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Habit, information acquisition, and the process of making travel mode choices

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Abstract

Three studies examined the role of habit on information acquisition concerning travel mode choices. On the basis of Triandis' (1980) model of attitude–behaviour relations it was expected that habit strength attenuates the elaborateness of choice processes. The studies focused on different phases in the choice process, namely the appreciation of situational cues and appreciation of choice option information. In line with expectations, it was found that, compared to weak habit participants, those who had a strong habit towards choosing a particular travel mode acquired less information and gave evidence of less elaborate choice strategies. It was attempted to break effects of habit by manipulating either accountability demands or level of attention. Although accountability demands raised the level of information acquisition, no interactions with habit were found. Enhanced attention to the choice process initially did override habit effects in a series of choice trials. However, in spite of this manipulation, chronic habit effects emerged during later trials. The results demonstrate the profound effects that habit may have on the appreciation of information about choice situations and choice options. ©1997 John Wiley & Sons, Ltd.

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INTRODUCTION

In the area of attitude–behaviour relations, research has been dominated for decades by the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), and its successor, the theory of planned behaviour (Ajzen, 1991). On the one hand, we were thus provided with a solid model, which has proved useful in a large variety of domains (e.g. Sheppard, Hartwick, & Warshaw, 1988). On the other hand, the popularity of the model may have led social psychologists to underestimate the importance of daily, repetitive, and habitual behaviours. Yet, although such behaviours are not salient, many are socially relevant (Eagly & Chaiken, 1993), for instance behaviours that are related to health (e.g. eating), safety (e.g. using seat belts), or the environment (e.g. litter disposal). It may be argued that it is not so much the occurrence of single instances of such behaviours that make them important objects of study, but rather the fact that individuals may develop habitual behavioural patterns, which are executed in a variety of circumstances, for instance always choosing fatty food. Although habitual behaviours have certainly not been neglected in applied fields such as health psychology and consumer behaviour, social psychological theorizing and research on habit has been limited so far (Eagly & Chaiken, 1993). In this paper we focus on travel mode choices as an example of behaviour that may acquire a strong habitual component.

The concept of habit has a long history in social sciences. It has been used by early Western thinkers in a relatively broad sense to denote rules of conduct that characterize a civilized society (e.g. Durkheim, 1893). Psychologists have been fairly unanimous in adopting a more narrow conceptualization of habit as learned sequences of acts that become automatic responses to specific situations, which may be functional in obtaining certain goals or end states (Hull, 1943; James, 1890; Triandis, 1977, 1980; Watson, 1914). Habits thus comprise a goal-directed type of automaticity, which may be consciously instigated (Bargh, 1989), for instance eating a candy in response to feeling hungry, or taking the car to go shopping. Goal-directedness distinguishes habits from other forms of repeated automatic behaviour, such as body reflexes. A history of successful repetition of relevant acts distinguishes habits from behaviour that is performed without much attention, but is not necessarily repetitive, for instance behaviour resulting from a state of 'mindlessness' (Langer, 1989).

HABIT VERSUS REASONED ACTION

The theory of reasoned action emphasizes reasoning-based antecedents of behaviour. However, when behaviour is repeatedly performed and becomes habitual, it may be less guided by such considerations. It has frequently been demonstrated that measures of past behaviour or habit predict future behaviour over and above measures of attitude and intention (e.g. Bentler & Speckart, 1979; Duellette & Wood, 1996). One of the few models in social psychology that explicitly

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incorporated habit is Triandis' (1977, 1980) model of the attitude–behaviour relation. According to his model the probability of the occurrence of an act (P_a) is a function of habit (H), intention (I), which are weighted by w_h and w_i respectively, the individual's physiological arousal (P), and objective conditions that facilitate or inhibit the performance of the act (F). These relations were expressed as:

$$P_a = (w_h H + w_i I).P.F$$

The weights of the habit and intention component vary between 0 and 1, and add up to 1. In other words a high weight of intention implies a low weight of habit, and vice versa. For instance, new behaviour may be guided by intentions (low w_h, high w_i), while behaviour that has satisfactorily been repeated many times may be under the control of habit (high w_h, low w_i). This balance between habitual versus reasoned action in the prediction of behaviour has been empirically supported in studies that included measures of past behaviour, intention, and repeated measures of later behaviour (e.g. Bagozzi, 1981; Charng, Piliavin, & Callero, 1988), and in studies that explicitly tested habit × attitude or habit × intention interaction terms (e.g. Mittal, 1988; Montano & Taplin, 1991; Verplanken, Aarts, van Knippenberg, & Moonen, 1996; Verplanken, Aarts, van Knippenberg, & van Knippenberg, 1994).

Although in many studies that examine relations between attitudes, intentions, past behaviour or habit, and later behaviour, statistical associations between these constructs have been demonstrated, *processes* underlying these relations remain unseen. For instance, the balance between habit and intention in their relation to behaviour, which was postulated by the Triandis schema, suggests that when behaviour is new, or when old behavioural patterns cannot be executed anymore, choices are under control of reasoned processes, whereas habitual behaviour is performed without much reasoning or deliberation (cf. Ronis, Yates, & Kirscht, 1989). However, to our knowledge there is no research that has actually examined this. Also, although several models of multiple-alternative behavioural choices have been proposed in the attitude literature (e.g. Ajzen & Fishbein, 1969; Jaccard, 1981; van den Putte, Hoogstraten, & Meertens, 1996), these models do not address the underlying choice processes. In three studies to be presented here we attempted to reveal more details of such decision-making processes, in particular information search, and their relationships to habit strength.

In Figure 1, a process model is represented that constitutes the basis of our studies. In this model, the process is instigated by goal activation, for instance the need to go shopping. We suppose that once a travel goal is activated, two aspects may mediate the choice of a travel mode option. First, the situation may have particular characteristics that call for particular solutions, for instance travel distance, time limits, or weather conditions. Second, available choice options may have particular characteristics, which may or may not fit situational demands, for instance speed of travelling or comfort. Such information may be retrieved from memory, or may be acquired externally, for instance consulting a timetable. Our hypothesis is that the extent to which a person is engaged in both processes (appreciation of situational cues and information search concerning choice options) is related to the strength of a habit concerning one particular option. In the case of a strong habit, engagement in these processes may be minimal, and goal activation may—in the extreme case—directly lead to choosing the habitual option. When no or only weak habits exist, the

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individual may go through situational cue appreciation and choice option information search more extensively. Studies 1 and 2 address the choice option information search part of the model, and Study 3 the appreciation of situational cues. We focused on the habit of choosing the bicycle in Studies 1 and 2, and on the habit of choosing the car in Study 3.

The studies employ process-tracing methods by which predecisional information acquisition behaviour is recorded (e.g. Ford, Schmitt, Schechtman, Hults, & Doherty, 1989; Jacoby, Jaccard, Kuss, Troutman, & Mazursky, 1987; Payne, 1976). These paradigms assume that information acquisition behaviour reflects participant's decision-making strategies. In Studies 1 and 2 we used a traditional option × attribute information-display-board (e.g. Jacoby *et al.*, 1987; Payne, 1976), from which the amount of information acquired and the pattern of information search are indicative of the type of choice strategy that the decision-maker employs. In Study 3 we had participants search information about the nature of travel situations in a large number of consecutive trials. In all three studies we test the hypothesis that habit strength is negatively related to the amount of information that is acquired before making a choice between travel mode options.

HABIT VERSUS SITUATIONAL REQUIREMENTS

In spite of a strong habit, there may occasionally be reasons for an individual to expend more effort on reaching a decision. For instance, when one has a job interview, it is useful to select the travel mode that ensures being there on time, no matter what travel mode habit one has. In order to learn more about effects of habit versus situation-specific factors, we attempted to overrule habit by additional, manipulated, factors. In Studies 1 and 2 this was attempted by manipulating accountability demands, and in Study 3 by instructions to focus one's attention on the decision-making process. These manipulations were supposed to stimulate more systematic information processing, thus blocking the automatic mode that was supposed to prevail among strong habit participants. We thus expected that both habit and situation-specific motivation would be related to information search, i.e. habit was expected to decrease the amount of information search, while accountability and enhanced attention were expected to increase depth of information search (cf. Tetlock, 1983; Weldon & Gargano, 1988). In addition, we expected interactions between habit and the manipulated factors, namely that level of information search would be relatively high under conditions of accountability and enhanced attention, irrespective of habit strength.

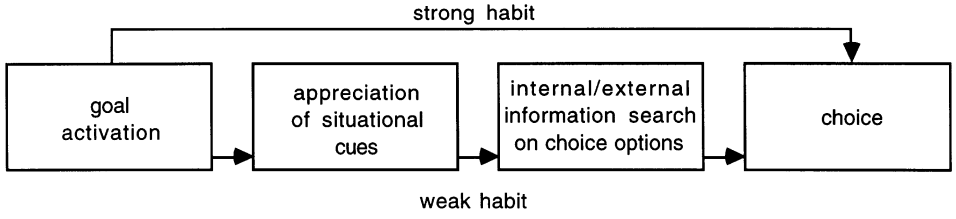


Figure 1. Process model of making choices by weak and strong habit individuals

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THE MEASUREMENT OF HABIT

Most social psychologists use self-reported frequency of past behaviour as a measure of habit. However, it has been argued that this operationalization is not optimal (e.g. Ajzen, 1991; Eagly & Chaiken, 1993; Ronis *et al.*, 1989; Triandis, 1980). First, to the extent that behaviour is habitual and is performed automatically, it may be difficult to retrieve episodic memories of instances of performing that behaviour (e.g. Pearson, Ross, & Dawes, 1992). Frequency estimates may also be affected by biases such as availability or representativeness (Tversky & Kahneman, 1974). In addition, we may wish to have a measure of habit that somehow incorporates an element of automaticity, which is one of the essential characteristics of the concept.

We developed an alternative measurement instrument, one which uses mental representations of activities that may involve habitual acts (Aarts, 1996; Verplanken *et al.*, 1994). In order to measure habit strength concerning travel mode choices, participants are presented with a number of globally described trips (e.g. 'going to the supermarket', 'visiting a friend in a nearby town'). For each destination, they are requested to mention as quickly as they can the first mode of transportation that comes to mind as the one they would use. The frequency of choices for one particular travel mode (e.g. car) across the stimulus destinations serves as a measure of habit strength for choosing that behavioural alternative in general. Time pressure further increases the likelihood that responses capture an element of automaticity, and are thus based on schematic and readily available cognitive structures, in this case concerning habitual acts, rather than on reasoned deliberations (e.g. Kruglanski & Freund, 1983). Such cognitions may stem from memories of episodic instances of past behaviour, but may also comprise a script-type representation involving that particular activity (Abelson, 1981; Schank & Abelson, 1977). For instance, presenting someone with the item 'going to the supermarket' may activate his or her personal 'supermarket script'. When this person always goes by car, this choice may be a built-in part of this script. By presenting a variety of travel goals we assume that the respective representations are activated. A strong habit of choosing one particular travel mode (e.g. the car) may then be assumed to exist to the extent that responses reveal a high level of *invariance* across the stimulus activities. Conversely, absence of a particular travel mode choice habit may be reflected in a high variability of responses. Presenting a variety of situations might make the measure less vulnerable to idiosyncratic responses to one particular stimulus trip. We will refer to this instrument as the *response frequency measure* of habit.

The response frequency measure has been used and validated in a number of studies that were reported elsewhere (Aarts, 1996; Aarts, Verplanken, & van Knippenberg, 1997; Verplanken *et al.*, 1994, 1996). For instance, the measure was used to record car choice habit among commuters who lived very close to their job (Aarts, 1996). The measure appeared to correlate strongly with the number of times that participants, in spite of the short distance, took the car to one's job during the 5 days before the interview ($r = 0.60$, $p<0.001$), also when the measure was controlled for participants' attitude toward using the car. The measure also correlated significantly ($r = 0.66$; $p<0.001$) with self-reported frequency of car use in general, which is traditionally used as a measure of habit, as well as with the respondents' annual mileage ($r = 0.37$; $p<0.001$). In addition, the test–retest reliability of the measure across 4 months appeared to be very high ($r = 0.92$, $p<0.001$). In another

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study (Verplanken *et al.*, 1996) it was found that the response frequency measure correlated equally strongly with actual travel mode choices that were recorded across a 7-day period, as did self-reported frequency of past behaviour ($r = 0.28$ and $r = 0.27$, respectively, both $ps < 0.001$).

STUDY 1

Method

Procedure and measurement of habit strength

Participants worked in separate cubicles. The experiment was computer-controlled. First, the response-frequency measure of habit was administered. Participants were presented with nine imaginary travel goals (e.g. 'Going to the beach with some friends', 'Playing a sport as a leisure activity', 'Visiting friends in the village', 'Shopping after work'). For each stimulus journey participants were required to mention as quickly as possible a travel mode. In this case, *bicycle choice habit* was indexed by the number of choices that were made for the bicycle. The measure thus varied from 0 to 9. The mean score across the sample was 4.96, S.D. = 1.68. The sample was split as close as possible to the median of the measure into participants with relatively strong versus relatively weak bicycle choice habit. In addition to the habit measure ancillary questions were presented, among which an attitude toward using the bicycle for going into town. Responses were given on an 11-point favourable–unfavourable scale.

The information acquisition task

Participants were familiarized with an information-display-board, which was also intended to remove the habit measure task from their working memory. They were then asked to imagine that they had to travel from their home to a shop in the town centre. In order to reach this destination they could choose from four travel mode options, i.e. walking, bus, bicycle, and train. An information-display-board was shown with the four travel options as rows, and six attributes as columns (i.e. physical effort, probability of delay, travel time, nuisance caused by other people, expected personal convenience, and freedom). Each cell of the matrix represented a travel mode option $\times$ attribute combination, and contained, hidden, the respective attribute values. These values were presented in verbal form (i.e. 'very little', 'little', 'average', and 'much'), except for travel time, which was presented in minutes. Participants could freely inspect and reinspect pieces of information in any order by clicking the mouse on the respective cells. As soon as they felt that they had acquired sufficient information, they indicated their choice. The computer maintained a record of which information items were inspected and reinspected.

In order to manipulate *accountability*, half of the participants were told that they would have to explain their choice at the end of the session. This manipulation was

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implemented after the instructions for the main choice task, and before participants actually started work on it.

After the choice task participants were presented with each option × attribute combination, and were asked to recall the attribute value they had seen when they had inspected that information item during the search task. The four possible values were presented in multiple-choice format. If a particular piece of information had not been inspected, they were asked to estimate the value that they believed to be the correct one. For each item (inspected and not inspected) participants were asked to rate how *certain* they were of their response on an 11-point scale, ranging from 'not certain at all' (1) to 'very certain' (11).

Participants and design

Participants were 80 undergraduate students. They were recruited from one particular student dormitory building, which was located at a distance of 3 kilometres from the town centre. This was done in order to match the sample with respect to the travel scenario described in the choice task, especially concerning the distance between their house and the town centre. Furthermore, the building was very near a bus stop and a railway station with direct connections to the town centre, which were therefore realistic travel mode options. All participants owned a bicycle and a public transportation annual pass. Participants were paid for participation. The design of the experiment was 2 (habit: strong versus weak) × 2 (accountability: accountable versus not accountable) mixed model. ANOVAs were conducted according to this design.

Results

Manipulation check

As a check on the accountability manipulation, participants were asked to indicate to what extent they felt that they had to make a choice that they could explain. They responded on an 11-point scale ranging from 'little' (1) to 'strongly' (11). Participants in the accountability condition scored higher ($m = 6.63$) than those who were not held accountable ($m = 4.65$), $t(76) = 3.34$, $p < 0.001$.

Information acquisition

On average 9.22 pieces of information were inspected (S.D. = 6.42). One subject did not inspect any information, and five participants inspected all 24 pieces of information. The number of *re*inspected items was low (i.e. 3.9 per cent of all inspected items across the sample). All analyses were performed on the number of inspected items, thereby excluding reinspections, although including reinspections yielded the same results.

The number of inspected information items was subjected to an ANOVA. As expected, strong habit participants inspected less information, $m = 7.25$, than weak habit participants, $m = 10.84$, $F(1,76) = 6.28$, $p < 0.02$. Participants under accountability demands also searched more information, $m = 10.57$, than

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participants who were not held accountable ($m = 7.88$), although this effect was marginally significant, $F(1,76) = 3.38$, $p<0.07$. Contrary to expectations, a nonsignificant interaction suggested that the effects of habit and accountability were independent, $F(1,76) = 0.02$.

In order to control the effect of habit for the extent to which the habit measure taps participants' attitude to using the bicycle for this particular trip, the attitude was regressed on the habit measure, and participants were split at the median of the distribution of the residuals into weak and strong habit participants. Using this corrected measure, the habit main effect remained highly significant, $F(1,76) = 7.88$, $p<0.01$.

In addition to the overall amount of information inspected, it was investigated whether there were differences in *selectivity* of information search across choice options. In the traditional information-display-board paradigm, selectivity of information search across options is interpreted as the extent to which cognitively demanding compensatory strategies (low selectivity) versus less complex noncompensatory strategies (high selectivity) were used (e.g. Payne, 1976). Most noncompensatory strategies are characterized by an early rejection of some choice options, which thus results in search patterns that comprise large differences in the amount of information that is inspected across options. Selectivity is indexed by the standard deviation of proportions of information items selected across choice options. For weak habit participants this measure equalled 0.18, and differed marginally significantly from strong habit participants' mean score, 0.24, $F(1,75) = 3.80$, $p<0.06$, suggesting that strong habit participants tended to follow relatively more noncompensatory choice strategies. There was no significant effect of accountability, $F(1,75) = 0.43$, and no significant interaction, $F(1,75) = 0.05$[1].

In Figure 2 (upper panel, p. 550) the amount of information that was acquired for each choice option is graphically presented. As was indicated by the selectivity index, weak habit participants not only searched more information than did strong habit participants, but also inspected more equal amounts of information pieces across the options. Strong habit participants particularly neglected information about alternatives to their habitually chosen option.

Travel mode choices

After the information search stage, participants indicated their choice of travel mode. Choices for walking, bus, bicycle, and train were made by 1, 3, 55, and 21 participants, respectively. Strong habit participants chose the bicycle versus an alternative option more frequently (81 per cent versus 19 per cent) than did weak habit participants (59 per cent versus 41 per cent), $\chi^2(1) = 4.25$, $p<0.04$, which demonstrated the effect of habit on choice outcome. There was no significant effect of accountability on choice for bicycles, $\chi^2(1) = 1.45$.

[1]Another traditional process measure is the extent to which search patterns are attribute-wise versus option-wise (e.g. Payne, 1976). However, regarding our purposes, it is not clear whether either type of search pattern is indicative of a more or less elaborate decision strategy. In addition, the validity of this measure has recently been challenged on methodological grounds, in particular when the number of options does not equal the number of attributes (e.g. Stokmans, 1992).

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Certainty of estimated not-inspected attribute values

One reason why strong habit participants inspected less information in the choice task than did weak habit participants may have been that strong habit participants were more certain about the attribute values that they did *not* inspect. Whether or not an information item was inspected was inferred from the computer logs. A mean score of participants' judgments of how certain they were about the estimated attribute values of the non-inspected items was subjected to an ANOVA. Strong habit participants were more certain about these estimates, $m = 8.74$, than were weak habit participants, $m = 7.50$, $F(1,70) = 10.21$, $p<0.002$. The effect of accountability, $F(1,70) = 0.26$, and the interaction, $F(1,70) = 0.13$, were both nonsignificant[2].

Discussion

The results of this study suggest that as habit strength increases, depth of predecisional information search decreases. Strong habit individuals apparently need less information about the pros and cons of available options. This effect was independent of participants' attitude toward using the bicycle for the stimulus trip. Also, holding participants accountable for their choices seemed to have increased the level of information search, suggesting a more complex decision-making process (Tetlock, 1983; Weldon & Gargano, 1988).

The average number of inspected information items was relatively low, i.e. 39 per cent of the available information. One reason for this may be the fact that the stimulus trip, which represented a realistic situation, was well known to the participants. It is conceivable that participants who have developed a strong bicycle choice habit had done so in exactly the context that was used in the experiment, and therefore needed less information. In other words, strong habit participants' level of knowledge about this particular trip might have been higher compared to the weak habit participants' level of knowledge. The hypothesized effect of habit strength on the elaborateness of the decision-making process may thus be confounded with knowledge. We therefore replicated the present study, this time using an unfamiliar stimulus journey. In addition, we used a more extensive version of the habit measure.

STUDY 2

Method

The method of this study was very similar to Study 1. The differences were the following.

[2]Because subjects were asked to recall inspected information, recall accuracy could be analysed. A marginally significant difference in recall accuracy between strong and weak habit subjects, $F(1,71) = 3.58$, $p<0.07$, suggested that strong habit subjects recalled the inspected information better than did weak habit subjects. However, the interpretation of this effect is ambiguous: because strong habit subjects inspected less information than weak habit subjects, their mental load was less, which may have been the reason for the memory advantage.

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The response frequency measure of habit

An extended version of 15 items was used in this study, which comprised five short distance destinations, five middle-range distance destinations, and five long distance destinations in The Netherlands. The mean habit score was 4.69, S.D. = 2.11.

The information acquisition task

The information acquisition task now comprised an unknown travel scenario. The computer displayed a map of an imaginary town, showing the outlines of the town's centre, a shopping area, where participants were supposed to go to, the participant's location of his or her imaginary home, the routes of buses, train, and tram, and their stops. A legend indicated the scale of the map. The information-display-board contained five travel mode options, i.e. walking, bus, bicycle, train, and tram, and six attributes, i.e. physical effort, probability of delay, travel time, expected nuisance from other people, post-transportation distance (e.g. from station to shop), and freedom.

Participants

Participants were 42 undergraduate students.

Results and discussion

Manipulation checks

Accountable participants indicated that they had made more effort in choosing the best option ($m = 7.32$) compared to non-accountable participants ($m = 5.80$), $t(40) = 2.02$, $p<0.05$. Accountable participants also felt a greater pressure to make a good decision ($m = 7.18$) than non-accountable participants ($m = 5.75$), $t(40) = 1.79$, $p<0.05$, one-tailed.

Information acquisition

As expected, participants inspected a larger proportion of information items than did participants in Study 1. The average number of information items that were inspected was 16.83 (i.e. 56 per cent; S.D. = 8.29). All participants inspected at least one information item, while seven participants inspected all 30 pieces of information. All analyses were performed on the number of inspected items, thereby excluding reinspections. Although the number of reinspections was higher than in Study 1 (i.e. 23.8 per cent of all inspected items across the sample), the results were the same when reinspections were included in the analyses.

As expected, strong habit participants inspected less information ($m = 14.45$) than did weak habit participants ($m = 19.45$), $F(1,38) = 6.83$, $p<0.02$. Participants who were held accountable searched more information ($m = 18.86$) than did participants

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who were not held accountable ($m = 14.60$), $F(1,38) = 5.62$, $p<0.03$. As in Study 1, the interaction term was not significant $F(1,38) = 0.00$. The results thus replicate the findings of Study 1.

Weak and strong habit participants differed more strongly than in Study 1 in the extent to which equal amounts of information were inspected across options. Strong habit participants searched more selectively, indicating the use of noncompensatory strategies, than weak habit participants. The standard deviation of proportions of information items selected across choice options was 0.07 for weak habit participants and 0.13 for strong habit participants, $F(1,38) = 6.95$, $p<0.02$. Figure 2 (bottom panel) shows that weak habit participants inspected relatively equal amounts of information for each option, whereas strong habit participants left information particularly about alternatives to their habitual choice, uninspected. There was no significant effect of accountability, $F(1,38) = 1.03$, and no significant interaction, $F(1,38) = 0.39$.

Travel mode choices

No choice was made for walking, whereas choices for bus, bicycle, train, and tram were made by 4, 28, 8, and 2 participants, respectively. Strong habit participants chose the bicycle versus an alternative option more frequently (82 per cent versus 18 per cent) than did weak habit participants (50 per cent versus 50 per cent), $\chi^2(1) = 4.77$, $p<0.03$. There was no significant effect of accountability on bicycle choice, $\chi^2(1) = 0.76$.

Certainty of estimated not-inspected attribute values

Mean certainty judgments about estimates of non-inspected information items were submitted to an ANOVA. Strong habit participants were *not* significantly more certain of their estimates of non-inspected information ($m = 7.16$) than were weak habit participants ($m = 7.92$), $F(1,31) = 3.26$. There was also no significant effect of accountability $F(1,31) = 0.30$, and the interaction was also nonsignificant $F(1,31) = 0.12$. These results suggest that the finding that strong habit participants acquired less information than did weak habit participants cannot simply be attributed to strong habit participants thinking they were more knowledgeable about the non-inspected attribute values. In other words, although a confound of habit and knowledge cannot be completely ruled out, and might to some extent be inherently present in research on effects of habit, the fact that strong habit participants searched less information is more likely to be the result of a higher degree of automaticity in habitual choices than of knowledge about the particular trip.

STUDY 3

Whereas Studies 1 and 2 focused on pre-choice information search about features of choice options, Study 3 investigated a perhaps more fundamental phase in the choice

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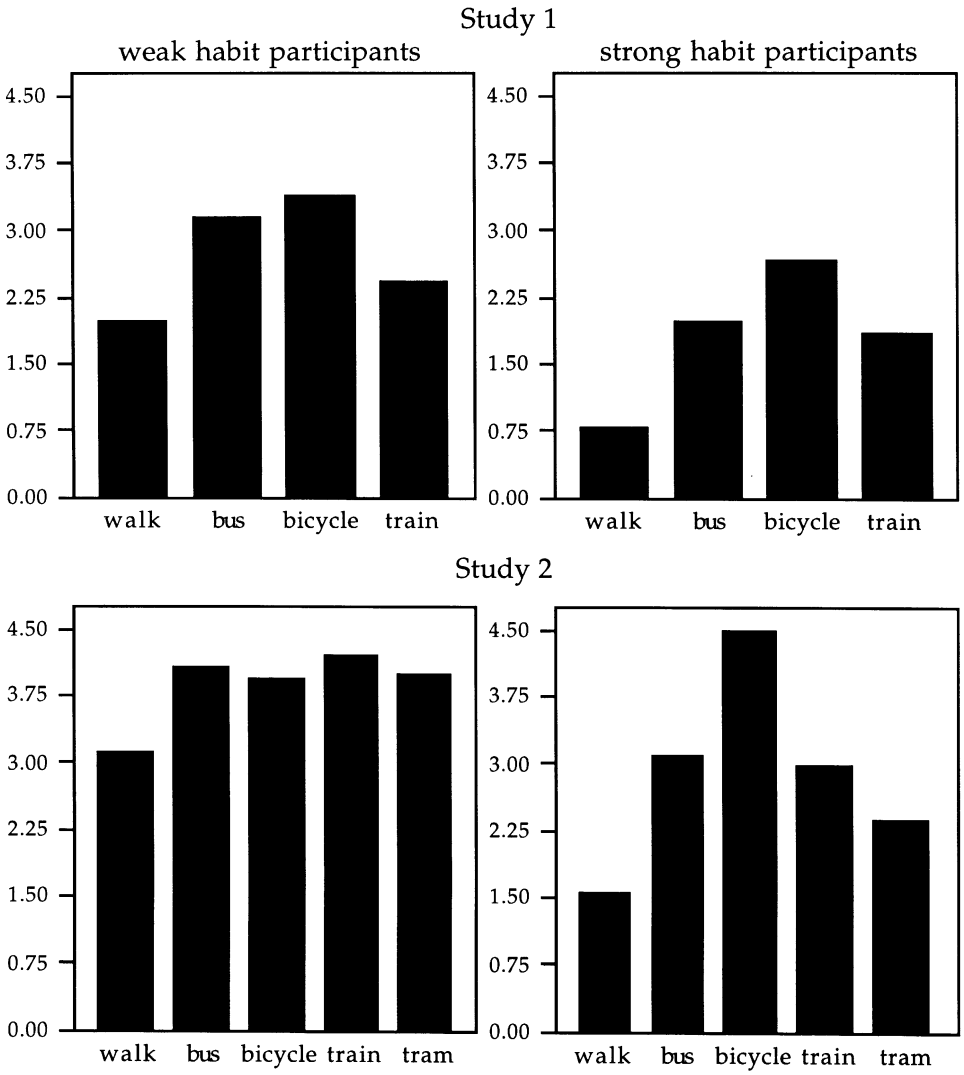


Figure 2. Mean number of inspected information items across travel mode options for weak (left-hand side) and strong habit participants (right-hand side) in Study 1 (upper panel) and Study 2 (lower panel)

process, namely the appreciation of features of the choice situation itself, as was represented as the first step after goal activation in Figure 1. In the context of travel mode choices, this phase involves the appreciation of aspects of the trip itself and the circumstances under which it is made, for instance the distance to the destination, the weather, available time, and so on. Such aspects need to be appreciated before any consideration of travel mode options can be made at all. In this third study we examined the role of habit in participants' perceptions of the nature of travel choice problems. Thus, participants' task in this study was to acquire information that

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disclosed the nature of a trip. Unlike Studies 1 and 2, participants of this study made a large number of travel mode choices. The rationale behind using repeated choices is the expectation that habit may be more clearly revealed in tasks that provide the opportunity of performing them in a routinized mode. In addition, as in the previous two studies, we attempted to manipulate the choice process directly. Whereas in the previous studies accountability demands were used to elicit a more elaborate choice process, in the present study participants' attention was manipulated by asking them in between consecutive trials about the importance of the available information. In this study a non-student sample of adults was used, and habit strength concerning the use of the car was measured.

Method

Procedure and measurement of habit strength

Participants worked in separate cubicles. The experiment was computer-controlled. Participants were first presented with the 15-item habit measure described in Study 2. In the present study the number of times the car was mentioned across the 15 items was used as a measure of *car choice habit* ($m = 8.28$, S.D. $= 3.50$). The sample was split as close as possible to the median of the distribution so as to distinguish between participants with relatively strong versus relatively weak car choice habit. The habit measure was followed by ancillary questions, among which was participants' attitude toward using the car, which was measured on an 11-point favourable–unfavourable scale.

The information acquisition task

The information search task consisted of 27 trials. Participants were told that each trial contained an imaginary trip aimed at picking up some goods in a shop. For making the trip they could choose between four travel modes, i.e. walking, bus, bicycle, and car. Participants could learn more about the trip by inspecting information about five aspects, i.e. weather conditions, the weight of their luggage, travel distance, time of departure, and available time. The vertical order in which the aspects were simultaneously displayed on the screen was systematically varied, i.e. there were five different orders across which each aspect appeared in the first, second, third, fourth, and last position, respectively Participants were randomly assigned to the five different order conditions. Information about an aspect appeared on the screen by clicking the respective box, and disappeared when another aspect was selected. Participants were free to inspect and reinspect the available information items. They were instructed to proceed to the next screen to indicate their travel mode choice, as soon as they felt that they were sufficiently informed about the nature of the trip in order to make a choice. They then proceeded to the next trial.

For each aspect the information that could be displayed on request could take one of three values. For instance, weather conditions always referred to precipitation (i.e. 'no rain', 'a little drizzle', or 'heavy rain'). The combinations of values of the five aspects in each trial were chosen such that, when the three possible values for each

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aspect are coded as 1, 2, and 3, respectively, aspects were uncorrelated across the 27 trials. This was done in order to ensure that participants' information search behaviour was not affected by interdependency of aspect values. Complete independency was accomplished by using a fractional replication design (Cochran & Cox, 1957). Finally, for each subject the order of presentation of the 27 trials was randomly determined by the computer.

In order to examine the effect of focusing participants' *attention* on the decision-making process, participants were randomly assigned to one of three conditions. One-third of the participants (the 'relevant attention' condition) were asked at the end of each trial to indicate how important they judged one particular aspect (e.g. weather conditions) to be for the choice that they just had made. In order to keep the working load within acceptable limits across the 27 trials, an importance rating of only one aspect was required for each trial, which was randomly chosen by the computer. The other participants served as controls in two conditions. For one-third of the participants (the 'irrelevant attention' condition) the same procedure was implemented, but ratings of importance of aspects of the travel mode decisions were substituted by ratings of the ease of working on the computer (e.g. handling the mouse). Finally, one-third of the participants were not exposed to either of these attention treatments (the 'no attention' condition).

Participants and design

Participants were 135 non-student adults. Ages ranged from 18 to 78 years, $m = 37.5$, S.D. $= 13.7$. All participants had a driver's licence, and had a car at their disposal. They were paid for participation. The design of the experiment was 2 (habit: strong versus weak) $\times$ 3 (attention: relevant, irrelevant, no) $\times$ 27 (trials:1–27) mixed model with repeated measures on the last factor. MANOVAs were conducted according to this design, while ANOVAs were conducted according to a 2 (habit: strong versus weak) $\times$ 3 (attention: relevant, irrelevant, no) mixed model design.

Results and discussion

Manipulation checks

Participants indicated on an 11-point scale, ranging from 'little' (1) to 'much' (11) the extent to which they had been actively thinking about their choice of travel mode in each trial. Participants in the relevant attention condition thought more about their choices ($m = 4.51$), compared to the pooled conditions of irrelevant attention ($m = 3.47$) and no attention ($m = 3.56$), $t(133) = 2.10$, $p<0.04$. The irrelevant attention and no attention conditions did not differ significantly, $t(88) = 0.16$. Interestingly, weak habit participants indicated that they thought more about their choices ($m = 4.73$) than did strong habit participants ($m = 3.13$), $t(133) = 3.56$, $p<0.001$. There was no significant habit strength $\times$ attention interaction, $F(2,129) = 0.99$. Finally, participants in the irrelevant attention condition indicated that they had paid more attention to working with the computer ($m = 4.67$)

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compared to the pooled conditions of relevant attention ($m = 3.13$) and no attention ($m = 2.93$), $t(133) = 2.96$, $p<0.004$.

Information acquisition

The average number of information items that were inspected per trial was 3.43 (S.D. = 1.06). Travel distance was most frequently inspected (92 per cent of the total number of inspections), followed by luggage weight (81 per cent), weather conditions (71 per cent), available time (61 per cent), and time of departure (36 per cent). Only 2.8 per cent of the information was *re*inspected. All analyses were performed on the number of inspected items, thereby excluding reinspections, although including the reinspections in the analyses did not alter the results.

The number of inspected information items was subjected to a MANOVA with repeated measures on the factor trials. A significant habit main effect indicated that across the 27 trials strong habit participants acquired less information about the choice problems ($m = 3.25$) than did weak habit participants ($m = 3.66$), $F(1,129) = 4.71$, $p<0.04$. This effect remained significant when the habit measure was controlled for participants' attitude toward using the car, following the same procedure as in Study 1, $F(1,129) = 5.60$, $p<0.02$. There were no significant between-participants effects of attention, $F(2,129) = 1.17$, and the habit × attention interaction was also nonsignificant, $F(2,129) = 0.65$. This result thus extends the findings in Studies 1 and 2 that habit strength is negatively related to depth of predecisional information search.

As for the within-subjects effects, there was a significant downward linear trend in the number of inspections across the 27 trials, $F(1,129) = 4.92$, $p<0.03$. This effect is qualified, however, by a habit × attention interaction for the linear trend, $F(2,129) = 3.64$, $p<0.03$. In Figure 3 the mean number of inspections in each trial is graphically presented. It is important to note that the trials in the graphs represent a time sequence. Because the 27 trials were randomly presented to participants, a particular trial number in the figure thus represents different trips for different participants. A contrast between the two control conditions yielded no significant interaction with habit for the linear trend, $F(1,129) = 0.84$. In the following analyses we therefore contrasted the relevant attention condition with the two control conditions pooled. In Figure 3 the two control conditions are averaged.

A contrast between the relevant attention condition versus the control conditions revealed a significant habit × attention interaction with respect to the linear trend, $F(1,129) = 6.41$, $p<0.02$. Within the control conditions the effect of habit was marginally significant for the linear trend, $F(1,131) = 3.61$, $p<0.06$. Whereas strong habit participants consistently inspected relatively little information across all trials, $F(1,131) = 0.02$, n.s., weak habit participants showed a decay in their relatively high level of search, $F(1,131) = 5.45$, $p<0.03$. Within the relevant attention condition the habit effect for the linear trend was also marginally significant, $F(1,129) = 3.12$, $p<0.08$. In this condition, however, the weak habit group maintained a high level of information acquisition items across all trials (see Figure 3, bottom panel), $F(1,129) = 0.04$, n.s., whereas the strong habit group started off at a level comparable to the weak habit group, but thereafter showed a significant decay across the 27 trials, $F(1,129) = 5.36$, $p<0.03$.

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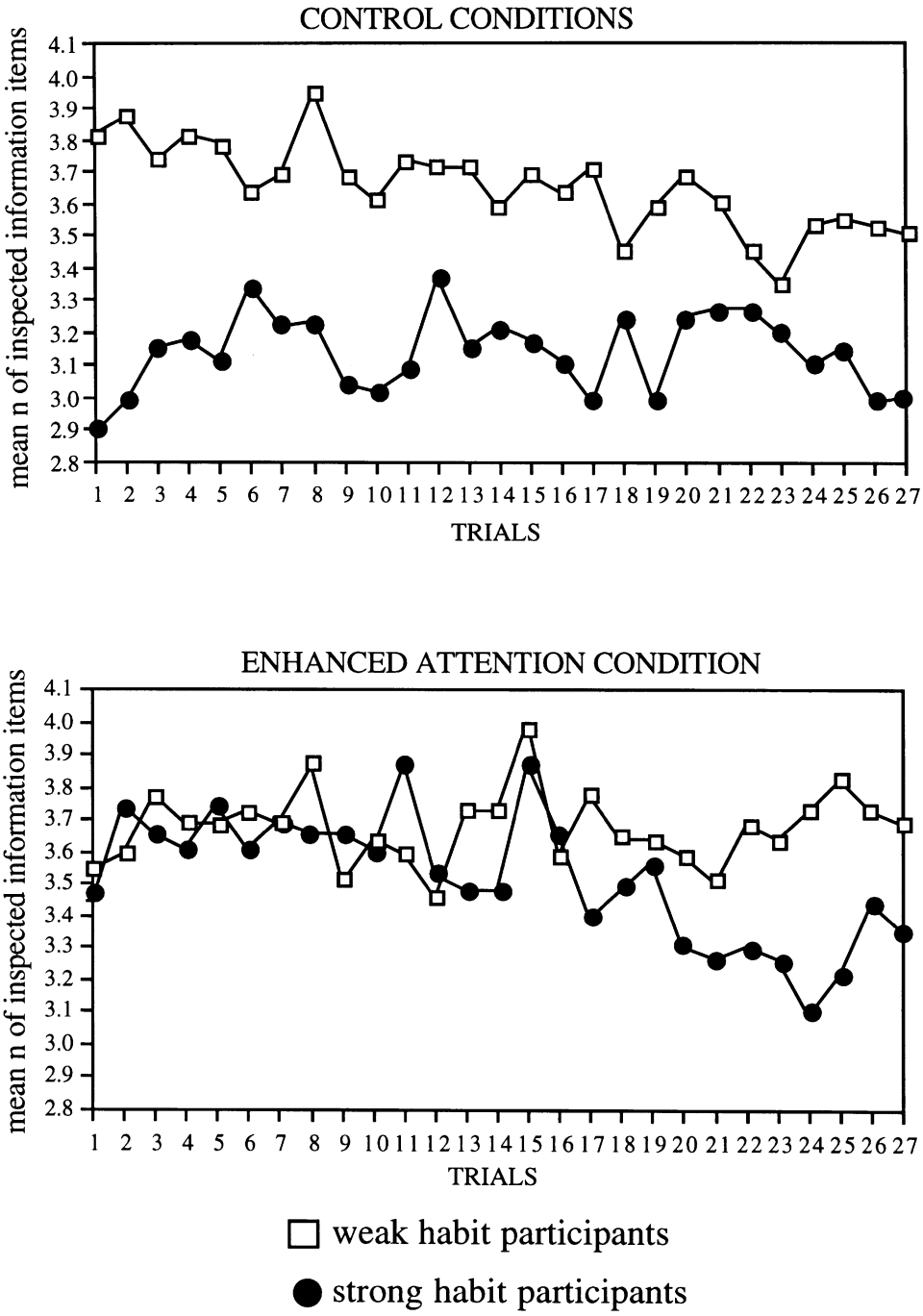


Figure 3. Mean number of inspected information items across the 27 trials for the combined control conditions (top panel), and the relevant attention condition (bottom panel)

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To summarize the results, strong habit participants acquired less information than weak habit participants did. Furthermore, focusing participants' attention on the importance of the information was effective for both weak and strong habit participants, but in different ways. In the control conditions, weak habit participants—showing overall deeper search than did strong habit participants—slightly diminished their information search over time. In the relevant attention condition, weak habit participants maintained a high level of search depth throughout the 27 trials. Strong habit participants in that condition started off at the same high level of search, comparable with weak habit participants, but, in spite of the attention manipulation, their level of search declined over time. Apparently, it is possible to affect strong habit individuals' level of processing, but only temporarily, as the chronic tendency to engage in minimal processing ultimately seemed to prevail.

Travel mode choices

On average across the 27 trials participants made 3.62 choices for walking, 0.66 choices for the bus, 9.26 choices for the bicycle, and 13.47 choices for the car. Frequency of car choices was subjected to ANOVA. Strong habit participants chose the car more frequently ($m = 15.56$) than did weak habit participants ($m = 10.85$), $F(1,129) = 29.38$, $p<0.001$, which once more illustrates the effect of habit on choice outcome. There was no significant effect of attention $F(2,129) = 0.21$, and the interaction was also nonsignficant, $F(2,129) = 1.30$.

GENERAL DISCUSSION

Table 1 presents an overview of proportions of information selected in each study by weak and strong habit participants under low and high manipulated accountability/attention conditions. Clearly, strong habit participants consistently selected less information, whether this concerned characteristics of choice options or choice situations, than did weak habit participants. In addition, in Studies 1 and 2 we provided evidence to suggest that strong habit participants employed less compensatory choice rules than weak habit participants. In all, these results suggest that weak habit participants' choice processes were more elaborate compared to strong habit participants' choice processes, both in terms of their perceptions of choice situations and of choice options. This was expected on the basis of Triandis' (1977, 1980) model of attitude–behaviour relations, and suggested by the process model in Figure 1.

On the one hand, a less elaborate choice process may be expected when a habit is based on a high level of knowledge and experience concerning the domain of interest. In those cases there is little need for external information, and relevant information may be processed efficiently (e.g. Bettman & Park, 1980). In that case a limited choice process is functional. Experts, for instance, may acquire little information and yet make an accurate decision. This might explain the results of Study 1, in which strong habit subjects acquired less information concerning a real and well-known trip than

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Table 1. Amount of information acquired, proportionally to the available amount of information, in each of the three studies, as a function of habit strength and manipulated attention

	Not accountable	Accountable
Study 1: choice option information, known choice situation		
Weak habit	0.39	0.51
Strong habit	0.26	0.35
Study 2: choice option information, unknown choice situation		
Weak habit	0.57	0.77
Strong habit	0.36	0.55
Study 3: choice situation information		
	No attention focused	Attention focused
Weak habit	0.73	0.73
Strong habit	0.63	0.70

did weak habit subjects. On the other hand, the automaticity of experts' decisions differs from the type of automaticity that characterizes most mundane behaviours, in that experts are generally aware of all relevant choice alternatives, whereas habit in daily behaviours may lead to a narrow focus on the habitually chosen option, i.e. habit may limit the decision-maker's consideration set (cf. Pieters & Verplanken, 1995). In other words, habit may be accompanied by less motivation to search out information, regardless of whether this information is unknown, and regardless of its importance. This was illustrated by the results of Studies 2 and 3, in which participants were presented with unknown stimulus trips. Whereas a limited choice process may be functional as a result of experience and knowledge, shortcuts that exclude appreciation of basic information about the choice problem, as was found in Study 3, may result in suboptimal decisions. In the extreme, as was indicated in Figure 1 by a direct link from goal activation to choice under conditions of strong habit, strongly habitual choices are relatively simple stimulus–response relations. In this case, the individual may not perceive such a situation as a choice at all, which thus precludes the consideration of situational cues and alternative options.

Although this is an inherent problem of laboratory studies in general, a drawback of the present studies is the artificial nature of the experimental choice tasks, rendering the question of external validity. Some support for the external validity of our results may be provided by two field studies that were reported elsewhere, which focused on the relationships between habit, attitudes, and behaviour (Verplanken *et al.*, 1994, 1996). In both studies the focus was on actual behavioural decisions, i.e. car-choice behaviour, which was measured as self-reports of recent behaviour in the former, and through a 7-day diary in the latter study. In both studies it was found that habit strength interacted with attitude or intention in the prediction of behaviour, as was predicted on the basis of Triandis' (1977, 1980) model of attitude–behaviour relations. In other words, those field studies too provided evidence to suggest that weak habit individuals' behavioural choices are guided by more extensive reasoning than strong habit individuals' choices. We thus feel comfortable that the laboratory results reflect phenomena that are related to actual travel mode choice behaviour.

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What can we say about the status of the process model that was presented in Figure 1 on the basis of the present results? Although the three studies do not constitute a comprehensive test of the model, the results do provide some evidence. At least on the basis of each study separately, the information search data strongly suggest that the causal chain 'goal activation' → 'appreciation of situational cues' and 'external information search on choice options' → 'choice' seems to play a more important role for weak than for strong habit persons. This, together with the consistent relationship between habit strength and choice, makes a more direct link between 'goal activation' and 'choice' for strong habit persons also more likely. However, future research may be conducted to provide a more comprehensive test of the model, for instance studies that focus on a link between 'appreciation of situational cues' and 'external information search on choice options'.

Can habit be overruled?

While habit seems to exert a chronic influence on the elaborateness of information search and decision-making, the effects of manipulated accountability and attention suggest that, as expected, situational requirements may enhance people's decision efforts. Both increasing the perceived functional importance of information acquisition, as well as directly asking to pay attention to the choice process may lead to a more analytical mode of decision-making. This is generally consistent with numerous studies demonstrating the contingency of elaborateness of judgment and decision-making processes on situation-specific and task-related demands (e.g. Chaiken, 1980; Payne, 1982; Petty & Cacioppo, 1979; Tetlock, 1983). However, at first sight the effects do not seem to be quite consistent across the three studies. The predicted interaction effect of manipulated attention and habit was found in Study 3, but accountability and habit did not interact in Studies 1 and 2. The reason for the latter might be that the two manipulations elicited different processes (Verplanken & Svenson, 1997). Accountability had an effect on depth of information search, but not on search strategy, as was suggested by the measure of search selectivity, while habit affected both depth and strategy. Thus, accountable participants may have inspected more information so as to prepare for the expected justification, without adopting more elaborate decision rules (cf. Simonson & Nye, 1992), whereas strong habit participants' lower level of search depth may relate to the use of less elaborate decision rules.

In Study 3 an interaction of habit and manipulated attention was obtained: in the high attention condition *both* weak and strong habit participants initially inspected relatively much information. However, habit seemed to have 'taken over' among the strong habit subjects after approximately half of the 27 trials: while weak habit subjects continued to select relatively much information, strong habit participants' level of search dropped substantially over time. These results suggest that, in spite of strong habits, it is possible to enhance individuals' motivation to engage in more complex decision-making for reasons relating exclusively to the specific decision-making context. However, this does not affect the chronic effect that habit ultimately seems to impose on the process (cf. Bargh & Barndollar, 1996). In other words, the results suggest that consequences of habit can be overruled, but only temporarily, even under the relatively ideal circumstances in a laboratory.

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The response frequency measure of habit

How valid is the response frequency measure as a measure of habit? In addition to the material on validity and reliability that was summarized in the Introduction section, the present studies provided additional evidence. First, the measure predicted not only information search behaviour, but also the travel mode choices in each study, as should be expected from a measure of habit.

Second, because habit was measured rather than experimentally manipulated, it is important to consider alternative interpretations of the results. For instance, the measure might tap mere preferences or attitudes, rather than habit. Speaking against this interpretation, in Studies 1 and 3 the results remained reliable when the response frequency measure was controlled for participants' attitude toward using the bicycle or car respectively[3]. It might also be argued that, especially because of the imposed time pressure during the administration of the measure, the measure might tap individual differences in motivation to expend mental effort to this task. In Studies 2 and 3 we included the 18-item *need for cognition* scale. The correlations between this scale and the response frequency measure were 0.16 (n.s.) and -0.04 (n.s.), respectively, thus providing no support of a mental laziness explanation.

Finally, in Study 3 we also included a self-report of frequency of past car choices. This measure correlated 0.58 ($p<0.001$) with the response frequency measure, while both measures were significantly related to the total amount of selected information (response frequency measure: $r = -0.18$, $p<0.05$, self-reported frequency of past car choices: $r = -0.25$, $p<0.01$).

Concluding remarks

The type of habit we focused on and measured is of a general nature, i.e. habitual patterns concerning the choice of a travel mode (e.g. the car) in a variety of situations. This does not exclude the possibility that specific habits may develop that are only associated with a well-determined situation. For instance, a person may have a strong general car habit, and thus even take the car for distances he might easily walk. However, this same person may like to walk daily to the nearby bakery so as to have a fresh start to his morning. We believe that *general* habitual patterns (e.g. taking the car, eating fat, littering) are particularly interesting because of the large-scale impact that such behaviours may have for society.

Investigating decision-making processes as a function of habit may seem paradoxical. It means focusing on decisions that are made quickly and automatically, which some people might not consider as decisions at all. We may have demonstrated that habit affects the way we look at and handle such choices. Although many habits are functional, they may lead to suboptimal choices. The present studies may thus demonstrate the importance of such split-second processes.

In the latest comprehensive overview of social psychology to date (Higgins & Kruglanski, 1996), *habit* was not an entry in the subject index. We would like to argue that it is time to put habit on the social psychologists' research agenda again.

[3]It is conceivable, however, that *any* measure of habit taps a person's preferences or attitudes to some extent, because after all most habits reflect choices that have been found satisfactory in the past.

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