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Environmentally friendly behavior - can heterogeneity among individuals and contexts/environments be harvested for improved sustainable management?

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Abstract

The study of behavior with environmental consequences (recycling, water conservation, and so on) has received a significant attention from social scientists over the past few decades. However, few studies have closely examined the systematic heterogeneity of behavior with environmental consequences. This study tests two specific hypotheses about such heterogeneity: that individuals differ systematically in their patterns of behavior with environmental consequences, and that behavioral patterns systematically differ between contexts/environments. We investigate both hypotheses empirically in the home and vacation environment. Results support the assumption that systematic differences in behavioral patterns exist across individuals. With respect to contexts/environment dependence, some groups of individuals do not change their behavior much between contexts/environments. The majority, however, tends to engage in fewer pro-environmental behaviors in the vacation context. These findings have significant implications for environmentally sustainable management, both for local councils and tourism destinations.

Keywords: heterogeneity, patterns of pro-environmental behavior, context dependence, environment dependence

1 Introduction

The study of behavior with environmental consequences has a long tradition among social scientists. Besides the theoretical value of such studies, they are of significant practical value because they identify for organizations and policy makers which actions to take to increase the level of pro-environmental behavior, and consequently protect natural resources.

Research into household recycling behavior identifies several ways to increase household recycling, including information campaigns, prompting, and "block-leader programs," where community members encourage their neighbors to recycle (Hopper & McCarl Nielsen, 1991). These reports indicate that information campaigns should focus on awareness and favorability of recycling, rather than attitudes towards recycling themselves (Oskamp et al., 1991). Another highly practical finding to emerge from research into recycling behavior is the central importance of external conditions; more specifically, owning a recycling bin (Guagnano, Stern, & Dietz, 1995). Also, Barr (2007) demonstrates that encouraging different forms of household waste management requires different interventions from policy makers.

Research into public acceptance of recycled water in areas where the availability of drinking water is limited (Bruvold & Ward, 1970; Baumann, 1983; McKay & Hurlimann, 2003; Hurlimann & McKay, 2004; Dolnicar & Schafer, 2006) helps inform policy makers about the areas of application where people would be most comfortable using recycled water, but also about strategies to increase public acceptance for alternative water schemes, thus addressing an environmental issue of major national importance.

Research into environmental volunteering (Edwards & White, 1980; Yavas & Riecken, 1985; Florin, Jones, & Wandersman, 1986; Curtis, Grabb, & Baer 1992; McPherson & Rotolo, 1996; Reed & Selbee, 2000; Dolnicar & Randle, 2004) provides information to

volunteering organizations about the segments of the community which are more likely to engage in environmental volunteering — essential knowledge in an increasingly competitive market where volunteers must be actively attracted.

Several studies investigate emotional and attitudinal aspects associated with various kinds of pro-environmental behavior, such as giving financial support to protected parks, and household gas consumption (Becker, Seligman, Fazio, & Darley, 1981; Kals, Schumacher, & Montada, 1999; Carrus, Bonaiuto, & Bonnes, 2005). These studies show how emotional affinity and positive attitudes to people's natural environment increase pro-environmental behavior. This indicates to practitioners that active communication campaigns aimed at improving attitudes, and possibly increasing emotional affinity, represents one possible avenue to increase pro-environmental behavior in the community.

Despite the wide range of behaviors with environmental consequences which have been studied, only a few studies investigate heterogeneity of behavior with environmental consequences, both between individuals and between contexts or environments. A review of articles published in the past two years in *Environment and Behavior* supports this: 17 articles investigate behavior related to the environment, mostly using behavior as a dependent variable (such as recycling, the use of public transport, water conservation, buying of organic food, and so on). Of these 17 studies, 47 percent account for heterogeneity of individuals, typically by investigating whether socio-demographic (six percent), psychographic (42 percent), or both socio-demographic and psychographic (42 percent) differences between individuals are related to behavior affecting the environment. "Psychographic variables" refer to personal characteristics related to attitudes, values, personality, or lifestyles. Only one study uses a multidimensional answer pattern of respondents to investigate individual-level heterogeneity: Bodur and Sarigollu (2005), which grouped individuals on the basis of nine

variables indicating their pattern of pro-environmental behavior (such as using less pollutant fuels, using heating at low levels, and so on). They identified three groups: the active concerned, passive concerned, and unconcerned individuals, and showed that these segments differ in several socio-demographic and psychographic dimensions. However, Bodur and Sarigollu do not consider different contexts in their study. Only one study out of the 17 reviewed investigates different contexts: Bamberg (2006), which discusses changes in public transport use when individuals move to a new location, which found that a particular intervention (a free public transport ticket and individual schedule recommendation) was effective in increasing people's use of public transport. Bamberg argues that the intervention alone did not cause the effect, but that the change in the environment and its interaction with the intervention were responsible for the alteration. The mechanism proposed by Bamberg is likely to affect other kinds of behavior in different contexts, such as pro-environmental behavior in the home or vacation context.

This paper contributes to the understanding of environmentally friendly behavior by investigating systematic heterogeneity in environmentally friendly behavior. "Heterogeneity" merely denotes that differences exist between individuals. Generally, not all differences between people can be explained; some heterogeneity might be due to independent, but possibly latent variables. These can be used to explain differences between people, and we refer to as "systematic heterogeneity" throughout this paper. We focus on two specific aspects of heterogeneity: inter-individual heterogeneity and context/environment heterogeneity. With respect to inter-individual heterogeneity, we offer the hypothesis (H1) that individuals differ in the environmentally friendly behaviors they undertake — in the general level of their environmentally friendly behavior, but also in the actual activities they engage in. With respect to context/environment heterogeneity, we hypothesize (H2) that individuals will engage in different environmentally friendly behaviors in different contexts/environments.

More specifically, we investigate this question for the home and vacation contexts/environments. It is not clear *a priori* whether individuals feel more obliged to behave in an environmentally friendly way at home or on vacation. It could be hypothesized that they would behave more environmentally friendly at home because the long-term impact of their behavior is more immediate to them. Alternatively, individuals might behave more environmentally friendly on vacation because they are guests, and guests behave respectfully.

The results of this study have significant practical implications: if inter-individual heterogeneity exists, people with specific behavioral patterns (environmentally friendly market segments) could be targeted with customized social advertising messages. For instance, an advertising campaign promoting rainwater tanks could be developed in a much more effective and efficient way knowing which individuals will be attentive to such a message, and what main arguments in the message to use to appeal to these people. If the context/environment heterogeneity hypothesis is supported, reasons need to be identified why such behavioral differences exist. If, for instance, lack of infrastructure emerges as the main reason for lower levels/different patterns of environmentally friendly behavior on vacation, a tourism destination could take active measures to improve the situation. If, however, attitudinal reasons are the cause of behavioral differences, tourism management may actively have to target environmentally friendly people, because improving the infrastructure is unlikely to have a positive effect on the environmental friendliness of tourists' behavior.

2   Data and Methodology

The data was collected through a permission-based internet panel. These panels are maintained by market research companies. The members of the panels (who give their permission to be contacted for the purpose of research) are recruited through a wide range of communication channels (internet, mail, telephone), and the panel profile is maintained to be

representative of the respective nation's census profile. Panel members receive a small monetary compensation for their help. The amounts are set by the market research company and depend solely on the average time required to complete a survey.

The number of randomly chosen respondents invited to participate in the study (4,751) was determined by the internet panel company, based on the internet panel's experience with response rates to questionnaires of certain lengths. The survey was withdrawn as soon as the first 1,000 respondents had completed the survey. Only those respondents who had completed all environmental behavior questions (n = 798) were used.

The questionnaire contained the following questions:

1) Twenty items on environmental behavior. This list was compiled based on prior studies into environmental behavior (Corraliza & Berenguer, 2000; Trumbo & O'Keefe, 2001; Johnson, Bowker, & Cordell, 2004), and included, for example, "recycling newspaper" and "picking up litter". Respondents were asked to state whether they engaged in each one of these activities "always", "often", "sometimes", "rarely", "never", or whether the specific behavior was "not applicable" to them. Respondents were asked to answer these questions twice, one time thinking of their home environment, and a second time thinking of their last vacation.

2) After respondents rated the frequency of behaviors in the two different contexts, they were asked whether they felt more morally obliged to carry out these behaviors at home or on vacation. They were also asked to provide an open-ended explanation why.

3) Travel-related background questions, such as the number of holidays taken in a year and their typically chosen accommodation type were asked (hotel, bed & breakfast, holiday apartment, private room, camping site, youth hostel/backpackers, with friends/relatives), as well as questions on their travel motivations. The travel motivations from the *Austrian*

Guest Survey (Dolnicar, 1998) were used, and respondents were presented with a pick-any

format, in which they could choose to tick all, none or a specific subset of motivations

applicable to them. Motivations were measured using 25 different statements, such as "I

want to rest and relax", or "I go on holiday for a change from my usual surroundings."

4) Two additional environment-related variables were collected and used to validate the

derived segmentation solution externally:

(a) Pro-environmental attitude was measured using the New Ecological

Paradigm Scale (NEP, Dunlap et al., 2000), which contains 15 items covering

five dimensions using three items each. The five dimensions are referred to as

"reality of limits to grow," "anti-anthropocentrism," "fragility of nature's

balance," "rejection of exemptionalism," and "possibility of ecocrisis". An

individual-level score was derived by adding the responses to all items, with

negatively worded items (that is, human-centered versus environment-

centered) being reverse-coded before summation (Cronbach's alpha = 0.80,

item-to-total correlation: mean = 0.52, standard deviation = 0.08). A large

number of studies use the NEP scale, and it has been consistently shown to be

associated with environmental behavior. Examples include Floyd, Jang and

Noe's study (1997), in which the NEP score was associated with levels of

acceptance for environmental impacts on national parks; Hunter and Rinner's

study (2004), in which the NEP score is associated with how much priority

individuals place on species preservation; and Kotchen and Reiling's study

(2000) supporting the hypothesis that NEP scores are predictive of people's

willingness to pay for species protection funds.

(b) The likelihood to use recycled water was measured using 20 items and a summated scale across all items was computed to derive a value of likelihood of adoption for each individual (Cronbach's alpha = 0.90, item-to-total correlation: mean = 0.59, sd = 0.06).

5) Political orientation was measured using six of the eight variables used by Samdahl and Robertson (1989) in their study investigating social determinants of environmental concern. The eight items included four indicators of pro-regulatory liberalism (passing the US Equal Rights Amendment*, enforcing laws against businesses that practice loan discrimination, establishing laws to protect rights of homosexuals, and establishing state laws against housing discriminations); and four indicators of social welfare liberalism (spending tax money on day care centres for low-income parents, providing public housing for low-income families, helping with heating bills for low-income people, providing "cost-of-living" increases for welfare payments*). Two of the original variables (marked with asterisks above) which were not relevant for the Australian public were omitted — one representing pro-regulatory liberalism and one representing social welfare liberalism, so the number of items for both political orientations remained balanced. Respondents were presented with a full binary scale and asked to tick either "yes" or "no" for each item. A summated scale across all six items was used for analysis (Cronbach's alpha = 0.64, item-to-total correlation: mean = 0.60, sd = 0.07).

6) Socio-demographic information about respondents, including gender, age and the size of town where they lived (by letting them provide an approximate number of inhabitants), and their feeling of belonging/attachment to the region where they live (by asking respondents to assess directly the strength of their feelings of belonging on a four-point

multi-category scale, and to indicate whether they are happy to live in the region, would prefer not to, or do not care where they live).

7) Questions on media behavior asked respondents to state how many days a week they usually read the newspaper/watch TV. Respondents provided a number in response to this question. A list of newspapers and TV channels was provided and respondents were asked to tick their favorites.

Different modeling techniques are possible for segmenting respondents and accounting for unobserved heterogeneity. Model-based clustering is based on a probabilistic model which can be interpreted and statistical inference can be used for model validation (Fraley & Raftery, 2002). For multivariate categorical data, latent class analysis (Magidson & Vermunt, 2004) is a widely used segmentation method for different applications (see for example, Green, Carmone & Wachspress, 1976; Sullivan, Kessler, & Kendler, 1998; Baudisch, 2007). These models assume that correlations between the different variables in the observed data are caused by latent groups in the population. Hence, the variables are mutually independent, given the membership to the latent segments. This implies that not all respondents are expected to have the same likelihood of responding to each question in a certain manner, but that different homogeneous groups of individuals exist, who respond to questions in the same way.

Details on the model are provided in the Appendix; methodological details specific to the respective hypotheses are provided in the Results section.

3 Results

3.1 (H1) Inter-individual heterogeneity

Latent class models are fitted to the observations on the behavior at home. Given that respondents' answers were recorded on a five-point scale labeled "always", "often", "sometimes", "rarely", and "never", each of these answer categories represents a probability of engaging in each of the behaviors with environmental impact. "Always" essentially signifies that a behavior occurs four times out of four, while "never" means that it does not occur once. Under this assumption, the answers follow a binomial distribution with four repetitions. Each segment of the latent class model is therefore assumed to follow a distribution given by the product of binomial distributions for each dimension.

The number of segments varies from 1 to 10, and for each number of segments the expectation-maximization (EM) algorithm is repeated 20 times with different random initializations to ensure detection of the global optimum. The better models with respect to the log likelihood for each number of segments are compared with respect to the Bayesian information criterion (BIC). The BIC decreases for up to six segments and flattens off for higher numbers of segments. The relative change in BIC values when adding one component is -4.9% from one to two components, and -1.6%, -1.2%, -.5%, -.3% and .0% for up to seven components. The model with six segments is therefore selected. The relative segment sizes π_k of the mixture with six components are .15, .25, .22, .21, .11, and .06.

The respondents are assigned to one segment with respect to their maximum *a posteriori* probability in order to determine a segmentation of the respondents. The separation between the segments is good, with 66% having an *a posteriori* probability of 90% or higher for one segment, 78% with more than 80%, and 85% with more than 70%. The numbers of respondents assigned to each segment are 121, 206, 174, 160, 88, and 49. The following

discussion uses this partition of the respondents for analyzing differences in background variables between the segments.

Figure 1 shows the profiles of all six segments. The black horizontal lines represent the total sample, and the grey bars the segment. The lengths of the lines and bars indicate the average sample and segment engagement in each of the environmental behaviors, with 0 indicating "never" and 1 indicating "always".

----------- Figure 1 about here -----------

Figure 1 shows how all segments resulting from the analysis demonstrate very distinct profiles. The resulting segments demonstrate distinct patterns of environmental behavior. However, they also differ significantly with respect to background variables[1]. Segments differ significantly with respect to socio-demographic variables, such as gender (chi-square test p-value <.001), age (Kruskal-Wallis rank sum test p-value <.001), and the size of town where respondents live (Kruskal-Wallis rank sum test p-value <.001). They differ with respect to other environment-related questions, such as attachment to the region where respondents live (chi-square p-value <.001), willingness to adopt recycled water (Kruskal-Wallis rank sum test p-value <.05) and pro-environmental attitude measured with the NEP scale (Kruskal-Wallis ranks sum test p-value <.001). Travel-related variables that differ significantly between

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[1] Background variables are pieces of information about respondents which are not used to form the segments. They are independent of the segmentation and can consequently be used to externally validate the segmentation solution.

segments are the number of holidays undertaken per year (Kruskal-Wallis rank sum test p-value <.05) and travel motivations (chi-square p-value <.001). Other variables with significant differences are political orientation (Kruskal-Wallis rank sum test p-value <.001), media behavior (chi-square p-value <.001), and reading of newspapers (Kruskal-Wallis rank sum test p-value <.005).

Segment 1, representing 15% of the sample, is clearly the most environmentally friendly segment: members of this segment engage in all pro-environmental behaviors more frequently than the general population, while engaging less frequently in environmentally *unfriendly* behaviors such as littering. Segment 1 contains the highest proportion of women with 64 percent, and also represents the oldest group, with an average age of 49 years (sd = 12). Members of Segment 1 also live in the smallest communities with a median number of residents of 32,500. Members of Segment 1 are also characterized by the strongest feeling of belonging/attachment to the region.

Segment 1 was identified as one of the most liberal, with most segment members responding in the affirmative for all statements in the scale. With respect to travel-related questions, Segment 1 ranks third, with an average of four holidays. With respect to travel motivations, Segment 1 members care about nature (chi square p-value <.001), want to maintain unspoiled surroundings (chi square p-value <.001), are interested in the lifestyle of locals (chi square p-value <.001), and want to engage in creative activities (chi-square p-value <.005). With respect to environment-related background variables and pro-environmental attitude, Segment 1 expresses the highest willingness to adopt recycled water and, unsurprisingly, demonstrates the most pro-environmental attitudes of all groups.

Significant differences exist between segments' media behavior. Members of Segment 1 watch more state TV (in Australia, SBS and ABC) than the entire sample does. Segment 1

also reads newspapers significantly more often than the other segments — on average 4.3 times a week. Such differences in media behavior are of particular importance to marketers, because certain segments are defined as a target for specific social or environmental campaigns.

Segment 2, representing 25% of the sample, demonstrates an average profile of environmental friendliness, except for not composting, littering, and damaging trees, and ranks third in pro-environmental attitudes. Segment 2 members are the most active travelers: they undertake 4.7 trips per year.

Segment 3 (22% of the sample) has a similar profile to Segment 2, except for composting, an activity this segment engages in heavily. Members of Segment 3 also show similarly active travel patterns, undertaking an average of 4.6 holidays per year. They rank second in pro-environmental attitudes. Segment 3 demonstrates media behavior similar to Segment 1 (environmentally friendly respondents): segment members watch more state-run TV than the entire sample.

Segment 4 (21% of the sample) are the recyclers. Their pro-environmental behavior is below average in general, but they do recycle domestic waste. Segment 4 contains the highest proportion of men (64%), compared to the overall sample proportion of men (53%). They also live in the largest cities with a median number of residents of 425,000. Members of this group rank fifth (out of six) with respect to their pro-environmental attitudes. While they show no particularly strong characteristics with respect to the number of holidays taken per year, Segment 4 demonstrates distinct travel motivations: seeking fun and entertainment (chi-square p-value <.01), wanting to engage in creative activities (chi-square p-value <.01), and wanting to experience nature (chi-square p-value <.005).

Segment 5 (11% of the sample) has an extremely interesting pattern of environmental behavior: they read nature magazines and donate; but that is as far as their pro-environmental behavior goes. From this profile, we might hypothesize that donating is a "compensation" for not acting in an environmentally friendly manner. Members of Segment 5 rank fourth (out of six) in pro-environmental attitudes. Together with members of Segment 1 (environmentally friendly respondents), Segment 5 members are the most liberal with respect to their political orientation.

Finally, Segment 6 (6% of the sample) contains the "environmentally unfriendly" respondents, who demonstrate some behavior that has negative effects on the environment, and have a below-average engagement in pro-environmental behaviors. Segment 6 represents the youngest group, with an average age of only 40 years (sd = 14). This group is also characterized by having the highest proportion of members who state that they do not at all feel belonging/attachment to the region where they live. Unsurprisingly, members of Segment 6 do not care about nature (chi-square p-value <.01), and do not care about maintaining unspoiled surroundings (chi-square p-value <.01) when on vacation. They also do not want to pay attention to prices and money while on vacation (chi-square p-value <.04). With respect to environment-related background variables, Segment 6 demonstrates the lowest adoption likelihood, as well as ranking last on pro-environmental attitudes. This result reflects the general pattern of behavior with consequences for the environment, and thus validates the segment solution. Finally, Segment 6 also demonstrates an extremely distinct position with respect to media behavior: members state that they only read newspapers 2.7 times a week on average, which represents the lowest level of newspaper readership among all groups.

3.2 (H2) Context/environment heterogeneity

We investigated context/environment heterogeneity by testing whether significant changes in segment membership occur when behavior with environmental consequences is studied in different contexts/environments, particularly the home and on vacation. The original segmentation solution used to investigate H1 was produced using the responses related to the home context/environment. All respondents also stated how often they engaged in each of the behaviors with environmental consequences when they were on vacation. The comparison of these two sets of responses at individual level forms the basis of the investigation of H2.

The answers pertaining to the vacation context/environment were classified to one of the 6 segments derived from the responses on the home context/environment. For segment assignment, the segment with the maximum *a posteriori* probability is determined in a manner similar to the classification step for the home context/environment.

If all respondents are assigned to the same segment twice — once for their responses relating to the home context/environment and once for their responses relating to the vacation context/environment — we might conclude that context/environment heterogeneity does not exist, and that individuals are highly stable with respect to their environmental behavior. However, if a substantial number of individuals are reassigned to a different segment for their vacation-related responses, we can conclude that behavior with environmental consequences is context/environment or situation dependent. Whether or not behavior with environmental consequences is context/environment dependent or not is not only of theoretical interest. The practical significance lies in identifying suitable strategies for improved environmental sustainability. For instance, from the point of view of a tourism organization, support for the context/environment independence hypothesis would imply that attracting tourists who

behave in an environmentally friendly way is likely to be a more successful strategy than trying to educate and motivate them at the tourism destination to behave in an environmentally friendly manner. Contrarily, if the context/environment dependence hypothesis is supported, a tourism destination could develop several measures at the destination itself to promote pro-environmental behavior.

To assess how many respondents were assigned to the same segment both for their home and vacation context/environment items, we computed a cross-tabulation of segment membership. Figure 2 shows a mosaic plot illustrating this cross-tabulation.

----------- Figure 2 about here -----------

Figure 2 shows that Segment 6 members are the most likely to be assigned to Segment 6 in both contexts/environments (97%). This is illustrated by the long vertical bar at the position 6 on the vertical (home) axis and at position 6 on the horizontal (vacation) axis. This tendency is visible for all segments: the number of respondents who remain in the same segment is significantly higher than one would expect under independence of the two variables (as illustrated by the blue coloring of the respective bars). However, the proportions are lower than for Segment 6: 50% of Segment 1, 32% of Segment 2, 23% of Segment 3, 58% of Segment 4, and 52% of Segment 5 stay in the same segment even when on vacation. In most cases respondents shift from their original segment for the home context/environment to Segment 6 in the vacation context/environment (this is true for 25% of Segment 2 members, 28% of Segment 3 members, 42% of Segment 4 members, and 33% of Segment 5 members), indicating that the extent of their pro-environmental behavior drops in the vacation

context/environment. The only exception is Segment 1, where only three percent switch to Segment 6 on vacation.

4 Discussion

The results that emerge from testing H1 lead to the conclusion that inter-individual heterogeneity with respect to behavior with environmental consequences exists; consequently, H1 cannot be rejected. This finding offers further insight into patterns of behaviors with environmental consequences, and makes targeted communication aimed at certain environmental behavior segments feasible. Only one prior investigation of heterogeneity of pro-environmental behavior exists: Bodur and Sarigollu (2005). The three segments resulting from their study are similar in that they highlight that sub-segments of the population exist who behave in a highly environmentally friendly manner, while other sub-segments do not. Agreement also exists with respect to several additional personal characteristics included in both studies. For example, in both studies, the segment of environmentally friendly people reports that they appreciate nature more (engaging in outdoor activities or caring about an unspoiled environment) when on vacation. Both studies also report differences in environmental attitudes between the behavioral segments. However, results differ with respect to findings regarding age and gender: Bodur and Sarigollu found no significant differences; however, we found that significant differences do exist.

Differences in findings can be explained by two factors. First, Bodur and Sarigollu grouped respondents into three segments, whereas we chose six. Consequently, our segments would be expected to demonstrate more differences in behavior and — assuming that behavior is indeed associated with personal characteristics in a valid way — also personal characteristics. Second, several methodological differences put the comparison of findings into perspective: Bodur and Sarigollu use a Turkish quota sample, they conducted interviews,

used a set of nine environmental behaviors, and used k-means cluster analysis for the actual partitioning task. We used an Australian random sample of respondents, 20 pro-environmental behaviors, collected data using a written survey and conducted latent class analysis.

Age and gender were identified as discriminants between the segments identified in the present study, although prior work leads to conflicting findings, with respect to the significance of socio-demographic differences (for example, Barr, 2007, found no difference in the context of recycling and reuse), as well as the direction of differences (for example, Juric, Cornwell, & Mather, 2002, found ecotourists to be older, while Tao, 2004, found them to be younger).

Barr (2007) acknowledges socio-demographics as situational variables affecting recycling and reuse behavior and summarizes previous findings by stating that "as a very crude stereotype, it has been found that young, female, single-family dwelling, high-income earning, well-educated, and politically liberal individuals tend to play an active part in waste management activites" (p. 439). Segment 1 in the present study fits this crude stereotype relatively well: members have a higher likelihood of being female and politically liberal. They do not match the age group, however, and are instead among the older segments. The results with respect to regional identification support the findings reported by Carrus, Bonaiuto, and Bonnes (2005). Many variables investigated in the present study are not included in previous studies, for example, media behavior. Yet this is a central piece of information, given that knowledge is often associated with pro-environmental behavior (for example, Barr, 2007), and given that information campaigns are among the most frequently recommended public interventions by researchers studying pro-environmental behavior (for example, Hopper & McCarl Nielsen, 1991).

Several studies into pro-environmental behavior, as well as comparative studies of alternative intervention measures, were designed as experiments, randomly assigning respondents to different interventions. Such studies do not provide profiles of personal characteristics of people who are inherently more or less environmentally friendly in their behavior (for example, Hopper & McCarl Nielsen, 1991). Other studies (which are non-experimental in nature and do provide test results with respect to personal characteristics) focus on particular kinds of pro-environmental behavior. For example, Oskamp et al. (1991) investigated curbside recycling, and found that being a single personal household, owning one's own home and recycling by friends and neighbors were strong predictors of behavior. Consequently, the results of both experimental studies as well as studies focussing on specific kinds of pro-environmental behavior cannot be compared directly to the findings of the present study.

With respect to the context hypotheses, results do not provide a clear answer to H2. On the one hand, a significant proportion of segment members are not affected by a change of context/environment in their pattern of behaviors with environmental consequences, which would support the context/environment independence hypothesis. On the other hand, a systematic shift occurs from *all* segments to Segment 6 (the segment with the least pro-environmental behavioral pattern) when respondents are asked to state their behavior in the vacation context/environment. This indicates that, to some extent, context/environment dependence exists. However, the results indicate that these behavioral changes are generally unfavorable from an environmental perspective, suggesting that there may be a lack of infrastructure at the destination, or that tourists want a break from their daily responsibilities when on vacation. The only segment that does not change its behavioral pattern to the environmentally unfriendly pattern of Segment 6 is Segment 1, the "environmentally friendly" respondents. They maintain their pro-environmental behavior pattern even when on

vacation, and consequently represent a highly attractive target market for tourism destinations interested in leaving the smallest possible environmental footprint.

The direction of the shift is clear: people become less environmentally friendly when they move from their home context/environment into the vacation context/environment. This is not necessarily what one would hypothesize *a priori*. We might assume that people would take better care of their homes to ensure a good long-term living environment; but also that people want to behave as good guests, good visitors. To understand the reasons why people behave more environmentally friendly at home or on vacation we asked them whether they felt more "morally obliged" to do so in either of the two context/environments, and to state why in open-ended format. We then coded all open-ended responses to understand why the context/environment has such an impact on people's pro-environmental behavior.

Most respondents said that they felt morally obliged to carry out pro-environmental behavior at home. A majority (733 respondents, or 92%) indicated that they felt more morally obliged at home, while only 64 (8%) respondents indicated the same feeling during vacation. The proportion of agreement with more moral obligation at home compared to when during vacation differed significantly between segments (chi-square p-value <.05), with 16% of the respondents feeling more obliged during vacation in Segment 6 and only five percent in Segments 2 and 3. Table 1 shows the results for the coded open-ended answers, which includes all categories that were stated by at least 10 respondents. The coding of a single coder is used after checking the reliability of the coding work using three independent coders (PRL reliability measure: 0.86, Rust & Cooil, 1994).

----------- Table 1 about here -----------

Notably, only one of the reasons among the top 17 argues for higher levels of pro-environmental behavior on vacation. This is precisely the reason hypothesized originally: being a "good guest". All other arguments explain the main tendency of higher levels of pro-environmental behavior at home. The main reasons are that the consequences are felt more directly, that the infrastructure is available and pro-environmental behavior is consequently easier to implement, and that a vacation is a break from everything, where one wants to be selfish and not worry about being responsible.

The accommodation type people usually choose is associated significantly with the probability that people feel more morally obliged to behave environmentally friendly on vacation (chi-square test p-value <.002). People who stay on a camping site are the most likely to feel more morally obliged to behave environmentally friendly on vacation (19%), followed by those staying in a bed & breakfast (13%), while people staying in a holiday apartment (5%) or a hotel (5%) are the least likely. People staying with friends or relatives have only an average probability (9%) of behaving more environmentally friendly on vacation.

5   Conclusions

This paper investigated heterogeneity in environment-related behavior, and hypothesized that heterogeneity exists among people with respect to the behaviors they engage in (H1), but also that heterogeneity exists across different context/environments, such as at home and on vacation (H2).

Results support H1, and lead to mixed results with respect to H2. Six segments with distinctly different profiles of environment-related behavior were identified and found to differ significantly in most of the additional information collected, such as environmental attitudes, travel behavior, and socio-demographics.

The context/environment had a significant impact on people's behavior: generally, the levels of pro-environmental behavior decreased. The only segment "immune" to compromising on their low environmental footprint was Segment 1, the "environmentally friendly" respondents.

An analysis of the main stated reasons indicates that people feel more responsible for the environment where they live and are willing to make a bigger effort to maintain a good living environment in their immediate surroundings. They do not feel obliged to behave in the same way on vacation. Two main reasons are that they feel vacation time is supposed to be worry-free, selfish time which should be free of responsibilities, and that the infrastructure is not available in the vacation context/environment to enable them to maintain their usual levels of environmentally friendly behavior.

These findings lead to valuable practical implications: in the home context/environment, local councils can clearly derive from Table 1 the main advertising messages that need to be communicated to residents in order to motivate them to act in a more pro-environmental manner: maintaining the environment for yourself and your family. The only other support measure local councils could take is to provide more infrastructure for pro-environmental behavior. For instance, Segment 4 (recyclers) are restrained by the city environment which might not provide much more than recycling bins if public transport is inadequate to compete with individual transportation. From the perspective of tourism destinations, three conclusions can be drawn. First, a segment of people exists that will remain pro-environmental in their behavior even when on vacation. This calls for an active target segment strategy to invite those people to visit, rather than, for instance, members of Segment 6. Second, there may be a problem with how people perceive infrastructural support at the destination: respondents generally indicated that there is a lack of infrastructure to

support pro-environmental behavior. This could certainly be changed on the supply side at the destination, to enable those segments that are generally willing to act responsibly to do so during their vacation. Differing media approaches will be helpful for both the target segment approach and the communication at the destination if on domestic holiday within Australia. The most powerful communication message for tourists may the notion of promoting people to behave "like a guest". Such a message could be well integrated into a general welcoming message, and may increase the levels of moral obligation tourists feel when visiting a destination.

6   References

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7 Appendix

The latent class model is given by:

$$H(y, \Theta) = \sum_{k=1}^{K} \pi_k \prod_{i=1}^{I} F(y_i, \theta_{ik}),$$

where $H(\cdot)$ is the mixture distribution, $y = (y_i)_{i=1,...,I}$ is the vector of I observations for one respondent and Θ is the vector of all parameters of the mixture distribution. The number of segments is given by K. Each class/segment is of size π_k, and the segment sizes must fulfill the following constraints:

$$\pi_k > 0 \quad \forall k = 1, ..., K \quad \wedge \quad \sum_{k=1}^{K} \pi_k = 1.$$

Each component distribution is given by the product of the distribution functions F for each observation i. It is assumed that the component distribution is from the same distributional family for each observation, and that they differ only with respect to the component specific parameter θ_{ik}. For identifiablity, it is assumed that the vectors of all component specific parameters $\theta_k = (\theta_{ik})_{i=1,...,I}$ differ between the components. The posterior probability τ_{kn} for respondent n and segment k is given by:

$$\tau_{kn} = \frac{\pi_k \prod_{i=1}^{I} F(y_{in}, \theta_{ik})}{\sum_{l=1}^{K} \pi_l \prod_{i=1}^{I} F(y_{in}, \theta_{il})}.$$

The expectation-maximization (EM) algorithm (Dempster, Laird and Rubin, 1977) is used to determine the maximum likelihood (ML) estimates. The EM algorithm is a data augmenting procedure for missing data. In the case of latent class analysis, the segment membership is the missing information. The algorithm is an iterative procedure which alternates between E- and M-step. In the E-step the expected segment memberships are

determined by estimating the *a posteriori* probabilities of each observation to be from a specific segment given the current parameter estimates; while in the M-step the ML estimates for the parameters are determined for the complete likelihood where the unobserved segment memberships are replaced with the *a posteriori* probabilities. As in each step, the log likelihood is increased the algorithm converges if the log likelihood is bounded. However, the convergence is only to a local optimum. In general, several runs of the EM algorithm with different random initializations are performed, and the best solution with respect to the log likelihood is used as an ML estimate in order to eliminate local optima. Random initialization of the EM algorithm can be made by assigning the observations to segments and using them in the first M-step instead of the *a posteriori* probabilities.

The number of segments can be determined using model information criteria such as the Bayesian information criterion (BIC). The BIC takes the model fit as well as the number of estimated parameters into account, that is, a more complex model is only preferred if the improvement in model fit (increase of the log likelihood) exceeds the penalization for the additional parameters. Model selection based on the BIC chooses the model with the minimum BIC.

8 Tables and Figures

8.1 Tables

Table 1: Main reasons for differences in pro-environmental behavior in different

context/environments

|	Frequency	% of responses
Spend most of my time at my home	115	18%
Feel more responsible for my home	87	14%
More control/opportunity/time at home	73	11%
Supposed to enjoy my vacation/selfish time	50	8%
No infrastructure on vacation/lack of choice	46	7%
More difference at home in the long run/more impact	40	6%
Easier at home	27	4%
At home the costs associated with not saving energy	24	4%
In holiday mode/out of routine/vacation is a break from everything	19	3%
Behave like a good guest	*18*	*3%*
Habit at home	17	3%
Difficult away from home	16	2%
Familiarity with home conditions and facilities	15	2%
Lack of control over holiday destinations' practices	15	2%
Actions directly effect my local environment/family	14	2%
More aware at home	14	2%
Set an example for my children, family and neighbors	13	2%
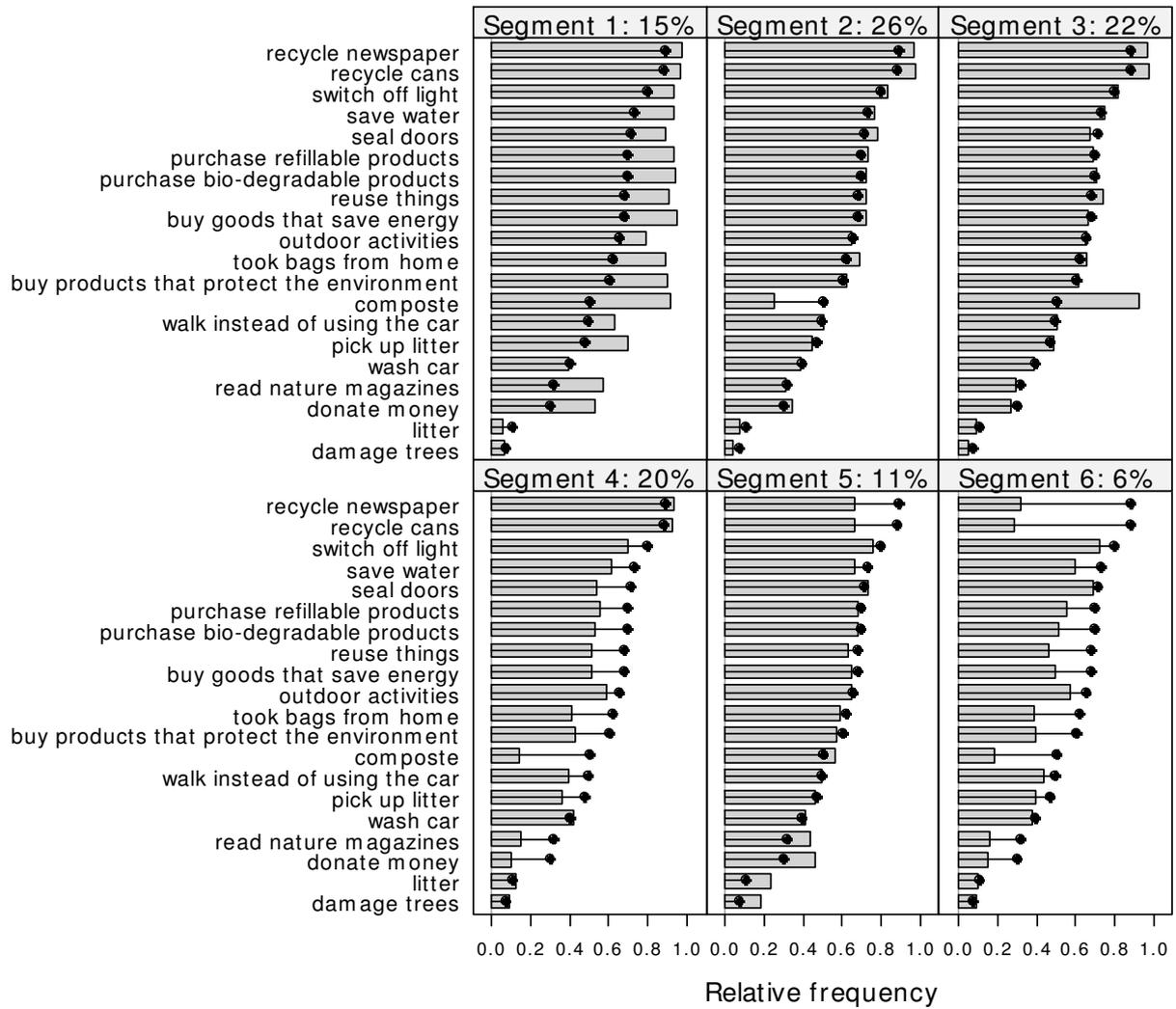
Figure 1: Environmental behavior segment profiles
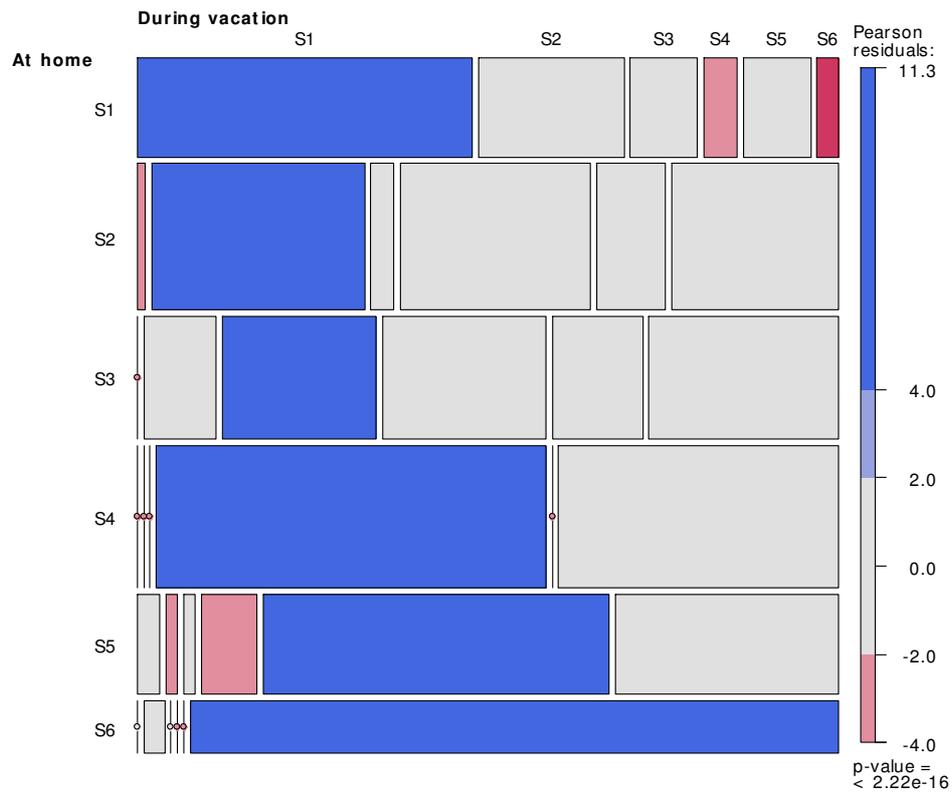
Figure 2: Segment shifts between contexts/environments