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Context change and travel mode choice: Combining the habit discontinuity and self-activation hypotheses

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Abstract

The habit discontinuity hypothesis states that when a context change disrupts individuals' habits, a window opens in which behavior is more likely to be deliberately considered. The self-activation hypothesis states that when values incorporated in the self-concept are activated, these are more likely to guide behavior. Combining these two hypotheses, it was predicted that context change enhances the likelihood that important values are considered and guide behavior. This prediction was tested in the domain of travel mode choices among university employees who had recently moved versus had not recently moved residence. As was anticipated, participants who had recently moved and were environmentally concerned used the car less frequently for commuting to work. This was found not only when compared to those who were low on environmental concern (which would be a trivial finding), but also to those who were environmentally concerned but had not recently moved. The effects were controlled for a range of background variables. The results support the notion that context change can activate important values that guide the process of negotiating sustainable behaviors.

1. Introduction

Traffic jams, high oil prices, air pollution, noise, and a significant contribution of cars to carbon dioxide emissions do not seem to impress the vast majorities of car owners in Western societies, as the car remains the prevalent mode of transport. Subjective expected utility models of behavior suggest that car use is driven by a perceived balance of costs and benefits, which thus often favors the car over alternative modes of transport (e.g., Ajzen, 1991; Bamberg & Möser, 2007; Feather, 1982; Fishbein & Ajzen, 1975). These models also suggest that people should be sensitive to changes in the pay-off structure of travel mode choices. For instance, Fujii and Gärling (2003) documented travel mode choice changes in a panel of students as they moved from being student to being employed in a company, and changed their travel mode behavior according to the newly perceived balance of costs and benefits. Changes in pay-off structure may also be deliberately invoked. Bamberg, Ajzen, and Schmidt (2003) found that the theory of planned behavior adequately modeled modal split changes that were observed in the context of an intervention to promote public transport use by providing students with free bus passes. On the basis of a review of 29 intervention studies, Kearney and De Young (1996) concluded that providing material incentives and personalized information can be effective in changing car use frequency. On the other hand, Ogilvie, Egan, Hamilton, and Petticrew (2004) reviewed 22 studies aimed at shifting mode from car to walking and cycling, and concluded that although there is some evidence that targeted behavior change programs can change motivated subgroups, publicity campaigns, engineering measures, and other interventions generally have not been very effective (see also Ogilvie et al., 2007). Although subjective expected utility accounts of travel mode choice have proven useful, these do not fully explain why individuals do or do not change their behavior in response to new information or new circumstances. We therefore turn to another aspect of travel mode choice, i.e., its habitual quality.

1.1. Travel mode choice as a habit

As mobility is deeply ingrained in modern everyday life, making travel mode choices is an extremely repetitive type

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of behavior. The habitual quality of travel mode choice behavior has been acknowledged as a factor of importance and is included in models of travel mode choice (e.g., Aarts, Verplanken, & van Knippenberg, 1998; Bamberg & Schmidt, 2003; Gärling & Axhausen, 2003; Klöckner, & Matthies, 2004; Klöckner, Matthies, & Hunecke, 2003; Verplanken, Aarts, van Knippenberg, & van Knippenberg, 1994). Habituation has important implications. The first relates to the fact that habitual behavior is cued by recurring stimuli in a stable context (Wood, Tam, & Guerrero Witt, 2005; Wood & Neal, 2007). We refer to 'context' as the environment where behavior takes place. This may include the physical environment and infrastructure, but also spatial, social and time cues which instigate action. When context changes or an individual changes context, old habits are disrupted, and behavior has to be renegotiated. A second implication of frequent performance of behavior relates to the degree to which behavior is driven by conscious intent. In a meta-analysis on the relations between past behavior, behavioral intentions and future behavior, Ouellette and Wood (1998) demonstrated that when behaviors are performed in unstable or difficult (e.g., new) contexts, past behavior relates to future behavior through behavioral intentions, thus following the social cognitive models (e.g., Ajzen, 1991). However, when behaviors are well-practiced and repeatedly performed, frequency of past behavior reflects habit strength and has a direct effect on future performance, whereas intentions have a much lower impact. In the realm of travel mode choices, Verplanken, Aarts, Moonen, and van Knippenberg (1998) demonstrated that intentions predicted the use of car versus public transport only when existing car-use habits were weak, whereas no relation between intention and behavior was present among habitual car users (see also Danner, Aarts, & De Vries, in press). Finally, habituation attenuates information acquisition. Verplanken, Aarts, and van Knippenberg (1997) showed that individuals with strong travel mode habits were less likely to acquire information about alternative options and travel mode choices conditions compared to weak habit individuals.

Taken together, the habit literature strongly suggests that frequently performing behavior in stable contexts is unlikely to be spontaneously reconsidered and changed (Dahlstrand & Biel, 1997). An important caveat is that if for whatever reason a stable context *is* disrupted, habits associated with that context are broken too, at least temporarily (Wood et al., 2005). Verplanken and Wood (2006) reasoned that such a disruption provides a window within which behavior may have a higher likelihood to be (re)considered. In other words, context change has the potential to make behavior-relevant information more salient and influential, which may lead to new choices and decisions. We refer to this contention as the *habit discontinuity hypothesis*.

We see two important implications of the habit discontinuity hypothesis. These implications capitalize on the assumption that context change makes behavior-relevant information more salient and individuals more attentive and deliberate. One implication is that interventions may be more effective when these are delivered shortly before, during, or shortly after context change. For example, Bamberg (2006) described a successful intervention program aimed at promoting the use of public transport among households 6 weeks after they relocated. The intervention may thus have benefited from an enhanced sensitivity due to context change. In this article, we focus on a second implication, which concerns people's values, attitudes and beliefs that are relevant to the behavior proper. Following the habit discontinuity hypothesis, we suggest that context change may make these cognitions more salient and individuals be more attentive to them. We elaborate this idea in the next section.

1.2. Habit discontinuity and self-activation

When we make deliberate choices between travel mode options, the perceived balance of behavioral and monetary costs and benefits is often the main decision criterion. However, travel mode choices may also be informed by environment-related arguments, which thus go beyond merely considering individual consequences. Norm activation models have been developed to explain such influences (e.g., Nordlund & Garvill, 2002, 2003; Stern, 2000). For instance, the value–belief–norm theory of environmentalism (e.g., Stern, 2000; Stern, Dietz, & Kalof, 1993) posits a causal chain of five variables leading to pro-environmental behavior: altruistic values, beliefs about human–environment relations, awareness of adverse consequences, the perceived ability to reduce these threats, and finally the sense of obligation to take pro-environmental action. The theory thus suggests that broader values lead to pro-environmental action through the activation of environmental concern and personal norms. Individuals differ widely in embracing such values and beliefs. However, even if a person holds pro-ecological values and beliefs, there is a significant gap between those values and actual behavior (cf., Kristiansen & Hotte, 1996; Nordlund & Garvill, 2003; Verplanken & Holland, 2002). Verplanken and Holland (2002) provided experimental evidence to suggest that values influence choices and behavior only when two conditions are met; a value should be part of a person's self-concept, and a value should be cognitively activated. This is referred to as the *self-activation hypothesis*. For instance, in some of Verplanken and Holland's studies, participants were presented with a multi-attribute choice task (selecting a television set) in which one attribute related to environmental aspects. Those who were high on environmental concern did not make more environmentally friendly choices compared to low environmental concern participants, unless the environmental dimension was cognitively activated. In another experiment, participants only followed their pro-social values if they went through a procedure that made them self-focused (cf., Utz,

2004). This research thus demonstrated that values do not drive choices and behavior by default, but that some form of cognitive activation is required.

Some interesting predictions emerge when we combine the habit discontinuity and self-activation hypotheses. In the previous section, we concluded that context change might disrupt habits and make individuals more likely to focus on internal information in adapting to a new situation. In the case of environmentally relevant behaviors, the chain of variables contained in the value–belief–norm theory of environmentalism (e.g., Stern, 2000) may be that kind of internal information. If altruistic values and environmental concern make up part of an individual's self-concept, self-attention as a consequence of context change may activate these values and beliefs and thus increase the likelihood of value-consistent behavior. The habit discontinuity and self-activation hypotheses together thus predict that environmentally concerned individuals are more likely to make environmentally friendly choices under conditions of context change. This not only holds for a comparison with environmentally unconcerned individuals (which would be a rather trivial prediction), but, more importantly, also for a comparison with environmentally concerned individuals who do not face context change.

The present study tested this prediction for commuter travel mode choices. The study compared individuals who had recently moved residence versus individuals who had not moved. It was thus anticipated that environmentally concerned individuals who had recently moved would use the car less frequently in favor of environmentally friendlier alternatives than environmentally concerned commuters who had not moved.

2. Methods

2.1. Participants and design

Participants were 433 employees of a small English university. There were 189 men (44%) and 244 women (56%). Ages ranged from 20 to 64 ($M = 41.30$, S.D. = 11.29). There were 252 academics or research-related employees and 181 non-academics (e.g., clerical, administrative, technical, and security staff). Participants responded to a recruitment call through the internal email service and the university electronic bulletin board.[1] Respondents were directed to a website, where they were presented with a web-based questionnaire which typically took around 5 min to complete. The project was announced as a study on mobility. The study had a 2 (context change: recently moved versus not recently moved) × 2 (environmental concern: low versus high) mixed design with the proportion of car versus alternative travel mode use as the dependent variable.

2.2. Measures

2.2.1. Attendance and geographic information

Participants were asked how many days they came to the university in a typical week. Responses ranged from 1 day a week (1%), 2 days (3%), 3 days (7%), 4 days (8%), 5 days (76%), up to 6 or 7 days a week (5%). Participants indicated whether they took children to school or nursery on their way to the university. They could answer "never" (0), "sometimes" (1), "often" (2) and "always" (3). Participants were also asked to identify their postal code, which provided a rough estimate of the distance they lived from university. Fifty-six percent of the participants lived within 10 km from the university, 20% lived between 10 and 15 km, and 24% lived further away.

2.2.2. Context change

As part of the demographic information, participants were asked to indicate how many years it was since they last moved house. Participants who had moved within the last year were categorized as "recently moved" ($N = 69$), whereas the others were categorized as "not recently moved" ($N = 364$).[2] Among those who had recently moved, 25% relocated within town, 29% moved from outside to town, 7% moved from town to outside, and 38% relocated outside town.

2.2.3. Travel mode choices

The university is located just outside a small town. The campus is readily accessible by car, although parking is restricted. There are reasonable bus services from town to the university. The town is served by a railway and buses run from surrounding villages; another village near the town, which is a popular location for university staff, has a bus service direct to the university and has relatively easy cycling and walking options to the campus. Participants were asked to indicate how frequently they traveled to the university in a typical week by eight possible travel mode options: driving a car, walking, cycling, car pooling, bus, train, motorbike, and taxi (participants could choose more than one option). Responses for each option were "never or less than once a week" (0), 1 day a week (1), "2 days a week" (2), "3 days a week" (3), "4 days a week" (4), "5 days a week" (5) and "6 or 7 days a week" (6). Motorbike

[1] Due to the internet-based data collection method, we were unable to determine how many individuals received our initial request. It was therefore not possible to conduct non-response analyses. Although internet-based studies may raise some concerns, such as potential multiple submissions, lack of control during responding, or dishonest behavior, these tend to be not problematic in most studies (e.g., Reips, 2006). Inspection of the data and response patterns did not raise any suspicion of sloppy responding in the present study.

[2] The 1-year period was chosen under the assumption that it may take such a time frame to develop and establish new travel mode choice habits. However, as there is no theory or empirical basis to support this assumption, this was an arbitrary choice. How long it takes for habits to kick in and which processes are involved (e.g., linear or non-linear) are interesting questions in their own right, which deserve further research attention.

was mentioned only by 13 participants and taxi by one participant. These travel modes were added to the car category. For each participant a proportion of driving a car versus alternative modes of transportation was calculated, taking into account the number of days they typically attended the university. The alternative modes of transport incorporated any combination of single modes, including those in which the car was used, e.g., to reach a train or bus station.

2.2.4. Environmental concern

Environmental concern was measured by the revised version of the New Environmental Paradigm Scale (Dunlap, Van Liere, Mertig, & Emmet-Jones, 2000). This instrument contains fifteen items. Three sample items are "humans are severely abusing the environment", "we are approaching the limit of the number of people the earth can support", and "humans have the right to modify the natural environment to suit their needs". Items were accompanied by seven-point agree–disagree response scales. The scale showed good internal reliability, coefficient alpha = 0.84. Participants were categorized as low or high in environmental concern according to a median split.

3. Results

3.1. Checks on group differences

It was checked whether participants who had recently moved versus not recently moved differed in background variables. The two groups did not differ statistically significantly in gender distribution, $\chi^2(1) = 0.68$, $p = 0.41$. Recently moved participants were younger on average than not-recently moved participants, $M = 33.74$ versus $M = 42.74$, respectively, $t(431) = 6.33$, $p < 0.001$. There were no statistically significantly differences in the distribution of academics versus non-academics between recently moved and not-recently moved participants, $\chi^2(1) = 0.05$, $p = 0.82$. Nor did the two groups differ in the number of days they typically came to the university, $t(431) = 1.15$, $p = 0.25$. The two groups did not differ in the distance between their place of residence and the university, $t(431) = 0.47$, $p = 0.64$. Not-recently moved participants combined commuting more often with transporting children than recently moved participants, $M = 0.48$ versus $M = 0.20$, respectively, $t(431) = 2.24$, $p < 0.03$, perhaps reflecting their tendency to be older and thus more likely to have children requiring transport. Finally, the two groups did not differ statistically significantly on environmental concern, $t(431) = 0.38$, $p = 0.71$.

Likewise, it was checked whether the low versus high environmental concern groups differed on these background variables. The low and high concern groups differed statistically significantly in gender distribution, $\chi^2(1) = 18.85$, $p < 0.001$. Women were more environmentally concerned than men. There were no statistically significant differences in age, $t(431) = 0.83$, $p = 0.41$, distribution of academics versus non-academics, $\chi^2(1) = 0.49$, $p = 0.48$, number of days they attended the university, $t(431) = 1.19$, $p = 0.23$, distance, $t(431) = 1.19$, $p = 0.24$, or frequency of combining commuting with transporting children, $t(431) = 0.46$, $p = 0.64$.

3.2. Hypothesis testing

The main hypothesis was tested by conducting a 2 (context change: recently moved versus not recently moved) × 2 (environmental concern: low versus high) analysis of variance. The proportion of days on which the car (i.e., versus alternative modes of transport) was used was the dependent variable. There was no statistically significant main effect of context change, $F(1,429) = 0.39$, $p = 0.53$. Low environmental concern participants traveled to the university more frequently by car than high concern participants, $F(1,429) = 4.10$, $p < 0.05$, $\eta_p^2 = 0.01$. However, as anticipated, this main effect was qualified by a statistically significant context change × environmental concern two-way interaction, $F(1,429) = 12.79$, $p < 0.001$, $\eta_p^2 = 0.03$. The mean proportions of car trips in the four cells are presented in Table 1. Post-hoc tests indicated that those who had recently moved and were high in environmental concern traveled to the university less often by car and thus used more environmentally friendly alternative modes of transport compared to all other participants. Our main hypothesis was therefore supported.[3]

The checks on group differences had revealed that the context change and environmental concern groups differed on two background variables, i.e., age and frequency of combining commuting with transporting children (context change), and gender (environmental concern). These differences may thus provide alternative explanations for the results. We therefore conducted the main analysis with these three variables included as covariates. The results were virtually identical, $F(1,429) = 0.59$, $p = 0.45$, and $F(1,429) = 4.67$, $p < 0.04$, $\eta_p^2 = 0.01$, for the context change and environmental concern main effects, and $F(1,429) = 12.35$, $p < 0.001$, $\eta_p^2 = 0.03$ for the context change × environmental concern two-way interaction.

Finally, the data were analyzed by means of multiple regression. In this case the full environmental concern scale

[3] In order to shed some light on whether our choice for designating a 1-year time frame as "recently moved" made sense, the number of years since participants last moved house was also investigated as a continuous variable. The critical correlation was between the proportion of days on which the car was used and the number of years participants last moved among those who were high on environmental concern (i.e., the right-hand column of Table 1). This correlation was 0.21, $p < 0.001$, when our original dichotomy was used, and 0.17, $p < 0.01$, when the full time scale was used. In other words, the effect size was not enhanced by using the full time scale, suggesting that our dichotomy was optimal in accounting for the variance in car use among the environmentally concerned participants. These correlations also suggest that the imbalance in group sizes between recently moved and not recently moved participants did not affect the results.

Table 1
Proportions of car use as a function of context change and environmental concern

Context change	Environmental concern	
	Low	High
Recently moved	0.73a	0.37b
Not recently moved	0.54a	0.64a

Note. Cell means that do not share a common letter differ at $p<0.05$.

was used. A context change × environmental concern interaction term was calculated on the basis of centered scores (Aiken & West, 1991). As expected, this interaction term was statistically significant, $\beta = 0.17$, $p<0.007$. Simple slope analyses indicated that among those who had recently moved, environmental concern is negatively related to the proportion of car use days, $\beta = -0.25$, $p<0.04$. Among those who had not recently moved, this regression weight was statistically non-significant, $\beta = 0.09$, $p = 0.11$. The difference between the two regression slopes was statistically significant, $t = 2.65$, $p<0.01$.

4. Discussion

The habit discontinuity hypothesis states that when context change disrupts individuals' habits, a window opens in which behavior is more likely to be deliberately considered (Verplanken & Wood, 2006; Wood et al., 2005). The self-activation hypothesis states that when values that are incorporated in the self-concept are activated, these are more likely to guide behavior (Utz, 2004; Verplanken & Holland, 2002). Combining these two hypotheses it was predicted that context change enhances the likelihood that important values and related beliefs are activated and thus guide behavior. This prediction was tested in the domain of travel mode choices and environmental concern among university employees who had recently versus had not recently moved residence. As was anticipated, participants who had recently moved and were environmentally concerned used the car less frequently for commuting to the university. Importantly, this was found not only when compared to those who were low on environmental concern, but also to those who were environmentally concerned but had not recently moved. These results thus support the notion that context change can activate ecological values and beliefs, which thus guide the process of (re)negotiating pro-environmental behaviors.

Given that pro-environmental behavior is characterized by a mixture of self-interest and pro-social motives (Bamberg & Möser, 2007), one might ask why context change would not activate both motive types. We think that individual interests such as monetary costs have a strong impact on travel mode choices by default, whereas pro-social motives remain secondary choice attributes (Verplanken & Holland, 2002). Pro-social motives may also be more vulnerable to erosion over time, resulting in a larger weight of self-interest, even among environmentally concerned individuals. Verplanken and Holland (2002) demonstrated that ecological values may receive "upgrading", i.e., gain a larger decision weight by cognitive priming among environmentally concerned participants. Context change may fulfill a similar role in real life and may thus (re)boost the decision weight of ecological values in comparison with the more stable weight of individual interests.

Although the theory-derived predictions in this study were confirmed, the study has a number of limitations. First, while the self-activation hypothesis has been developed with respect to values, the present study only provided circumstantial evidence for this hypothesis by focusing on environmental concern. In accord with the value–belief–norm theory of environmentalism (e.g., Stern, 2000), we adopted the auxiliary assumption that activating altruistic or ecological values would activate environmental concern. Given that this theory has been widely supported, this assumption seems not unreasonable. Another limitation is that the study is cross-sectional and correlational. It is therefore not possible to draw causal conclusions, e.g., about whether context change causes value activation. Activation proper could not be demonstrated, as this would require other paradigms (e.g., Verplanken & Holland, 2002). A related question is whether the differences in the proportions of using the car versus alternative means of transport between the four groups in our design actually reflect shifts in travel mode choices. Only longitudinal and/or experimental designs can provide a more definite answer to such a question. Although we assumed that context change has been the decisive factor in driving a more environmentally friendly transportation mode choice among environmentally concerned participants, alternative explanations cannot be ruled out. The four groups may have differed in ways that resulted in the observed pattern. Relatedly, we did not gather further information about whether and how relocation might have affected the need to travel by car among those who recently relocated. We were able to control for a number of candidates for such alternative explanations, i.e., differences in age, gender, job type, travel distance, frequency of attending the university, and combining commuting with transporting children. The results were robust against these factors. However, it remains possible that non-measured variables played a confounding role.

Assuming that our account of context change and the role of important values in making new travel mode plans holds, this study may have some important implications. The first is the non-trivial realization that there is still a great potential among environmentally concerned individuals to actually act upon these values when circumstances are propitious. Even more so than the well-known attitude–behavior gap, there is a value–behavior gap (Kristiansen & Hotte, 1996); adhering to ecological values

does not translate in pro-environmental behavior by default. In the studies conducted by Verplanken and Holland (2002), environmentally concerned participants did not differ in their (environmentally relevant) behaviors from those who were not concerned. Only when such values were activated did value-congruent behavior follow. Such activation may occur in many ways. For example, Eriksson, Garvill, and Nordlund (2008) conducted a field experiment in which participants were asked to consider possibilities to reduce car use and to form concrete plans of action (implementation intentions) to change their travel behavior if a change was perceived to be feasible. An important finding in that study was that the intervention strengthened the association between personal norms and car use behavior. Also, a larger reduction in car use as a result of the intervention was found among those with both a strong car habit and a strong personal norm (see also Garvill, Marell, & Nordlund, 2003). The results of our study supported the assumption that context change (relocation) instigated such activation, and may have resulted in the environmentally concerned participants to act upon their values when they had the opportunity to make new choices in the changed circumstances. The results thus provide strong support to the model of normative decision making for travel mode choice, which was recently put forward by Klöckner and Matthies (2004). These authors proposed a dual-process account of travel mode choice, which consists of a norm-based route and a habitual route. The norm-based route follows the principles of normative decision making (e.g., Nordlund & Garvill, 2003; Schwartz & Howard, 1981). Habitual travel mode choices on the other hand are direct responses to situational cues, and thus bypass any moral or normative considerations (see also Aarts et al., 1998; Ouellette & Wood, 1998).

The second implication of the present study is that the results indirectly give support to the notion that interventions may be more effective when these are delivered in association with a disruption of a stable context. Such context change may occur incidentally. For instance, Fujii, Gärling, and Kitamura (2001) found that habitual car drivers who switched to public transport due to a temporal freeway closure corrected their previous overestimations of commute times by public transport, and continued to use public transport at least during the period of freeway closure. Context change may also be used as a vehicle to deliver interventions, such as Bamberg's (2006) intervention, which was implemented shortly after participants relocated. Contrast this with the generally poor performance of travel mode interventions in which context was not taken into account, even in circumstances where participants were willing to change their behavior (Ogilvie et al., 2004, 2007). If our results reflect a genuine spontaneous shift in modal split (i.e., a change without an intervention of any sort), this may at least demonstrate that environmentally concerned individuals are more receptive to act upon their values when they face a situation of context change. Interventions would therefore provide more "value-for-money" and a greater probability of success when these are targeted to motivated individuals at times of context change.

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