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Abstract

Widely cited literature assumes *habits* to be: (1) specific and rigid behavioral responses; (2) in response to location- and timing-stable, external contexts, (3) goal-independent, and (4) enacted without conscious awareness. Hagger (2019) recently reviewed this literature as it applies to the physical activity domain. The purpose of this article is to challenge these assumptions in favor of a habit conceptualization that is more applicable to physical activity: (1) behavioral instigation and/or execution can be habitual, allowing for variable responses to cues; (2) stable contexts can be internal or *functional* (cued by a preceding action) but may vary in timing and physical location; (3) a shift from *external* to *internal* goal **dependence** may characterize habit development; and (4) types of **automaticity** other than purely nonconscious enactment may characterize habitual action. I present theory and research that supports these alternative characterizations and discuss their ramifications for physical activity adoption and maintenance via habit.

Keywords

Habit, Physical activity, Intrinsic motivation, Exercise habit

Disciplines

Applied Behavior Analysis | Exercise Science | Human Factors Psychology | Personality and Social Contexts | Psychology

Comments

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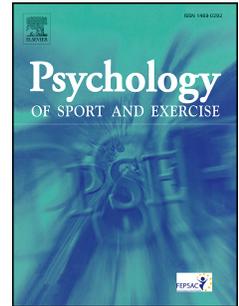
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Abstract

Widely cited literature assumes *habits* to be: (1) specific and rigid behavioral responses; (2) in response to location- and timing-stable, external contexts, (3) goal-independent, and (4) enacted without conscious awareness. Hagger (2019) recently reviewed this literature as it applies to the physical activity domain. The purpose of this article is to challenge these assumptions in favor of a habit conceptualization that is more applicable to physical activity: (1) behavioral instigation and/or execution can be habitual, allowing for variable responses to cues; (2) stable contexts can be internal or *functional* (cued by a preceding action) but may vary in timing and physical location; (3) a shift from *external* to *internal* goal dependence may characterize habit development; and (4) types of automaticity other than purely nonconscious enactment may characterize habitual action. I present theory and research that supports these alternative characterizations and discuss their ramifications for physical activity adoption and maintenance via habit.

Keywords. Habit; physical activity; intrinsic motivation; exercise habit

Challenging assumptions about habit: A response to Hagger (2019)

In his recent narrative review of habit and physical activity, Hagger (2019) highlighted some of the published literature regarding the conceptualization, measurement, development, and maintenance of *habit* as it applies to physical activity.

Hagger (2019) summarizes defining features of habitual action as presented in the literature:

Habits are defined as specific behavioral responses co-occurring with environmental cues or contextual features. Habitual behaviors such as physical activity are represented in associative memory, and experienced as low effort, automatic, and independent of goals and intentions.

Habits are developed through repeated experience of the activity in stable contexts. The activity is initially controlled by goals and rewards, but control shifts to nonconscious, automatic processes as habits develop (emphases added; p.1).

The purpose of this article is to further this discourse by challenging some of the basic assumptions in the published literature regarding the defining features of habit, in favor of a habit conceptualization that is potentially more applicable to physical activity and that fits with existing evidence and theory. These points may augment researchers' and practitioners' efforts to integrate the habit concept into their research and interventions geared towards changing and maintaining individuals' physical activity.

Assumption 1: Habits are Specific, Rigid/Chunked Sequences of Actions

Habits are assumed to relate to *specific* behaviors or patterns of action (always the same behavioral response), often described as “chunked” sequences of action (Grove, Zillich, & Medic, 2014; Wood, 2017). However, as Hagger (2019) discusses, complex behavior (e.g., physical activity) can be broken down into its instigation and execution, each of which may be habitual or not (Phillips & Gardner, 2016). Therefore, behavioral responses to a cue need not necessarily be specific (i.e., an instigation habit may be followed by varying executions) or in a rigid sequence (i.e., execution of a behavior may not be habitual). Physical activity habit has been conceptualized as an automatic *impulse* (not necessarily the action itself; see Gardner, 2015) to exercise in the presence of conditioned contextual cues (an instigation habit) but with variable action in response to those cues—and those responses (exercise execution) may

be a single habit, several substitutable habits, or not habitual at all. Habitual execution of behavior in the form of chunked sequences of actions or patterned action, may or may not be beneficial for long-term behavioral maintenance. Phillips and Gardner (2016) showed that exercise instigation habit (e.g., “Deciding to exercise is something I do automatically”) was more strongly predictive of subsequent physical activity than was exercise execution habit (e.g., “Once I am exercising, going through the steps of my routine is something I do automatically”) and only changes in instigation habit (not execution habit) were related to changes in physical activity over time. Interventions that focus on forming instigation habit may therefore be the most important for physical activity maintenance; however, it is possible that starting with a single, rigid routine in response to a chosen context facilitates instigation habit formation initially.

Some researchers would claim that this varied action (range of responses to a conditioned cue) are not habits but are instead primed goals (Hagger, 2019). However, primed goals encompass automatic responses to sporadic cues/primes and that are not due to repetition in stable contexts. For example, individuals who are primed with words about a common cold or flu may be automatically primed to notice symptoms of a cold (sore throat) and to seek out treatment (over the counter throat lozenges) (see Orbell & Phillips, 2018, for discussion). Primed goal responses are unlike habitual physical activity responses, which may vary but are automatically triggered by contexts in which physical activity has been performed regularly.

A separate but related distinction mentioned in Hagger (2019) is the difference between preparatory and performance actions (Kaushal, Rhodes, Meldrum, & Spence, 2017). Although Hagger (2019) portrays this distinction as overlapping with or even the same as the distinction between instigation and execution, the preparation for and performance of physical activity are separable behaviors, each of which can be broken down into its instigation and execution. For example, physical activity preparation, such as packing a gym bag before going to work, has an instigation (e.g., deciding to pack one’s gym bag directly after breakfast, which may be habitual or not) and an execution (e.g., packing particular items in a particular order, a process which might be deliberative or habitual). Physical

activity performance, such as actually going to the gym after work, has an instigation (i.e., deciding to go to the gym, which may be habitual or not) and an execution (e.g., choice of activities once at the gym, which may be deliberative or habitual). Variable executions (e.g., some days packing running gear, other days packing swimming gear; then actually going for a run or for a swim) may be fully deliberative, even if their instigation is habitual/automatic, or may be habitual themselves (e.g., one might go for a run every Monday but go for a swim every Thursday). Future research can identify different strategies for forming these various types of habit (for instigation and execution of preparatory and performance actions) and determine more/less effective strategies for short- and longer-term physical activity engagement. More broadly, research can attempt to identify which aspects of physical activity can and should ideally be habitual versus non-habitual (see e.g., Verplanken, 2010) and therefore targeted with interventions that promote these processes.

Assumption 2: Habits Develop and are Triggered in Stable, External/Environmental Contexts

“Habits are developed through repeated execution of behaviors in the presence of salient cues or contextual features (Gardner, 2015; Gardner & Lally, 2013; Wood, 2017; Wood & Rünger, 2016)” (Hagger, 2019; p.3). An assumption in the literature is that these contexts and cues must be environmental, or external to the individual, and associated with a stable physical location and timing of action. However, cues could be internal cues (Verplanken, 2006), such a mood state or emotion, potentially triggered themselves by external cues or by the presence of another individual. Research has yet to evaluate this potential empirically, at least in the physical activity domain.

Further, as Wood and Neal (2007) state but do not discuss, a preceding sequence of actions can provide the context for habit. Although daily routines may be closely linked with a physical location and time of day, they do not have to be. For example, some university students I have interviewed regarding their exercise routines state that they exercise directly after their last class of the day, which may be 11am some days and 5pm other days.

Research that has tested location- and timing-stability of action as measures of habit strength have not found that these forms of stability predict behavior as expected. Tappe and Glanz (2013), for example,

found that exercise timing and location stability (self-reported) were unrelated to self-reported habit strength (the Self-Report Habit Index; Verplanken & Orbell, 2003) and amount of physical activity. Contexts for activity may be *functionally* stable (i.e. fit within a sequence of behaviors) yet externally variable (time and location wise). This has ramifications for habit measurement and promotion. Researchers are just starting to evaluate objective, longitudinal data for evaluating habit formation and strength (see conference proceedings, Society of Behavioral Medicine, 2019). However, objective measures could at most tell us when behaviors occur in consistent locations (via GPS, as mentioned by Hagger, 2019) and/or at consistent times of day (measured with sensors). Interventions may focus on consistent action in stable locations and at stable times, but this may not be optimal for long-term maintenance—rather, focusing on functionally stable contexts, as part of regular routines but adaptable to schedule variations, may be more successful in the longer-term.

Assumption 3: Habits are Goal-Independent

“Although the process that leads behaviors to develop into habits is likely to involve the pursuit of goals or rewards, once acquired, habits are themselves said to be enacted without the necessity of goals or rewards” (Hagger, 2019; p.2). This characterization of habits by their goal-independence is primarily supported by evidence from animal models of habit (Wood & Neal, 2007; Wood & Runger, 2016). In animal models, researchers use *devaluation of outcomes* as a marker of habit formation (e.g., a mouse that will continue pressing a lever for food pellets despite being satiated or the food being paired with a drug that makes the mouse nauseous; Rossi & Yin, 2013). Some evidence for this comes from research with humans showing travel mode choice from habit is made regardless of weather conditions (see e.g., Verplanken, Aarts, & van Knippenberg, 1997).

Applied to physical activity, Hagger (2019) gives the example of an individual that begins an exercise program because of a goal to lose weight but, as gym attendance becomes habitual, the weight loss goal no longer influences the behavior. Does it make sense to conclude from this that exercise, once habitual, requires only presentation of the conditioned context cue for enactment? Without a reason to exercise, any habit that developed would most certainly cease—just as a mouse that no longer receives a

food pellet while pressing a lever will eventually lose the habitual response. *Not* exercising is very easy to do, at least logistically, if there is no longer any reason for someone to exercise (unlike efforts to *not* eat a tempting food directly in front of the person).

I will not re-hash (and cannot settle, here) arguments in the literature regarding whether habits are goal-mediated (Aarts & Dijkterhuis, 2000) or not (Wood & Neal, 2007), since this debate regards only goals that are external to the behavior (in the case of exercise, for example, payment/incentives, weight loss, meeting someone else's expectations). Rather, I highlight the importance of *internal* goals for complex habit formation and maintenance. Phillips, Chamberland, Hekler, Abrams, and Eisenberg (2016) showed that intrinsic rewards (positive reward, such as enjoyment, or negative reward, such as stress reduction) predicted exercise frequency via habit strength for individuals in a maintenance stage of change. Intrinsic goals, or motivation, may therefore be fundamental to physical activity habit (without intrinsic reward, the habit would cease/extinguish). In addition to playing a role in maintenance of PA through habit, research has shown that intrinsic rewards may be important for habit *formation*: studies have found that intrinsic reward is associated with greater short-term behavioral repetition, needed for habit formation, and a stronger relationship between behavioral repetition and subsequent habit strength (Gardner & Lally, 2013; Wiedemann, Gardner, Knoll, & Burkert, 2014).

This work fits in with research showing that even if an individual reports valuing behavioral *outcomes* more strongly than his/her behavioral *enjoyment*, it is behavioral enjoyment that more strongly predicts behavioral frequency and/or duration (Bluemke, Brand, Schewitzer & Kahlert, 2010; Brand & Schewitzer, 2015; Wooley & Fishbach, 2015). Further, although the concept of habit has yet to be formally integrated into it, Self Determination Theory (Ryan & Deci, 2000; Teixeira, Carraça, Markland, Silva, & Ryan, 2012), supports the proposition that intrinsic motivation (enjoyment) promotes the greatest frequency, intensity, and duration of activity over time, compared to all other forms of motivation (from extrinsic rewards).

Thus, it may be that habit should be conceived of as a shift from external goal-dependence to internal goal-dependence and that intrinsic rewards are necessary for habit formation and maintenance in

complex health domains, such as physical activity. This has important implications for physical activity promotion in addition to the strategies listed by Hagger (2019). In addition to facilitating context-stable behavioral repetition, interventions should facilitate choice of intrinsically rewarding activities and/or focus on increasing intrinsic reward from activities over time. Repetition may directly increase enjoyment (Phillips & Chapman, 2012), potentially via increased feelings of competence/mastery, relatedness, and/or autonomy (Ryan & Deci, 2000). Motivational interviewing also holds promise for promoting intrinsic, or autonomous, motivation to engage in a new behavior (see e.g., Ellingson et al., 2019).

Assumption 4: Habits are Characterized by Non-Conscious Automaticity

“Habit may be considered a specific form of a system 1 process (Hall & Fong, 2007; Verplanken & Aarts, 1999; Wood, 2017; Wood, Labrecque, Lin, & Runger, 2014), in which behavior is nonconsciously, automatically enacted in response to the presentation of associated cues or contextual features” (Hagger, 2019; p. 2). As reviewed in Hagger (2019), habitual action is described in the literature as being non-conscious and is measured in some instruments as engaging in a behavior *without thinking* and starting a behavior *without realization* of one’s actions (Gardner, Abraham, Lally, & de Bruijn, 2012; Verplanken & Orbell, 2003). However, to enact (instigate and execute) a complex health behavior without conscious awareness is unlikely in the extreme, and no data exists to show exercising can be done without conscious awareness of one’s actions.

Theory in the literature allows for a different view of automaticity that is more applicable to complex health behaviors, such as exercise. Different types of automaticity, not all of which need to be present for a process to be considered automatic, have long been recognized (see Moors & DeHouwer, 2006)—some of which may be more applicable to exercise instigation and/or execution, such as cognitive and physical *efficiency* and lack of attention to alternative behaviors (Danner, Aarts, & de Vries, 2008). Such non-deliberative enactment of exercise would satisfy the function of habits, which is freeing up cognitive and self-regulatory resources required for making new decisions and carrying out non-habitual actions (Hagger, 2019). Further, more recent theorizing on non-conscious versus conscious processes calls into question the strict divide between these processes (often referred to as “dual processes”) (e.g.,

Van Bavel, Xiao, & Cunningham, 2012). These processes may be dynamically related to each other and qualities of “system 1” and “system 2” may co-occur, such as in processes that are conscious (system 2) but unintentional (system 1) or efficient (system 1) (Melnikoff & Bargh, 2018). Therefore, the habitual enactment of physical activity (including its instigation and execution) and other complex health behaviors may involve a combination of automatic and non-automatic or conscious and non-conscious processes. Further, maintenance of physical activity in the long-term may involve complex interactions between automatic and non-automatic, conscious and non-conscious processes.

Conclusions

In this article, I have challenged four core assumptions in the habit literature regarding the basic conceptualization of habitual action and proposed alternative interpretations of those habit characteristics that may be more applicable and useful in a physical activity (or other complex behavioral) domain. The interested reader is also directed to read recent literature that challenges additional assumptions of automaticity for the habit domain, in general (Trafimow, 2018). Instead of seeing physical activity habits as nonconsciously enacted, specific and rigid sequences of behaviors in the presence of stable, external/environmental cues that do not depend on goals for their enactment, we can view them as consciously yet non-deliberatively and efficiently enacted actions (whether instigation and/or execution of activity) that satisfy intrinsic/internal goals in functionally stable contexts that may vary by time and physical location. Regarding future research, I second Hagger (2019)'s call for a more comprehensive habit theory, or at least synthesis of habit theories across fields that study habitual behaviors. I also suggest that existing health behavior theories (e.g., Health Action Process Approach, Schwarzer, 2008; Self-Determination Theory, Ryan & Deci, 2000) should integrate habitual action and processes of habit development and maintenance with other automatic and deliberative processes. Relatedly, I also second Hagger's (2019) call for more longitudinal study designs, including individuals in all relevant stages of behavior change (Prochaska & Velicer, 1997), so that researchers can successfully evaluate multiple processes (that may vary in degree and nature of automaticity) of behavior initiation and maintenance, including habit formation and continuation, in stable and in changing contexts. It is possible that

accepting these alternative characterizations of habits may necessitate theorizing and studying behavior-specific differences in habit formation and maintenance processes, perhaps related to behavioral complexity (Mullan & Novoradovskaya, 2018). Future research can address whether different strategies for habit formation may be required for different types of behaviors.

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