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

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

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4
5 **Abstract**

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

20
21 **Keywords:** behavioral change, behavioral intention, behavioral
22 willingness, plastic bag usage, voice prompt.

23 **1. Introduction**

24
25 “Think Globally, Act Locally” is one of the most famous slogans in
26 environmental activism. Because local activity is necessary to reduce
27 carbon dioxide emissions, an interventional approach (e.g., Bamberg et
28 al., 2003; Heath and Gifford, 2002) is one of the recommended strategies
29 for encouraging individuals to engage in pro-environmental behaviors in
30 their everyday life. Reduction of the usage of plastic bags is an effective
31 pro-environmental behavior that relatively few people engage in, despite
32 the small effort required to do so (e.g., Ayalon et al., 2009; Convery et al.,
33 2007; Funaki, 2006). In particular, most Japanese supermarkets provide
34 free plastic bags for shoppers to carry their purchases, and consumers use
35 these bags excessively. According to one estimate (Funaki, 2006), 302
36 thousand tons of plastic, (i.e., 44 billion plastic bags), that is 24 kg (i.e.,
37 360 plastic bags) per person, are consumed every year in Japan. Another
38 study (Eco-Design Forum for Civic Society, 2010) estimated that one
39 person not using plastic bags for a single year would reduce carbon
40 dioxide emissions by 18.9 kg. Therefore, reducing the usage of plastic
41 bags is considered one of the most simple and effective resource reduction
42 behaviors that everyone can perform on a daily basis.

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

50 Paper (2013), over 300 plastic bags per person are consumed every year.
51 Usage of free plastic bags at supermarkets is a repetitive type of behavior
52 in daily life, which is acknowledged as a habit (Aarts and Dijksterhuis,
53 2000; Ouellette and Wood, 1998). The habituation of free plastic bag use
54 induced an inconsistency between people's environmental concern and
55 their actual behavior. Through repetition of behavior in the same context
56 (e.g., regular supermarket), plastic bag usage is likely to become a
57 habitual behavior that is activated automatically. People who have formed
58 a habit behave automatically by reacting habitually in the same behavioral
59 setting, without further consideration of other available alternatives
60 (Danner et al., 2008; Neal et al., 2011). Thus, habitual behavior is elicited
61 automatically by a response to the behavioral context regardless of
62 environmental concerns, as long as the behavioral context is stable.

63 Although there have been some field experiments aimed at
64 promoting environment-friendly behavior, particularly in relation to
65 travel mode choice and water and energy conservation (Bamberg et al.,
66 2003; Heath and Gifford, 2002; Verplanken et al, 1998), only a few field
67 studies have focused on and measured habits for promoting resource
68 reduction behaviors. Knussen and Yule (2008) investigated the role of
69 recycling habits in the disposal of household waste. They suggested that
70 the lack of a recycling habit was an obstacle to behavioral change.
71 Therefore, the purpose of this study was to conduct a field study to
72 intervene in the behavioral context that induced habitual behavior and to
73 clarify psychosocial determinants of environmentally friendly behavior.

74

75

76

77 **2. Theoretical framework**

78

79 The theory of planned behavior (TPB: Ajzen, 1991; Ajzen and Madden, 1986) has
80 been one of most frequently cited models, in many domains of social science, for
81 understanding some psychosocial determinants of human social behavior (Nosek et al.,
82 2010). The TPB postulates that human actions are a result of consciously controlled or
83 deliberative decision-making. According to the TPB, an attitude does not directly
84 determine behavior, but does so only indirectly via a behavioral intention, which is a
85 deliberative motivation. The TPB also stresses the importance of social influences in
86 the behavioral decision. In addition to the influence of attitude, the behavioral
87 intention is also determined by perceived behavior control (PBC), which reflects the
88 extent to which an individual feels it to be easy or difficult to perform the behavior in
89 a given situation.

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

94 The TPB has been successfully applied to examine the psychosocial
95 determinants of resource reduction behaviors. For example, a study by Thøgersen
96 (1994) suggested the utility of the TPB framework to reveal the motivational process
97 of recycling behavior. Tonglet et al. (2004a) applied TPB to identify the determinants
98 of recycling behavior in a local curbside recycling scheme, and suggested that attitude
99 and past recycling behavior were the important determinants of intention. Moreover,
100 Tonglet et al. (2004b) showed that different factors are involved in waste
101 minimization and recycling behaviors. Knussen et al. (2004) also examined recycling
102 behavior using the TPB framework. They reported that the relationship between
103 perceived behavioral control and behavioral intention was weaker for people who

104 perceived that they lacked facilities for recycling.

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

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

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

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

154

155 **3. The present study**

156

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

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

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

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

182
183 Hypothesis 1-1. The introduction of prompt intervention would cause a shift from
184 unintended (habituated) behavior to intended behavior in shoppers.

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

188
189 This context change was expected to improve the psychosocial determinants of
190 shoppers' behavior. That is, the voice prompt intervention would activate a
191 consciousness toward discouraging plastic bag usage, causing the intended behavior
192 of rejecting the offer to use the plastic bags. Thus, the following was hypothesized:

193
194 Hypothesis 2. The behavioral intention, which is the conscious motivation to reduce
195 the use of plastic bags, would have a greater effect on the target behavior in the
196 presence of the intervention than in its absence.

197
198 It should be noted that the voice prompt used in this study did not include a
199 persuasive message (i.e., "You should reduce the usage of free plastic bags for
200 environmental conservation"), but a neutral message serving as a reminder of
201 behavioral choice (i.e., "Do you want free plastic bags?"). Because the voice prompt
202 does not produce a persuasive effect, the attitude to plastic bag usage would not be
203 changed. However, if the intervention changes the perception of other people's plastic
204 bag use, then social norm factors, such as a descriptive norm and an injunctive norm
205 might be reconsidered. Previous studies demonstrated that an intervention changed
206 the perceptions of a descriptive norm (Heath and Gifford, 2002) and a subjective norm
207 (Bamberg et al., 2003). Thus, we hypothesized the following:

208
209 Hypothesis 3-1. Shoppers may perceive that most shoppers receive free plastic bags in
210 the post-intervention than in the pre-intervention.

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

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

214
215 A voice prompt intervention was also expected to improve the PBC over
216 reduction of free plastic bag usage. A study of interventions (Heath and Gifford, 2002)
217 indicated that once people began to change their behavior as a result of an intervention,
218 they developed less biased and more realistic perceived behavioral control. Thus, we
219 hypothesized the following:

220
221 Hypothesis 4. People would evaluate PBC as more positive after reducing their usage
222 of plastic bags, as a result of the voice prompt intervention. In addition, influence of
223 PBC on behavior would become stronger during post-intervention than during
224 pre-intervention.

225
226 Furthermore, the results of a previous study suggested that the impact of
227 antecedents on pro-environmental motivation differ depending on the behavioral
228 context (Bamberg et al., 2007). Thus, we also constructed the following hypothesis:

229
230 Hypothesis 5. Improvements in the antecedents of dual motivations strengthen the
231 effect of behavioral intention on the behavior and weaken the effect of behavioral
232 willingness.

233
234 To test these hypotheses in the field, we collected two types of data: observations
235 of shoppers' actual plastic bag use at supermarkets, and responses to a questionnaire
236 that measured components of the dual-motivation model.

237

238

239 **4. Method**

240 4.1. Design

241 *4.1.1 Intervention procedure*

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

259 *4.1.2 Observation of behavior*

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

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

265 supermarkets, data collection was implemented on the Wednesday from 10.00 to 12.00,
266 from 13.00 to 15.00, and from 16.00 to 18.00. For the other two supermarkets, the data
267 collection was implemented on the Saturday. In the second (post-intervention) phase
268 of data collection, the procedures were identical to those used in the pre-intervention
269 phase. The total number of shoppers who were observed at the checkout counter was
270 4105 in the pre-intervention phase, and 4057 in the post-intervention phase.

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

282 4.2. Questionnaire items

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

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

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

291 people who are important to me (e.g., family or friends) would support a decision not
292 to receive free plastic bags” and “Most people would approve of me not receiving free
293 plastic bags.” The two items were averaged to give a subjective norm mean score (α
294 = .69).

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

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

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

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

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

328

329 **5. Results**

330 5.1. Observed behavior

331 As shown in Table 1, about 78% of shoppers received free plastic bags, and
332 22% of shoppers declined the bags during the pre-intervention phase. In addition,
333 about 73% of shoppers received free plastic bags, and 27% of shoppers declined the
334 bags in the post-intervention phase. There was a significant difference in the
335 proportions between pre- and post-intervention phases ($\chi^2(1) = 37.55, p < .001$). Thus,
336 the intervention including the voice prompt made shoppers less inclined to use free
337 plastic bags. Furthermore, there was no significant difference in the proportions
338 between Wednesday and Saturday ($\chi^2(1) = .03, p = .857$).

339 5.2 Demographics

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

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

346
347 5.3. Comparison of psychological constructs between pre-and post-intervention
348 samples

349 Table 3 shows the means and standard deviations of the constructs of the
350 dual-motivation model in the pre- and post-intervention samples. We implemented a
351 linear mixed model analysis because the four different supermarkets were nested
352 within intervention. The results indicated that attitude was almost unchanged between
353 the pre- and post-intervention samples (intervention; $F(1, 862) = 1.79$; intervention
354 (supermarket) = $F(6, 862) = .97$). However, subjective norm, descriptive norm,
355 perceived behavior control, behavioral intention, behavioral willingness, and
356 anti-plastic behavior changed from the pre- to the post-intervention assessment ($F_s >$
357 $8.46, p < .01$). Also, these effects on subjective norm, descriptive norm, behavioral
358 intention, behavioral willingness, and anti-plastic behavior differed between the
359 supermarkets ($F_s > 2.25, p < .05$). Therefore, although some constructs were not
360 equally affected between the supermarkets, overall, the intervention affected the
361 constructs of the dual-motivation model, except for attitude.

362
363 5.4. Differences in the dual model between the pre- and post-intervention samples

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

368 path coefficients in the two samples for the constructs of the dual-process model (χ^2
369 (12) = 82.49, $p < .01$, GFI = .97, CFI = .98, RMSEA = .08)³. Second, a fully
370 constrained model was estimated which assumes equal path coefficients for the two
371 samples ($\chi^2(21) = 121.38$, $p < .01$, GFI = .96, CFI = .95, RMSEA = .07). Thus, giving
372 up the constraints of equal path coefficients results in a significantly better model fit
373 ($\chi^2(9) = 38.89$, $p < .01$). As a last step, several constrained models were tested. All
374 paths between the constructs that seemed to show a statistically significant difference
375 in their coefficients in a fully-constrained model were additionally freed of equal path
376 constraints. A chi-square difference test was conducted to see if the additional path
377 release led to a statistically weaker model fit.

378 Table 5 shows the fit indexes of the constrained models and the unconstrained
379 model. The results show that a model without the constraints of equal path coefficients
380 from behavioral willingness and behavioral intention to behavior, from descriptive
381 norm to behavioral willingness and behavioral intention, and from perceived
382 behavioral control to behavioral intention and behavior, fit the data better ($\chi^2(17) =$
383 88.86, $p < .01$, GFI = .97, CFI = .97, RMSEA = .07). In particular, the Akaike
384 Information Criterion (AIC)⁴, which is used to compare competing models, indicates
385 a better fit of the unconstrained model (AIC = 166.86) relative to the other models
386 (AIC > 169.95).

387 Figure 3 shows the unstandardized and standardized path coefficients for the
388 pre- and post-intervention samples. The results indicate that the effect of behavioral
389 willingness on anti-plastic bag behavior was weaker in the post-intervention sample (β
390 = $-.12$, $p < .01$) than in the pre-intervention sample ($\beta = -.22$, $p < .01$). On the other
391 hand, the effect of behavioral intention on anti-plastic bag behavior was stronger in
392 the post-intervention sample ($\beta = .37$, $p < .01$) than in the pre-intervention sample (β
393 = $.25$, $p < .01$). Furthermore, the effect of perceived behavioral control on behavioral
394 intention was stronger in the post-intervention sample ($\gamma = .65$, $p < .01$) than in the

395 pre-intervention sample ($\gamma = .50, p < .01$). Although the influence of perceived
396 behavioral control on behavior was non-significant in the pre-intervention sample (γ
397 = .04, $p = .39$), this effect was significant in the post-intervention sample ($\gamma = .19, p$
398 < .01).

399

400 **6. Discussion**

401

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

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

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

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

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

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

466

467 **7. Conclusions**

468

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

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

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

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

Footnotes

522

523

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

525 ² Amos 20.0 was used for the analysis.

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

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

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

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539
540
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542 Co., Ltd. for conducting the large-scale intervention in the supermarkets.
543

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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.

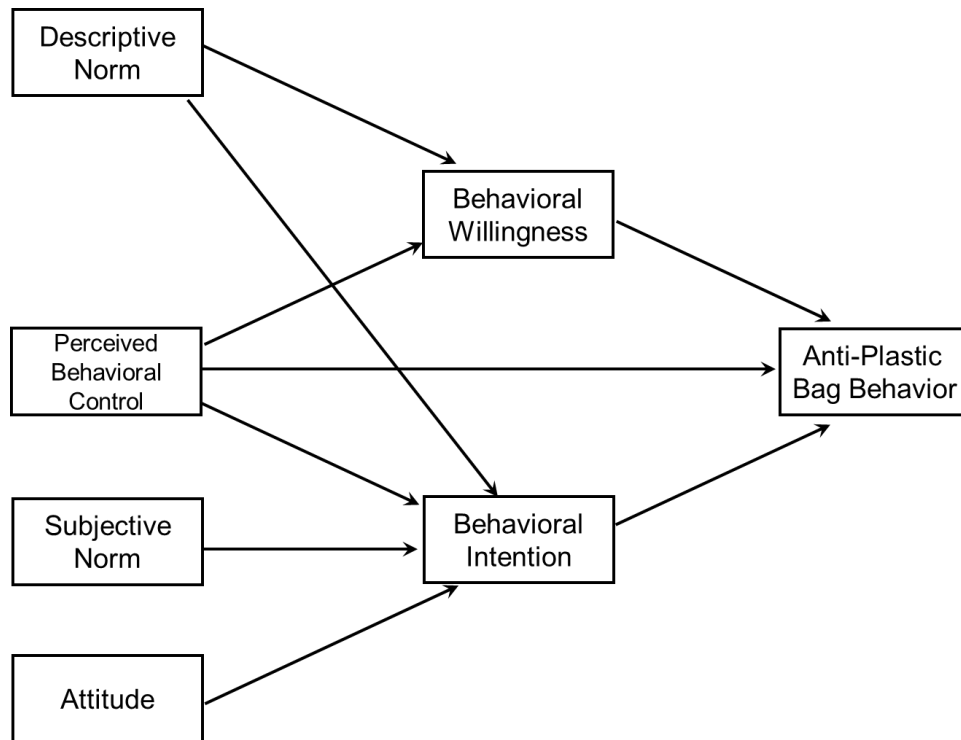


Figure 1. Theoretical model for anti-plastic bag behavior

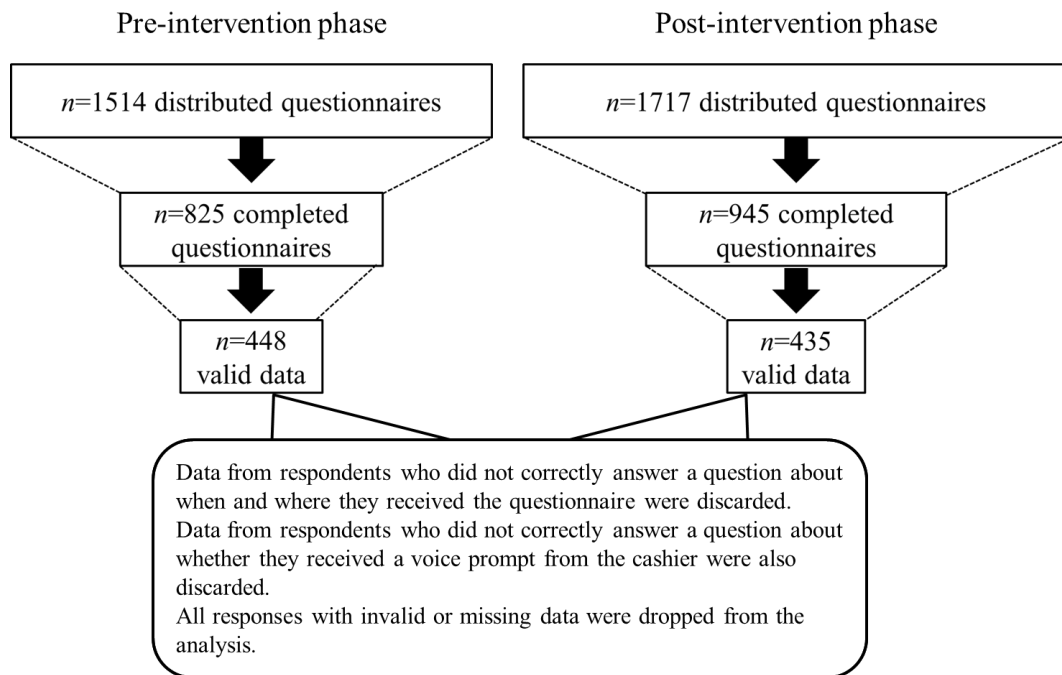


Figure 2. Collection of questionnaires

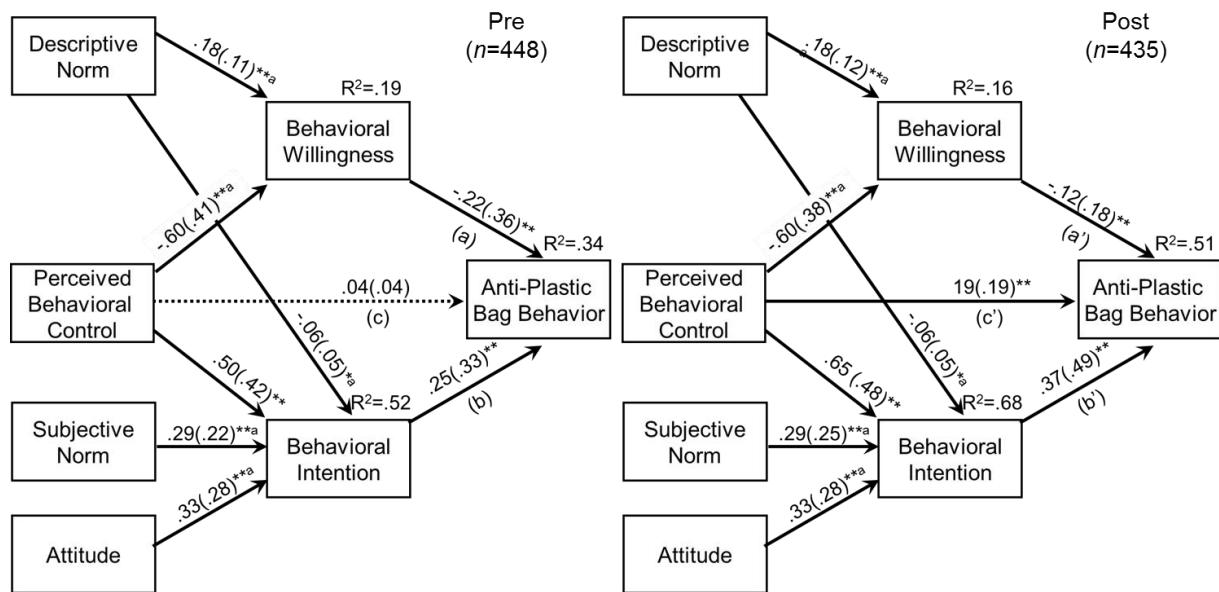


Figure 3. Multi-group analysis between the pre- and post-intervention samples

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.