The Measurement of Habit

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In: T. Betsch, & S. Haberstroh (Eds.). *The routines of decision making.*

Mahwah, NJ: Lawrence Erlbaum, 2005, pp.231-247.

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We seldom do things for the first time. Most of our everyday behaviors are recurrences or variants of behaviors we have previously executed, most of which numerous times. The frequency of occurrence and the stability of behavior were central themes in the behaviorist tradition (e.g., Hull, 1943), and James (1890) already devoted an intriguing chapter about habit in his famous *The Principles of Psychology.* Although social psychologists never lost sight of the behavioral side of human functioning, the repetitive aspect of behavior has only received minimal attention in social psychology. In the decision making area it seems that repetition of choices has almost been neglected, or has been studied in specific contexts such as decision making by experts (e.g., Shanteau, Friel, Thomas, & Raacke, this volume). However, given the prevalence of repeated over new behavior, there is good reason to pay more systematic attention to constructs like past behavior, repetitive choices, experience, routines, and habit. This chapter focuses on *habits*, and addresses in particular the issue of the measurement of habit strength. We will first discuss the habit construct in more detail and give a brief summary of some work that has been done on habits. We then review four instruments to measure habit strength. Finally a study is presented in which these measures were used simultaneously.

The construct

Verplanken and Aarts (1999) defined habits as "... learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end states" (p.104). Some features in this definition should be highlighted. First, habits are learned acts and are goal-directed. This refers to the fact that habits do not develop randomly, but are formed first and foremost because they serve us. Habits develop in a stable situation when a particular sequence of acts appears functional, efficient or gives us pleasure (cf., Bagozzi & Dholakia, this volume). This relates directly to the behaviorist approach: stable behavior is established through a history of systematic repetition and reinforcement. Thus, the

everyday early morning routines may include a range of habits, which make the transition from waking up to starting work at the office as convenient and efficient as possible. It is important to realize that this holds for any behavior that becomes habitual, including behaviors that we may consider as unhealthy, unadaptive, or pathologic (e.g., Verplanken & Faes, 1999). In each of these cases habits may be analyzed in terms of their history of repetition and their functions.

Another important feature in the definition of habit is that habit is a form of automaticity, which is triggered by specific cues. This conceptualization thus suggests that habits are executed without much awareness or deliberation, which comes close to how the habit construct appears in everyday language (Bargh, 1994). Wood, Quinn, and Kashy (2002) nicely documented this aspect in a diary study. Using a signal-contingent diary procedure they demonstrated that people are less likely to think about and have fewer emotions related to habitual than non-habitual behaviors. In terms of social cognition models, habits may be considered as behavior that is guided by implicit structures like schemas or implicit attitudes, rather than by explicit evaluations of behavior or conscious decision making (cf., Sanbonmatsu, Prince, Vanous, & Posavac, this volume). These cognitive structures are activated by relevant cues, such as for example time cues (walk to the bus stop at 7.47 am), location cues (stop for a coffee on my way to work), or internal stimuli (feeling hungry). It might be important to note that because habits are automatically triggered by cues, one may infer that control over behavior is primarily rooted in the environment, rather than in an individual's motives or conscious will. Aarts and Dijksterhuis (2000) demonstrated the notion of habits as goal-directed automatic behavior. Participants who had either strong or weak bike habits indicated whether various travel modes were realistic options for a number of travel destinations. Half of the participants were previously primed with travel goals that were related to bike use. It was found that participants with a strong bike habit responded more

quickly when bike was combined with a travel destination. However, this speed advantage only occurred when participants were primed with a bike-related travel goal. These results not only suggest that habits are goal-directed cognitive structures, but also that goal activation is a necessary component for habit-related responses (cf., Aarts, Verplanken, & van Knippenberg, 1998; Bagozzi & Dholakia, this volume).

Habits can be distinguished from a number of other concepts that build on prior knowledge. For example, Abelson (e.g., 1981) introduced the concept of a *script.* Scripts are sequences of acts that are executed automatically. However, scripts differ from habits in being rooted in culture and thus being shared by many individuals, such as the 'restaurant script' (enter, give coat, be seated, study the menu, order, etc.). Some scripts have a normative flavor, such as the casual conversation before starting a formal meeting (Aarts & Dijksterhuis, 2003). Abelson also suggested the idea of a personal script, which comes close to our conception of habit. *Experts'* behavior usually also consists of a range of automatic acts. These behaviors may be prescribed or may have been developed by experience so as to serve optimally the expert's work (e.g., Omodei, McLennan, & Wearing; Orasanu; Plessner; Ross, Lussier, & Klein; Shanteau et al.; this volume). Although expert routines may certainly be highly automized, this needs not be the case, which distinguishes them from habits. Finally, habits may be distinguished from *routines* and *routinized decision making* (e.g., Betsch, Haberstroh, & Höhle, 2002; Betsch, Haberstroh, Glöckner, Haar, & Fiedler, 2001; Haberstroh et al., this volume). These authors defined routines as behavioral solutions to decision problems. As is the case with experts' behavior, routines may be automized, but need not be so. Furthermore, routines differ from habits in that a person does not necessarily need to have personal experience with the behavior, such as is the case when performing a task according to a manual. Therefore, unlike habits, routines do always not require a history of successful repetition.

Consequences

What are the consequences of habit formation? First of all, habit formation implies the establishment of stable behavioral patterns. Indeed, as has been demonstrated in numerous studies on attitude-behavior relations, measures of past behavior are reliable predictors of future behavior, and may outperform established predictors of behavior like attitudes and intentions (Ouellette & Wood, 1998). Many of these behaviors are likely to have a habitual component. Although there is an ongoing debate as to how to interpret this general finding (e.g., Ajzen, 2002; Bagozzi & Dholakia, this volume), the strong behavior-behavior correlations can be interpreted as indications of stability. One question is whether the predictive value of past behavior is contingent on its frequency. Ouellette and Wood (1998) demonstrated in a meta-analysis of studies on intention-behavior relations that this is indeed the case. They found that for frequent behaviors past behavior was more predictive of future behavior ($r = 0.47$) than for infrequent behaviors ($r = 0.25$). The reverse was the case for the relationship between behavioral intentions, which can be considered as a representation of motivation and conscious will, and future behavior. Infrequent behaviors were found more under the control of intentions ($r = 0.64$) than frequent behaviors ($r = 0.12$). These findings suggest that there may be two ways by which past experiences influence future behavior. One is through deliberate thinking and decision making, which occurs with infrequent behaviors. This route represents the process by which we may consider past experiences and incorporate these as input of a future decision. Models like the theory of planned behavior apply to this route (e.g., Ajzen, 1991, 2002). The second route may represent the result of a habit formation process. When behavior is repeated frequently, the effects of motivation and conscious may fade away and control over behavior may be taken over by the automatic cue-response mechanism that was described above as the way a habit functions (Wood et al., 2002). Such a pattern was modeled earlier by Triandis (1980). He suggested that the probability of an act is

predicted by a weighted function of habit and behavioral intention in such a way that the two weights are compensatory: a strong weight of the habitual component implies a weak influence of intention, and vice versa (Verplanken & Aarts, 1999). Bagozzi and Dholakia (this volume) distinguished three roles of past behavior in goal setting and goal striving, i.e., past behavior as statistically controlling for 'unmeasured effects' of other antecedents of behavior, past behavior as a direct predictor of goal-directed behavior, and past behavior as influencing the process of goal setting and goal striving. Our distinction between the habit and deliberate routes clearly fits Bagozzi and Dohlakia's second and third role, respectively.

A study on travel mode choices illustrated this habit-intention balance (Verplanken, Aarts, van Knippenberg, & Moonen, 1998). Car owners kept a diary for seven days in which they registered where they went during these days and which mode of transportation they used for each trip. The proportion of trips made by car versus public transport was predicted by previously measured behavioral intentions to use the car and a measure of car use habit strength. It appeared that there only was a significant relation between intention and behavior when habit strength was weak. At moderate and high levels of habit strength there was no significant relation between intention and behavior.

Habit formation may have other, and perhaps more fundamental, effects. In a series of lab studies it was demonstrated that habit attenuates the depth of processing during decision making. A strong habit in one particular travel mode (e.g., bike or car) appeared to be associated with using less information about available travel mode alternatives (Verplanken, Aarts, & van Knippenberg, 1997, Studies 1 and 2), and with using less information that described the nature of the choice situations themselves (Aarts, Verplanken, & van Knippenberg, 1997; Verplanken et al., 1997, Study 3). In the latter study the attention to information about travel situations was manipulated. It appeared that the relatively low level of information acquisition under strong habit conditions could be increased by having

participants make their choices in a more deliberative fashion. However, this effect was only temporary, as after about half of the twenty-seven trials these participants returned to the low information acquisition level comparable with strong habit participants in the control group. This study suggested that even under ideal intervention conditions (e.g., motivated participants, no distraction), which will never be accomplished in real life situations, it was very difficult to have strong habit individuals pay more attention to new information. In general, the finding that strong habit individuals' behavior is not or only weakly related to attitudes and intentions, together with the apparently low interest for information, presents a grim picture for those who wish to influence habitual behavior through information campaigns and attitude change: if information is attended to and changes attitudes in the first place, the weak attitude-behavior link among strong habit individuals seriously limits the likelihood of success for such an approach.

Measurement

Eagly and Chaiken (1993) concluded in their book *The Psychology of Attitudes*, that "… the role of habit *per se* remains indeterminate (…) because of the difficulty of designing adequate measures of habit" (p.181). Indeed, while research on habit in social psychology is scarce in the first place, the measurement issue has not been given much attention.

The first problem in the measurement of habit is that usually no distinction is made between past behavior and habit. Thus, indicators of behavioral frequency are mostly used as measures of habit. Although some of those indicators are smarter than others, such as indicators obtained by observation (e.g., Landis, Triandis, & Adamopoulos, 1978) or reports of ongoing experiences (Wood et al., 2002), most measures consist of some kind of self-report of past behavioral frequency. Because a history of repetition forms the basis of a habit, using past behavioral frequency as a measure of habit thus does not seem unreasonable. However, there are a number of problems with self-reported behavioral frequency as a measure of habit.

The first is that although habit implies repeated behavior, repeated behavior needs not necessarily involve habituation (Ajzen, 2002). A second problem is that we can not be sure that there is a linear relation between behavioral frequency and habit. For instance, how many trials does it take to form a habit? Ronis, Yates, and Kirscht (1989) defined a habit as behavior that is repeated at least twice a month and has been performed at least ten times. However, there is no empirical evidence to support such an absolute statement. Then, when a habit has formed, does behavioral frequency keep on strengthening it? Behaviorist models of conditioning do not suggest such a relation. These models suggest that once a behavior has been established, repetition and reinforcement schedules are needed to sustain it, but *not* that repetition will infinitely strengthen a habit, which is basically what a measure of behavioral frequency suggests. Another problem with self-reported frequency measures is that such reports might be flawed. This holds in particular if a measure asks participants to recall instances of behavior. Such episodic memories are notoriously inaccurate, which can especially be expected when behavior is habitual. If there is a stable pattern of repeated behaviors (e.g., doing the weekly shopping) estimation strategies might yield relative accurate reports of behavioral frequency. However, this cannot be generally assumed to be the case (see Verplanken & Aarts, 1999, for more details of this argument). In addition, many factors may bias a self-reported behavioral frequency measure, such as recency and salience effects, which may influence the ease with which behavioral episodes can be retrieved from memory (e.g., Aarts & Dijksterhuis, 1999). In general, because retrieval of episodic memories of habitual behavior is difficult almost by definition, frequency estimates will be made by using a variety of different strategies and heuristics, which may all be vulnerable to biases and distortions (e.g., Betsch & Pohl, 2002; Haberstroh & Betsch, 2002; Schwarz & Wänke, 2002).

Some researchers used a variant of a self-reported frequency measure by asking how often a behavior was conducted in the past “without awareness” or “by force of habit” (e.g.,

Kahle & Beatty, 1987; Mittal, 1988; Towler & Shepherd, 1991; Wittenbraker, Gibbs, & Kahle, 1983). In addition to the potential problems of frequency estimates discussed above, these measures suffer from the problem that an item asks two questions at the same time, i.e., a frequency estimate and the question to what extent a behavior can be qualified as a habit. Also, an attempt to measure a construct like habit with only one item is likely to result in an unreliable measure.

In all, although self-reported frequency of past behavior does not seem an unreasonable measure of habit strength at first sight, there are questions about the validity of these measures, while such reports may also be inaccurate and biased. In the following we discuss two alternative measures of habit strength, i.e., the Response Frequency measure, and the Self-Reported Habit Index.

The Response Frequency measure

The Response Frequency (RF) measure was developed and used in a research program on traffic mode choices (e.g., Aarts, 1996; Aarts et al., 1997, 1998; Verplanken et al., 1997, 1998; Verplanken, Aarts, van Knippenberg, & van Knippenberg, 1994). In order to measure travel mode choice habits, this measure presented participants with a number (e.g., fifteen) of travel destinations. For each destination participants were requested to respond as quickly as possible which transportation mode they would use. The idea behind the RF measure was that general habits (for instance taking the car) are represented as behavioral schemas. When such a schema is activated, in this case by the travel destination vignettes (e.g., visiting a friend in town), it is supposed to elicit the dominant travel mode response of that schema, for instance using the car. The measure has been validated in a number of studies and showed good psychometric properties (Aarts, 1996). The advantage of the RF measure is that it does not ask participants to make estimates or judgments about their own behavior or psychological processes. It is also a measure that was designed to be used in contexts where multiple

behavioral choice options are available. The measure is also attractive for behaviors that are conducted in a variety of situations, such as for instance travel mode choice or food choice. For these behaviors the habit itself may consist of making a particular choice in different situations. For instance, the habitual car user may take the car for any trip, even to bring a letter to a nearby mailbox. The person who has a habit of taking fatty food may do so in a variety of food choice situations. In particular the generality of such a habit may render it problematic and socially relevant (Dawes, 1998; Verplanken et al., 1994). The RF measure seems especially adequate in such contexts. However, the RF measure has its downsides as well. For instance, because participants are supposed to respond as quickly as possible, it is difficult to use in self-administered questionnaires. If participants are given the opportunity to think and deliberate, the measure may tap other constructs, such as attitudes or preferences, rather than habit. Another inconvenience is that a new version of an RF measure should be constructed for each particular context, which requires pilot work and pretesting of the vignettes.

The Self-Report Habit Index

Perhaps the most straightforward approach to the measurement of habit strength is to ask people directly to report on their habits. Such an approach has of course a number of potential problems. In addition to problems that are inherent to all self-report instruments, such as their sensitivity to social desirability and consistency biases, the main problem might be that people usually have little access to psychological processes, which has been put forward in the seminal paper by Nisbett and Wilson (1977). In order to use self-reports of habit strength and to know which questions would measure it, we should firstly be sure that people agree on what habits are. However, there is no unequivocal lay conception of what a habit is. For instance, "habit" has a number of different connotations in addition to doing things often or regularly, such as the connotation of bad habits or addictive behavior (e.g.,

Sinclair, 1989). Therefore, measures that attempt to ask directly to report on "habit", such as the self-reported habit frequency measure discussed above, may be low in validity.

Verplanken and Orbell (2003) took a different approach and constructed a twelve-item self-report instrument to measure habit strength, which was named the Self-Report Habit Index (SRHI). The reasoning behind this measure was that whereas it might be difficult to report on habit strength as such, a more valid measure might ask to report on a number of qualities of habitual behavior that are easier to conceptualize. The habit concept was thus broken down into a number of components that characterize habits, i.e., a history of repetition, lack of awareness, lack of control, mental efficiency, and expressing self-identity. A history of repetition forms a core element of habits. Lack of control, lack of awareness, and mental efficiency represent three features of automaticity, which were put forward by Bargh (1994). Bargh distinguished a number of variants of automaticity according to whether or not one or more of four features (the fourth feature is lack of intention) are present. The three features included in the SRHI are typical for habitual behavior. Finally, the element of self-identity was included in the SRHI. This refers to the fact that habits may be considered as idiosyncratic behaviors, which may part of a person's self-description. In some cases a habit may even reflect attitudes or values that are central to the self-concept (cf., Verplanken & Holland, 2002). Whereas reporting on habit strength per se may be too difficult to provide a valid measure, reporting on these more specific aspects seems feasible if one is posed with the right questions.

The SRHI has been used in a number of studies measuring a variety of habits. As far as published studies to date are concerned, the SRHI has been used to measure habit strength of travel mode choices, eating candies, listening to music, watching a TV soap series and chatting with colleagues (Verplanken, 2004; Verplanken & Orbell, 2003). In addition, the measure was used in a number of recent as yet unpublished data sets measuring habits of

buying on impulse, taking unhealthy snacks, fish consumption, fruit consumption, and thinking negatively about oneself. In all data sets collected so far the internal reliability of the SRHI was excellent (coefficient alphas > 0.90). In addition, the index also showed a high test-retest reliability when administered one week later (r = 0.91, Verplanken & Orbell, 2003, Study 1). Verplanken and Orbell (2003) presented a number of studies that provided evidence for convergent validity of the measure. For instance, the SRHI correlated strongly with the RF measure and with measures of past behavioral frequency. The index also discriminated between behaviors that varied in frequency and between daily and weekly habits. The SRHI has been included as part of larger models. For instance, in a study on job satisfaction among nurses Verplanken (2003) found that the habit of chatting with each other predicted nurses' attitude toward their ward, which in turn predicted job satisfaction.

Summary

To date four measures of habit strength are available, i.e., self-reported frequency of past behavior, self-reported habit frequency, the response frequency (RF) measure, and the Self-Report Habit Index (SRHI). The measures differ in a number of ways. In Table 1 five characteristics are summarized. The first characteristic refers to whether or not each measure requires participants to reflect on their own behavior. Bassili (1996) distinguished meta-judgmental measures (self-reflections) from operative measures (e.g., response latencies). Self-reported frequency of past behavior, self-reported habit frequency, and the SRHI can be qualified as meta-judgmental measures, whereas the RF measure is an operative measure. Meta-judgmental measures are easy to interpret, but are vulnerable to judgmental and motivational biases. Operative measures, such as the RF measure, avoid such biases, but their drawback is validity. The second characteristic concerns whether the measure is a single-item or a multiple-item instrument. Multiple-item instruments are more reliable than single-item instruments. The third characteristic is whether the measure asks participants to make

behavioral frequency estimates, which is the case for self-reported frequency of past behavior and self-reported habit. Frequency estimates may be difficult to make and may be subject to biases, especially when numeric estimates are involved. The fourth characteristic indicates whether or not the measure applies to decisions with multiple behavioral options. The RF measure was designed for such contexts. The other measures focus on one behavioral option. In this case one behavioral option refers either to a yes-no decision, or to a focus on one choice option, thereby ignoring alternative options. Finally, the measures are scored on whether they can easily be used in self-administered questionnaires. This is no problem for all measures except the RF measure, which requires a time pressure instruction. Although not impossible in self-administered questionnaires, the optimal fashion of administering the RF measure is by a research assistant in a controlled research environment.

[please insert Table 1 about here]

A study with four measures

In order to compare the four habit measures that were discussed above, a study was conducted that included the four measures simultaneously, i.e., self-reported frequency of past behavior, self-reported habit frequency, the RF measure, and the SRHI. The habit domain we chose was travel mode choices. The study was conducted among students at the University of Tromsø. The four measures were taken with respect to taking the bus and the car, which were the two mostly used travel modes among this sample. The first aim was to inspect intercorrelations between the four measures within each travel mode alternative. The second aim was to inspect correlations between the two travel mode alternatives for each measurement method. It can be expected that habit strength of competing travel mode

alternatives in a particular setting (in this case going by bus or taking the car) are inversely related.

Method

A questionnaire was presented to ninety-eight students at the University of Tromsø, Norway. There were sixty females and thirty-eight males. Ages ranged from 19-43 years (M = 24.5 years). The questionnaire contained four measures of habit strength concerning traveling by bus and by car, respectively. The four measures were self-reported frequency of past behavior, self-reported habit frequency, the RF measure, and the SRHI. Self-reported frequency of past behavior consisted of the question how many times the bus (car) was used during the past week. Self-reported habit frequency was asked by the question how many times the bus (car) was used during the past week by force of habit. A RF measure of habit was constructed in which thirteen travel destinations were presented that could be reached by bus or car. Participants were asked to respond as quickly as possible for each destination by choosing between four alternatives, i.e., walk, bus, car, or taxi. Finally, the SRHI was presented for bus and car use, respectively A seven-point Likert scale format was used. Coefficient alphas were 0.93 and 0.96 for the bus and car SRHI, respectively. The measures were presented in a fixed order, i.e., the SRHI for bus and car, the RF measure, self-reported frequency of past behavior for bus and car use, and self-reported habit frequency of bus and car use, respectively. All measures were coded such that high values indicate strong habits.

Results

Correlations between the habit measures

Table 2 presents intercorrelations for the two sets of habit measures, i.e., self-reported frequency, self-reported habit frequency, the response frequency measure, and the Self-Report Habit Index, each set with respect to traveling by bus and traveling by car. Although there were some exceptions, the correlations between the four habit measures were relatively high

within each travel mode alternative, thus demonstrating convergent validity. As for the correlations of particular measures *between* the two travel mode alternatives, a negative correlation between a particular measure of bus and car habit should be expected because bus and car were the most likely alternatives, which was exactly what was found. Note that in this case the -0.90 correlation correlation between the two RF measures is a methodological artefact, because the RF measure asked participants to choose between travel mode choices, and was thus used to infer both a bus and a car habit in one measurement. It seems that the SRHI is better able to tap the expected inverse relationship between bus and car habits (r = -0.59) compared to the self-reported frequency of past behavior and self-reported habit measures (r = -0.30 and r = -0.27), respectively. The difference in correlations between the SRHI and the two other self-report measures are statistically significant (z = 2.59 and z = 2.80, ps < .01), respectively.

[please insert Table 2 about here]

Habit qualities

Whereas the frequency and RF measures consist of one score indicating habit strength, the SRHI provides a profile of scores on the different facets of the index. In principle this gives the possibility to distinguish between different variants of habits. Whereas most habits can be expected to be based on a history of repetition, some habits may be particularly characterized by mental efficiency, others by lack of control, lack of awareness, the self-identifying aspect, or some combination of these features. Although the SRHI has so far been shown to be fairly one-dimensional, we explored this line of reasoning by subjecting the bus and car SRHIs to principle component analyses (PCA) and structural equation modeling (SEM). Both PCAs suggested a predominantly one-dimensional structure, although for the

bus SRHI two eigenvalues greater than one appeared. Yet, inspection of a two-component solution yielded quite a similar structure for both travel modes. In this structure one component was determined by the three frequency-related items (e.g., taking the bus is something I do frequently), and the other component by the three items indicating a lack of awareness (e.g., taking the bus is something I do without thinking). These two sets of items were subsequently averaged and subjected to a structural equation modeling analysis (AMOS 4). In the estimated model the awareness and frequency components of each SRHI were tested as indicators of latent variables representing a bus and car habit, respectively. The two latent habit constructs were assumed to be (negatively) correlated, as these were two alternative choice options. The model, though relatively simple, showed an excellent fit, *Chi-sqaure*(1) = 1.24 (p = 0.27), *Goodness of Fit Index* = 0.99, *Adjusted Goodness of Fit Index* = 0.94, *Comparative Fit Index* = 0.99, *Root Mean Residuals* = 0.06, *Root Mean Square Eorror of Approximation* = 0.05. The model and the estimates are presented in Figure 1. The analysis thus portrays bus and car habit as alternative options (r = -0.70), which are predominantly characterized by frequency of occurrence and lack of awareness.

[please insert Figure 1 about here]

Discussion and conclusions

Habit is an undervalued construct in social psychology. Whereas interest in other forms of schematic and automatic processes has been booming during the last decade, research on habits remained scarce. We think undeservedly, because a large portion of everyday behaviors might be characterized as habits. Undoubtedly, as expressed by the quote from Eagly and Chaiken (1993) earlier in this chapter, the problem of how to measure habit strength has been a major obstacle. Therefore, there is much to gain from investing in the

development of reliable and valid habit measures, which seems most necessary in order to move habit research forward.

How should we evaluate the measures that were focused on in this chapter? Important criteria for such an evaluation are psychometric properties, conceptual clarity, external validity, vulnerability to biases, and practical aspects such as applicability and the ease of using the measure. As for *psychometric properties*, internal reliability is not relevant for the two frequency measures, which consist of one item. It should be noted though that in general one-item measures suffer from being unreliable. The RF measure consists of multiple items (the vignettes). Because this measure consists of a count of the target behavior across the vignettes a measure of internal reliability is not applicable. The SRHI is a multi-item instrument. It showed excellent internal reliability in the present study, as well as in the studies where it has so far been used. In the present study the four measures showed good convergent validity, as was shown by the moderate to high intercorrelations for each travel mode alternative.

When it comes to *conceptual clarity*, the self-reported frequency measures are problematic. Although repetition of behavior is an important element of habit, not all repeated behavior are habits. Thus, a measure of past behavioral frequency is not necessarily a valid measure of habit (Ajzen, 2002). The self-reported habit frequency measure is difficult to interpret because of its confound of frequency and habit strength. The validity of the RF measure has been criticized for measuring intentions or preferences, rather than habit strength (Ajzen, 2002). This may particularly be the case when the measure is not properly administered, i.e., when respondents fill out the measure at their own pace instead of being under time pressure. The SRHI is an attempt to encompass the habit construct more fully by capturing the variety of aspects of the habit construct. This thus only includes behavioral frequency, but also facets of automaticity, i.e., lack of awareness, lack of control, and mental

efficiency. The present study also provided some evidence that demonstrates how the SRHI may be used to present 'habit profiles'. That is, habits in different areas may have a different profile in terms of the facets of the SRHI. For instance, lack of control may be a particularly relevant feature of eating habits, while mental efficiency may be a salient aspect of driving a car. In the present study the data suggested that in particular behavioral frequency and lack of awareness were the most salient qualities of travel mode choices. A similar approach was tentatively attempted on other data sets that included a SRHI. For instance, the most salient elements of habits to buy on impulse were frequency, self-identity, and the difficulty to control the behavior. The potential of the SRHI to distinguish between different habit qualities might be further investigated in future research. Clearly, whereas past behavioral frequency is undoubtedly an aspect of habit, the SRHI captures a much richer picture of what a particular habit might look like compared to other measures.

The *external validity* of the four measures is difficult to compare, particularly because the measures have been applied in different contexts and to date there are no systematic empirical comparisons of external validity. In our own research program on travel mode choices both the self-reported frequency measure and the RF measure were found to predict information search behavior (Verplanken et al., 1997) as well as actual travel mode choices over a seven-days period (Verplanken et al., 1998). The SRHI was found to distinguish between daily and weekly executed behaviors (Verplanken & Orbell, 2003). As further evidence of external validity, the SRHI also performs well as part of larger models, such as in a study on chatting habits and job satisfaction (Verplanken, 2004), and in as yet unpublished studies on snacking habits, fish and meat consumption, fruit consumption, impulsive buying habits, and the dysfunctional habit of negative thinking, respectively.

The frequency measures might be most *vulnerable to biases*. Judgmental biases can particularly be expected when numerical frequences are involved. E.g., biases due to recency

or salience effects. The RF and particularly the SRHI seem less vulnerable to these problems. In the SRHI the habit construct is broken down into elements that can well be reflected upon, and there is no reason to suspect that biases may be very problematic.

Finally, habit measures may be compared on *practical aspects*. Self-reported frequency of past behavior and the SRHI are convenient instruments. Both measures can be incorporated in self-administered questionnaires, and do not require particular instructions. On the other hand, the RF requires pilot and pretest work for every new habit or habit context. In addition it is preferably not used in self-administered questionnaires, as it requires a time pressure instruction.

Is there a 'best' habit measure? In order to answer this question it should first be clear what the goal of the measurement is. A researcher may be interested in behavioral frequency and not necessarily in habituation. For instance, in the case of physical exercise, frequency may be more important information than habituation. In such cases self-reported frequency of past behavior is the best measure. If the target behavior clearly involves making choices between multiple alternatives, the RF measure might the right choice, provided that the measure can be taken properly. The self-reported habit frequency measure should be disqualified because of its double-barreled and one-item nature, which comprises its validity and reliability. The SRHI is the better measure if one wishes to tap the degree to which a particular choice or behavior is habitual. This measure has multiple items, good psychometric properties, and is based on current notions of automaticity. In addition, it has a generic format, and can easily be incorporated in questionnaires. A context to which the SRHI seems especially interesting to apply is to measure *change* in habit strength, i.e., habit formation or habit decay. In this context behavioral frequency as a measure of habit may not work. Take for example medicine use. It can be assumed that a person who is put on long-term medication begins by taking medicine in a deliberative and thoughtful fashion. In due time,

however, this may turn into a habit. A measure of behavioral frequency would be useless in this case, because it can be assumed that the person immediately establishes a prescribed fixed schedule. The habituation in this case concerns medicine intake to become an automatic act, *not* a more frequent act. The SRHI might be a measure that taps this type of habituation, such as changes in the amount of thinking and the need to remind oneself of taking the medicine. In general, frequency measures cannot provide information about other features of habit such as the degree and quality of automaticity, which makes the SRHI a new and challenging instrument.

To date most researchers equate past behavioral frequency with habit, and thus use measures of past behavioral frequency as indicators of habit strength. However, this approach first of all ignores the fact that repeated behavior is not necessarily habitual behavior, and secondly that the habit construct is richer and more interesting than the mere repetition of behavior. A habit can be considered as a psychological construct, and should be measured accordingly. Whereas in some contexts behavioral frequency gives important information, the SRHI does measure habit as a psychological construct. The SRHI gives researchers the opportunity to represent different qualities of habits, and to monitor changes in habit strength and habit qualities over time or as result of interventions. This measure may thus contribute to the further development of future habit research.

Author note

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Table 1: Characteristics of the four habit measures

	Habit measure[*)]			
Characteristic	SRF	SRHF	RF	SRHI
Type of measure	meta-judgmental	meta- judgmental	operational	meta- judgmental
Single/multiple-item	single	single	multiple	multiple
Frequency estimate	yes	yes	no	no
Focus on multiple options	no	no	yes	no
Usable in self-administered questionnaires	yes	yes	preferably not	yes

[*)] *Note:* SRF = self-reported frequency; SRHF = self-reported habit frequency; RF = response frequency measure; SRHI = Self-Report Habit Index.

Table 2: Pearson correlations, means, and standard deviations of four measures of habit with respect to bus and car use, respectively.

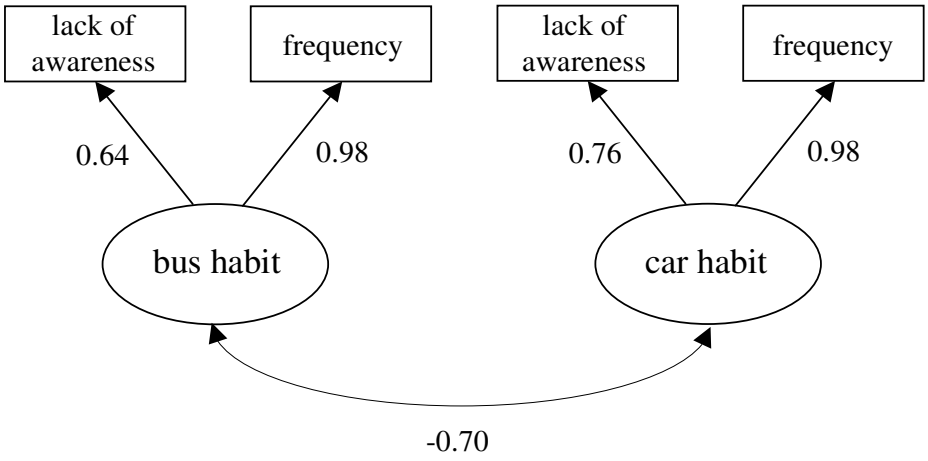
	1	2	3	4	5	6	7	8
1. SRF bus	--	0.74	0.50	0.59	-0.30	-0.38	-0.38	-0.39
2. SRHF bus		--	0.38	0.55	-0.21	-0.27	-0.28	-0.34
3. RF bus			--	0.73	-0.65	-0.58	-0.91	-0.71
4. SRHI bus				--	-0.48	-0.47	-0.64	-0.59
5. SRF car					--	0.90	0.73	0.69
6. SRHF car						--	0.68	0.69
7. RF car							--	0.76
8. SRHI car								--

Note: $p < .05$ for correlations larger then 0.20; $p < .01$ for correlations larger then 0.25; $p < .001$ for correlations larger then 0.33. SRF = self-reported frequency; SRHF = self-reported habit frequency; RF = response frequency measure; SRHI = Self-Report Habit Index.

Figure caption

Figure 1: Latent variable model of bus and car habits as two alternative travel mode choices.

FIGURE 1


lack of awareness
frequency
lack of awareness
frequency
0.64
0.98
0.76
0.98
bus habit
car habit
-0.70