prototype model to apply to recycling behavior. This model focused on the effects of contrary motivations (i.e., behavioral intention vs. behavioral willingness), to reveal the intention-behavior gap in environmental behavior. Their results showed that recycling behavior was determined by both behavioral intention (i.e., conscious motivation) toward eco-friendly behavior, and behavioral willingness (i.e., unintentional motivation) based on a reaction to a situation affording eco-unfriendly behavior (Fig. 1). This indicated that recycling behavior was promoted or inhibited, depending upon whether the intentional motivation or the unintentional motivation was more salient. They also tested the antecedent factors of these dual motivations and found that behavioral intention was affected by both a subjective norm (i.e., perceived approval or disapproval by others) and attitude toward the environment, while behavioral willingness was affected by a descriptive norm (i.e., perceptions of how most people behaved). Therefore, the framework of the prototype model is appropriate for examining the different processes affecting pro-environmental behavior, including both intentional motivations based on individuals' volition, and unintentional motivation elicited by given situations. This model is also suitable for exploring the determinants of such dual motivations. However, little research has examined the dual-motivation model in a real situation, particularly in relation to interventions aimed at changing non-intentional routes (i.e., willingness-behavior relationships) to habitual eco-unfriendly behaviors.

3. The present study

This study implemented an intervention to reduce the usage of plastic bags at

supermarkets, in order to examine the effects of an intervention based on the dual-motivation model (Fig. 1). In most Japanese supermarkets, when shoppers purchase products, the cashiers give them free plastic bags and say nothing about the usage of plastic bags. However, if shoppers do not want to use the free plastic bags, they have to actively decline them. Such circumstances inhibit pro-environmental behavior (i.e., avoiding plastic bag use), and induce people to receive free plastic bags, thus unintentionally promoting their use.

The present study introduced a simple “voice prompt intervention” to activate an eco-friendly intention, in order to encourage a reduction in the use of free plastic bags. In the intervention, cashiers asked to shoppers, inquiring whether they wanted plastic bags or not, and gave bags to shoppers only if the response was affirmative. A prompt is a visual or auditory cue that reminds people to carry out a target behavior. According to McKenzie-Mohr and Smith (1999), the effect of a prompt is not to persuade people to change their behavior, but to recall people’s consciousness toward an action that they intended to perform. In previous studies, a prompt has been shown to be an effective intervention, such as in the purchase of returnable bottles (Geller et al., 1971), promotion of recycling actions (Austineet al., 1993), and control of littering (Houghton, 1993). DiClemente and Hantula (2003) reviewed that prompt is one of the effective interventions for pro-social consumer issues (e.g., pro-environmental and health care behaviors). However, these studies focused on the direct effect of the prompt on the behavior, but did not examine the effect on the motivational processes that determine the behavior.

Accordingly, the present study tested the effect of voice prompt as a reminder that activates individual intention. We formulated the following hypotheses:

Hypothesis 1-1. The introduction of prompt intervention would cause a shift from unintended (habituated) behavior to intended behavior in shoppers.

Hypothesis 1-2. The voice prompt intervention induces a context change, which should mitigate the influence of the situation affording habitual free plastic use, and then decrease bag usage.

This context change was expected to improve the psychosocial determinants of shoppers' behavior. That is, the voice prompt intervention would activate a consciousness toward discouraging plastic bag usage, causing the intended behavior of rejecting the offer to use the plastic bags. Thus, the following was hypothesized:

Hypothesis 2. The behavioral intention, which is the conscious motivation to reduce the use of plastic bags, would have a greater effect on the target behavior in the presence of the intervention than in its absence.

It should be noted that the voice prompt used in this study did not include a persuasive message (i.e., "You should reduce the usage of free plastic bags for environmental conservation"), but a neutral message serving as a reminder of behavioral choice (i.e., "Do you want free plastic bags?"). Because the voice prompt does not produce a persuasive effect, the attitude to plastic bag usage would not be changed. However, if the intervention changes the perception of other people's plastic bag use, then social norm factors, such as a descriptive norm and an injunctive norm might be reconsidered. Previous studies demonstrated that an intervention changed the perceptions of a descriptive norm (Heath and Gifford, 2002) and a subjective norm (Bamberg et al., 2003). Thus, we hypothesized the following:

Hypothesis 3-1. Shoppers may perceive that most shoppers receive free plastic bags in the post-intervention than in the pre-intervention.

Hypothesis 3-2. Shoppers would also perceive a stronger expectation of not receiving

free plastic bags in the post-intervention assessment than in the pre-intervention assessment.

A voice prompt intervention was also expected to improve the PBC over reduction of free plastic bag usage. A study of interventions (Heath and Gifford, 2002) indicated that once people began to change their behavior as a result of an intervention, they developed less biased and more realistic perceived behavioral control. Thus, we hypothesized the following:

Hypothesis 4. People would evaluate PBC as more positive after reducing their usage of plastic bags, as a result of the voice prompt intervention. In addition, influence of PBC on behavior would become stronger during post-intervention than during pre-intervention.

Furthermore, the results of a previous study suggested that the impact of antecedents on pro-environmental motivation differ depending on the behavioral context (Bamberg et al., 2007). Thus, we also constructed the following hypothesis:

Hypothesis 5. Improvements in the antecedents of dual motivations strengthen the effect of behavioral intention on the behavior and weaken the effect of behavioral willingness.

To test these hypotheses in the field, we collected two types of data: observations of shoppers' actual plastic bag use at supermarkets, and responses to a questionnaire that measured components of the dual-motivation model.

4. Method

4.1. Design

4.1.1 Intervention procedure

In 2007, the voice prompt intervention was implemented at four medium-sized supermarkets in Hokkaido, Japan. All the four supermarkets were located in urban areas that were at a 30-min (approx.) driving distance from the city center; however, they were not large shopping malls. Some customers would stand chatting together inside the shops. The study consisted of two phases, pre- and post-intervention. During the first week, which was the pre-intervention phase, shoppers were given free plastic bags by the cashier, who said nothing about the usage of plastic bags (as is typical). In the second week, the post-intervention phase, cashiers asked shoppers whether they wanted plastic bags. During the intervention, the cashiers did not offer any plastic bags until the shoppers answered “yes,” “please,” or a similar response. Some might wonder what the alternative choice was for those who had not brought their own bags. Typical observed behaviors were a) shoppers using cardboard boxes, which they could get for free from the shops; b) shoppers taking out folded bags from their handbags, particularly middle-aged and elderly women; and c) several shoppers purchasing reusable shopping bags sold at cash counters. The intervention was continued during the second week even when data collection (observation and questionnaires, as described below) was not conducted.

4.1.2 Observation of behavior

As shoppers paid their bill at the checkout counter, the investigators unobtrusively observed the checkout counter from a distance and recorded whether each shopper received or declined free plastic bags.

The first (pre-intervention) collection of behavioral data was implemented at each supermarket on Wednesday or Saturday of the same week. For two of the

supermarkets, data collection was implemented on the Wednesday from 10.00 to 12.00, from 13.00 to 15.00, and from 16.00 to 18.00. For the other two supermarkets, the data collection was implemented on the Saturday. In the second (post-intervention) phase of data collection, the procedures were identical to those used in the pre-intervention phase. The total number of shoppers who were observed at the checkout counter was 4105 in the pre-intervention phase, and 4057 in the post-intervention phase.

Questionnaire: Immediately after each shopper paid the bill and went through the checkout counter, investigators (who were different from the observers) gave the shopper a questionnaire, with instructions to answer it at home and send it back by mail. The place and time of data collection were the same as for the observational data collection. The only difference was that in the second week (post-intervention), the investigators ensured that the shoppers were not the same participants who had already participated in the pre-intervention phase. If participants had already answered the questionnaire in the pre-intervention phase, they were not asked to complete or return it. We had to obtain data from different individuals as the analysis design was between samples, and it could not be within samples due to the strict requirement of anonymity.

4.2. Questionnaire items

Each of the constructs included in the questionnaire was assessed using two or three questionnaire items. With one exception (anti-plastic bag behavior: see below) respondents were asked to rate items on 5-point scales ranging from 1 (completely disagree) to 5 (completely agree).

Attitude: Two items were used to assess attitude: “I think I should take action to reduce the usage of plastic bags” and “I think using plastic bags is harmful to the environment.” The two items were averaged to give an attitude mean score ($\alpha = .76$)¹.

Subjective norm: Two items were used to assess subjective norm: “Most

people who are important to me (e.g., family or friends) would support a decision not to receive free plastic bags” and “Most people would approve of me not receiving free plastic bags.” The two items were averaged to give a subjective norm mean score ($\alpha = .69$).

Descriptive norm: Two items were used to access descriptive norm: “Most people receive free plastic bags” and “Most people do not bring shopping bags as an alternative to receiving new free plastic bags.” The two items were averaged to give a descriptive norm mean score ($\alpha = .68$).

Perceived behavioral control: Three items were used to access perceived behavioral control: “It is easy for me to decline free plastic bags,” “It is inconvenient for me to bring reusable shopping bags (reversed item),” and “If I want to, I can use reusable shopping bags instead of free plastic bags.” After the scores of the reversed item was reversed, the three items were averaged to give a perceived behavioral control mean score ($\alpha = .76$).

Behavioral intention: Two items were used to access behavioral intention: “I intend not to receive free plastic bags” and “I intend to go shopping with reusable shopping bags in the future.” The two items were averaged to give a behavioral intention mean score ($\alpha = .85$).

Behavioral willingness: The procedure of Ohtomo and Hirose (2007) was adapted to evaluate free plastic bag usage. To access behavioral willingness, participants were asked to imagine themselves in the two different hypothetical situations that afford environmental unfriendly behavior and then indicate what they willing to do under those situations. The first situation was: “If a cashier gives me free plastic bags spontaneously, I am likely to receive them without thinking too much.” The second situation was “In a daily situation, I am likely to receive the free plastic bags unconsciously.” The two items were averaged to give a behavioral willingness mean score ($\alpha = .85$).

Anti-plastic bag behavior: Two items were used to assess anti-plastic bag behavior: The first item was measured by responses to the following question: “How often do you decline free plastic bags during daily shopping?” Respondents were asked to rate on a 4-point scale ranging from 1 (never decline) to 4 (always decline). The second item was measured by responses to the following question: “When you purchase some goods, how often do you use your own bag instead of receiving free plastic bags?” Respondents were asked to rate on a 5-point scale ranging from 1 (never do) to 5 (always do). For analysis, the two items were standardized because these two behaviors were measured with different point scales. Afterwards, the two standardized items were averaged to give an anti-plastic bag behavior mean score ($\alpha = .62$).

5. Results

5.1. Observed behavior

As shown in Table 1, about 78% of shoppers received free plastic bags, and 22% of shoppers declined the bags during the pre-intervention phase. In addition, about 73% of shoppers received free plastic bags, and 27% of shoppers declined the bags in the post-intervention phase. There was a significant difference in the proportions between pre- and post-intervention phases ($\chi^2(1) = 37.55, p < .001$). Thus, the intervention including the voice prompt made shoppers less inclined to use free plastic bags. Furthermore, there was no significant difference in the proportions between Wednesday and Saturday ($\chi^2(1) = .03, p = .857$).

5.2 Demographics

Figure 2 shows the results of the collection of questionnaires. We analyzed accurate questionnaire data (pre-intervention $n = 448$, post-intervention $n = 435$). The demographics in the pre- and post-intervention phases are shown in Table 2. There are

no statistical differences in gender, age, or occupation between pre and post samples. Therefore, from the results, it appears that the samples in the pre- and post-intervention periods were essentially equivalent.

5.3. Comparison of psychological constructs between pre-and post-intervention samples

Table 3 shows the means and standard deviations of the constructs of the dual-motivation model in the pre- and post-intervention samples. We implemented a linear mixed model analysis because the four different supermarkets were nested within intervention. The results indicated that attitude was almost unchanged between the pre- and post-intervention samples (intervention; $F(1, 862) = 1.79$; intervention (supermarket) = $F(6, 862) = .97$). However, subjective norm, descriptive norm, perceived behavior control, behavioral intention, behavioral willingness, and anti-plastic behavior changed from the pre- to the post-intervention assessment ($F_s > 8.46, p < .01$). Also, these effects on subjective norm, descriptive norm, behavioral intention, behavioral willingness, and anti-plastic behavior differed between the supermarkets ($F_s > 2.25, p < .05$). Therefore, although some constructs were not equally affected between the supermarkets, overall, the intervention affected the constructs of the dual-motivation model, except for attitude.

5.4. Differences in the dual model between the pre- and post-intervention samples

Table 4 lists the correlations between the constructs in the pre- and post-intervention samples. To examine the differences in the dual-motivation model (Fig. 1) between the pre- and post-intervention samples, a multi-group analysis was conducted². First, an unconstrained model was estimated which does not assume equal

path coefficients in the two samples for the constructs of the dual-process model ($\chi^2(12) = 82.49, p < .01, \text{GFI} = .97, \text{CFI} = .98, \text{RMSEA} = .08$)³. Second, a fully constrained model was estimated which assumes equal path coefficients for the two samples ($\chi^2(21) = 121.38, p < .01, \text{GFI} = .96, \text{CFI} = .95, \text{RMSEA} = .07$). Thus, giving up the constraints of equal path coefficients results in a significantly better model fit ($\chi^2(9) = 38.89, p < .01$). As a last step, several constrained models were tested. All paths between the constructs that seemed to show a statistically significant difference in their coefficients in a fully-constrained model were additionally freed of equal path constraints. A chi-square difference test was conducted to see if the additional path release led to a statistically weaker model fit.

Table 5 shows the fit indexes of the constrained models and the unconstrained model. The results show that a model without the constraints of equal path coefficients from behavioral willingness and behavioral intention to behavior, from descriptive norm to behavioral willingness and behavioral intention, and from perceived behavioral control to behavioral intention and behavior, fit the data better ($\chi^2(17) = 88.86, p < .01, \text{GFI} = .97, \text{CFI} = .97, \text{RMSEA} = .07$). In particular, the Akaike Information Criterion (AIC)⁴, which is used to compare competing models, indicates a better fit of the unconstrained model (AIC = 166.86) relative to the other models (AIC > 169.95).

Figure 3 shows the unstandardized and standardized path coefficients for the pre- and post-intervention samples. The results indicate that the effect of behavioral willingness on anti-plastic bag behavior was weaker in the post-intervention sample ($\beta = -.12, p < .01$) than in the pre-intervention sample ($\beta = -.22, p < .01$). On the other hand, the effect of behavioral intention on anti-plastic bag behavior was stronger in the post-intervention sample ($\beta = .37, p < .01$) than in the pre-intervention sample ($\beta = .25, p < .01$). Furthermore, the effect of perceived behavioral control on behavioral intention was stronger in the post-intervention sample ($\gamma = .65, p < .01$) than in the

pre-intervention sample ($\gamma = .50, p < .01$). Although the influence of perceived behavioral control on behavior was non-significant in the pre-intervention sample ($\gamma = .04, p = .39$), this effect was significant in the post-intervention sample ($\gamma = .19, p < .01$).

6. Discussion

This study controlled the effects of the behavioral context using a voice prompt intervention that draws people away from habitual usage to reduce the usage of free plastic bags. Observations of shoppers' behavior showed that implementation of the voice prompt intervention caused a 5% reduction in free plastic bag usage, which demonstrates the effectiveness of the intervention. Although a 5% reduction does not appear to be a large effect, it is substantial, considering that shoppers did not necessarily have a reusable shopping bag with them at the time of the intervention, and thus many could not have refused the free plastic bag. One possible interpretation is that some repeat shoppers changed their behavior during subsequent opportunities after an initial exposure to the intervention. Another interpretation is that those who happened to bring their own bag or who bought only a few small purchases did not ask for plastic bags. However, the questionnaire data showed that intervention improved the tendency to decline free plastic bags. Therefore, the results from both observational and questionnaire data indicate significant effects of the voice prompt intervention. These results are consistent with hypothesis 1-2.

The context change brought about by the intervention changed the motivational process of free plastic bag usage. The intervention led people to decrease the unintentional motivation to use plastic bags (i.e., behavioral willingness), and increase the intentional motivation not to use plastic bags (i.e., behavioral intention). These results indicate that there is a stronger connection between behavior and

intention to reduce the use of plastic bags as a result of the voice prompt intervention. Moreover, the effects of motivational factors (intention and/or willingness) on anti-plastic bag behavior were different between the pre- and post-intervention phases. The intervention attenuated the influence of behavioral willingness to engage in habitual, automatic usage of plastic bags (paths (a) and (a') in Figure 3). On the other hand, the intervention strengthened the influence of the behavioral intention to reduce usage of plastic bags voluntarily (paths (b) and (b') in Figure 3). These results indicate that Hypotheses 1-1 and 2 are supported. Thus, our findings suggest that the voice prompt intervention served to make people more attentive and deliberative in their usage of plastic bags. Hence, people's behavior was more likely to be guided by an intentional motivation based on the conscious intention to reduce the usage of plastic bags, rather than an unintentional motivation to go along with a situation in which plastic bags are automatically provided and received.

Concerning normative factors, as hypothesis 3-1 predicted, the difference in the descriptive norm between pre- and post-intervention samples indicated that people came to believe that fewer people would take plastic bags. As hypothesis 3-2 predicted, the difference between pre- and post-intervention samples for the subjective norm indicated that people came to perceive a stronger social pressure to reduce the usage of plastic bags. This change might not be a direct effect of voice prompt; it may be because shoppers noticed changes in others' behaviors. In other words, people might become more sensitive to these norms because they looked around at other people when they were being spoken to and found that others were actually not using plastic bags. Although we could not differentiate between these reasons, intervention changed the social influence related to plastic bag usage.

The effects of perceived behavioral control were found to vary depending on the intervention. Compared to the pre-intervention sample, perceived behavioral control enhanced behavioral intention and anti-plastic bag behavior strongly in the

post-intervention sample (paths (c) and (c') in Figure 3). This result suggests that, as a result of the intervention, people were able to choose their behavior deliberately or thoughtfully, and thus self-control over the use or non-use of plastic bags was strengthened. Hence, people were more likely to engage in the intended behavior under the regulation of perceived behavioral control. A previous study also reported that perceived behavioral control shaped behavioral intention strongly when the intervention disrupted automatic execution of the behavior and initiated deliberate action (Bamberg et al., 2003). Klöckner and Matthies (2009) also examined the influence of perceived behavioral control and suggested that the influence of perceived behavioral control is adjustable depending on the setting, i.e., the structural, psychical, and social changes. Thus, the context change induced by our intervention attenuated a habitual response and promoted intentional control over plastic bag usage. According to Ajzen (1991), the direct relationship between perceived behavioral control and behavior reflects actual control with some degree of accuracy. Our finding indicates that the voice prompt improved the accuracy of behavioral control and produced a direct effect on the behavior. Therefore, we confirmed that perceived behavior control was improved by the intervention in accordance with hypothesis 4.

7. Conclusions

We designed a field study in supermarkets and used shoppers as the sample. A voice prompt intervention succeeded in activating anti-plastic bag use behavior by drawing shoppers into the influence of motivational processes. As a result of the week-long intervention, shoppers were able to take an intended pro-environmental action purposively, rather than spontaneously receiving plastic bags based on a habitual reaction to the situation. The behavioral change brought about by the intervention resulted from an increase in cognitive activation that caused a switch

from the execution of unintended behavior to that of intended behavior. These results are consistent with the hypothesis 5. However, this study only measured the effects of the week-long intervention shortly after its implementation and did not examine how long the intervention effect persisted. Although the supermarkets reported a higher plastic bag refusal rate among shoppers (about 20% before intervention and about 25% one week after intervention), after six months, it had increased to nearly 40% as a result of continuous interventions including the voice prompt (RALS, 2008). This suggests that continuous intervention would be more effective; however, this study could not capture any longer-term effects. Further studies should be conducted to investigate the long-term effects of voice prompt. Furthermore, this study recorded only the number of received and declined plastic bags but not the number of plastic bags distributed for free. It was impossible for observers to keep track of the number of plastic bags because they were standing at a distance from the cashiers so as not to disturb their work. It might have been more effective if the number of plastic bags distributed could have been counted. However, most consumers usually take only one plastic bag, and the cashiers give plastic bags according to the amount of goods purchased. Thus, there is no substantial difference between the decline rate and the number of distributed plastic bags.

The present study has profound implications for pro-environmental interventions. A voice prompt can be introduced at a low cost, compared to other popular economic incentives (e.g., an extra charge for plastic bags). Implementation of a prompt requires only a simple manipulation for a targeted behavioral context (i.e., asking). Although this study did not examine the effects of economical incentive, it would be worthy to combine the interventional approach used in this study to examine it. Indeed, results from another study showed that charging for plastic bags alone failed to reduce their usage in Taiwan (Asari et al., 2008). Businesses usually hesitate to charge extra for plastic bags because they are afraid of losing their customers to

competitive shops and damage their profits. The Environmental Agency, Japan used to discuss the implementation of extra charge for plastic bags; however, unions and supermarket companies opposed it, while consumer groups approved of it (Ministry of the Environment, 2006). Every stakeholder understood that it was delicate to adopt a stringent regulation to charge extra for plastic bags, which implied that it was difficult to control those not obeying the rule. This is because unions and companies opposed the new rule of charging extra for plastic bags. They are afraid of freeriders that do not implement the extra charge for plastic bags to retain customers. Accordingly, voluntary cooperation, such as voluntary agreement, is recommended to reduce the fear of losing customers, with the commitment of consumer groups⁶. Implementation of economic incentive sometimes provokes controversy, which underlies the potential barrier against achieving successful reduction of plastic bag usage. On the contrary, the voice prompt intervention is a useful measure for avoiding controversy. As our study has suggested, the voice prompt intervention induced a behavioral change. However, implementation of a prompt requires specification of the context that relates to the targeted pro-environmental behavior. Further field research on various pro-environmental behaviors is required to fully optimize the applicability of the prompt intervention as well as the dual motivation model. Our model of pro-environmental behavior remains to be improved through additional research.

Footnotes

¹ The “ α ” indicates the Cronbach alpha reliability index.

² Amos 20.0 was used for the analysis.

³ Chi-square test is used for testing hypothesis to evaluate the appropriateness of the structural equation model. However, as is often the case for large samples, there is a significant discrepancy between predicted and obtained covariance structures. The fit between structural model and data were evaluated by means of standard indexes: goodness-of-fit (GFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). GFI and CFI estimates can vary from 0 to 1, and a good fit is indicated by values above .90 or .95. RMSEA is bounded below by zero, and a good fit is indicated by values below .05 or .08.

⁴ The AIC is used to select between competing models. A lower AIC value indicates a better fitting model (Schermelleh-Engel et al., 2003).

⁵ Until the end of 2011, many supermarkets charged extra for plastic bags following the voluntary agreement with municipalities and consumer groups (Ministry of Environment, 2012).

Acknowledgement

The authors are grateful for the cooperation of RALSE Co., Ltd., and Dolphin Mothers Co., Ltd. for conducting the large-scale intervention in the supermarkets.

References

- Aarts H, Dijksterhuis Ap. Habits as knowledge structures: Automaticity in goal-directed behavior. *J Personal Social Psychol* 2000;78:53–63.
- Ajzen I. The theory of planned behavior. *Organ behave Hum Decision Processes* 1991;50:179–211.
- Ajzen I, Madden TJ. Prediction of Goal-Directed behavior: Attitudes, intentions, and perceived behavioral control. *J Exp Social Psychol* 1986;22:453–74.
- Asari M, Sato N, Sakai S, Nakamura K, Gunjima T. Plastic shopping bag waste from the quantity-quality viewpoints: present status and vision. *Jpn J Waste Manag* 2008;19:187–93.
- Ayalon O, Goldrath T, Rosenthal G, Grossman M. Reduction of plastic carrier bag use: An analysis of alternatives in Israel. *Waste Management* 2009;29: 2025-2032.
- Bamberg S, Ajzen I, Schmidt P. Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic Appl Social Psychol* 2003;25:175–87.
- Bamberg S, Hunecke M, Blöbaum A. Social context, personal norms and the use of public transportation: Two field studies. *J Environ Psychol* 2007;27:190–203.
- Bamberg S, Möser G. Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *J Environ Psychol* 2007;27:14–25.
- Danner UN, Aarts H, de Vries NK. Habit vs. intention in the prediction of future behavior: The role of frequency, context stability and mental accessibility of past behavior. *The Br J Social Psychol* 2008;47:245–65.
- Eco-Design Forum for Civic Society. (n.d.). Eco-Money. Retrieved January, 4, 2010, from <http://eem.jp/jp/about02.html>
- Funaki K. The environmental economic policy of the “plastic shopping bag.” *Recycle*

Bunkasha; 2006.

Geller ES, Wylie RC, Farris JC. An attempt at applying prompting and reinforcement toward pollution control. *Proceedings of the 79th Annual Convention of the American Psychological Association* 1971;6:701–2.

Gerrard M, Gibbons FX, Vande Lune LSV, Pexa NA, Gano ML. Adolescents' substance-related risk perceptions: Antecedents, mediators and consequences. *Risk Decis Policy* 2002;7:175–91.

Gerrard M, Gibbons FX, Houlihan AE, Stock ML, Pomery EA. A dual-process approach to health risk decision making: The prototype willingness model. *Dev Rev* 2008;28:29–61.

Gibbons FX, Gerrard M, Blanton H, Russel DW. Reasoned action and social relation: Willingness and intention as independent predictors of health risk. *J Personal Social Psychol* 1998;74:1164–80.

Gibbons FX, Gerrard M, Reimer RA, Pomery EA. Unintentional behavior: A subrational approach to health risk. In: de Ridder D, de Wit J, editors. *Self-regulation in health behavior*. UK: Wiley and Sons, Inc; 2006. p. 45–70.

Gibbons FX, Gerrard M, Vande Lune LS, Wills TA, Brody G, Conger RD. Context and cognitions: Environmental risk, social influence, and adolescent substance use. *Personal Social Psychol Bull* 2004;30:1048–61.

Gibbons FX, Houlihan AE, Gerrard M. Reason and reaction: The utility of a dual-focus, dual-processing perspective on promotion and prevention of adolescent health risk behavior. *Br J Health Psychol* 2009;14:231–48.

Global Warming White Paper. (n.d.). Plastic bags. Retrieved April, 10, 2013, from <http://www.glwvp.com/main/bag.html>.

Heath Y, Gifford R. Extending the theory of planned behavior: Predicting the use of public transportation. *J Appl Social Psychol* 2002;32:2154–89.

Houghton, S. Using verbal and visual prompts to control littering in high schools.

- Educ Studies 1993;19:247–54.
- Klößner CA, Matthies E. Structural Modeling of car use on the way to the university in different settings: Interplay of norms, habits, situational restraints, and perceived behavioral control. *J App Social Psychol* 2009;39:1807–34.
- Knussen C, Yule F. “I’m not in the habit of recycling” the role of habitual behavior in the disposal household waste. *Environ Behav* 2008;40:693–702.
- Knussen C, Mackenzie J, Wells M, Yule F. An analysis of intention to recycle household waste: The role of past behaviour, perceived habit and perceived lack of facilities. *J Environ Psychol* 2004;24:237–46.
- Lepper MR, Greene D. The hidden costs of reward. Hillsdale;Lawrence Erlbaum;1978.
- Mckenzie-Mohr D, Smith W. Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing. Canada: New Society Publishers;1999.
- Ministry of the Environment: Minutes of 42th sectional meeting of waste and recycling. 2006.
- Ministry of Environment; Report of survey of plastic bags. 2012: http://www.env.go.jp/recycle/yoki/c_1_questionnaire/index.html
- Neal DT, Wood W, Wu M, Kurlander D. The pull of the past: When do habits persist despite conflict with motives? *Personal Social Psychol Bull* 2011;37:1428–37.
- Nosek BA, Graham J, Lindner NM, Kesebir S, Hawkins CB, Hahn C, Schmidt K, et al. Cumulative and career-stage citation impact of social-personality psychology programs and their members. *Personal Social Psychol Bull* 2010;36:1283–1300.
- Ohtomo S, Hirose Y. The dual-process of reactive and intentional decision-making involved in eco-friendly behavior. *J Environ Psychol* 2007;27:117–25.
- Ouellette JA, Wood W. Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychol Bull* 1998;124:54–74.
- RALS Co. Ltd. Annual report of RALS company for CSR; 2008.

- Schermelleh-Engel K, Moosbrugger H, Müller H. Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of psychol res.* online, 2003;8:23-74.
- Thornton B, Gibbons FX, Gerrard M. Risk perception and prototype perception: Independent process predicting risk behavior. *Personal Social Psychol Bull* 2002;28:986–99.
- Thøgersen J. A model of recycling behaviour, with evidence from Danish source separation programs. *International J Res Mark* 1994;11:145–63.
- Tonglet M, Phillips PS, Read AD. Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. *Resour Conserv Recycl* 2004a;41:191–214.
- Tonglet M, Phillips PS, Bates MP. Determining the drivers for householder pro-environmental behaviour: waste minimisation compared to recycling. *Resour Conserv Recycl* 2004b;42:27–48.
- Verplanken B, Aarts H, van Knippenberg Ad, Moonen A. Habit versus planned behaviour: A field experiment. *The Br J Social Psychol* 1998;37:111–28.
- Webb LT, Sheeran P. Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychol Bull* 2006;132:249–68.

Table 1. Observed behavior of accepted and declined plastic bags in the pre- and post-intervention assessments

Weekday (Wednesday)						
	pre-intervention			post-intervention		
	received	declined	% of decline	received	declined	% of decline
10:00~12:00	342	124	26.6%	396	203	33.9%
13:00~15:00	342	121	26.1%	349	134	27.7%
16:00~18:00	565	157	21.7%	452	171	27.4%
Total	1249	402	24.3%	1197	508	29.8%
Saturday						
	pre-intervention			post-intervention		
	received	declined	% of decline	received	declined	% of decline
10:00~12:00	616	175	22.1%	534	195	26.7%
13:00~15:00	624	129	17.1%	565	188	25.0%
16:00~18:00	734	176	19.3%	653	217	24.9%
total	1974	480	19.6%	1752	600	25.5%

Table 2. The demographics of all respondents who submitted valid questionnaires in the pre- and post-intervention

	pre-intervention	post-intervention	
Gender			
Male	27%	26%	$\chi^2(1) = .13$
Female	73%	74%	
Age			
under 19	0.2%	0.5%	$\chi^2(6) = 8.02$
20-29	3%	4%	
30-39	17%	16%	
40-49	22%	19%	
50-59	28%	24%	
60-69	21%	25%	
over 70	9%	12%	
Occupation			
homemaker	32%	34%	$\chi^2(3) = 6.02$
full-time or part time worker	55%	49%	
student	0.2%	1%	
miscellaneous (e.g. retired)	13%	16%	
Possession of reusable shopping bag			
None	20%	16%	$\chi^2(3) = 6.07$
1	27%	23%	
2-3	42%	46%	
more than 4	11%	15%	

Table 3. Means and standard deviations of the indicators for the pre- and post-intervention samples
intervention

	Attitude	Subjective Norm	Descriptive Norm		Perceived Behavioral Control	Behavioral Intention	Behavioral Willingness	Anti-Plastic Bag Behavior
total(<i>n</i> =441)	3.88 (.90)	2.26 (.82)	3.75 (.84)		3.82 (.89)	3.42 (1.08)	3.22 (1.29)	-.14 (.83)
pre supermarket A(<i>n</i> =112)	3.80 (.82)	2.34 (.81)	3.75 (.77)		3.91 (.79)	3.44 (1.08)	3.26 (1.23)	-.12 (.82)
supermarket B(<i>n</i> =168)	3.88 (.92)	2.19 (.77)	3.78 (.81)	a	3.78 (.93)	3.39 (1.03)	3.09 (1.33)	-.19 (.83)
supermarket C(<i>n</i> =105)	3.97 (.92)	2.22 (.87)	3.86 (.92)	b	3.77 (.92)	3.26 (1.14)	3.43 (1.23)	-.19 (.86)
supermarket D(<i>n</i> =56)	3.82 (.96)	2.33 (.91)	3.40 (.82)	ab	3.86 (.94)	3.71 (1.10)	3.06 (1.36)	.03 (.77)
total(<i>n</i> =429)	3.95 (.94)	2.48 (.96)	3.57 (.84)		4.05 (.82)	3.67 (1.10)	2.78 (1.30)	.07 (.86)
post supermarket A(<i>n</i> =104)	3.88 (1.04)	2.41 (.90)	3.60 (.73)	a	4.01 (.83)	3.66 (1.15) a	2.63 (1.27)	.07 (.89) a
supermarket B(<i>n</i> =155)	3.97 (.87)	2.38 (.96) a	3.60 (.80) b		3.92 (.79)	3.55 (1.06) b	2.95 (1.32) a	.02 (.82) b
supermarket C(<i>n</i> =113)	3.85 (.99)	2.46 (.95)	3.78 (.87) c		4.33 (.84) a	3.48 (1.09) c	2.95 (1.29) b	-.10 (.90) c
supermarket D(<i>n</i> =57)	4.12 (.79)	2.82 (.98) a	3.11 (.80) abc		4.05 (.72) a	4.33 (.83) abc	2.38 (1.24) ab	.54 (.69) abc
intervention : <i>F</i> (1,862)	1.79	14.91 **	8.46 **		16.90 **	15.37 **	27.00 **	16.69 **
intervention(supermarket): <i>F</i> (6,862)	.97	2.25 *	6.33 **		1.92	5.67 **	2.85 **	4.42 **

Note. * $p < .05$, ** $p < .01$, SDs are inside parentheses. The common superscript indicates the significant difference between the constructs (5% Bonferroni adjustment). Anti-plastic bag behavior is a standardized variable.

Table 4. Correlations among indicators between the pre- and post-intervention samples

	1. Att	2. SN	3. DN	4. PBC	5. BI	6. BW	7. B
1. Att	-	.41 **	-.01	.47 **	.57 **	-.23 **	.29 **
2. SN	.50 **	-	-.07	.25 **	.58 **	-.17 **	.22 **
3. DN	.01	-.07	-	-.11 *	-.15 **	.18 **	-.18 **
4. PBC	.55 **	.39 **	-.10 *	-	.60 **	-.41 **	.39 **
5. BI	.66 **	.55 **	-.08	.74 **	-	-.48 **	.56 **
6. BW	-.28 **	-.25 **	.13 **	-.41 **	-.46 **	-	-.54 **
7. B	.49 **	.35 **	-.16 **	.61 **	.67 **	-.47 **	-

Note. * $p < .05$, ** $p < .01$. Correlations in the pre-intervention sample are above the diagonal and correlations in the post-intervention sample are below diagonal. Att = attitude; SN = subjective norm; DN = descriptive norm; PBC = perceived behavioral control; BI = behavioral intention; BW = behavioral willingness; B = anti-plastic bag

Table 5. Model fit indexes of constrained and unconstrained models comparing pre-intervention to post-intervention samples.

Model	χ^2	<i>df</i>	<i>p</i>	$\Delta\chi^2$	Δdf	Δp	AIC	GFI	CFI	RMSEA
Unconstrained model	82.49	12	< .01	-	-	-	170.49	.98	.97	.08
Full constrained model	121.38	21	< .01	38.89	9	< .01	191.38	.96	.95	.07
Model without BI to B path constraint	107.79	20	< .01	13.60	1	< .01	179.79	.97	.96	.07
Model without BI to B & BW to B path constraints	101.56	19	< .01	6.23	1	< .05	175.56	.97	.96	.07
Model without BI to B, BW to B & PBC to BI path constraints	93.95	18	< .01	7.61	1	< .05	169.95	.97	.96	.07
Model without BI to B, BW to B, PBC to BI & PBC to B path constraints	88.86	17	< .01	5.08	1	< .05	166.86	.97	.97	.07

Note. PBC = perceived behavioral control; BI = behavioral intention; BW = behavioral willingness, B = anti-plastic bag behavior.

Figure 1. Theoretical model for anti-plastic bag behavior

Figure 2. Collection of questionnaires

Figure 3. Multi-group analysis between the pre- and post-intervention samples

Note. The coefficients of the pre-intervention sample (n = 448) are at the left side and the coefficients of the post-intervention sample (n = 435) are at the right side. Un-standardized coefficients are outside parentheses and standardized coefficients are inside parentheses. The paths with a common superscript mean the constraint of equal path coefficients between the pre- and post- intervention samples. To reduce the complexity of the figure, the correlations and error terms are not shown. * p < .05, ** p < .01.

***Highlights (for review)**

This study implemented a field study to reduce free plastic bags at supermarkets.

The dual motivation model was examined with the intervention, which proposes that pro-environmental behaviors were determined by two motivations.

Voice prompt intervention induced context change and promotes pro-environmental behaviors.

A voice prompt can be introduced at a low cost, compared to other popular economical incentives.