Journal of Environmental Psychology (2000) **20**, 75–82
0272-4944/00/010075 + 08 $35.00/0

doi:10.1006/jevp.1999.0156, available online at http://www.idealibrary.com on IDEAL®

Journal of ENVIRONMENTAL PSYCHOLOGY

THE AUTOMATIC ACTIVATION OF GOAL-DIRECTED BEHAVIOUR: THE CASE OF TRAVEL HABIT

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Abstract

In the present paper, automaticity in habitual travel mode choice behaviour was investigated. Expanding on the idea that habits are mentally represented, it was proposed that when travel behaviour is habitual, activation of a travel goal automatically activates a travel mode in memory. In an experiment, participants were presented with travel goals (e.g. having to go to the university) and asked to mention a transport mode. The typical travel mode choice for those destinations was either permitted, or not permitted under conditions of cognitive load or not. Results showed that suppressing habitual responses is difficult, and often not successful under conditions of cognitive load, indicating that a transport mode choice can become automatically associated with travel goals.

Introduction

In daily life, people are regularly instigated to act upon the goal to travel. These goals to travel thus call for the use of a certain type of transport mode to achieve the travel goals. Indeed, since the domestication of animals and the invention of the wheel we have been able to select different types of transport modes in a variety of circumstances and for all kinds of purposes.

At first sight, travel mode choice seems to involve a real decision problem. Consider, for example your own shopping behaviour. When one has the goal to go to the supermarket, a number of subsequent judgements and decisions have to be made before you reach your final goal, such as determining the target or travel location, generating a proper route to travel, and deciding which mode of transport to use. Travel decisions are conceptualized as a mental structure that comprises a hierarchically arranged set of action plans (Russel & Ward, 1982; see also Gärling *et al.*, 1986; Bell *et al.*, 1996). Thus, when confronted with a specific goal to travel, people take the target location and travel route into account, subsequently consider various travel mode alternatives, and eventually select one (e.g. Gilbert & Foerster, 1977; Dobson *et al.*, 1978; Reibstein *et al.*, 1980; Levin & Louviere, 1981). Accordingly, travel mode choice behaviour is seen as a product of a reasoning process (see Fishbein & Ajzen, 1975; Ajzen, 1991).

It may, however, be questioned whether people often go through such a contemplative process, as sketched above, when they select a travel mode for a particular travel goal. When we have to go shopping in a nearby supermarket, are we really considering several transport mode options before deciding which one to use? When we use the car in order to visit a friend in a nearby town, have we consciously rejected other travel mode options, or was our decision to use the car rather automatic? It seems plausible to assume that travel mode choices can often be characterized as habitual, especially when we have used the same travel mode to reach the same goal repeatedly in the past (e.g. Goodwin, 1977; Banister, 1978; Aarts *et al.*, 1997; Verplanken *et al.*, 1998). The focus in this article is on the habitual nature of travel mode choice behaviour.

The habit concept is strongly rooted in behaviourist approaches to learning theory, typically emphasizing that mental (or cognitive) processes do not mediate the automatic activation of habitual responses to environments (Watson, 1914; Skinner, 1938). In contemporary research however, it is often argued that cognition does play a role in the environmental control of behaviour (e.g. Norman & Shallice, 1986; Ronis *et al.*, 1989; Bargh, 1990; Bargh & Gollwitzer, 1994). In line with this research, our central assumption is that habits are automatic goal-directed behaviours that are mentally represented (Aarts & Dijksterhuis, 2000). Habits are represented as strong associations between goals (e.g. going to the supermarket) and actions (e.g. using a bike). These associations develop as a result of frequent and consistent choices made to attain a certain goal (e.g. always use a bike to go to the supermarket). Because of these associations, the habitual choice or action is automatically activated upon the activation of the relevant goal. In concrete terms, activation of the goal to go to the supermarket automatically leads to activation of the associated action, that is, to take a bicycle (see Aarts & Dijksterhuis, 2000, for a more elaborate discussion of this model of habits).

The main assumption underlying our process-oriented approach towards habits is that frequent and consistent behavioural choices made to attain the same goal determines the formation of an association between a goal and an action, and thus, a habit. This assumption is supported by other findings. Ouellette and Wood's (1998) meta-analysis on habits showed that the direct influence of past behaviour on future behaviour was most pronounced for behaviours that are executed frequently (that is, on a daily basis) and consistently in a stable context. Behaviours that are carried out less often were more accurately predicted by consciously formed intentions towards the behaviour (see Aarts *et al.*, 1998, for a similar observation in the domain of travel behaviour). This pattern of results indeed confirms the assumption that when behaviour is performed many times in the past, subsequent behaviour becomes more and more governed by an automatized cognitive process, in the sense that it is evoked without (much) deliberation and thought. However, behaviours executed less frequently are (still) guided by a controlled or deliberated process of considering different alternatives as expressed, for instance, in the theory of reasoned action (Fishbein & Ajzen, 1975).

To recap, our conceptualization of habits is as follows: we assume that habits are represented as associations between goals (e.g. 'going to the university') and behavioural responses (e.g. 'taking the bike') that allow an automatic behavioural response upon activation of a goal. The strength of the association between goal and action is a function of frequency: non-habitual—or less frequently performed—behaviour (e.g. 'going to a meeting in another city by train') is not expected to be represented by such strong associations between goals and action.

In the present paper, we would like to test a key assumption that can be derived from our conceptualization. We conceive of habits as automatic behavioural responses. The literature on automaticity shows that automatic responses are hard to suppress or hard to control (Shiffrin & Schneider, 1977; Bargh, 1994). This should be no different for habitual behaviour. If we habitually go by bicycle to the supermarket, and for some reason we decide to take the bus on a given day, we have to actively suppress or inhibit the habitual bicycle response. This may be easier said than done. Fishbein and Ajzen (1975, p. 371) also pointed to this difficulty in their discussion of the role of habit in their attitude–behaviour model: 'Possible breakdown of the BI-B (behavioural intention-behaviour) relation may be due to a person's habits. Although a person may intend to perform one behaviour, 'by force of habit' he may perform an alternative one.' Accordingly, such slips (or action switches) can be seen as 'strong habit intrusions'.

However, under some circumstances habits are more difficult to control than under other circumstances. If one intends to perform a counterhabitual goal-directed action (e.g. using the bus instead of the bike to go to the supermarket) conscious attention is required to interrupt the habit. When attentional resources are absorbed by other tasks, and the intention to perform an alternative course of action is not capable of 'over-ruling' the activation of a habitual programme (Reason, 1979; Norman, 1981; Heckhausen & Beckmann, 1990) an action slip may result; instead of going to the bus stop, we may find ourselves riding the bicycle again. In sum, attentional resources are critical. Relevant research in several domains show that suppression of an automatic response is especially hard when one's attentional resources are absorbed by other tasks (Gilbert, 1989; Wegner, 1994).

In the present study, we would like to use our process-oriented model of habits to shed light on the process that leads to action-slips. Specifically, we would like to show that habitual responses are harder to control or suppress than non-habitual responses, and secondly, we would like to show that suppression of habitual responses will be especially difficult when attentional resources are absorbed by a secondary task.

The present research

In this experiment, carried out in the laboratory, we studied travel behaviour among Dutch university students. Contrary to other studies on habits (in which measures of habit are usually obtained by self-reported estimates of frequency of past behaviour; see Ouellette & Wood, 1998), we did not measure habit strength. Instead, we experimentally varied habit strength. More concretely, we studied students' bicycle choices in response to travel goals as an example of habitual (relatively high frequent) behaviour and train choices as an example of nonhabitual (relatively low frequent) behaviour. Among many students, bicycle is, at least for the Dutch, far more frequently used than train (e.g. CBS, 1997). Bicycle use can therefore be seen as much more habitual than train use. Hence, bicycle choices in response to travel goals were treated as habitual, while train choices in response to travel goals were treated as nonhabitual.

To demonstrate that habitual responses are hard to suppress or control, we employed an experimental procedure that is largely similar to a procedure used by Jacoby (1991) (see also Debner & Jacoby, 1994). In an adaptation of the Jacoby paradigm, we asked participants to respond, within a short limit of time, to travel destinations (e.g. university) under the instruction of either mentioning the typical mode of transport they would use for this trip (e.g. bicycle) or avoiding to respond with the typical travel mode (and to name an alternative, e.g. walking). This second experimental condition is crucial, since participants are asked to suppress their habitual transport mode choice in response to a travel goal. If there is automatic association between a travel destination and a travel mode after behaviour has become habitual (e.g. 'a university–bicycle link'), the suppression of this automatic, habitual response will be difficult and will require attentional control (*cf*. Kahneman, 1973; Logan, 1979; Gilbert, 1989; Wegner, 1994). Hence, habitual responses (i.e. the absence of successful suppression — in other words, errors) will most likely be revealed in the absence of sufficient mental capacity. Hence, in the experiment, suppression of the habitual (and nonhabitual) mode was tested both under conditions of mental load and under conditions of no mental load.

It is predicted that when instructions allow the typical mode of transport, load will have no effect on the probability of responding with the habitual or nonhabitual mode, since the response will occur anyway, either automatically or intentionally. More importantly, it is predicted that instructions to suppress the typical mode will reveal (relatively) successful suppression under no load conditions but not under conditions of mental load. However, unsuccessful suppression will only emerge for habitual actions. That is, we expect load to impair the successful suppression of habitual responses but not of nonhabitual responses.

Method

Participants and design

Fifty-six undergraduate students of the University of Nijmegen participated in the experiment. We recruited participants who lived in the city centre (within 2 km) who were able to walk and who owned a bicycle. Furthermore, all participants lived near a bus stop and railway station with direct connections to various cities and towns. Hence, these four travel modes (i.e. to walk, to use the bicycle, bus or train) were realistic travel options for either short or relatively long-distance trips for all participants. The experiment follows a 2 (Typical mode: permitted vs not permitted) $\times$ 2 (Cognitive load: yes vs no) between-participants $\times$ 2 (Habit: yes (bicycle) vs no (train)) within-participants design. Participants were randomly assigned to experimental conditions.

Selection of materials

First, a pilot-study was conducted to obtain travel goals that are usually reached by bicycle and by train. Thirty students (inhabitants of the city centre of Nijmegen and participants other than those in the actual experiment) were presented with 50 travel destinations, and asked to state which mode of transport they usually use to reach these destinations. We were able to obtain five travel destinations that are all located in the city centre and that were typically reached by bicycle (e.g. sports centre, university, and a very popular student discotheque called the Swing). Responses of bicycle use on these destinations varied from 87 to 97 per cent. Thus, these destinations represent travel targets for which participants tend to usually use their bike. Apart from these five bicycle trials, we obtained five travel destinations involving trips that participants do not usually make by bicycle but make by train (e.g. to Arnhem, a city about 20 km from Nijmegen). Responses of train use on these destinations varied from 83 to 100 per cent. Accordingly, these destinations are supposed to be visited by train. In sum, the experimental task consisted of 10 target trials: five habitual trials for which bicycle constitutes the typical mode of transport, and five nonhabitual trials for which train constitutes the typical travel mode.

Experimental task and procedure

The experiment was run on computers, and participants worked in separate cubicles. Participants were told that the study was about travel behaviour and that we would like to know which transportation mode (e.g. walking, bicycle, bus, train, car) they would use for several trips. First, they were asked to imagine that they had to travel from their home to several destinations they regularly visit inside as well as outside the city centre of the town. After elaborating on the goal to travel, they learned that they had to mention a travel mode in response to the several destinations that were to be presented on the screen.

Manipulation of permission of the typical mode. Half of the participants received instructions to mention the travel mode they would normally use for the presented destinations. This condition was referred to as the Typical mode permitted condition. Thus, bicycle was the typical mode for the habitual trials, and train constituted the typical mode for the nonhabitual trials. The other half of the participants were given instructions not to mention the mode of transport they normally would use, but to name an alternative instead (e.g. bus, walking, car). Because these instructions do not allow participants to respond with the typical travel mode, this condition was labelled Typical mode not permitted. As a result, in this condition participants were implicitly requested to suppress the typical (and in the case of bicycle trials, the habitual) travel mode.

Manipulation of cognitive load. For half of the participants, load was manipulated using a resource consuming secondary task. For this task, digits were placed on both sides of the travel location word (e.g. 5 university 8). Participants were required to report the sum of the two digits before responding with a travel mode. This condition is labelled the Cognitive load condition, because during the trial, attention was divided between summing the digits and responding with a travel mode. Only digits ranging from 1 to 9 were used. No identical digits were used in the same trial. The other half of the participants were not presented with digits, and thus did not perform the summation task. This condition is referred to as the No cognitive load condition.

An experimental trial consisted of the following sequence of events: (1) presentation of a fixation point for 2 s; (2) presentation of a premasking word for 500 ms; (3) presentation of the travel destination word for 300 ms (including the digits in the load conditions); (4) presentation of postmasking word for 500 ms; and (5) a dot indicating the request to respond. Everything appeared at the same location on the screen. The masks were words designating fruit (e.g. apple) or furniture (e.g. chair). In addition to masking the travel destination word, the masks served as a distraction to make the task a bit more difficult (*cf*. Debner & Jacoby, 1994).

Responding on trials was verbal and registrated by an audio-recorder. Participants were given 3 s to respond to each trial. Pilot work indicated that this was the minimal amount of time individuals needed to respond with a travel mode under conditions of cognitive load. All participants were told that they should always respond with a travel mode. In this way, we hoped that they would respond within the allotted time-limit and take the imposed time pressure seriously. If participants completed a trial within the allotted time, they pushed a button that initiated the next trial. However, if after 3 s no response was given, a tone indicated that the computer would automatically initiate the next trial. The ten target trials obtained by the pilot-study were presented in random order, and preceded by four practice trials. The dependent variable was the proportion of typical mode responses across the five habitual trials (i.e. bicycle use), and the proportion of typical mode responses across the five nonhabitual trials (i.e. train use). After participants finished this task, they were debriefed, thanked and dismissed.

Results

One participant did not complete a single trial within the allotted time. Therefore, data from this participant were excluded from the analyses. All participants in the cognitive load condition performed the task as required, that is, they first reported the sum of the digits and only then responded with a travel mode.

Self-reported indices of habit strength of bicycle use and train use

At the beginning of the experimental session, as part of a larger questionnaire, participants were asked to indicate how frequently they had used the bicycle and the train in the past 2 weeks, and also the extent to which they felt they were using the bicycle and the train by 'force of habit'. These four items were measured with 7-point answering scales ranging from 'not at all' to 'very often'. Participants' answers revealed that they had chosen bicycle more often ($M = 5{\cdot}49$), as a mode of transport than the train ($M = 4{\cdot}07$), $t(54) = 5{\cdot}22$, $p < 0{\cdot}001$, and that they felt that their bicycle choices were more strongly driven by habit ($M = 5{\cdot}31$) than their train choices ($M = 4{\cdot}16$), $t(54)3{\cdot}50$, $p < 0{\cdot}001$. These results suggest that, at least in the present study, travelling by bicycle is indeed more habitual than travelling by train. In other words, the selected bicycle trials can be conceived of as habitual, while the selected train trials can be seen as nonhabitual.

The typical mode: Bicycle and train responses

We subjected the proportions of bicycle and train responses to an ANOVA, with Typical mode and Cognitive load as between-participants factors, and the Habit strength as a within-participant factor. This analysis yielded a significant three-way interaction, $F(1,51) = 4{\cdot}68$, $p < 0{\cdot}04$, supporting the prediction that participants responded differently to habitual and nonhabitual associations. Or, in concrete terms, this effect shows that responses to bicycle trials and train trials differed.

The mean proportions of bicycle responses across the five bicycle trials for each cell in the design are presented in Table 1. As can be seen, the mean proportion of bicycle responses under permitted instructions was much higher (0·90) than under not permitted conditions (0·12). Of course, this trivial effect was highly significant, $F(1{\cdot}51) = 471{\cdot}54$, $p < 0{\cdot}001$. More importantly, the Typical mode × Cognitive load interaction was highly significant, $F(1,51) = 14{\cdot}95$, $p < 0{\cdot}001$. Planned comparisons revealed that in the condition where the typical mode was permitted the proportion of bicycle responses for no load and load did not differ reliably, $F(1{\cdot}51) = 2{\cdot}93$, N.S. However, in the not permitted condition the proportion of bicycle responses was significantly higher in the load condition compared with the no load condition, $F(1{\cdot}51) = 18{\cdot}60$, $p < 0{\cdot}001$, suggesting that habitual responses were more difficult to suppress when the cognitive load is high.[1]

The mean proportions of train responses across the train trials for each cell in the design are presented in Table 2. As Table 2 shows, the mean proportion of train responses under permitted instructions was much higher (0·94) than under not permitted instructions (0·05). Again, this trivial effect was highly significant, $F(1{\cdot}51) = 1217{\cdot}87$, $p < 0{\cdot}001$. Although the means show, at first sight, a similar pattern as for bike use, the Typical mode × Cognitive load interaction was not significant, $F(1{\cdot}51) = 3{\cdot}15$, N.S.

In sum, the three-way interaction shows that habitual (bicycle) actions are harder to suppress than nonhabitual (train) actions. More specifically, the bicycle response data show that suppression of habitual responses is more difficult under cognitive demanding conditions. In general, these failures to suppress corroborate the notion that the bicycle responses are automatically triggered by travel goals, while this does not pertain to (or at least to a lesser extent) nonhabitual train responses.

Discussion

In the introduction, we defined travel habits as goal-directed automatic behaviours that are mentally represented. Goals are associated with behavioural responses, and hence, goals are capable of activating behavioural responses automatically. In other words, the goal to travel to the university is strongly connected to bicycle use, and this habitual response is automatically activated upon the presentation of the location 'university'. Habit strength of behaviour was argued to be a consequence of the frequency and consistency with which these behaviours were performed in the past (Ouellette & Wood, 1998; Aarts & Dijksterhuis, 2000). The main goal behind the present experiment was to provide a first test of one of the key assumptions derived from this conceptualization. Given the fact that habits are automatic, in the sense that habitual

TABLE 1
Mean proportions of bicycle responses for permitted and not permitted instructions under no load and load conditions

	Typical transport mode	
Cognitive load	Permitted	Not permitted
No	0·94	0·03
Yes	0·86	0·22

TABLE 2
Mean proportions of train responses for permitted and not permitted instructions under no load and load conditions

	Typical transport mode	
Cognitive load	Permitted	Not permitted
No	0·96	0·01
Yes	0·92	0·08

responses are activated automatically, we hypothesized that habitual responses are difficult to suppress or control, at least under some circumstances.

Results of the present experiment provide support for the hypothesis that habitual responses are indeed difficult to suppress under mentally demanding conditions. In concrete terms, participants were asked not to respond (i.e. to suppress) with the travel mode they normally use for regularly visited travel destinations. Instead, they were asked to name an alternative. Results showed that the suppression of a habitual travel mode choice (that is, bicycle use) was successful, although mainly when enough attention could be given to this task. Success rates of suppression were significantly impaired when attention was absorbed by a secondary task. This effect did not emerge for nonhabitual (train use) travel mode choice.

The fact that participants had difficulty in suppressing the habitual travel mode under cognitive load conditions, that is, when attention is absorbed by a secondary task, corroborates the notion that habits are automatized responses. That is, travel habits are mentally represented structures in which a travel goal is automatically associated with a travel mode response (e.g. a 'university–bicycle link'). Thus, the present findings may reveal the cognitive mechanism that mediates the so often empirically established direct link between frquency of past behaviour and later behaviour (e.g. Aarts *et al.*, 1998; Ouelette & Wood, 1998). Also, in more general terms, our results on associative links support the notion that frequent goal-directed actions (or habits) are mentally represented in a more or less similar way as other mental (knowledge) structures that are repeatedly consulted and automatically activated, such as stereotypes and attitudes (e.g. Fazio *et al.*, 1986; Devine, 1989; see also Bargh & Gollwitzer, 1994; Kruglanski, 1996).

It should be noted that in the present study our participants had several mode options at their disposal to travel to various destinations presented in the task. For instance, bus could be used as an alternative to train, and walking could be chosen instead of bicycle. Furthermore, in our experimental paradigm both nonhabitual and habitual trials, i.e. train use and bicycle use, imply the existence of an association between travel destinations and a typical mode in memory (see also the pilot-study). This association is required to obtain a high probability of train and bicycle responses when the typical mode is permitted, either under conditions of load or no load. However, the strength (or degree of 'habitualness') of the association was argued to be a function of relative frequency of performance in the past. That is, as the number of repeated pairings between a travel goal and a travel mode increases, so does the strength of that association or habit. Based on the observation that our participants indicated using their bicycle more frequently (and more strongly by force of habit) than train to reach several travel destinations (see also CBS, 1997), we assumed that, at least in the current study, bicycle use can be conceived of as habitual and train use an nonhabitual. And, as our results indicated, only when the link between travel destinations and travel mode is habitual or automatic are persons more likely fail to suppress the habitual travel mode option (and to mention an alternative) in response to a travel destination under conditions of cognitive load.

The failure to suppress (or control) a habitual action in response to goal activation is more common in everyday life than we think or would like to admit. For instance, sometimes we intend to take another course of action than the usual or habitual one to obtain a certain goal, but sometimes our habit becomes accessible and interferes. These habitual actions intrude because they are activated automatically and can therefore cause action slips. As is argued before, action slips occur primarily in familiar surroundings and when attentional resources are low (Norman, 1981; Heckhausen & Beckmann, 1990). Our results indeed confirm that attentional resources are needed to suppress habitual responses and hence, our results show that action slips can be hard to prevent when attentional resources are low. In our view, and the reputed role of environment and mental processes in their occurrence, actions slips are worthwhile to consider for more systematic future research.

It should of course be noted that the present study explored the suppression of automatic activation of goal-directed behaviours under relatively controlled conditions. Furthermore, our study is confined to a specific sample of persons (undergraduate students) and two types of behaviours (habitual bicycle use and nonhabitual train use). Obviously, the observed results cannot simply be generalized to all kinds of settings, persons and goal-directed behaviours. How often people indeed suffer from action-slips in a given behavioural domain in real life remains unanswered. Also, whether habitual car-users would show the same pattern of results as our undergraduate bicycle users should be explored before a firm answer can be given. However, we do feel that we have come closer to capturing the general process underlying action-slips. In addition, we have been able to shed more light on an important mechanism underlying a common experience in real life; the feeling that we do things the way we did them before, despite our intention to do it another way.

In line with the spirit of scientific inquiry, we believe that the implications (and applications) of the present research should not only be assessed by looking the experiment itself. The question of generalizability should also be looked at by including the theoretical framework under investigation and the alleged underlying processes that are proposed to explain the particular phenomenon. Or as Mook (1983) lucidly explicates: 'Ultimately, what makes research findings of interest is that they help us understand everyday life. That understanding, however, comes from theory or analysis of mechanism; it is not a matter of 'generalizing' the findings themselves' (p. 386). In other words, it is the theory (or, as is currently the case, our focal hypothesis) that should generalize to the real world, not necessarily the experiment that has been employed to test it (see also Dawes, 1996). Thus, the main issue here is the general acknowledgment that we are dealing with a more theoretical test of real world phenomena.

A lot of what we do in daily life becomes highly habitual or automated, a notion conscientiously put forth by William James (1890) more than a century ago. As does James, we believe that in trying to explain what we choose to travel with, what and how we consume, and how and when we take care of work and home-related activities, habits will prove to be conceptually very useful tools.

Notes

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(1) Correct responses on the summation of digits across all trials did not significantly differ between the permitted and not permitted instructions, $t(25) = 0{\cdot}74$, N.S., means were 7·21 and 7·85 (out of 10), respectively, indicating that the summation task is performed equally well under both instructions.

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