Habit Strength of Physical Activity and Sedentary Behavior Among Children and Adolescents

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Internal reliability, convergent validity, and construct validity of the Self-Report Habit Index (SRHI) were examined with respect to physical activity (Study 1) and sedentary behavior (Study 2) among children and adolescents. Internal reliabilities of the SRHI proved to be high in both studies. The SRHI correlated significantly with behavioral frequency measures, as well as with known cognitive associates of these behaviors. Moreover, theory-based moderating influences of habit on the attitude–intention and intention–behavior relationships were identified. The study provides early evidence to support the concept of habit as being important in dealing with physical activity in children.

At first sight, walking, running, and jumping would seem to be behaviors that are a natural part of children’s and adolescents’ everyday lives that, once learned, do not require intentional efforts to be set in motion (1). Nevertheless, researchers tend to use models of reasoned action or planned behavior to study physical activity in children (e.g., 23,33,34). In contrast with these models, Triandis (38,39) posited that deliberate decisions to act become irrelevant in guiding behavior when the behavior has been performed repeatedly in the past. Repeated behaviors might be largely determined by habit rather than by reasoned action. When habits are formed, subsequent behavior is associated with, and automatically triggered by, specific environmental cues that normally precede the action (1). In addition, because habits are part of how we organize our everyday lives, they reflect a sense of identity or personal style (36). Based on theoretical and empirical knowledge on habit formation, Verplanken and Orbell (44) highlighted three features of habits: a history of repetition, automaticity (expressed by uncontrollability, lack of awareness, and efficiency), and expressing identity.

The reason for the domination of theories of reasoned action and planned behavior in the study of determinants of physical activity might be the fact that habit is a difficult-to-catch concept for researchers, and the measurement of habit strength has long been an underdeveloped issue (44). The use of behavioral frequency reports (3), measures of duration and intensity (10), or instruments such as pedometers (20) or accelerometers (13) is worthwhile, but such measures can
only be viewed as a proxy for a true measure of habit strength. As Verplanken and Orbell (44) have pointed out, such measures do not address the heart of the habit construct, that is, automaticity.

Habit strength might be ideally measured in a laboratory setting. For example, response-frequency measures (43) can be used to find indicators of habit strength. This approach presents participants with a number of habit-related situations in a controlled research environment and asks them to respond as quickly as possible to produce the behavioral response option that they associate with that situation. Although such measures have proved useful to study habits, their use has been restricted by a major barrier. Because these measures require controlled research environments, they are not easy to administer. Verplanken and Orbell (44) constructed the Self-Report Habit Index (SRHI), a self-report instrument to measure habit strength, consisting of 12 items. The instrument is based on the habitual features discussed above, that is, history of repetition, difficulty of controlling the behavior, lack of awareness, efficiency, and the identity element.

The SRHI has shown high internal reliabilities with respect to a large variety of behaviors, including active transport behavior and TV viewing (44). So far, however, the SRHI has mostly been used among undergraduate students of universities and high schools. We do not know whether the questionnaire can also be applied to physical activity behaviors among children and adolescents. Because physical activity and sedentary habits are often formed in childhood and adolescence, it is important to measure habit strength in these age groups, for example, as a prerequisite for evaluations of interventions that aim to induce or strengthen physical activity habits.

The present studies aimed to investigate reliability and validity of the SRHI regarding physical activity (Study 1) and sedentary behavior (Study 2) among children and adolescents. We investigated internal reliabilities and psychometric characteristics of the SRHI in both studies. Study 1 tested the convergent validity of the SRHI by examining correlations with a frequency measure of the behavior. Study 2 examined construct validity by relating the SRHI scores with attitude and intention scores, as major cognitive associates of the behavior (18). This study additionally investigated Triandis’ (38,39) theoretical assumption of the presence of a habit × intention interaction in the prediction of behavior. Triandis hypothesized a strong intention–behavior association when habit is weak, but a weak intention–behavior association in the case of strong habits. In line with this hypothesis, Trafimow (35) argued that behavioral intentions can be constructed directly on the basis of habit instead of going through a reasoned process in which attitudinal beliefs (pros and cons) regarding the behavior are carefully weighed. In other words, for people who are not in the habit of performing a behavior, the pros–intention relationship and the cons–intention relationship should be stronger than for those who habitually perform the behavior. The potentially moderating role of habit in the attitude–intention relationship is also examined in Study 2. Both studies functioned as pilot studies for two large-scale intervention studies (11,31), which were granted institutional ethical approval and used informed-consent procedures.
Study 1

This study aimed to establish the convergent validity of the SRHI with respect to exercise behavior by correlating the index with estimates of past behavior frequency. Verplanken and Orbell (44) showed that the SRHI correlated consistently and significantly with behavioral frequency measures. Because the effect sizes of the found correlations were large (6) but did not approach 1 (rs between .55 and .74), Verplanken and Orbell (44) concluded that the SRHI provides a more complete account of habit than behavioral frequency measures. In line with Verplanken and Orbell (44), we hypothesized the behavioral frequency measure of exercise behavior to correlate significantly with the SRHI but not to approach 1.

Method

The research population consisted of 419 children (mean age = 10.3, SD = 1.0, range 8–13 y; 50.4% girls) at five primary schools in Amsterdam, The Netherlands. The sample consisted of both native children and ethnic minorities. A total of 32% of the children were of Dutch origin, 17% were of Turkish origin, 29% Moroccan, 7% Surinam/Antilles, and 15% of the children were natives of other countries. The children completed the SRHI questionnaire with respect to the behavioral object of “exercise.” Habit strength was assessed by 12 items on a five-point scale (totally agree +4 to totally disagree 0); for example, “Exercising is something I start doing before I realize I’m doing it.” In addition, respondents filled out a frequency measure with respect to their exercise behaviors.

Based on previous empirical studies (26,37,46) and existing instruments (29), a questionnaire was designed to assess exercise behaviors among children. The 38-item questionnaire was divided into various segments corresponding to the parts of the day (morning, school hours, afterschool hours, evening; see 10), which has been shown to increase recall of individual exercise behavior among children (37). The questionnaire was pretested for comprehensibility among a small sample of 8- to 10-year-old children and adapted accordingly. The total number of minutes per day spent on activities with a metabolic equivalent (MET) value ≥5 was computed (14). MET is the ratio of the work metabolic rate to the resting metabolic rate. One MET is defined as kcal · kg⁻¹ · h⁻¹ and is roughly equivalent to the energy cost of sitting quietly.

Results

Principal component analyses (unrotated, orthogonal) showed three eigenvalues greater than 1 (4.51, 1.47, and 1.14). The first component accounted for 37.56% of the variance, Cronbach’s alpha of the SRHI scale was 0.84, and the mean SRHI score was 30.92 (range 2–48; SD = 9.24).
The mean number of minutes that the children spent per day on activities with a MET ≥5 was 92.97 (SD = 54.10). The correlation of the SRHI score with the behavioral measure (r = .31, p < .001) reached a medium effect size (9).

Study 2

The goal of this study was to examine construct validity of the SRHI by investigating associations between the SRHI and sedentary behaviors and cognitive factors that are known to be relevant correlates of sedentary behavior (18). The SRHI index was formulated for two main forms of sedentary behavior among children and adolescents: watching TV and using a computer (22,41). The index was correlated with estimates of the past behavioral frequency of television viewing and using a computer, as well as with attitude (perceived advantages [pros] and disadvantage [cons]) and intention toward these behaviors. In addition, we examined the hypothesized moderating influence of habit on the pros–intention, cons–intention, and intention–behavior relationships.

Method

The sample consisted of a total of 383 adolescents (mean age = 13.5, SD = 0.6; range 12–17 y; 55.4% girls) at five schools in the region around the town of Nijmegen, The Netherlands. A total of 55 adolescents (14.4%) were of nonnative origin. Parents of 19.8% of the children were divorced. The adolescents completed the SRHI questionnaire with respect to the behavioral object of watching TV and using a computer, for example, “Watching TV and using a computer belong to my daily routine.” The frequency measure with respect to these behaviors consisted of six items, assessing the number of minutes that the respondents spent on these behaviors. Two items assessed the number of days they engaged in watching TV or video and using a computer (surfing the Internet, playing games, chatting) during a normal week. Four additional items assessed the amount of time that the adolescents engaged in each of these behaviors during a regular weekday (two items) and during a regular weekend day (two items). A sum score was computed of the total number of minutes spent per day watching TV or using a computer.

The pros of watching TV and using a computer were assessed by three items on a five-point scale (totally agree +2 to totally disagree −2): “If I watch TV or use a computer, I find it relaxing/sociable/enjoyable.” Cronbach’s alpha of the proscale was .65. Cons were measured on the same answering scale by three items: “If I watch TV or use a computer, I find it boring/get tired/get a headache.” Cronbach’s alpha was .68. Sum scores were computed of both the pros and the cons. Intention was measured by one item: “Do you intend to watch TV or use a computer every day for the next 6 months?” with five answering categories ranging from definitely (+2) to definitely not (−2).

To test the hypotheses regarding the pros–intention, cons–intention, and intention–behavior relationships, the SRHI score was dichotomized into “weak habit” and “strong habit,” using the median split. Hierarchical-regression analyses were performed, in which the pros × habit interaction and the cons × habit interaction were added to the regressions with intention as the dependent variable (separate regressions for perceived pros and cons). The intention × habit interaction was added
to the hierarchical regression on behavior. In case of significant interactions, simple regression slopes were calculated for both habit-strength groups (2).

**Results**

A principal-component analysis (unrotated, orthogonal) on the SRHI yielded two eigenvalues greater than 1 (5.67 and 1.53). The first component accounted for 47.27% of the variance, and Cronbach’s alpha of the SRHI scale was 0.90. The mean score on the index was 25.31 (range 0–48; SD = 9.59).

The mean number of minutes that the respondents spent per day watching TV and using a computer was 255.3 (SD = 152.3). The SRHI score correlated positively with the behavioral measure, intention, and the perceived pros and correlated negatively with the cons (Table 1).

Hierarchical-regression analyses with intention as the dependent variable revealed main effects of habit and perceived pros, as well as a significant habit × pros interaction (Table 2). Simple slope analyses indicated a significant relation between pros and intention in the weak-habit group ($\beta = 0.34; t[379] = 4.80; p <$

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*Note. All correlations were statistically significant at a level of $p < .001.$

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<th>Table 2 Hierarchical Multiple Regressions to Test Moderating Influence of Habit on the Pros–Intention, Cons–Intention and Intention–Behavior Relationship</th>
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.001) and a nonsignificant relation ($\beta = 0.12; t(379) = 1.69$) in the strong-habit group. The habit $\times$ cons interaction was not statistically significant.

Regarding the intention–behavior relationship, hierarchical regression revealed main effects for both intention and habit, as well as a significant habit $\times$ intention interaction (Table 2). Simple slope analyses showed a significant relation between intention and behavior in the weak habit group ($\beta = 0.30; t(379) = 4.26; p < .001$) and a nonsignificant association in the strong-habit group ($\beta = 0.08; t(379) = 1.21$).

**Discussion**

Many physical activities and sedentary behaviors among children, such as playing outside after school or watching TV, are typically routine behaviors. They are repeatedly performed, and children and adolescents might engage in them without much cognitive effort. As a result, the concept of habit is important in studying these behaviors, in addition to measures of behavioral frequency, duration, and intensity. The current study provides limited but intriguing early evidence to support the concept of habit as being important in dealing with physical activity in children. The SRHI (44) proved to be a reliable instrument for the assessment of habit strength of physical activity or inactivity in children and adolescents, acknowledging theoretically and empirically based features of habit.

Mean SRHI scores were slightly above midscale for both behaviors, indicating the habitual nature of the investigated behaviors. Standard deviations were around one fifth of the total range of the scale, reflecting considerable variation in the scores of habit strength. The SRHI correlated significantly with behavioral frequency measures of physical activity and sedentary behavior among children and adolescents. Because the behavioral frequency measures and the SRHI are very different instruments, it is not likely that these correlations are inflated by common measurement error. In fact, the imperfect relationship between the SRHI and the behavioral frequency measures might indicate that the SRHI provides a more complete and full account of habit than frequency measures (44). In essence, low levels of physical activity can be reached habitually and high levels of physical activity can be the result of a strong deliberative process. On the other hand, the significant correlations between SRHI and the behavioral frequency measures might reflect the repetition feature of habit. Furthermore, the SRHI proved to be useful in testing potentially moderating influences of habit in the attitude–intention and intention–behavior relationships. Because the SRHI is theory driven and has practical advantages, it might well contribute to the study of habit in physical activity and thus encourage research that acknowledges the importance of automatic (i.e., unplanned or unreasoned) determinants of physical activity behaviors.

Because the studies reported on in this article were cross-sectional, we have no data on test–retest reliability, on the predictive value of the SRHI in terms of behavioral change, or on intention consistency (30). Furthermore, the behaviors were assessed by frequency questionnaires. Although objective measures, such as energy expenditure assessed by the doubly labeled water method, accelerometers, or pedometers, would seem an obvious choice for assessing physical activity, such methods do not yield information on behavioral aspects, such as the type of activity and the frequency, duration, and intensity of specific types of behavior,
or underestimate these factors without additional measures that compromise the noninvasive nature of the method (40). The use of unvalidated measures of physical activity and sedentary behavior in the current study, however, should be considered as a methodological limitation. In addition, the SRHI measures applied in the current study lack specificity. For example, individuals might be in the habit of watching specific television programs rather than being in the habit of watching television in general. Adolescents might, in another scenario, complete their homework on their computer, although playing computer games is considered a weak habit. In-depth investigations are needed to address these issues.

The current study showed that intentions are unrelated to behavior in adolescents with strong habits. Interventions to increase physical activity or decrease physical inactivity in this target group should therefore go beyond providing information to increase motivation. In fact, information provision will only have an impact if the individual is likely to pay attention to it and if the individual is highly motivated and able to actively process it (7,8). The latter two conditions are unlikely in the case of strong habits (15,42). Multiple studies have shown that interventions focusing on the provision of information are ineffective in changing physical activity in young people (12,25).

Breaking sedentary habits and promoting active habits require disrupting the environmental factors that automatically cue habit performance (5,16,24,27,32,45), time, and repetition (19). Environmental interventions in schools include creating environments that are more attractive in terms of playing during breaks and offering more frequent, as well as longer, physical education classes (21,28). Persuasive communication should be used to provide individuals in the target group with informational support, enabling them to implement their behavioral plans in the changed environment. The potential effect of the intervention is increased when environmental changes are supported by information in lessons (e.g., about new games and when they are based on planned development and theory-based evaluation) (4,6,17). Recently, two types of potential habit change interventions have been proposed (45). So-called downstream-plus interventions provide informational input at points when habits are vulnerable to change, such as when individuals are undergoing naturally occurring changes in environments in which many everyday physical activities are performed (e.g., moving households, changing schools). Upstream interventions are aimed at disrupting old environmental cues and establishing new ones. Typical upstream interventions involve policy changes. For example, a school board might implement a policy to increase the frequency of physical education lessons provided to their students. Such interventions will directly improve physical activity levels of the students and might eventually increase habit strength. Generally, interventions aimed at increasing length, frequency, or intensity of physical education lessons have indeed been found to yield positive effects on youngsters’ physical activity (12). The SRHI could be a useful tool to evaluate changes in habit strength in interventions aimed at increasing physical activity levels in children and adolescents (11).

**Acknowledgments**

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References


Commentary

John Hay, Brock University

The article by Kremers and Brug introduces an intriguing notion: that much of the physical activity or inactivity of children stems not from planning, reasoned action, or intention but from habit. As such, they argue that interventions to decrease inactivity and increase physical activity need to understand the habit strength of the inactive behaviors to allow change and to understand the conditions necessary to introduce and strengthen an active habit. At first glance, this seems both plausible and reasonable, but a closer look is unsettling. This might be a classic case of an argument being necessary but insufficient for proof. Although children might engage in apparently habitual sedentary or physically active behaviors, this might not be the result of unthinking and automatic habits being expressed but rather the expression of what a child is free to do among the opportunities available. Habitual activity for children might be substantially different than that of adults and might differ by age, gender, socioeconomic status, geographic location, and political, social, and religious environments. In addition, each of these factors is moderated by parental style and belief.

We are surrounded by common phrases that refer to the existence of habit, such as, “We are creatures of habit,” “Bad habits are easy to make and hard to break,” or “I have a habit of doing that.” Even the clothes worn by nuns in traditional religious orders are referred to as habits because they remain the same. The belief is that we do the same things over and over again (a history of repetition) without thinking...
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(automaticity). The question is, regardless of the validity of the previous statements for adults, how much of this is true for children? Just as children develop, so do habits. They do not appear out of thin air, nor are they solidified in a day or two. At the root of the development of a habit is a decision to do, or to not do, some action or to express or not express some behavior. The decision to repeat that action or behavior to the point where it becomes almost reflexive is based on the consequence derived. The initiation of a habit, however, comes from a decision to do or not to do something that one is able to do. It is that last phrase—able to do—that is the key distinction between children and adults.

There are two continuums at play here. One continuum is autonomy and the second is opportunity choice. Autonomy refers to one’s ability to freely decide, and choice refers to the range of opportunities available. Opportunity choice is moderated by numerous factors commonly referred to as barriers or promoters (e.g., the environment, socioeconomic standing, self-efficacy, etc.), whereas autonomy is moderated by factors such as politics, law, and religion. Thinking of this as a 2 × 2 table, on the x-axis opportunity choice is absent or present and on the y-axis autonomy is absent or present. A true habit would seem to be that point where individuals are free to choose to do something that they are able to do and where they have chosen to do so repetitively and to the exclusion of other possible opportunities. In epidemiological terms, this would be a true positive in which both opportunity choice and autonomy are present. This only appears in one of the four possible conditions. A behavior is only truly habitual when it is repeated with no apparent thought involved in the face of multiple available and possible choices. Both conditions must be present for the appearance of a true habit. On both continuums, however, children are limited. Autonomy is severely attenuated because children are captive to the desires and demands of their parents.

Opportunity choice is equally limited by physical capacity, as well as socioeconomic and environmental location over which the child has no influence. In the 2 × 2 table where an action is repeated (no choice, no autonomy), a true negative would appear, that is, a false habit. At the far extreme could be a female child of very observant Muslim parents living in extreme poverty in equatorial Africa who has a dream of becoming an ice dancer. Neither the autonomy nor opportunity choice is present, and there is little danger of ice dancing becoming a habitual activity! Moreover, some children might have the autonomy to choose to do ice dancing but not the opportunity, and others might have the opportunity choice but not the autonomy to select ice dancing as a choice. In neither group could ice dancing become a habit.

Thus, the consideration of habit for children requires an understanding of the conditions that both led to and allowed the apparent habit to develop. Children living in substandard and crowded conditions in the inner city might be in the habit of watching television after school, but that may be a reflection more of attenuated opportunity choice than of anything else. Children living in strict religious orders might spend little time playing active games, but this largely reflects curtailed autonomy. One group appears to be in the habit of watching television and the other in the habit of doing chores and study, but neither group truly selected their habit. Therefore, a measure of habit strength that questions if watching TV is part of a daily routine, as mentioned on page 8, would indicate a very high score for the inner-city group but would provide no indication of why that behavior is so
strongly present. As such, this information would provide no greater insight for this behavior than typically used scales that measure television viewing. More important, it would provide no greater understanding of the development of interventions to reduce TV viewing.

The health-beliefs model is commonly used in public health settings to understand and influence the uptake of health-related behaviors, that is, condom use, vaccination uptake, and such. Adopting a health behavior requires that it be seen as reducing perceived susceptibility to a disease or diseases perceived as sufficiently severe to make one want to adopt that behavior. In children, the development of health habits such as brushing teeth and washing hands is well established as a parental responsibility. Children to some extent get in the habit—an automatic behavior to a regularly occurring stimulus—but as every parent knows, even these “habits” require constant reminders and checking, with the fear of dentist’s drills and horrible gastrointestinal illnesses being used to heighten the need to comply. Physical activity could be considered a habitual health behavior—something done to prevent disease. A child’s perceived susceptibility to heart disease or the perceived severity of Type II diabetes as examples is so small, however, that attempting to instill physical activity as a health habit in children is almost certainly bound for failure.

All behaviors that appear to be habitual have roots in decisions that were made based on the autonomy present and the choice selection available. It is interesting to note, for example, that the correlation between generalized self-efficacy toward being physically active and participation in organized sports becomes increasingly strong with age (2). Most children whose parents have annually enrolled them in community baseball, soccer, or hockey leagues do not continue their involvement as they become older and parents ask them their wishes. Children might appear to be in the habit of taking physical education class, for example, up to that point where it moves from a required course to an elective course, where suddenly the habit is broken for most secondary-school children. It has been demonstrated that this choice to break the habit can be predicted by generalized self-efficacy with almost 80% accuracy 3 years before the choice becomes available (1).

The key consideration is that behaviors that are apparently automatic and repetitive and that occur without apparent thought or reason are based on decisions made to the extent that the individual was able to make them at the outset. That some of these habits might continue even when the original conditions have changed is also true, but it could be argued that there is a conscious decision to not change. For children, the conditions of autonomy and selection choice are established by conditions outside their control. Therefore, the consideration of habit in interventions might need to focus more on equipping children to make the best choices within their present circumstance and being ready and willing to make new choices as their autonomy and selection choices expand with age.

Does this mean that a consideration of habit strength is without merit? Not at all. In situations in which autonomy and choice are present, the consideration of habit is necessary. Perhaps most important is that juncture where either choice or opportunity becomes available to the child or adolescent. At this point the substitution of a false habit for a true habit might be a particular risk. If children come to a point where they are able to play outside (rather than stay inside and watch television as previously demanded by their parents) and they choose not to do so, then
TV watching has become a true habit by default and this is a dangerous juncture in the development of an inactive lifestyle. It is necessary for intervention programs to consider the role of choice and autonomy and how that changes with age and circumstance in developing programs designed to reduce inactive behaviors and increase active behaviors with the aim of developing healthy levels of habitual activity. It is difficult to comment on the utility of the SRHI for this purpose with only a single item described in the article. The intent, however, seems reasonable if incomplete. If items probing autonomy and opportunity choice were included, a more complete and useful measure of habit strength in the context of childhood might become an integral part of activity counseling and program development. The target here, as is increasingly apparent elsewhere, needs to be the family unit and the environment in which it resides.

References