

**Reflections on Past Behavior: A Self-Report Index of Habit Strength**

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## Abstract

We argue that habit is a psychological construct, rather than simply past behavioral frequency. A twelve-item self-report index of habit strength (the Self-Report Habit Index, SRHI) was thus developed and tested for reliability and construct validity in four studies. The index is based on an analysis of features of habit, i.e., a history of repetition, automaticity (lack of control, lack of awareness, efficiency), and expressing one's identity. High internal and test-retest reliabilities were found. The SRHI correlated strongly with the response frequency measure of habit (Verplanken et al., 1994) and measures of past behavioral frequency. The index discriminated between three behaviors that differed in frequency as measured three weeks earlier, and also between thirty-one behaviors that were performed daily versus thirty-one behaviors that were performed weekly. The SRHI might be useful when habit strength is a dependent variable, or when one wants to determine the role of habit without measuring behavioral frequency.

**KEY WORDS:** habit, past behavior, frequency of behavior, measurement, self-report

### Reflections on Past Behavior: A Self-Report Index of Habit Strength

When was the last time you performed a new behavior? In everyday life we do things for the first time far less often than we perform behaviors which we have done many times before. The role of repetition of behavior has long been an issue of debate in the area of attitude-behavior relations (e.g., Eagly & Chaiken, 1993). A consistent finding has been that measures of past behavioral frequency predict the occurrence of future behavior over and above a number of established antecedents of behavior such as attitudes and intentions (e.g., Ouellette & Wood, 1998; Sutton, 1994).<sup>1</sup> However, the debate about the role of past behavior seemed to have stalled for a long time on the conclusion that a statistical relation between the frequency of past and later behavior is not insightful by itself because frequency of past behavior is a construct that has no explanatory value (e.g., Ajzen, 1991; Ajzen & Fishbein, 2000; Eagly & Chaiken, 1993). Residual shared variance between measures of frequency of past and later behavior (e.g., after attitudes and intentions have been taken into account) might reflect the influence of unmeasured variables on both occasions. This indeed is not a particularly revealing conclusion. A perhaps significant twist in this debate is the acknowledgment that repeated behavior might become habitual (cf., Ajzen, 2001; Ronis, Yates, & Kirscht, 1989; Triandis, 1977; Verplanken & Aarts, 1999). By satisfactory repetition a behavior might become automatic in the sense that a specific response is spontaneously triggered by a specific cue in the environment. A statistical relationship between past and future behavior might thus become more meaningful: once behavior has been sufficiently repeated, it might be habit, i.e., the automaticity in responding to certain cues, and not

frequency of behavior as such, that determines the occurrence of future behavior.

Therefore, if one acknowledges that habituation is a quality that repeatedly performed behaviors might gain, there is good reason to develop an instrument that measures the degree to which a behavior has acquired that quality. In other words, we wish to argue that habit is a psychological construct, and not simply past behavioral frequency, and should therefore be measured as such.

Habits can be defined as ‘... learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end-states’ (Verplanken & Aarts, 1999, p.104). Thus, the first feature of habits is that they have a history of repetition. The more frequently we perform a behavior the more likely it is to become habitual. However, it is not the recurrence of a behavior per se that constitutes a habit. Rather, a habit is created by frequently and satisfactorily pairing the execution of an act in response to a specific cue (e.g., Hull, 1943; Tolman, 1932). This process results in a mental representation of an association between a goal and an action. For example, Aarts and Dijksterhuis (2000) measured bicycle use habit and manipulated the activation of travel goals (e.g., going shopping). In a subsequent task they measured the time it took to indicate whether using the bicycle was suitable for specific travel locations (e.g., a particular shopping mall). They found that habitual bicycle users showed faster responses than nonhabitual bicycle users, but only if travel goals had been primed. These results demonstrated that when a goal that is associated with a habit is activated specific cue-response links become more accessible. Encountering such a cue thus automatically triggers the habitual response. In other words, whereas new behavior

may follow from conscious decision-making, the formation of a habit implies the delegation of control over the behavior to the environment (e.g., Bargh & Gollwitzer, 1994; Verplanken & Aarts, 1999). For example, you might find out that taking the 8.10 am bus gives you the best connection to your new job. Once you have satisfactorily practised this connection, an association is created between a particular cue (eight o'clock in the morning) and a particular behavior (going to the bus stop). If the goal of going to work is activated, encountering that cue will then automatically trigger the behavior. No conscious decision-making is needed anymore: a habit has been born. Note that goal activation is an important element: you do not go to the bus stop at eight o'clock on Sunday mornings. Thus, although a history of repetition remains a fundamental characteristic of a habit, the habit construct includes more than that, in particular the aspect of automaticity.

#### The measurement of habit strength

Because habits develop and gain strength by satisfactory repetition of behavior (e.g., Hull, 1943; James, 1890; Tolman, 1932; Triandis, 1977, 1980; Watson, 1914), it is not unreasonable to accept a measure of past behavioral frequency as a measure of habit strength. Such a measure is thus mostly used by social psychologists (e.g., Eagly & Chaiken, 1993; Ouellette & Wood, 1998; Verplanken & Aarts, 1999). Some researchers used observation or objective registration of behavior to obtain an estimate of behavioral frequency (e.g., Fredricks & Dosset, 1993; Landis, Triandis, & Adamoupoulos, 1978). In most cases self-reports of past behavioral frequency are used, for instance of the form 'How many times during the past two weeks did you use your seat belt'. However, if one

acknowledges that habit is a psychological construct, rather than past behavioral frequency, such measures do not seem adequate. Moreover, there are reasons why one might wish to have a measure of habit strength that directly taps the construct, and in particular the automaticity aspect, rather than an estimate of behavioral frequency. This is particularly the case in studies where habit strength is a dependent variable. For example, one might want to test whether there are changes in the degree to which a behavior is habitual (e.g., choosing low-fat products). Or one might want to test effects of interventions by which a behavior is supposed to increase and become habitual (e.g., dental flossing), or to decrease and lose its habitual quality (e.g., choosing the car versus public transport). In such cases pre and post measures of habit strength are required, and one might prefer measures that directly tap the habit construct over a mere estimate of past behavioral frequency. An independent measure of habit strength is also required when one wishes to determine the effect of habit in addition to behavioral frequency (cf., Ajzen & Fishbein, 2000). Finally, there might be contexts in which behavioral frequency measures have the danger of being unreliable, for instance when it is difficult to retrieve episodic memories (e.g., it is hard to remember how many times during the last month one took the car), or when behavior itself is fuzzy (e.g., eating unhealthy food).

What kind of alternative measures of habit are available? Verplanken, Aarts, van Knippenberg, and van Knippenberg (1994) introduced a measure of habit that was based on the idea that a habit is a form of scripted behavior. In this case scripts refer to idiosyncratic cognitive structures that represent associations between behaviors and goals in specific contexts (cf., Aarts & Dijksterhuis, 2000; Schank & Abelson, 1977; Trafimow

& Wyer, 1993; Wittenbraker, Gibbs, & Kahle, 1983). This measure, which was later referred to as the response-frequency measure of habit (Verplanken & Aarts, 1999), presents participants with a number of habit-related situations (e.g., travel destinations), and asks them to respond as quickly as possible to generate the behavioral choice option that they associate with that situation (e.g., taking the car). The assumption is that the more habitual that response is the more frequently it is chosen across the set of situations. The proportion of these responses thus serves as a measure of habit strength (Aarts, Verplanken, & van Knippenberg, 1997, 1998; Verplanken, Aarts, & van Knippenberg, 1997; Verplanken, Aarts, van Knippenberg, & Moonen, 1998; Verplanken et al., 1994). However, although the response frequency measure does not ask for behavioral frequency in the past, the measure cannot always be used, and is not easy to take. The use of the response frequency measure is restricted to choice behavior that is executed in various contexts (e.g., using the car to go shopping, visit friends, go long or short distances, drive for pleasure, and so on). The measure also requires participants to respond as quickly as possible, and a controlled research environment (e.g., a research assistant to install time pressure) is thus highly recommended. The response frequency measure also requires extensive pilot work for each new behavior so as to find an appropriate set of situations that should constitute the measure. In other words, although the response frequency measure has been found a satisfactory alternative to measures of past behavioral frequency in some contexts, there are a number of limitations to its use.

Another approach to a measure of habit is to ask participants directly to report on habit strength. For example, some researchers asked how often one conducted a particular



behavior in the past ‘without awareness’ or ‘by force of habit’ (e.g., Kahle & Beatty, 1987; Mittal, 1988; Towler & Shepherd, 1991; Wittenbraker et al., 1983). However, these self-report measures have two serious problems. The first is that participants are asked simultaneously to provide both an estimate of behavioral frequency and an indication of the degree to which behavior is habitual in one response. Behavioral frequency and habit strength are thus confounded in this measure. Secondly, single-item measures that are supposed to tap a latent construct (such as in this case habit strength) are notoriously unreliable and imprecise (e.g., Spector, 1992). However, although the self-reported habit strength measures used so far are problematic, there is no reason why habit strength might not be measured by means of self-reports. We think that, if measured appropriately, it is possible to have people reflect on their behavior in terms of the degree to which it is habitual. At least two conditions for a well-designed measure should be fulfilled: the instrument should have a theoretically sound foundation, and it should be a multiple-item instrument. A theory-based measure is preferable over a measure based on face value so as to be more confident that the measure is valid. Multiple items are needed for reasons of reliability. Multiple items are also required when the measured construct is multifaceted, which is the case with habits, as will be further outlined in the next section. In the following section we describe the theoretical rationale for a self-report index of habit strength, and present a twelve-item instrument. We then report four studies that provided a first test of the reliability and validity of this instrument.

#### A self-report index of habit strength

The definition of habit that we cited at the beginning of the last section highlights a number of features. The first is that habits have a history of repetition. The more frequently we perform a behavior the more likely it is to be habitual. Importantly, as has been argued above, a habit is a form of automaticity, in particular the automatic elicitation of behavior upon encountering specific cues in the context of an activated goal. Bargh (1994, 1996) distinguished four distinct and independent features of automaticity: (un)intentionality, (un)controllability, (lack of) awareness, and efficiency. A particular process might be characterized by each of these four features, which thus may lead to a number of variants of automaticity. Habits can be characterized as being intentional in their origins, to a limited extent controllable, executed without awareness, and efficient. Most habits that are studied by social psychologists are ‘intentional’, not in the sense of conscious or planned actions, but as being functional and goal-directed. We develop habits as behaviors that appeared satisfactory in fulfilling some goal (e.g., taking the car to reach a destination efficiently, using seat belts for safety, brushing teeth to keep ourselves healthy, eating fat food for pleasure). Although most habits are in principle controllable, for instance by deliberate thinking and planning, it is often difficult to overrule strong habits (e.g., Aarts & Dijksterhuis, 2000; Heckhausen & Beckmann, 1990; Verplanken & Faes, 1999). Finally, habits are efficient in the sense that they free mental capacity to do other things at the same time. The efficiency of habits appears in particular under conditions of heavy load, such as exhaustion, time pressure, distraction, or information overload. We assumed that uncontrollability, lack of awareness, and efficiency would be the features that will characterize the experience of habits in

everyday life. In addition to a history of repetition and features of automaticity we added another aspect of habits, namely the fact that habits are part of how we organize everyday life and might thus reflect a sense of identity or personal style. We thus assumed that although this may not hold for all habits, at least some might be descriptive of a person and thus express someone's identity (cf., Trafimow & Wyer, 1993).

We designed a self-report instrument to measure habit strength that was based on the features discussed above, i.e., the history of repetition of behavior, the difficulty of controlling behavior, the lack of awareness, efficiency, and the identity element. The instrument contains twelve items, and will be referred to as the Self-Report Habit Index (SRHI; see Appendix). Responses are made on Likert scales. Four studies were conducted to provide indications of reliability and validity of the SRHI. Internal structure and reliability of the SRHI were investigated by factor analyses and coefficient alphas in all studies. Study 1 inspected test-retest reliability of the index. In Study 2 convergent validity was obtained by relating the SRHI to the response frequency measure (Verplanken et al., 1994) as an alternative independent measure that is supposed to tap the automatic qualities of habitual behavior. In Study 3 the SRHI was taken with respect to three behaviors that varied in frequency of occurrence. Correlations between the SRHI and estimates of past behavioral frequencies provided further indications of convergent validity. This study also tested whether the index was able to differentiate between the behaviors which were supposed to differ in habit strength. Study 4 provided a replication of the latter in the context of a large number of different personal habits.

## Study 1

## Method

Ninety-three undergraduate students at the University of Nijmegen, The Netherlands, participated in this study, which was incorporated as a filler task in an unrelated experiment. There were 61 females and 32 males. Participants came twice to the laboratory with a week delay between the two sessions. They were told that the study was on travel mode choices, and responded to the SRHI concerning using the bicycle in town. Responses were made on seven point Likert scales anchored by the terms agree-disagree. The scores were recoded such that high values indicated strong habits. Eighty-six participants (92%) returned one week later. In the second session the same SRHI was again incorporated as a filler task.

## Results and discussion

Factor analyses were conducted on the twelve items of the SRHI on both occasions. For both indices three eigenvalues greater than one appeared, 5.73, 1.34, and 1.15 for the pretest index, and 6.58, 1.55, and 1.05 for the posttest index. However, the sizes of the eigenvalues clearly suggested a one-dimensional structure. The first component accounted for 47.76 % and 54.84 % of the variance for the pretest and posttest indices respectively. Coefficient alphas of the pretest and posttest indices were 0.89 and 0.92, respectively, which indicated high internal reliabilities.

The items of each respective SRHI were averaged. The mean SRHI scores in the pretest and posttest were 4.84 ( $sd = 1.23$ ) and 4.73 ( $sd = 1.33$ ), respectively. A correlation of 0.91,  $p < .001$ , between the pretest and posttest indices indicated a high test-retest reliability.

## Study 2

In this study the convergent validity of the SRHI was tested by relating it to the response frequency measure of habit (Verplanken et al., 1994). The response frequency measure is supposed to tap the degree to which choices are scripted and appear across a number of situations. This measure is thus considered as an alternative measure of the automatic qualities of habitual behavior.

### Method

Eighty-six persons participated in this study. Participants were undergraduate students at the University of Tromsø, a school for physiotherapy, and a highschool for fishery in Tromsø, Norway, respectively. There were 51 females and 35 males. The study focused on transportation mode choices, and the target behavior was taking the bus. A response frequency measure of bus habit was composed of twelve travel destinations (Verplanken et al., 1994). The destinations were located inside the town of Tromsø (e.g., “a bar in the town center”), within seven kilometers from the town center (e.g., “Tromsø Museum”), or further away than seven kilometers, but reachable by bus (“a friend in Kvaløysletta”). Participants were asked to choose as quickly as they could between five modes of transportation, i.e., car, walking, bus, bicycle, or cab, respectively. The number of times the bus was chosen served as a measure of habit strength. The instrument was taken as a filler task in an unrelated experiment. Later in the (unrelated) study the SRHI was also presented as a filler task. Participants responded to the stem “Taking the bus is something...”, and were presented with the twelve SRHI items. Responses were made on

seven point Likert scales anchored by the terms agree-disagree. The scores were recoded such that high values indicated strong habits.

### Results and discussion

The response frequency measure of habit strength scores ranged from 0-12,  $m = 5.19$ ,  $sd = 3.94$ . The SRHI items were subjected to a factor analysis. Three eigenvalues were greater than one (5.80, 1.23, and 1.12, respectively), while the first component accounted for 47.32 % of the variance. The pattern of eigenvalues thus suggested a one-dimensional structure. Coefficient alpha of the SRHI was 0.89. The SRHI correlated strongly and significantly with the response frequency measure,  $r = 0.58$ ,  $p < .001$ . The size of this correlation thus contributed to the convergent validity of the SRHI.

### Study 3

The goal of this study was to establish convergent validity of the SRHI by correlating the index with estimates of past behavioral frequency of three behaviors that differed substantially in frequency. The study thus also tested whether the SRHI was able to differentiate between these behaviors in terms of habit strength.

### Method

Participants were one hundred and forty-three undergraduate students at the University of Nijmegen, The Netherlands, who were paid for participation. The sample consisted of one hundred females and forty-three males. Participants came to the laboratory twice with a three-week delay between the two sessions. Ten participants did not show up at the second session, thus leaving one hundred and thirty-three participants

(93%) in the study. During the first session participants were presented with twenty-six behaviors, and were asked to indicate the frequency with which they conducted these behaviors. For each behavior participants indicated this frequency by selecting one of the following entries: “never“, “once a month“, “twice a month“, “three times a month“, “once a week“, “twice a week“, “three times a week“, “four times a week“, “five times a week“, “six times a week“, “once a day“, “twice a day“, “three times a day“, “four times a day“, “five times a day“, “more than five times a day“. These responses were coded from 0-16 respectively (i.e., low values indicating low frequencies, and vice versa). From the twenty-six behaviors three were selected to be included in the second session three weeks later. The three behaviors were selected such that they varied in reported frequency from the first session. The three behaviors were watching Goede Tijden, Slechte Tijden (GTST), which was a well-known soap on Dutch TV at that time (broadcast five times a week), eating candies, and switching on music at home. The frequency measures of the three behaviors indicated that these were executed on average about three times a month, four to five times a week, and twice a day, respectively. During the second session three weeks later the SRHI was administered for each of the three behaviors. Responses were made on eleven point Likert scales anchored by the terms agree-disagree. The items were recoded such that high values indicated strong habits. This session was computer-controlled. The order of behaviors was random for each participant.

### Results and discussion

Factor analyses were conducted on the SRHI for each respective behavior. In all three cases a one-dimensional structure appeared. For watching GTST two eigenvalues

were greater than one (7.56 and 1.65), while the first component accounted for 62.98 % of the variance. For eating candies only the first eigenvalue was greater than one (6.58), and the first component accounted for 65.56 % of the variance. For switching on music two eigenvalues were greater than one (7.41 and 1.01), and the first component accounted for 61.73 % of the variance. Coefficient alphas of the SRHI were high for each behavior: 0.94 (watching GTST), 0.95 (eating candies), and 0.94 (switching on music at home).

Table 1 shows the mean and standard deviation of the behavioral frequency measures, the SRHI, as well as correlations between the two measures for each of the three behaviors. As intended, the three behaviors differed significantly in frequency as measured during the first session. This was confirmed by a multivariate test on the three frequency means,  $F(2,136) = 227,71$ ,  $p < .001$ , and a highly significant linear trend that described the mean frequencies of watching GTST, eating candies, and switching on music, respectively,  $F(1,137) = 456,57$ ,  $p < .001$ . Paired-samples t-tests confirmed that the three behaviors differed significantly from each other,  $t(138) = 11.96$ ,  $p < .001$  and  $t(141) = 9.26$ ,  $p < .001$ , for watching GTST versus eating candies, and eating candies versus switching on music, respectively.

The results of Study 3 provide two important findings. The first was that the SRHI correlated substantially with the behavioral frequency measure, which was taken three weeks earlier. The fact that the three behaviors were among a set of twenty-six behaviors during the first session and the relatively long delay of three weeks between sessions made it very unlikely that these correlations were inflated by tendencies to appear consistent. The second finding was that, as expected, the SRHI differentiated between



behaviors that were assumed to differ in habit strength. This was indicated by a multivariate test on the three SRHI means,  $F(2,132) = 71.21, p < .001$ , a highly significant linear trend that described the mean SRHI of watching GTST, eating candies, and switching on music, respectively,  $F(1,133) = 142.41, p < .001$ , and paired-samples  $t$ -tests,  $t(133) = 6.32, p < .001$  and  $t(133) = 6.10, p < .001$ , for watching GTST versus eating candies, and eating candies versus switching on music respectively. Thus, the level of habit strength as measured by the SRHI increased proportionally to the level of behavioral frequency. Of course, because in this study level of habit strength was confounded with type of behavior the conclusion that the SRHI differentiates between levels of habit strength is not unequivocal. We therefore conducted a fourth study, which was aimed at testing this hypothesis in a more unequivocal fashion.

[Please insert Table 1 about here]

#### Study 4

This study was aimed at testing the generality of the finding in Study 3 that the SRHI can differentiate between levels of habit strength. In particular, we tested whether behaviors that were performed daily versus behaviors that were performed weekly differed on the SRHI. In Study 4 we aimed at testing the hypothesis across a large number of different behaviors, i.e., a unique behavior for each participant.

#### Method

Participants were seventy-six undergraduate students at the University of Nijmegen, The Netherlands, who were paid for participation. The sample consisted of fifty-two females and twenty-four males. As in the previous study, participants came

twice to the laboratory, in this case with a one-week delay between the two sessions. Two participants did not show up at the second session, thus leaving seventy-four participants (97%) in the study. In the first session, participants were asked to list two categories of their own habits: behaviors that were executed on a daily basis and behaviors that were executed on a weekly basis. For each behavior participants also indicated how frequently they performed that behavior (i.e., how many times per day in the daily category, and how many times per week in the weekly category). After this session, participants were randomly assigned to either a daily behavior or a weekly behavior condition. For the second session we selected for each participant a behavior that was mentioned in the first session from the category to which the participant was assigned (i.e., either a daily or a weekly performed behavior). Two criteria for the selection of a behavior for a particular participant were used. First, the behavior with the highest frequency within the participant's list in the assigned category was selected. Second, we wished to include as many different behaviors as possible and preferably a unique behavior for each participant. However, because some participants only listed one behavior in the assigned category, some behaviors appeared more than once across the sample (i.e., five of the thirty-one daily behaviors and five of the thirty-one weekly behaviors appeared twice, and one of the weekly behaviors appeared three times). The result was that in both conditions thirty-one behaviors were presented. In Table 2 the selected behaviors are presented for each condition. During the second session a SRHI with the same response scales as in Study 2 was presented for the selected behavior.

[please insert Table 2 about here]

## Results and discussion

First, we inspected the frequencies of the selected behaviors in order to be sure that the daily behaviors were indeed performed more frequently than the weekly behaviors (in theory participants could have listed behaviors in the weekly category that were executed daily). The average frequency of the selected behaviors was 3.86 in the daily behaviors category (i.e., how many times the behavior was executed every day), and 3.07 in the weekly behaviors category (i.e., how many times the behavior was executed every week). As expected, the daily behaviors were performed more frequently, and were thus assumed to be stronger, than the weekly behaviors.<sup>2</sup>

The SRHI (which in this case referred to a large variety of personal behaviors) was subjected to a factor analysis. The eigenvalues suggested again a one-dimensional structure. Three eigenvalues were greater than one (4.62, 2.02, and 1.16), while the first component accounted for 38.48 % of the variance. Coefficient alpha was 0.85.

The main analysis consisted of a comparison of the SRHI between the daily and weekly behaviors conditions. These differed significantly in the expected direction,  $\bar{m}$ -daily = 7.83,  $\bar{m}$ -weekly = 6.82,  $t(72) = 2.31$ ,  $p < .03$ . This suggested that the SRHI is sufficiently sensitive to differences between levels of habit strength. Across a large number of personal behaviors, the measure indicated that behaviors that were performed three times daily were stronger than behaviors that were performed three times weekly.

## General discussion

In four studies we tested a twelve-item self-report instrument of habit strength (SRHI), which was developed as a direct measure of habit strength that did not rely on

estimates of behavioral frequency. The SRHI showed high internal reliabilities in all studies. Study 1 demonstrated high test-retest reliability between two measurements that were separated by a week. In Study 2, the SRHI correlated strongly and significantly with the response-frequency measure, which is another measure of habit strength focusing on the automatic qualities of habitual responses (Verplanken et al., 1994). The response frequency measure is especially applicable to choices that are made in various contexts, such as in this case travel mode choices. The SRHI thus seems a proper measure for such contexts as well. In Study 3 the SRHI correlated consistently and significantly with behavioral frequency measures. Note that because the frequency measures and the SRHI are very different instruments, these correlations are unlikely to be inflated by common measurement error. In addition, the SRHI discriminated between three behaviors which differed in average behavioral frequency, and thus should be expected to differ in average habit strength. In Study 4, this latter finding was replicated across a large set of personal habits in a design in which behavioral frequency and type of behavior were not confounded. In a between-participants design it was demonstrated that the SRHI was higher for thirty-one behaviors that were executed daily than for thirty-one behaviors that were executed weekly. Taken together, the results suggested that the SRHI is a reliable and valid instrument. It measures habit strength by breaking it down to a number of features, i.e., a history of repetition, automaticity (lack of control, lack of awareness, efficiency), and expression of one's identity. Including these features in an instrument undoubtedly provides a more complete and full account of habit compared to the existing instruments.

Because the SRHI includes three items that refer to past behavioral frequency, one might argue that the results are not particularly new or might even be circular, because we used measures of behavioral frequency as criterion in Studies 3 and 4. First of all, of course, the SRHI items tap the experience of repetition, and thus differ from the frequency estimates that were used to validate the SRHI. However, in order to rule out any suspicion of circularity in our results, we reanalyzed the data in the four studies while leaving out the three frequency-related items (i.e., items 1, 7 and 12) from all SRHIs. Coefficient alphas of the nine-item SRHIs were very high in Studies 1, 3, 4, and acceptable in Study 2. Importantly, the main results in all studies remained unchanged, thus strongly suggesting that these were not solely dependent on the inclusion of the frequency-related items.<sup>3</sup>

How happy should we be with a new self-report instrument of habit strength? First and foremost it is important to consider habit as a psychological construct, which has a number of facets, rather than simply defining habit as past behavioral frequency. The SRHI was thus developed to measure this construct. Furthermore, there are many contexts in which we might wish to have an instrument that measures habit strength directly by addressing components of the habit construct, rather than an estimate of past behavioral frequency. Such contexts are those in which habit strength is a dependent variable. The SRHI might thus be useful to establish the extent to which a particular behavior gains or loses habitual qualities. For instance, whereas interventions usually aim at forming new behavior or changing old behavior (e.g., promoting a healthier diet), there seems too little attention to the habituation of the new behavior as a goal of the

intervention (e.g., Orbell, Hodgkins, & Sheeran, 1997; Orbell & Verplanken, 2000). It might also be useful to have an instrument of habit strength that is not based on estimates of behavioral frequency when we wish to establish the contribution of habit in addition to behavioral frequency. The SRHI might thus prove useful in the discussion of the residual effect of past behavior in the prediction of future behavior (e.g., Ajzen, 1991; Ajzen & Fishbein, 2000; Ouellette & Wood, 1998). In any case, a theory-based multi-item instrument like the SRHI seems a great improvement over the existing single-item self-report measures of habit strength. On the other hand, one might be suspicious of self-report instruments that attempt to tap qualities like the extent to which a behavior is automatic (cf., Nisbett & Wilson, 1977). The question here is whether or not people are able to reflect on how habitual a particular behavior is. Asking such a question directly (e.g., “to what extent is behavior x a habit”) would most likely yield responses that lack validity and reliability. We therefore broke the concept of habit down into components that seemed relatively easy to reflect on, such as the fact that habitual behavior is repetitive, difficult to control, goes with a lack of awareness, and is efficient and may reflect one’s identity. In our view, this might provide a way to obtain a valid and reliable indication of habit strength. From a practical point of view, the SRHI is an easy instrument, both for participants to respond to, and for researchers to use. It can be included in questionnaires, and does not require pilot studies, additional instructions, equipment, or a highly controlled research environment.

Some words of caution must be added. Undoubtedly, self-reports do have the disadvantage that responses are vulnerable to tendencies like wanting to appear consistent

or to provide socially desirable answers. The SRHI is no exception to that. Although the use of multiple items makes it less vulnerable to such threats compared to a single-item instrument, one should be careful when using it in the context of topics that are sensitive to such biases. In these cases, however, all self-report measures, thus including behavioral frequency estimates, suffer from the same problem. In those cases one might prefer implicit or operative measures (e.g., Basilli, 1996; Greenwald & Banaji, 1995) such as the response frequency measure (Verplanken et al., 1994). Such measures, however, cannot always be used because of practical limitations.

The measurement of habit strength has long been an underdeveloped issue. The use of behavioral frequency as a measure of habit, valid as it might be, is clearly only a proxy for a true measure of habit strength. Furthermore, behavioral frequency measures do not tap the heart of the habit construct: automaticity. The discussion of the role of habit in attitude-behavior relations has stalled particularly because we did not have direct measures of habit strength. This might be read in the words by Eagly and Chaiken (1993), who wrote ‘... the role of habit per se remains indeterminate (...) because of the difficulty of designing adequate measures of habit’ (p.181). The development of practical measures such as the SRHI might contribute to this discussion, and stimulate the further development of theory and research on habit.

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## Author note

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## Footnotes

1. The precise balance between the strength of these relations varies of course across studies, and depends for instance on the degree of correspondence (Ajzen & Fishbein, 1977).
2. If one assumes that the ‘daily’ behaviors were performed at least five days a week (e.g., some behaviors are typically performed on working or school days), the frequencies of daily and weekly behaviors differed highly significantly,  $\underline{m}$ -daily = 19.30,  $\underline{m}$ -weekly = 3.07,  $t(72) = 4.85$ ,  $p < .001$ .
3. The exact results of the analyses with the three frequency-related items removed from the SRHIs were as follows. Coefficient alphas were, respectively, 0.88 and 0.91 for the pre and post measures in Study 1; 0.61 in Study 2; 0.92, 0.93, and

0.93 for watching GTST, eating candies, and switching on music in Study 3; 0.82 in Study 4. The test-retest correlation in Study 1 was 0.90,  $p < .001$ ; the SRHI-response frequency measure correlation in Study 2 was 0.43,  $p < .001$ ; the SRHI-behavioral frequency correlations were 0.69, 0.54, and 0.63 (all  $ps < .001$ ) for watching GTST, eating candies, and switching on music in Study 3; the difference in SRHI between the daily and weekly behaviors condition in Study 4 was significant,  $t(72) = 2.31$ ,  $p < .03$ .

Table 1: Means, standard deviations and intercorrelations of behavioral frequency measures and self-reported habit (SRHI) for the three behaviors in Study 3.

Behavior	Behavioral frequency		SRHI		R-behavioral frequency- SRHI
	<u>M</u>	<u>sd</u>	<u>M</u>	<u>sd</u>	
Watching <u>GTST</u>	4.07	3.45	3.47	2.41	0.74
Eating candies	8.71	3.15	5.31	2.61	0.55
Switching on music	11.85	2.46	7.18	2.45	0.65

Note: The measures of behavioral frequency range from 0 (low) to 16 (high); self-reported habit ranges from 1 (weak habit) to 11 (strong habit). All correlations are significant at  $p < .001$ .

Table 2: Daily and weekly behaviors included in the second session of Study 4.

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DAILY BEHAVIORS ( $n = 36$ )	WEEKLY BEHAVIORS ( $n = 38$ )
Put out my shoes when I come home	Go out (3)
Make tea when I come home	Go into town on Friday afternoon
Make coffee	Travel by train (2)
Drink tea	Go shopping (2)
Drink coffee (2)	Inspect the fridge before shopping
Eat candies (2)	Buy bread and milk
Eat crispies	Buy chocolate
Eat an apple	Eat crispies
Cook	Cook dinner
Walk the dog	Take a long shower
Make the bed	Shave
Brush my teeth (2)	Weigh myself
Look into the mirror	Take the newspaper from the mailbox
Wash my hands (2)	Read the newspaper (2)
Read email	Sport (2)
Open the mailbox	Dance
Look at my watch	Play basketball
Switch on music	Run
Switch on the radio	Play guitar
Switch on the radio when I wake up	Go to church
Switch on the TV set	Call my friend
Watch TV (2)	Call my mom
Watch a soap series	Call home
Watch <u>GTST</u>	Watch the news
Zap	Watch <u>GTST</u>
Curse	Watch <u>ONM</u>
Smoke	Clean up my room
Go shopping	Vacuum
Make a phone call	Clean the house
Go to classes	Wash the dishes (2)
Take a seat on the left-hand side of the bus	Polish my shoes

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Note: The numbers refer to the number of participants for whom this behavior was selected. Behaviors without numbers were presented to one participant only. GTST (Goede Tijden Slechte Tijden) and ONM (Onderweg Naar Morgen) refer to popular soap series on Dutch TV at the time the data were collected.

### Appendix: The Self-Report Habit Index

(Behavior X) is something ...

1. ... I do frequently.
2. ... I do automatically.
3. ... I do without having to consciously remember.
4. ... that makes me feel weird if I do not do it.
5. ... I do without thinking.
6. ... would require effort not to do it.
7. ... that belongs to my (daily, weekly, monthly) routine.
8. ... I start doing before I realize I'm doing it.
9. ... I would find hard not to do.
10. ... I have no need to think about doing.
11. ... that's typically 'me'.
12. ... I have been doing for a long time.

Note: the items are accompanied by response scales that are anchored by agree – disagree, and should preferably contain five or more response categories. In the present studies seven-point (Studies 1 and 2) and eleven-point response scales (Studies 3 and 4) were used.