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What predicts household waste management behaviors? Culture and type of behavior as moderators

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ABSTRACT

This study seeks to examine the factors predicting waste management behaviors— recycling (difficult and easy) and waste minimization—based on social norms and environmental orientation in a cross-cultural context. A survey conducted among 401 university students from Japan, Germany and Israel included measures of social norms for recycling and minimization, biospheric value orientation, environmental concern (NEP), and waste management behaviors. Results showed that difficult recycling was lower than the other two behaviors, and that household waste management behaviors were higher among Germans than among the other two groups. The relative contribution of environmental orientation to waste management behavior was generally weaker in Japan than in Germany and Israel. Social norms significantly predicted easy recycling and minimization in all three groups, and difficult recycling only in Germany and Israel. Social norms were a stronger predictor of easy recycling among Israelis than among Japanese. The research results imply that both structural contexts and cultural factors influence the extent to which people engage in recycling and waste minimization. The results highlight the importance of integrating cultural considerations into waste management strategies.

1. Introduction

Household waste production is a growing concern in both the developed and developing world (Barr, 2007). More than four billion tons of solid waste are generated every year, almost half of it is municipal solid waste (Gutberlet, 2015), which includes waste generated at households, offices and retail (Ayalon et al., 2013). Between 1980 and 2005 municipal waste generation within the OECD countries has increased by as much as 2.5% per year, and assuming no policies are introduced, the total municipal waste generation is likely to increase by a further 1.3% by 2030 (Ayalon et al., 2013).

Waste generated in landfill has severe local as well as global environmental impact. The local environmental impacts include air pollution, surface and groundwater pollution and land and marine contamination. In addition, solid waste management accounted for around 3% of global greenhouse gas emissions, with most of that attributable to methane emissions from landfill sites (UNEP, 2015). It was estimated that an effective waste management and promotion of waste prevention could lead to a 10 to 20% reduction in global greenhouse gas emissions (UNEP, 2015).

In the past three decades, governments and local authorities worldwide have promoted various waste management strategies aimed at reducing the amount of waste in landfills (Ayalon et al., 2013; Hotta and Aoki-Suzuki, 2014). Nevertheless, as modern lifestyle and consumption habits persist, the total amount of generated waste continues to grow (Ayalon et al., 2013; Wan et al., 2015). Since household waste production constitutes an important share of the overall waste generated, understanding the predictors of householders' waste management behavior is important for changing these behaviors (Barr, 2007; Ebreo and Vining, 2001; Pandi, 2018).

The present study investigated two kinds of household waste management behavior—recycling and minimization—and focused on cultural variations in two predictors of these behaviors, namely social norms and environmental orientation.

1.1. Household waste management behaviors

Many models suggest that pro-environmental behavior has a multidimensional structure and that variations may exist in the extent to which specific predictors are related to specific behaviors (for a review

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see Bratt et al., 2015). Two waste management behaviors are minimization and recycling.

Household recycling involves primary separation of waste at home, distinguishing recyclables from the rest of the waste, preparing items for collection (e.g., washing and/or squeezing them), and throwing them into the right bin (Varotto and Spagnoli, 2017). Some recycling bins, such as those for collecting plastic bottles and paper, are usually widely available and located close to people's homes, while others such as those for collecting batteries and electronics are less available. The accessibility of recycling bins determines the difficulty involved in carrying out the recycling (Kaiser and Wilson, 2000). Since the convenience of certain pro-environmental behaviors affects the likelihood they will be performed (Schultz, 2014), differences in the relative level of recycling products can be expected based on the availability of the appropriate bins. When studying recycling it may be effective to distinguish between "easy recycling" and "difficult recycling".

The term "waste minimization" refers to actions of people aiming at reduction of their contribution to the waste stream, such as purchasing beverages in refillable bottles, reusing plastic bags and repairing broken items (Thøgersen, & Grunert-Beckmann, 1997). Waste minimization is more effective than recycling in terms of environmental impact (e.g., energy investment, air pollution and resource consumption), and is placed at the top of the hierarchy of efficient waste management (Matsuda et al., 2018; OECD, 2000). Nevertheless, it gained less attention of researchers and of authorities who try to promote waste reduction (Varotto and Spagnoli, 2017; Wan et al., 2015).

One of the objectives of the present study is to address this gap by learning more about the ways social norms and environmental orientation predict minimization across cultures. The next sections explain the prediction ability of personal environmental orientation and social norms regarding recycling and minimization and discuss how culture can moderate these predictions.

1.2. Personal environmental orientation and household waste management

Different conceptualizations have been used interchangeably to describe connectedness to and concern for the natural environment. Among them are environmental concern, environmental attitudes, environmental values, and nature relatedness (Dunlap et al., 2000; Mayer and Frantz, 2004). The term "environmental orientation" is used hereafter as a general concept to describe this human-environment interface (Swami et al., 2011). We focused on two relevant measures to measure personal environmental orientation (environmental orientation hereafter): biospheric value orientation and environmental concern.

Biospheric value orientation reflects a concern for the quality of nature and the environment for their own sake, without any clear link to the welfare of other human beings (Steg and De Groot, 2012). Studies that have investigated the relations between value orientation and pro-environmental behavior found that the more strongly individuals subscribe to biospheric values, the more likely they are to engage in pro-environmental behavior (Steg and Vlek, 2009; Stern et al., 2005).

The concept of environmental concern is used in the literature to refer to a whole range of environmentally related perceptions, emotions, knowledge and attitudes (Bamberg, 2003). It is thought to be a key component in fostering ecological behavior and to impact a wide range of beliefs and attitudes concerning specific environmental issues (Dunlap et al., 2000; Mayer and Frantz, 2004; Stern et al., 1995). One of the ways to measure environmental concern is through the New Ecological Paradigm scale (NEP) developed by Dunlap et al. (2000). This scale measures individuals' worldview concerning their relationship with nature and their environmental awareness, and it is considered to be the most commonly used measurement of environmental concern (Stern, et al., 1995; Steg and Vlek, 2009). Worldviews are less general and less stable than are values and deal with a more specific domain of life, while values are more general and can be challenged only in terms of their desirability or appropriateness (Stern, et al., 1995).

A common assumption is that increasing personal concerns about the environment will increase pro-environmental actions (Eom et al., 2016). Yet empirical studies of these relations have yielded mixed results, and the overall explanatory power of environmental orientation regarding pro-environmental behavior is usually low to moderate (Bamberg, 2003; Kollmuss and Agyeman, 2002). In the case of household waste management behavior, predictors of recycling may differ from predictors of minimization. Recycling is a behavior that is explicitly related to environmental outcomes and can therefore be predicted by environmental concern. Minimization, on the other hand, relates not only to environmental concern but also to financial saving and consumption habits (Wan et al., 2015). It can therefore be assumed that environmental concern will exhibit a stronger association with recycling than with minimization. Yet previous research did not support this assumption. While minimization was found to be significantly related to environmental orientation (Barr, 2007; Ebreo, and Vining, 2001), the findings for recycling are mixed (Barr, 2007; Ebreo, and Vining, 2001; Schultz and Oskamp, 1996).

A possible explanation for these inconsistent findings is that the measures of recycling ignore the accessibility of recycling bins. In the case of bins that are more difficult to access, a conflict may arise between the motivation to carry out pro-environmental behavior and a hedonistic motivation to minimize effort (Steg et al., 2014). To control for this variation, we classified recycling behavior into two distinct categories according to the average reported availability of recycling bins, and measured easy recycling (i.e., recycling bins are available) and difficult recycling (i.e., recycling bins are difficult to access) separately. Given the importance of this variable, we controlled for reported availability of recycling bins at the individual level when predicting recycling behavior.

1.3. Social norms and household waste management behavior

Social norms refer to personal beliefs about the common or accepted behaviors within a group (Cialdini and Trost, 1998), and constitute a key cultural component in explaining behavior at the social and cultural level (Eom and Kim, 2015). They are enforced by (expectations of) externally administered rewards and/or punishments, including social pressure (Ajzen, 1988; Thøgersen, 2006).

A large body of research has demonstrated the role of social norms in explaining various social behaviors in general, and pro-environmental behaviors in particular (Cialdini et al., 1991; Schultz & Kaiser, 2012; Shteynberg, Gelfand, & Kim, 2009). More specifically to the field of household waste management, social norms were found to be significant in explaining both recycling (e.g. Barr, 2007; Boertelo & Costa, 2016; Schultz, 1999) and reduction in certain behaviors such as the use of plastic bags in supermarkets (de Groot et al., 2013). However, only few studies thus far have compared the effect of social norms and environmental orientation on both recycling and waste minimization, and the findings about this issue are not consistent. In a study performed among UK residences, Barr (2007) has found that while social norms were significant predictor of recycling, they had a neglected role in explaining waste minimization; Waste minimization on the other hand was found to be mainly related to environmental orientation, and particularly to biospheric values, and not related to social norms.

It should be noted that social norms can be internalized and lead to a development of internal sources of behavior as well (Bertoldo and Castro, 2016; Thøgersen, 2006). It is therefore important to investigate the association between environmental social norms and environmental orientation and their unique prediction ability regarding pro-environmental behavior. There is a variation in the strength external versus internal factors can predict behavior (Thøgersen, 2006), that can be partly explained by cultural differences.

1.4. Cross-cultural variation in household waste management level and in its predictors

Studies conducted in cross-cultural contexts have shown that endorsement of environmental protection is universally high in developed as well as developing countries (Milfont and Schultz, 2016; Steg and de Groot, 2012). Cross-cultural variations exist in awareness of specific environmental issues (e.g., Eisler et al., 2003) and in the implications of environmental orientation for pro-environmental behavior (Milfont et al., 2006). For example, in a study conducted in New Zealand, Milfont et al. (2006) found that biospheric concerns positively predicted pro-environmental behavior among European New-Zealanders but negatively predicted this behavior among Asian New-Zealanders (Milfont et al., 2006).

One of the cultural dimensions that may moderate the relation between environmental orientation and pro-environmental behavior is individualism-collectivism (Eom et al., 2016; Tam and Chan, 2017). Individualism refers to the degree to which a culture places priority on personal goals over the goals of the collective (Triandis et al., 1988). A large volume of research provides evidence that in individualist Western cultures the motivation for "good" actions comes mainly from inner preferences and values, whereas in collectivistic cultures such motivation comes from being receptive to specific others and to culturally inscribed norms (Kim and Sherman, 2007; Kim and Markus, 1999; Markus, 2016).

Since greater value is assigned to self-expression of internal attributes in individualistic than in collectivistic cultures, the actions of individuals in individualistic cultures should conform to their beliefs and attitudes more than in collectivistic cultures (Eom et al., 2016). It was therefore proposed that the association between environmental orientation and pro-environmental behavior would be stronger in individualistic than in collectivistic cultures (Eom et al., 2016; Tam and Chan, 2017). Thus far, only a few studies have explored these cross-cultural variations, among them two large studies investigating 47 countries (Eom et al., 2016) and 33 countries (Tam and Chan, 2017), showing that internal attributions were stronger predictors of pro-environmental behaviors in individualistic than in collectivistic cultures.

The established link between social norms and pro-environmental behavior is also assumed to be moderated by the cultural context, so that social norms may be more influential in collectivistic than in individualistic cultures (Eom et al., 2016; Kim and Markus, 1999; Zou et al., 2009). The few studies that investigated this assumption indeed confirmed it (Chan and Lau, 2002; Eom et al., 2016).

In the case of household waste management, another cultural factor which may affect the level of employing waste management behavior, as well as the extent to which norms and environmental orientation are related to each other and to recycling and minimization, is the maturity of recycling system and governmental regulation regarding waste management. It was found that governmental regulations convey normative message that may lead to a change in perceived social norms as well as in personal attitudes, and that with time, behaviors related to these regulations become expected within given contexts and eventually adopted at the personal level (Bertoldo and Castro, 2018; Tankard and Paluck, 2017). Following this line of thought, it is reasonable to expect that in nations in which regulations related to recycling and minimization are matured and well established, the related behaviors will also be established and higher compared to nations in which these regulations are less mature.

The present study aims to examine the impact of social norms and environmental orientation in predicting recycling (difficult and easy) and waste minimization in a cross-cultural context. The objectives of the study were: (1) to study cultural similarities and differences in the levels of environmental orientation, social norms regarding recycling and waste minimization, reported recycling and reported minimization and (2) to examine the role of culture in the extent to which environmental orientation and social norms explain recycling and

minimization. The research used samples of university students from Japan, Germany, and Israel. In terms of individualism-collectivism, Germany and Israel are considered as individualistic cultures, whereas Japan is considered a collectivistic culture (Hofstede et al., 2010; Kurman, 2003). In terms of maturity of household waste management regulations, Germany and Japan are among the world's leaders. Germany today is the leading nation in Europe in terms of recycling, and 70% of its municipal waste is recycled (Earth 911, 2017; How to Germany, 2018). In addition, in 2013 the German Federal Ministry of the Environment formulated a waste prevention program aimed at strengthening waste prevention policies and diminishing waste generated in landfills (Nelles et al., 2016). In Japan, the shortage of landfill made recycling important as a solution for reducing the amount of trash, and since 2000 several laws have been passed to motivate both business and households to recycle (McCurry, 2011). In addition, the Japanese government adopted the 3Rs principle (reduce, reuse and recycle) to promote environmentally sound waste management (Japan Ministry of the Environment, 2014). In Israel, waste reduction strategies have lagged behind those of other modern countries. Only in the last decade has the Israeli Ministry of Environmental Protection initiated a national program for waste recycling (MoEP, 2018). While waste recycling policy appears to be making progress, both minimization policy and education for minimization are still lagging behind in Israel (TASC, 2016). Indeed, media policy propaganda includes many commercials stressing the importance of recycling but does not address the environmental importance of minimization (reduction and reuse), and focusing mainly on plastic bottles, and containers of various kinds. Based on level of maturity, we can expect that household waste management behaviors in Japan and Germany will be higher than in Israel.

Another cultural aspect that may affect people's household waste management behavior, and particularly minimization, is cultural norms and values related to consumerism. As above mentioned, minimization relates not only to the environmental rationale but also to financial savings on the one hand and to lifestyle and consumption habits on the other (Wan et al., 2015). Moreover, consumption is not just a way to satisfy human material needs for shelter, food and clothing, it also has symbolic values and meanings, and serves to express one's identity, demonstrating status and social aspirations (UNEP, 2015).

Another possible source for cultural values that may reduce minimization is aesthetic values. In the case of Japan, cultural norms emphasize various forms of aesthetics. Anderson and Wadkins (1991) contended that the main values constituting Japanese culture favor form over content. In her book *Wrapping Culture*, Hendry (1993) discusses the wrapping of gifts as an important part of Japanese cultural practice to demonstrate one's courtesy toward the receiver (Hendry, 1993). Compatible with consumerism, these sorts of cultural values work to reduce minimization and are tolerant of the production of packaging waste in daily life. Taking this emic cultural dimension into consideration, we may expect that although Japan and Germany are similar in their household waste management regulation maturation, the level of minimization in Japan may be lower compared to Germany.

Thus far, limited research has compared predictors of recycling between nations according to the maturity of their recycling system (Bertoldo and Castro, 2018; Miliute-Plepiene et al., 2016). The present study will be one of the first to study recycling in such cross-national context.

In line with the theoretical background described above, we hypothesize the following:

- H1.** Reported recycling behavior will be higher in Germany and Japan than in Israel.
- H2.** Minimization will be (a) higher in Germany than in Israel and in Japan, (b) lowest in Japan.
- H3.** Biospheric value orientation and NEP (a) will positively predict waste management behavior, (b) will exhibit stronger relations with

easy recycling than with difficult recycling.

H4. Social norms (a) will positively predict waste management behaviors, and (b) will exhibit a stronger relationship with waste management behaviors among Japanese participants than among German and Israeli participants.

2. Method

2.1. Participants and procedure

The research was conducted among university students in Japan, Germany, and Israel, who participated in the study for academic credit. Participants totaled 401 students: 136 Japanese ($M_{age} = 22.00$, $SD = 1.60$; 25.00% females), 119 Germans ($M_{age} = 24.20$, $SD = 7.37$; 76.50% females), and 146 Israeli Jews ($M_{age} = 24.50$, $SD = 3.06$; 75.00% females). Due to cultural differences in gender distribution we added gender as a control variable in further analyses.

An online questionnaire was administered through Google Docs. Scales that had not been previously translated into German, Japanese or Hebrew were translated and back-translated by two independent translators for each language, being highly proficient in the languages involved. All participants submitted their written consent before participating.

2.2. Measures

2.2.1. Biospheric value orientation

We used the biospheric value orientation sub-scale (de Groot and Steg, 2008). This sub-scale includes four items, each pertained to a different value: earth, unity with nature, protecting the environment, and preventing pollution. In line with de Groot and Steg (2008) the scale ranges between - 1 (contrary to my values) and 7 (extremely important). Previously, Cronbach's alpha was reported as 0.83 and 0.86 (de Groot and Steg, 2008). In the present study Cronbach's alpha values for the Japanese, German and Israeli samples were 0.93, 0.88 and 0.89, respectively.

2.2.2. NEP

This scale consists of 15 items representing beliefs related to human domination over nature. For each item, respondents are required to state their approval on a scale ranging from 1 (strongly disagree) to 5 (strongly agree). Seven of the items were reversed (Dunlap et al., 2000). Reported Cronbach's alpha of the scale was 0.83 (Dunlap et al., 2000). Cronbach's alpha values for the Japanese, German and Israeli samples were 0.63, 0.77 and 0.82, respectively.

2.2.3. Social norms for recycling and social norms for minimization

Each of the variables was measured by two 6-point Likert-type scale items, ranging from 1 (does not represent me at all) to 6 (represents me to a large extent). The scale was based on items from previous studies that measured social norms toward environmental behavior and recycling (Bortoleto, Kurisu, & Hanaki, 2012; Tonglet et al., 2004). Reported Cronbach's alpha of the scales in previous studies were 0.60 (Bortoleto, Kurisu, & Hanaki, 2012), and 0.78 (Tonglet et al., 2004). Items for recycling were: "Most people who are important to me make an effort to recycle their waste", and "Most people I know recycle their waste on a regular basis"; Cronbach's alpha values for the Japanese, German and Israeli samples were 0.78, 0.86 and 0.78, respectively. Sample item for minimization: "Most people who are important to me make an effort to reduce their waste production", and "Most people I know prefer to purchase reusable products rather than disposable items"; Cronbach's alpha values for the social norms for minimization scale for the Japanese, German and Israeli samples were 0.67, 0.70 and 0.54, respectively.

2.2.4. Reported waste minimization

Fifteen items for the waste minimization scale were designed based on previous studies that focused on waste management behaviors (Barr, 2007; Ebreo, and Vining, 2001). Respondents rated the extent to which each item represented them on a 6-point Likert-type scale ranging from 1 (does not represent me at all) to 6 (represents me to a large extent). Sample item: "I buy products with as little packaging as possible" (For a detailed description of the items see Table I in the electronic appendix.) Cronbach's alpha values of this scale for the Japanese, German and Israeli samples were 0.82, 0.80 and 0.87, respectively.

2.2.5. Availability of recycling bins

Respondents were asked to indicate the proximity of each type of bin to their residence ("quite close to my home"/"not very close but can be reached"/"very far"/"I do not know"). We then calculated the mean value for availability based on participants' reports for each material in each of the samples. All three groups described five kinds of bins as available within a reasonable distance: plastic bottles, paper, containers of various types, beverage cans and cardboard and two types of bins as or not readily available: electronics and batteries. We therefore calculated two availability variables: one was the mean of availability of the five available bins, and one was the mean of the two more difficult to reach bins.

2.2.6. Reported recycling behavior

Respondents were asked to indicate the percent of the products they recycle in nine categories of products (glass, plastic bottles, paper, containers of various kinds, beverage cans, cardboard, wet waste, electronics and batteries) on a 6-point Likert-type scale ranging from 1 to 6. The degrees were conceptualized as followed: 1(0–10%); 2(11–30%); 3(31–50%); 4(51–70%); 5(71–90%); 6(91–100%) (hereafter the term "recycling" refers to "reported recycling"). Two measures were created: Easy recycling, the mean of the reported recycling of the 5 materials with available bins; and difficult recycling, the mean of the reported recycling of the materials with not readily available bins. Cronbach's alpha values for the easy recycling scale for the Japanese, German and Israeli samples were 0.90, 0.72 and 0.90, respectively. Cronbach's alpha values for the difficult recycling scale for the Japanese, German and Israeli samples were 0.69, 0.77 and 0.77, respectively.

3. Results

The first and second research hypotheses pertained to cross-cultural differences in waste management behaviors. We tested them within a mixed-design ANOVA, with type of behavior as a within-subject factor (easy recycling, difficult recycling, minimization) and culture (Israel, Germany, Japan) as a between-subject factor. This analysis enables a comparison between the waste management behaviors themselves.

All effects were significant at a p -level $< .001$. The effect of type of behavior [$F_{(2,794)} = 100.80$, $p < .001$, $\eta_p^2 = .20$] emerged from lower scores for difficult recycling than for the other two behaviors. A significant main effect of culture [$F_{(2,397)} = 163.32$, $p < .001$, $\eta_p^2 = .45$] was explored by post-hoc Scheffé tests. Germans (G) were significantly higher than Japanese (J) and Israelis (I) in easy recycling (G: $M = 5.03$, $SD = 1.05$, J: $M = 3.01$, $SD = 1.05$; I: $M = 3.15$, $SD = 1.66$); difficult recycling (G: $M = 4.49$, $SD = 1.50$, J: $M = 2.08$, $SD = 1.25$; I: $M = 1.97$, $SD = 1.48$) and minimization (G: $M = 4.55$, $SD = 0.68$, J: $M = 2.96$, $SD = 0.78$; I: $M = 3.38$, $SD = 0.96$). No statistical difference was found between Israelis and Japanese. The interaction between culture and type of behavior [$F_{(4,794)} = 15.7$, $p < .001$, $\eta_p^2 = 0.07$] revealed cross-cultural differences in the relative levels of the three behaviors in the three samples (see Table 1 and Fig. 1). H1 was supported by the findings, as recycling level was higher among Germans than among Israelis. However, the hypothesis that Japanese recycle more than Israelis was not supported. The significantly higher waste

Table 1
Means, standard deviations and *F*-tests for the pro-environmental behaviors by cultures.

	Japanese (n = 136)		Germans (n = 119)		Israelis (n = 146)		F (2,397)	η_p^2
	M	SD	M	SD	M	SD		
Easy recycling	3.01 ^b	1.45	5.03 ^a	1.05	3.15 ^b	1.66	77.55 ^{**}	.28
Difficult recycling	2.08 ^b	1.25	4.49 ^a	1.50	1.97 ^b	1.48	125.89 ^{**}	.39
Minimization	2.92 ^c	.78	4.55 ^a	.68	3.38 ^b	.96	130.23 ^{**}	.40

Note: Groups marked by the same letter are not statistically different according to Scheffé post-hoc tests.

* *p* < .05.

** *p* < .01.

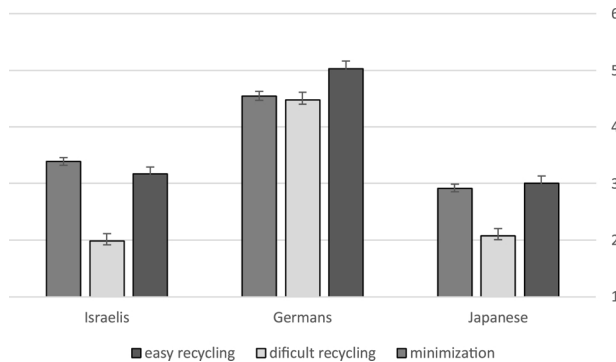


Fig. 1. Means of easy recycling, difficult recycling, and minimization in the three groups.

management behaviors among Germans than among Japanese and Israelis confirmed H2a, and H2b was confirmed as minimization was significantly lower in Japan than in the other two cultures.

The rest of the hypotheses pertained to the prediction of waste management behavior. To test them we first computed multiple linear regression analyses for each of the waste management behaviors across cultures (Table 2). The predictors were culture (as dummy variables, with Japan as the omitted category, creating Germany-Japan, and Israeli-Japan contrasts), biospheric value orientation (BVO), NEP and social norms. The model also included three interactions between culture and each of the other predictors (SN, BVO, and NEP), and two control variables: availability of recycling bins (not relevant to prediction of minimization) and gender. For all three behaviors, the regression model explained high portions of the variance: 56% for easy recycling, 56% for difficult recycling and 53% for minimization. For both easy and difficult recycling, the regression coefficient of

Table 2
Standardized regression coefficients predicting pro-environmental behavior by the study's variables across cultures.

	Easy recycling	Difficult recycling	Minimization
Adj. R ²	.56 ^{**}	.56 ^{**}	.53 ^{**}
Availability	.36 ^{**}	.35 ^{**}	NA
Gender	.09 [*]	-.01	-.04
Germany [#]	-.38	-.40	.29
Israel [#]	-1.16 ^{**}	-.55	-.77 [*]
BVO	.14 ^{**}	.03	.03
NEP	-.14	-.03	.07
SN	.14 [*]	.06	.17 [*]
Germany X BVO	-.08	.27 [*]	.44 ^{**}
Israel X BVO	.11	.12	.21
Germany X NEP	1.02 ^{**}	.43	-.13
Israel X NEP	.87 ^{**}	.25	.72 [*]
Germany X SN	-.04	.24	.08
Israel X SN	.24 [*]	.22	.09

[#] The groups are compared with the omitted category, Japan.

* *p* < 0.05.

** *p* < .01.

availability of recycling bins was significant. Gender was a significant predictor only for easy recycling (women recycled more than men).

H3 focused on the prediction ability of the two variables that represent environmental orientation, NEP, and BVO regarding waste management behaviors. H3a and H3b dealt with their general prediction. The regression coefficients of BVO was significant in predicting easy recycling ($\beta = .14, p < .01$), but not difficult recycling or minimization. NEP was not a significant predictor at all. These results yield only weak support for H3a and b. Nevertheless, significant interactions with culture imply that these hypotheses should be further explored. Separate regression models were computed for each culture (see Table 3). Explained variance was 30%, 15% and 11% in Japan, 41%, 33% and 36% in Germany and 47%, 35% and 36% in Israel; for easy recycling, difficult recycling and minimization; respectively.

The regression models revealed that for easy recycling at least one of the environmental variables significantly predicted waste management behavior in each culture. For the Japanese it was BVO ($\beta = .17, p < .05$), for the Israelis it was both BVO ($\beta = .23, p < .01$) and NEP ($\beta = .14, p < .05$), and for the Germans it was NEP ($\beta = .20, p < .05$). In the case of difficult recycling BVO was a significant predictor among Germans ($\beta = 0.25; p < .01$) but not among the Israeli and the Japanese samples, and NEP was not significant in any of the samples. In the case of minimization, NEP was a significant predictor ($\beta = .32, p < .01$) for Israelis but BVO did not, and among the Germans BVO was a significant predictor ($\beta = .46, p < .01$) but NEP did not. Among the Japanese none of these two variables contributed significantly to minimization. Note that the common variance between BVO and NEP (see Table II in the electronic appendix) reduced the probability that both will be significant predictors of behavior in the same model. Considering this common variance it can be concluded that H3a was supported for Germany, as in each of the three household waste management behaviors at least one of environmental orientation variables predicted the behavior significantly; partly supported for Israel, as BVO and/or NEP significantly predicted easy recycling and minimization, but not difficult recycling; This hypothesis was not confirmed for Japanese (but is in line with H3b).

Hypothesis 3b maintained that BVO and NEP will be stronger predictors in the more individualistic countries, Germany and Israel, than in Japan. A significant interaction between NEP and culture was found for both the Israel-Japan contrast ($\beta = .87, p < .01$) and the Germany-Japan contrast ($\beta = 1.02, p < .01$) in predicting easy recycling, a significant interaction between BVO and culture was found for the German-Japan contrast in predicting difficult recycling ($\beta = .27, p < .05$) and minimization ($\beta = .44, p < .01$) and a significant interaction between culture and NEP was found for the Israel-Japan contrast in predicting minimization ($\beta = .72, p < .01$). The separate regression models showed that whereas among the German sample BVO and/or NEP significantly predicted all three household behaviors ($\beta_{NEP} = .20, p < .05$ for easy recycling, $\beta_{BVO} = 0.25, p < .01$ for difficult recycling, and $\beta_{BVO} = .46, p < .01$ for minimization), among the Israeli sample they significantly predicted two of the behaviors ($\beta_{NEP} = .14, p < .05$, and $\beta_{BVO} = .23, p < .01$ for easy recycling, and for easy recycling, $\beta_{BVO} = 0.25, p < .01$ for difficult recycling, and $\beta_{BVO} = .32,$

Table 3
Standardized regression coefficients predicting pro-environmental behavior by culture.

	Easy recycling			Difficult recycling			Minimization		
	Japan	Germany	Israel	Japan	Germany	Israel	Japan	Germany	Israel
Adj. R ²	.30**	.41**	.47**	.15**	.33**	.35**	.11**	.36**	.36**
Avail.	.43**	.48**	.41**	.36**	.45**	.45**	—	—	—
gender	.17*	.06	.10	.08	-.11	-.02	.05	.05	-.18
BVO	.17*	.11	.23**	.04	.25**	.15	.03	.46**	.13
NEP	-.11	.20*	.14*	-.02	.10	.06	.04	.12	.32**
SN	.16*	.15*	.30**	.10	.23**	.26**	.36**	.30**	.38**

Note: Avail. = availability.

* $p < 0.05$.

** $p < .01$.

$p < .01$ for minimization), and among the Japanese only one ($\beta_{BVO} = .17, p < .05$ for easy recycling). Overall, these findings generally support H3b for the case of Germany-Japan comparison. In the case of Israel-Japan comparison the findings support the hypothesis only in two out of the three examined behaviors.

Hypotheses 4 dealt with social norms. H4a maintained that social norms would predict waste management behaviors. The models for the total samples revealed significant prediction for easy recycling ($\beta = .14, p < .05$) and minimization ($\beta = .17, p < .05$). Separate analyses for each culture showed that social norms significantly predicted all three behaviors in Germany and in Israel: easy recycling (G: $\beta = .30, p < .01$; I: $\beta = 0.15, p < .05$), difficult recycling (G: $\beta = .23, p < .01$; I: $\beta = 0.15, p < .05$), and minimization (G: $\beta = .30, p < .01$; I: $\beta = .26, p < .01$). Among the Japanese, social norms significantly predicted easy recycling ($\beta = .16, p < .05 = .16$) and minimization ($\beta = .36, p < .01$) but not difficult recycling. These results are not in line with H4b, which maintained that social norms would be a stronger predictor of waste management behavior in Japan than in the other two countries. In fact, an interaction effect was found for the Israeli-Japan contrast ($\beta = 0.24, p < .05$), but the differences were not in the hypothesized direction. Nonetheless, the findings show that while in the case of Germany and Israel both environmental orientation and social norms predicted minimization as well as recycling, in the case of Japan only social norms were a significant predictor.

Note that for hypotheses 3 and 4 the same trends were found when simple correlations were compared (see Electronic Appendix).

4. Discussion and conclusions

As household waste generated in landfill has severe local and global environmental impact, it is important to study the predictors of household waste management behaviors. Scientific knowledge on individual, as well as cultural aspects of recycling and waste minimization can help to design more waste management strategies. The aim of the present paper was to address this need. The present study shows that both individual and cultural factors may affect household waste management behaviors.

4.1. Cross-cultural differences in the level of household waste management behavior

In line with our expectations, the levels of both recycling (easy and difficult), and minimization were higher among the German sample compared to the Israeli sample. It seems that the long-lasting tradition in Germany of addressing environmental issues in general and recycling and minimization in particular, compared to a relative new tradition of environmentalism in Israel lead to greater internalization of these behaviors. It seems that as Bertoldo and Castro (2018) suggest, the rency of regulations related to household waste management have an impact on the extent to which these behaviors are internalized and

implemented. Nevertheless, in oppose to our expectation, the level of recycling in Japan was not significantly higher compared to Israel and was significantly lower compared to Germany. These findings are somewhat surprising considering the long-lasting regulations of waste management in Japan It is therefore suggested that other cultural or contextual factors as well as individual factors may affect the level of recycling, other than the ones that were included in the present study. Further research will be needed to address those issue.

As was expected, the level of minimization was lower among Japanese comparing to German and Israeli participants. Apparently, in Japan cultural esthetic values which affect minimization despite long lasting regulations related to waste management (Saito, 1999).

4.2. Cross-cultural differences in the predictors of household waste management behavior

In general, environmental orientation exhibited a stronger relationship with household waste management behavior among German and Israeli participants than among Japanese participants, as expected. This pattern of findings is in line with a body of research suggesting that inner preferences and values are more dominant in affecting behavior in individualist Western cultures than in collectivistic cultures, in which such motivation derives from being receptive to social norms (Eom et al., 2016; Markus, 2016; Kim and Sherman, 2007; Kim and Markus, 1999).

Nevertheless, in the case of difficult recycling, the power of environmental orientation in explaining the behavior was not significant among both Israelis and Japanese. Possible explanation for this result may be relates to the high amount of time and effort required to perform difficult recycling. Some previous studies have shown that when performing a behavior is more difficult, time consuming or expensive, attitudinal factors become weak predictors of behavior (Kaiser and Schultz, 2009). One of the models which address this issue is the Campbell paradigm (Kaiser et al., 2010), which claims that discrepancies between declarative and actual behaviors results from difficulties in performing the behaviors. They suggest that difficulty associated with some behaviors could mask the behavior-personal commitment relations. Thus, when people behaviorally manifest an attitude, they favor more convenient and undemanding behaviors over more strenuous and demanding ones (Kaiser, et al., 2010). This theoretical model may explain why in Israel, as well as in Japan, environmental orientation predicted easy recycling but not difficult recycling.

Lastly, in contradiction to our expectation, social norms was not a stronger predictor of household waste management behavior among Japanese than among Israelis and Germans. Furthermore, significant interaction was found, in which social norms was a stronger predictors of easy recycling among Israelis than among Japanese. These results are not in line with previous findings from cross-cultural studies that compared the role of social norms in explaining pro-environmental behavior (Chan and Lau, 2002; Eom et al., 2016)

An interesting explanation to the interaction effect of the Israel-Japan contrast can be found in [Miliute-Plepiene et al. \(2016\)](#) study. They showed that social norms were found to be important for source sorting in the early-stage recycling system but not in the mature recycling system. As Israel is in the early stage of the recycling system social norms may be especially relevant to behavior. Indeed, intensive campaigns are promoted in the Israeli media, which convey normative message about the importance of recycling. These campaigns focus mainly on recycling of bottles and containers of various kinds, two kinds of materials which are part of the easy recycling group, and may enhance the predicting ability of social norms in regard to easy recycling among Israelis. The non-significant role of social norms in predicting difficult recycling calls for further examination of this issue. Qualitative research which would focus on norms related to waste management, and on possible cultural and social sources for these norms might shed more light on this issue, and provide explanation to this pattern of results.

4.3. Contribution of the study to theory and to future research

In this study predictors of recycling and minimization were compared in three countries which differ in the level of household management maturity, and in cultural level of individualism versus collectivism.

Thus far limited research has compared predictors of recycling between nations according to the maturity of their recycling system ([Bertoldo and Castro, 2018](#); [Miliute-Plepiene et al., 2016](#)). The findings of this research contribute to the understanding of how external regulations may have an effect on internal development of standard related to recycling, and provide confirmation to models that discuss the way social norms are internalized ([Bertoldo and Castro, 2016](#); [Thøgersen, 2006](#)). The study also contributes to understanding of how cultural factors may affect pro-environmental behavior.

This study is also one of the first to investigate the effect of both social norms and environmental orientation on waste minimization. Many studies thus far investigated the predictors of recycling; yet directed less attention to differences in the predictors of recycling compared to minimization. In addition, this study is one of the first to distinguish between easy and difficult recycling. The research findings highlight the important of investigating the predictors of each of them separately, both because of differences in the level of performing them, and because of differences in the pattern of their predictors: among the Japanese sample environmental orientation predicted easy recycling but not difficult recycling and minimization, and social norms predicted easy recycling and minimization but not difficult recycling, among the Israeli sample environmental orientation predicted easy recycling and minimization, but not difficult recycling. These findings are consistent with previous research that highlighted the multidimensional nature of pro-environmental behavior ([Bratt, Stern, et al., 2015](#)). However, another interesting finding, is that in the case of Germany both environmental orientation and social norms contributed significantly to the explanation of all three behaviors.

4.4. Limitations and suggestions for future studies

This study was based on three student samples. The advantage of using student samples is that they are quite relatively comparable in aspects such as education and age. Nevertheless, since students are a distinct social group in any culture, caution should be taken in generalizing the conclusions to the entire culture. A replication of the study with community samples is needed. Furthermore, in this study we did not collect information on socio-cultural status of participants. Since it is not clear whether socio-economic factors affected students' behavior it is recommended that a future study will also include such information, in order to provide further understanding on social and cultural predictors of waste management behavior

The data in this study were based on self-reports. Self-reports are often thought to be not sufficiently rigorous to investigate pro-environmental behavior due to social desirability and inaccurate self-reports ([Kormos and Gifford, 2014](#)). Yet the alternative, which involves direct observation of recycling bins, poses a major disadvantage: The amount of waste in the recycling bins does not provide information on how much recyclable waste was placed in the regular mixed waste bin or on personal percentages of recycling. In line with this rationale, in this study we used a self-report measure of recycling percentages to assess recycling behavior.

Another limitation of this study relates to low internal consistencies in some cases. A relatively low internal consistency of social norms for waste minimization was found mainly in Israel. This may be related to low public awareness of minimization as a mean for waste reduction in Israel. A relatively low internal consistency was found for NEP among Japanese. In addition, this scale did not show any significant relations with other variables in Japan. These findings in Japan may be an outcome of cultural variance in the way environmental beliefs are structured. The underlying assumption in the development of the NEP scale was that people have a dualistic view regarding nature, so that they either believe that people should dominate or not dominate nature. However, world-views of non-Western individuals are not necessarily dualistic, since they may endorse the NEP and, simultaneously, believe that human beings are “special” ([Bechtel et al., 2006](#)). Findings of a research which compared the structure of NEP in Japan, US, Mexico and Peru found support to this suggestion ([Bechtel et al., 2006](#)).

Because of these findings regarding NEP, and since among Japanese the predictors examined in the current study explained relatively small part of the variance of difficult recycling and minimization, it is recommended that further research should explore the predictors of this behavior in Japan (and maybe in other collectivistic cultures). A first step in this direction could be a qualitative study aimed to explore reasons for consumption and avoiding minimization.

4.5. Conclusions

Since recycling of all kinds, as well as minimization, are important for environmental improvement, the findings of the present research should be taken into consideration when initiating new municipal and governmental recycling programs. Special efforts should be directed at solutions that improve recycling rates for materials that currently fall into the category of difficult recycling—that is, batteries and electronics—since the relative level of their recycling is significantly lower compared to the recycling of other materials for which the bins are easier to find. Structural improvements such as reducing the distance to the recycling point can be very effective in increasing recycling rates immensely, as well as campaigns that make use of social influence to promote the recycling of materials for which recycling requires some effort ([Otto et al., 2018](#)).

Our research shows that different structural contexts (such as recycling systems) as well as cultural factors influence the extent to which people engage in pro-environmental behavior such as recycling and waste minimization. Moreover, the influence of individual preferences and motives such as pro-environmental orientation and the influence of social norms on pro-environmental behavior differ with respect to culture. More effort should therefore be invested in developing research paradigms that account for cultural factors.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.resconrec.2019.01.045>.

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