Habits: A Repeat Performance

David T. Neal, Jeffrey M. Quinn, and Wendy Wood

Duke University

Corresponding author: Wendy Wood
Department of Psychology
Box 90085
Duke University
Durham, NC 27708

(919) 660-5785
fax: (919) 660-5726
e-mail: wendy.wood@duke.edu

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David T. Neal, Jeffrey M. Quinn, and Wendy Wood[1]

Duke University

Abstract

Habits are dispositions to enact past responses. They develop through repetition in stable contexts. When first giving a response, people are guided by goals and desired outcomes. With repetition, associations form in memory between the response and features of the performance context. These context cues then automatically trigger repetition of the response. We review evidence from behavioral, motivational, and neural research indicating that habits are cued directly without the need for goal activation. In this way, responses that initially were guided by goals become controlled by context. We conclude by considering the implications of habits for self-regulation, behavior prediction, and behavior change.

Key words: habit; automaticity; behavior change; behavior prediction; self-regulation

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From Anthony Robbins to Zen Buddhism, received wisdom exhorts us to be mindful, deliberative, and conscious in all we do. Contrasting this, contemporary research in psychology shows that it is actually our unthinking routines – or habits – that form the bedrock of everyday life. Without habits, people would be doomed to plan, consciously guide, and monitor every action, from making that first cup of coffee in the morning to sequencing the finger movements in a Chopin piano concerto. But what is a habit? How are habitual behaviors learned and represented at the cognitive, neural, and motivational levels? What costs and benefits accrue when actions are under habitual control? In addressing these issues, we argue that habits involve a qualitatively distinct kind of psychological control. By understanding this automated dimension of everyday life, psychologists can improve the predictive validity of behavioral models, increase the effectiveness of behavioral interventions, and gain important insights into the nature of self-regulation.

Within psychology, interest in habits initially emerged out of the behaviorist tradition that cast habits as direct, reflex-like links between physical/sensory events and motor responses. Fueled by advances in cognitive science, habits have since moved emphatically into the head. While retaining the behaviorists' focus on environmentally triggered responses, current research on habits draws heavily on cognitive models of learning and memory that explain how complex behaviors can be automated through simple mental associations. With these advances, habits again become legitimate constructs in models of human thought and action.

WHAT ARE HABITS?

We define habits as learned, non-motivated dispositions to respond automatically to one's context. Let's unpack each of these attributes in turn. Habits are *learned* in the sense that they are gradually laid down in procedural memory through repeated performance. They are *non-motivated* in the sense that, unlike many of the other things we do, they are not driven by a desire to achieve a certain goal or outcome. Instead, habits are set in motion by features of the *context* that were associated with the behavior during

previous performance. Context includes elements of the physical or social setting (location, presence of others), temporal cues (time of day), prior events (actions in a sequence), or internal states (moods). The presence of these features activates a disposition to perform the response automatically, that is, without the need for attention, conscious awareness, or intention. In this way, repetition transforms the psychological control of responses such that initially goal-directed responses become cued directly by context.

Under this definition, much of our everyday life can be defined as habitual. Indeed, our diary studies of both college student and community samples suggest that around 45% of people's behavior is habitual in the sense that it is repeated almost daily and usually in the same context (Quinn & Wood, 2005; Wood, Quinn, & Kashy, 2002). Predictably, these behaviors appear to require minimal conscious awareness, and participants typically report thinking about something other than what they were doing. Common examples include mindlessly driving one's daily route from home to work or engaging in a ritual breakfast table conversation while reading the paper. As we explain in the following sections, the view of habits as non-motivated, context-cued responses emerges out of a number of traditions within psychology, including animal learning, neuropsychology, and cognitive science.

THE POWER OF REPETITION: FROM GOALS TO CONTEXT CUES

Research on animal learning has provided direct evidence that with repetition, responses become less oriented to attaining goals or outcomes (see Dickinson & Balleine, 1995). When animals initially receive a reward for performing simple actions (e.g., getting food pellets for pressing a lever), they appear to learn associations between the action and the positive outcome. But with practice, the basis for action apparently shifts to a simple habit mechanism involving associations between the context (lever) and the press response. Evidence for this shift comes from studies that subsequently devalued the reward by, for example, pairing it with a toxin. When rats had not established a habit, reward devaluation dramatically reduced lever pressing. In contrast, when a habit had been established, devaluation had little impact in that

rats continued pressing the lever. This pattern suggests that habits are not driven by the current value of behavioral outcomes.

In humans, a shift in the control of action as it is repeated has been demonstrated using brain imaging techniques such as fMRI and PET. These changes are characterized by a shift away from parts of the brain associated with conscious, declarative memory and goal-setting (e.g., the medial temporal lobe and pre-frontal cortex) and towards areas associated with procedural memory and context-cued responding (e.g., basal ganglia). For example, Poldrack et al. (2001) measured brain activity while people played a computer game in which they learned to predict the weather (rain vs. shine) through trial and error based on a variety of geometric shapes presented on the screen. Initially, parts of the brain associated with more conscious, flexible, declarative memory were active, but as the task was repeated, areas associated with more rigid, context-driven procedural memory took over.

The independence of habit-based control of responses and more conscious, goal-directed control is powerfully evident when brain damage impairs one system but leaves the other intact. For instance, damage to the prefrontal cortex (i.e., part of the more conscious, goal-oriented system) can lead people automatically to perform behaviors associated with the context, even when this is inappropriate (e.g., drinking out of an empty cup, Lhermitte, 1983). In contrast, damage to the basal ganglia (i.e., part of the habit control system) can leave people with normal conscious memory but severely impaired capacity to use this knowledge to guide their behavior through habitual associations (Knowlton, Mangels, & Squire, 1996).

In sum, animal learning research and neuropsychological studies with humans show that response repetition can alter the psychological mechanisms that control action. Whereas novel, non-habitual actions rely principally on goal-directed control in the pre-frontal cortex, habits rely principally on contextually triggered associations in the basal ganglia and related structures.

HABITS VERSUS OTHER FORMS OF CONTEXT-CUED RESPONDING

It might seem unusual to think of actions as being determined by features of the performance context. However, the idea that action can be context controlled receives support from several lines of social psychological research. For example, people sometimes form plans, called implementation intentions, that deliberately link performance of an action to event or context cues (e.g., when I see my roommate, I will give her the message). These cues then automatically trigger the desired action (see Hassin, Uleman, & Bargh, 2005). Features of the environment also can activate goals automatically, and these nonconscious goals can guide behavior without the actor's awareness or intention (see Hassin et al., 2005). In addition, ideomotor behaviors, such as mimicking another person, occur nonconsciously because perception and performance of action are supported by a common neural architecture (see Hassin et al., 2005).

We prefer to distinguish habits from other forms of context-cued responding (see Quinn, Neal, & Wood, 2005, for a detailed discussion). Habits are unique in that their formation requires repetition. Furthermore, the evidence from animal learning and neuropsychological research that habits are not dependent on goal systems differentiates them from implementation intentions and other forms of automatic goal pursuit.

IMPLICATIONS FOR SELF-REGULATION

Self-regulation involves monitoring and adjusting responses in the service of the self. In current theorizing, self-regulation proceeds by consciously or non-consciously comparing one's current state of being with one's goals or desired states (see Hassin et al., 2005). Is it possible, though, to regulate behavior that is not guided by a goal? Although people exhibit decreased monitoring of well-practiced responses, they clearly are not automatons mindlessly repeating non-optimal habits. This raises the intriguing possibility that people can engage in forms of self-regulation in which the regulatory mechanisms require neither conscious awareness nor goal representations. Recent research on conflict monitoring

(Yeung, Botvinick, & Cohen, 2004) supports this prospect. Within this framework, the detection of negative behavioral outcomes is achieved not by comparing one's current states with desired states but rather by detecting the activation of multiple competing responses. According to Yeung et al. (2004), the presence of multiple competing responses is a common feature of many situations in which negative outcomes occur, and can therefore be used as a kind of proxy for evaluating outcomes. Thus, conflict monitoring provides a precedent for self-regulation in the absence of goals.

In addition to monitoring behavior, successful self-regulation involves controlling the implementation and inhibition of responses. Here, too, habits are unique. In a recent diary study, we explored the regulatory demands of habitual and non-habitual behaviors (Neal & Wood, 2005). Across four days, we monitored people's daily performance of a range of personally important behaviors (e.g., attending the gym, getting up on time). For two of the four days we also reduced people's self-control capacity by requiring them to use their non-dominant hand for a range of activities (an effortful task that drains will-power). When self-control was lowered, people were less likely to perform non-habitual behaviors but continued to perform habits successfully. They not only maintained beneficial habits, such as attending the gym, but also maintained bad habits, such as an afternoon trip to Krispy Kreme. Thus, habits represent a double-edged sword within self-regulation; desirable habits are easy to perform when one is depleted, but undesirable habits are difficult to inhibit.

Finally, habits influence the role of the self within self-regulation. Because people perform these actions often, it makes sense that habits would be powerful components of the self-concept. However, our diary studies suggest that people generally consider their habits less informative about themselves than their non-habitual actions (Wood et al., 2002). In part, this may reflect that behaviors that occur without effort, awareness, or intention (as is typical of habits) are unlikely to feel self-willed (Wegner, 2002). In addition, the disconnection between habits and the self could emerge from their different representation in memory. People's sense of self is informed by autobiographical memories, which are stored in the

declarative system. Given that habits rely on procedural memory, they may be somewhat removed from these autobiographies and hence the self-concept.

IMPLICATIONS FOR BEHAVIOR PREDICTION

Predicting people's behavior is a central project for many areas of psychology. Formal models in social and health psychology predict behavior using relatively mindful constructs such as intentions, attitudes, and decisions. If we are correct and the control of action shifts with repetition, then these constructs should be most successful at predicting actions that have not been practiced into habits. Demonstrating just this pattern, Ji Song and Wood (2005) predicted how often college students purchased fast food during a week-long period from their intentions to purchase and from their past purchasing habits. As can be seen in Figure 1, students with weak and moderate habits acted on their intentions, so that stronger intentions were associated with more frequent purchases. However, those with strong habits repeated past behavior regardless of their intentions. This pattern plausibly reflects the context control of repeated action in which past habits were cued automatically rather than guided by intentions.

Ji Song and Wood's findings also demonstrate the utility of including measures of context stability when estimating habit strength. Researchers often have equated strong habits simply with frequent past performance. This may be appropriate for actions that tend to be performed in a given context (e.g., using seatbelts). However, for purchasing fast food, simple measures of past frequency were not sufficient and the predicted pattern emerged only when habits were defined as frequent purchases in the same location. Presumably, purchasing fast food in different locations required thought and attenuated habit development.

IMPLICATIONS FOR BEHAVIOR CHANGE

Our claim that habits are cued by context has implications for changing behavior. Public health campaigns and other informational interventions attempt to change behavior by altering beliefs. If habits are repeated relatively independently of decisions, they should be minimally influenced by such interventions. To test this idea, Webb and Sheeran (in press) reviewed research on the effects of persuasive messages

and other informational interventions. For exercising and other behaviors that people could repeat sufficiently to form habits, interventions that changed intentions did not necessarily change behavior. However, for course enrollment and other actions that were not easily repeated into habits, interventions that were effective at changing intentions also changed behavior. Thus, habits are not easily altered through interventions targeted at people's intentions. However, habits should be vulnerable to interventions that change aspects of the performance context. To test this idea, Wood, Tam, and Guerrero Witt (2005) examined change in college students' habits for exercising, reading the paper, and watching TV upon transferring to a new university. They assessed students' behavior and intentions one month before and one month after the transfer. Students' habits maintained across the transfer when the performance context at the new university was similar to that at the old one, such as when they continued to watch TV in their dorm room. But when the context shifted with the transfer, apparently habits were no longer cued automatically, and students had to decide what to do. Then, they consulted their intentions, and continued to perform the behavior only if they intended to do so.

Our ideas about habit change provide new insight into the control of everyday health habits. Five of the leading health indicators in the U.S. are a product of everyday repetition of action, including substance abuse, obesity, tobacco use, risky sexual behavior, and inadequate physical activity. Instead of individual-level education and counseling interventions for those who possess these health-risk factors, successful efforts for changing habits should be directed to public policy and contextual interventions to strengthen social cues and supports for healthy behaviors (Verplanken & Wood, in press). Examples include reducing access to unhealthy products (via pricing, product design) and changing the built and social environment to encourage healthy behavior (e.g., sidewalks, community-based exercise programs).

CONCLUSION

We have argued here that behavior repetition has a powerful transforming effect on the psychological control of action. Culminating in habit formation, this process is characterized by a decreased

involvement of goals and an increased involvement of contexts as cues for action. It would be a mistake, however, to suggest that behavior is controlled in an either-or fashion. Our lives often demand a complex and nuanced interplay between habits and other guides to action. In Ji Song and Wood's (2005) study for example, even students with strong habits to purchase fast food were required to engage in some limited aspects of decision making (e.g., counting money). The impact of context, however, was apparent in their repetition of past purchasing in the same location regardless of intentions. In this way, behavior is controlled by the interleaving influence of habits and other guides to action. Looking forward, our research plan is to understand this synthesis between habitual control and other action systems as it plays out to guide responding in everyday life.

Notes

[1] Address correspondence to Wendy Wood, Department of Psychology, Box 90085, Duke University, Durham, NC 27708. e-mail: wendy.wood@duke.edu

References

Dickinson, A., & Balleine, B. (1995). Motivational control of instrumental action. Current *Directions in Psychological Science, 4,* 162-167.

Hassin, R. R., Uleman, J. S., & Bargh, J. A. (Eds.) (2005). *The new unconscious*. New York: Oxford University Press.

Ji Song, M., & Wood, W. (2004). Habits in consumer research: Prediction and measurement. Manuscript in progress.

Knowlton, B. J., Mangels, J. A., & Squire, L. R. (1996). A neostriatal habit learning system in humans. *Science, 273,* 1399-1402.

Lhermitte, F. (1983). 'Utilization behavior' and its relation to lesions of the frontal lobes. *Brain, 106,* 237-55.

Neal, D. T., & Wood, W. (2005). Ego-depletion and habits in everyday life. Unpublished manuscript, Duke University.

Poldrack, R. A., Clark, J., Pare-Blagoev, J., Shohamy, D., Creso Moyano, J., Myers, C., & Gluck, M. A. (2001). Interactive memory systems in the human brain. *Nature, 414,* 546-550.

Quinn, J. M., Neal, D. T., & Wood, W. Habits and the repetition of action in everyday life. Manuscript submitted for publication.

Quinn, J. M., & Wood, W. (2005) Habits across the lifespan. Unpublished manuscript, Duke University.

Webb, T. L., & Sheeran, P. (in press). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin.*

Wegner, D. M. (2002). *The illusion of conscious will*. Cambridge, MA: MIT Press.

Wood, W., Tam, L., & Guerrero Witt, M. (2005). Changing circumstances, disrupting habits. *Journal of Personality and Social Psychology, 88,* 918-933.

Wood, W., Quinn, J. M., & Kashy, D. (2002). Habits in everyday life: Thought, emotion, and action. *Journal of Personality and Social Psychology, 83,* 1281-1297.

Verplanken, B., & Wood, W. (in press). Breaking and creating habits: Consequences for public policy interventions. *Journal of Public Policy & Marketing.*

Yeung, N., Botvinick, M. M., & Cohen, J. D. (2004). The neural basis of error detection: Conflict monitoring and the error-related negativity. *Psychological Review, 111*, 931-959.

Recommended Readings

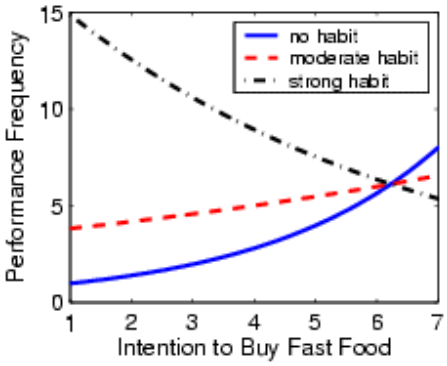
Quinn, J. M., Neal, D. T., & Wood, W. (2005). (See references)

Wood, W., Quinn, J. M., & Kashy, D. A. (2002). (See references)

Wood, W., Tam, L., & Guerrero Witt, M. (2005). (See references)

Figure Caption

Figure 1. Results of a Poisson regression analysis predicting frequency of buying fast food from intention to buy and from strength of past buying habits. The figure represents a simple decomposition of the significant interaction obtained between intention and habit strength, unstandardized B = -0.03, SE = 0.01 (p < .01).


15
10
5
0
1
2
3
4
5
6
7
Performance Frequency
Intention to Buy Fast Food
no habit
moderate habit
strong habit