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# Reasons to Remain Critical About the Literature on Habits: A Commentary on Wood et al. (2022)

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**Abstract**
Wood et al. (2022) reviewed arguments in support of the idea that much of human behavior is habitual. In this commentary, we first point at ambiguities in the way Wood et al. referred to habits. This allows us to clarify the question that lies at the core of the debate on habits: To what extent is habitual behavior mediated by stimulus–response associations or by goal representations? We then argue that Wood et al. dismissed goal-directed explanations of habitual behavior too easily. Finally, we point out that Wood et al.'s reanalysis of our data is misleading in that a more fine-grained analysis supports rather than questions goal-directed accounts.

**Keywords**
habits, goal-directed behavior, behavior change

Although it seems self-evident that people have habits, there is still a debate about the extent to which human behavior is habitual. In a recent review, Wood et al. (2022) argued that the "central feature of habit performance—direct context–response cuing without requiring a corresponding goal—is supported widely by research" (p. 3). In this commentary, we first point out that the debate about habits is not about whether behavior can be habitual in a descriptive sense (e.g., whether some behaviors are emitted frequently) or functional sense (e.g., whether some behaviors are performed seemingly without reflection) but about the extent to which habitual behavior is mediated by stimulus–response (S-R) associations or by goal representations. Whereas Wood et al. argued that goal-directed accounts of behavior are problematic because they are unfalsifiable, we point out that this does not provide sufficient grounds for dismissing goal-directed accounts of habitual behavior. Finally, we take issue with the reanalysis that Wood et al. provided of the data we reported earlier (De Houwer et al., 2018). We hope that the arguments presented in this commentary encourage researchers and practitioners to remain critical when considering evidence for the conclusion that habitual behavior is mediated by S-R associations.

## What Is the Debate About?

In any debate, it is important to be precise about the topic. The debate about habits is complicated by the fact that the term "habit" can be used in different ways (De Houwer, 2019b; Gardner, 2015): (a) descriptively, as behavior with certain observable properties (e.g., behavior that occurs frequently or that subjectively feels fluent); (b) in terms of functional causation, as behavior that is due to certain environmental events under certain conditions (e.g., behavior that is automatically triggered by stimuli in the context, that occurs because it was frequently emitted or rewarded in the past or that is insensitive to changes in rewards or reward contingencies); (c) in terms of mental causation, as behavior that is due to certain mental causes (e.g., behavior that is mediated by S-R associations in memory); or (d) representationally, as a type of mental representation (e.g., an S-R association in memory) rather than a type of behavior.

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Instead of clarifying this conceptual ambiguity, Wood et al. (2022) perpetuated it by using the word "habits" to refer to different things, including behavior with specific environmental causes (e.g., "In most modern accounts of habit, habitual responses are directly cued by contexts"; p. 1), behavior with specific mental causes (e.g., "habits are guided by cached representations in memory that store direct cue-response associations"; p. 2), and mental S-R associations that drive behavior (e.g., "In this article, we showed that habits—direct context-response associations learned through repeatedly rewarded responding—can account for important behavioral, cognitive, and neural phenomena in a systematic way"; p. 12).

This inconsistent use of the term "habits" complicates the debate. If habits are defined in terms of S-R associations (either as behavior that is caused by S-R associations or as the S-R associations themselves), then there is no point in discussing the causes of habits (in the sense of behavior) or the nature of habits (in the sense of mental representations) because they are declared to be S-R-based by definition. It is therefore confusing that Wood et al. (2022) defined habits in terms of S-R associations and at the same time tried to refute the idea that habits depend on goals. In our opinion, it makes more sense to clearly separate habitual behavior as an empirical phenomenon (defined descriptively or functionally) from mental concepts (e.g., S-R associations, goal representations) that could be used to explain this behavior (for a discussion of the benefits of separating explanandum and explanans, see De Houwer, 2011; Hempel, 1970). This allows one to clarify that the core debate in the habit literature is not about whether behavior can be habitual in a descriptive or functional sense but about the extent to which habitual behavior is mediated by S-R associations or goal representations. This debate can be rephrased as a debate about the extent to which behavior is goal-directed: Whereas the observation of habitual behavior as such does not challenge the idea that behavior is goal-directed, the conclusion that habitual behavior is mediated by S-R associations does.

During this debate, some colleagues might wish to use the term "habit" to refer to a behavioral phenomenon (i.e., descriptively or functionally habitual behavior), whereas others might wish to use it at a mental level of explanation (i.e., for behavior that is mediated by S-R associations or the S-R associations themselves). Although we do not want to adjudicate on this issue, we do believe that progress in the debate on habits can be made only if researchers always (a) make explicit their definition of habit and (b) clearly separate habitual behavior as a to-be-explained behavioral phenomenon (i.e., descriptively or functionally habitual behavior) from mental constructs that could be used to explain this behavioral phenomenon (e.g., S-R associations and goal representations).

## Wood et al. (2022) Dismissed Goal-Directed Accounts Too Easily

In the debate on habits, Wood et al. (2022) took the position that there is strong evidence for the conclusion that behavior can be mediated by S-R associations. In this section, we explain why it is good to remain cautious about this conclusion. First, because no one doubts that behavior can be goal-directed, the burden of proof is on those who wish to argue that a certain behavior is mediated by S-R associations. Second, providing such proof is a daunting task because S-R associations (like goals) cannot be observed directly. Researchers therefore often resort to finding proxies or markers for the involvement of S-R associations (e.g., lack of outcome-devaluation effects, the involvement of specific neural pathways, the impact of context change, stress or time pressure; see Wood et al., 2022).

Unfortunately, those markers are not always valid. For instance, the use of outcome-devaluation procedures in habit research hinges on the idea that if behavior is goal-directed, then devaluing the outcome at which the behavior is directed should reduce the probability of that behavior. If outcome devaluation does not influence a particular behavior, this is taken as evidence against the idea that this behavior is goal-directed and thus in favor of the idea that it is driven by S-R associations. Consider the study of Neal et al. (2011) in which it was found that people who habitually (i.e., often) eat popcorn in a cinema also eat stale (i.e., bad tasting) popcorn when in a cinema. On the basis of this observation, Neal et al. (2011) concluded that for these people, the behavior of eating popcorn is mediated by S-R associations. An important problem with this approach is that the absence of an impact of outcome devaluation could be due to many reasons other than the fact that behavior is driven by S-R associations. For instance, the devaluation procedure might have been too weak or might have targeted an outcome different from the outcome at which behavior was directed. Again consider the example of people who continue to eat stale popcorn when in a cinema. If this behavior is directed not at the goal of eating tasty food but at the goal of augmenting their cinema experience, then devaluing the taste of the popcorn should not have an effect (De Houwer et al., 2018, p. 58).

The absence of outcome-devaluation effects is of course only one of the markers for the impact of S-R associations on behavior. We and others have, however, identified several reasons for why other markers are

also not necessarily valid (e.g., Boddez et al., 2018; Buabang et al., 2021, in press; De Houwer et al., 2018; Kruglanski & Szumowska, 2020; Moors et al., 2017). Although the format of a commentary does not allow us to revisit these arguments, we do wish to draw attention to their existence because Wood et al. (2022) gave them little consideration and dismissed them in large part on the basis of the idea that it is always possible to think of some goal-directed account of a finding that seems to favor an S-R account. We agree that a goal-directed perspective is unfalsifiable in this sense.[1] However, this does not mean that one can simply dismiss goal-directed explanations of behavior that is habitual in a descriptive or functional sense. First, as noted above, the burden of proof remains firmly with those who wish to argue that a behavior is mediated by S-R associations. Second, a lack of falsifiability of a goal-directed perspective on behavior does not exclude the possibility that specific explanations within that perspective are falsifiable. For instance, if people tolerate the taste of bad popcorn because eating popcorn still contributes to their cinema experience, then offering alternative ways to increase the cinema experience (e.g., putting on 3D glasses) should result in a reduction in eating stale popcorn (De Houwer et al., 2018, p. 58). Such predictions can be falsified. We made this point explicit in an earlier article, but unfortunately, Wood et al. (2022) cited only part of what we wrote:

> If additional studies do not provide support for the alternative goal-directed account [of a specific empirical result], one should be willing to accept the conclusion that the behavior is habitual [in the sense of mediated by S-R associations] rather than adhere to the *irrefutable claim that the behavior must be mediated by some type of goal*. Nevertheless, researchers should consider the possibility that [outcome] devaluation . . . tests lack sensitivity or fail to target the goal that is actually driving behavior. (De Houwer, 2019b, p. 4; clarification added in brackets; words cited by Wood et al. are italic)

More generally, we believe that researchers should take alternative goal-directed explanations seriously before accepting the conclusion that a specific behavior is mediated by S-R associations. Such a critical stance is a matter of good science.

## Wood et al. (2022)'s Reanalysis of De Houwer et al. (2018) Is Incomplete and Misleading

As noted above, much of the evidence for S-R associations is based on outcome-devaluation tests. As Wood et al. (2022) acknowledged, we not only pointed out that these tests are problematic but also provided empirical support for this argument (see De Houwer et al., 2018). Wood et al., in turn, questioned the conclusiveness of our empirical arguments. Their analysis of our reaction-time data showed that, immediately after a change in outcomes, responses are slower for incongruent items (which they call "habit items") than for other items (which they call "nonhabit items"). Wood et al. explained this finding by arguing that on incongruent trials only, S-R associations trigger incorrect response tendencies that need to be inhibited.

However, the same finding can also be attributed to the fact that goal-directed responding to incongruent test items is more complex than responding to other items because the former involves integrating more pieces of information than the latter (e.g., information about whether a stimulus was a cue or outcome on a training trial). This alternative account can be tested by comparing the two types of so-called nonhabit items: biconditional items and congruent items. Responding to biconditional items is more complex than responding to congruent items because the former involves more pieces of information (i.e., information about more stimuli) than the latter, but neither should involve S-R associations (as indicated by the fact that Wood et al. considered both nonhabit items). Wood et al. (2022) reported analyses that averaged across biconditional and congruent items. However, the OSF pages that Wood et al. (2022) referred to include an alternative analysis in which these two trial types were analyzed separately. Figure 1a shows the plot published in Wood et al. (2022), whereas Figure 1b shows the plot obtained from the code on the OSF (Mazar et al., 2021). As can be seen in Figure 1b, the reaction times on congruent trials were, in absolute terms, shorter than those on biconditional trials, which in turn were shorter than those on incongruent trials. This is difficult to explain on the basis of the idea that habitual S-R responding was absent on congruent and biconditional trials but present on incongruent trials. Instead, it fits well with the well-established idea that the speed of (goal-directed) responding is a function of informational complexity, which is higher on incongruent than on biconditional trials and higher on biconditional than on congruent trials. It is important to note that only the difference between incongruent and congruent trials was significant. Thus, by averaging across congruent and biconditional trials, it is not apparent that the difference between incongruent and biconditional trials (which are also considered nonhabit items by Wood et al.) is not significant. This means the results are less conclusive than presented by Wood et al. (2022). Moreover, overall, the pattern of results is very much in line with a goal-directed account of habitual behavior.

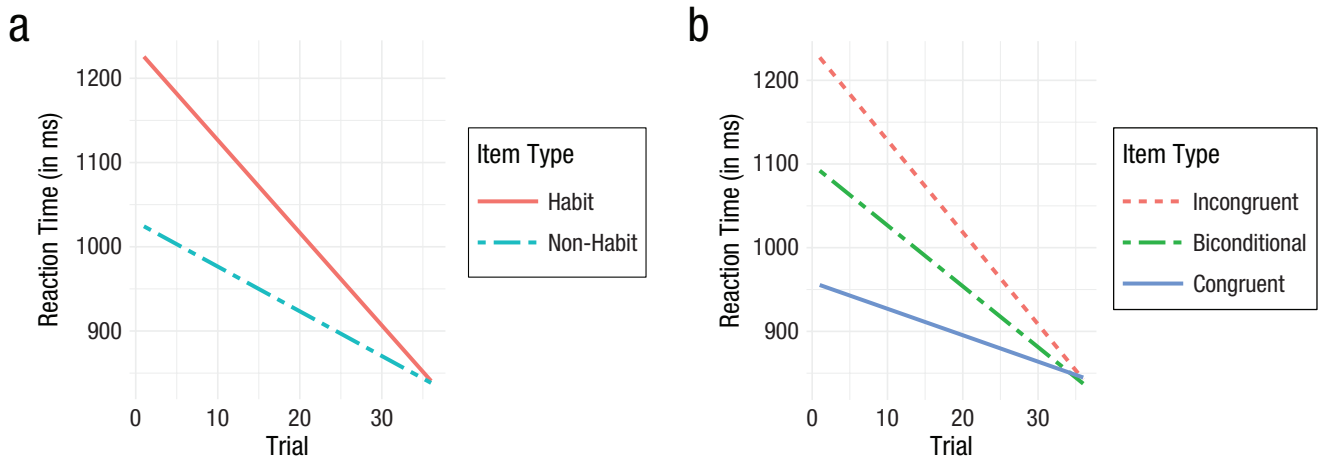



**Fig. 1.** Reaction time as a function of item type and trial in the reanalysis of the data from De Houwer et al. (2018) as reported in Wood et al. (2022; a) and on the OSF by Mazar et al. (2021; b).

## Conclusion

Although our arguments are certainly not strong enough to dismiss all existing evidence for S-R-based behavior, we do believe that they call for a more critical stance when evaluating evidence in support of S-R habits. We pursue the debate about the relative importance of S-R habits and goal-directed processes not merely for academic reasons. As we argued elsewhere (De Houwer, 2019a; Moors et al., 2017), for practitioners who aim to address real-world problems such as addictions and other types of psychological suffering, it is crucial to know whether problematic behavior is mediated by S-R associations or goal representations. In the former case, techniques such as extensive retraining are needed to change or replace S-R associations. In the latter case, the trick is to find out which goals drive behavior under which conditions and then to alter these goals or their impact on behavior. Other interventions may target the accessibility or effectiveness of different types of goal-directed strategies. It heartens us to see that in areas such as addiction research, recent evidence reveals the merits of such a goal-directed approach (e.g., Hogarth, 2020). We hope that other areas of research will also critically reexamine the available evidence for the role of S-R habits and explore the potential merits of goal-directed analyses (see Moors & Boddez, 2021).

### Transparency

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### Note

1. Note that within the philosophy of science many questions have been raised about whether falsifiability is crucial for scientific progress (Dellsén, 2018; Lakatos, 1974).

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