

Annual Review of Psychology
**Attitudes, Habits, and
Behavior Change**

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Abstract

Efforts to guide peoples' behavior toward environmental sustainability, good health, or new products have emphasized informational and attitude change strategies. There is evidence that changing attitudes leads to changes in behavior, yet this approach takes insufficient account of the nature and operation of habits, which form boundary conditions for attitude-directed interventions. Integration of research on attitudes and habits might enable investigators to identify when and how behavior change strategies will be most effective. How might attitudinally driven behavior change be consolidated into lasting habits? How do habits protect the individual against the vicissitudes of attitudes and temptations and promote goal achievement? How might attitudinal approaches aiming to change habits be improved by capitalizing on habit discontinuities and strategic planning? When and how might changing or creating habit architecture shape habits directly? A systematic approach to these questions might help move behavior change efforts from attitude change strategies to habit change strategies.

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INTRODUCTION

A long-established practice used to guide social policy is to rely upon informational and attitudinal strategies to accomplish behavior change. According to this perspective, it is assumed that behavior is goal directed and people's evaluative responses to recommended actions or to the outcomes of behavior are key to behavior change. A separate and arguably longer research tradition concerns the construct of habit, which developed in the context of learning. Although both perspectives investigate why people behave the way they do, they describe different processes and mechanisms. Only during the last two decades has the view started to emerge that attitude and habit processes are both important to consider when tackling societal problems such as obesity, congestion, climate change, or the need to regulate behavior during crises such as the COVID-19 pandemic.

Whereas attitudes and attitude change have a long history in the *Annual Review of Psychology* and started to be the objects of stand-alone articles since the 1960s (Moscovici 1963), an article on habit did not feature until recently (Wood & Runger 2016), and the two literatures have not previously been integrated into a single article despite earlier calls to incorporate habit into attitude models (Eagly & Chaiken 1993). There are good reasons to address these topics together. Habits are often

seen as ills of society that need to be overcome, perhaps via changes in attitude, in order to create healthier, safer, or more sustainable societies. However, this narrow view of habits overlooks the important role habits play in regulating desirable everyday behavior or in consolidating long-term behavior change. The reemergence of habit within the domain of social psychological inquiry can be attributed to investigations regarding the strength of the relationship of attitude to behavior and to the importance of habit in modulating this relationship.

The emerging literature on attitudes and habits co-occurs with three major paradigm shifts. The first shift began to flourish in the 1980s and 1990s and concerns a focus on nonconscious processes (Schneider & Schiffrin 1977), which contributed to a renewed interest in the habit concept. A second shift concerns the realization that behaviors may be triggered by context cues rather than arise from deliberation or willpower within the individual. This is for instance signified by the popularity of the concept of nudge (Thaler & Sunstein 2008). Authors adopting this framework proposed the engineering of the context where choices are being made, the choice architecture in their words, to influence people's behavior. Similarly, habitual behavior can be seen as being guided by a habit architecture, that is, cues in the performance context rather than individuals' attitudes and intentions (Lin et al. 2016). Finally, there is an increasing urge to test the validity of theories in field settings. Although laboratory experiments remain important for investigating processes in controlled research environments and for theory building, field experiments provide invaluable information on the robustness of the findings and effect sizes that might be expected in general population samples and in daily life contexts. This has been propelled by new technologies, such as online experiments, within-person designs used in experience sampling, or the analysis of big data—for instance, data retrieved from social media, which give unprecedented insight into people's ongoing behavior (Lee & Kwan 2018).

The Constructs of Attitude and Habit

Eagly & Chaiken (1993, p. 1) defined attitude as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor.” This definition identifies the core feature of an attitude as the propensity to produce an evaluative response. Our review focuses on attitudes toward behaviors such as buying new products, eating particular foods, or taking actions to sustain the environment. Consequently, attitude might be understood here as an individual's evaluation of behavior and its outcomes.

The notion of habit was for a long time equated with that of past behavioral frequency, which is how most laypeople understand the term. This thwarted progress in habit theory since the heyday of behaviorism (Eagly & Chaiken 1993). Contemporary writers arrived at definitions of habits that are remarkably similar to William James's (1887) conception (Wood & Neal 2007). Habits are memory-based propensities to respond automatically to cues that led to performance of behavior in the past. These propensities derive from cue-response associations in memory that were acquired through repeatedly acting in response to those cues in a stable context (Verplanken 2018). A distinction can be made between a habit (the mental construct; see Verplanken 2006), which is automatically activated when a cue is encountered, and the habitized response that may follow. This response may be an overt action or habitized thinking (Verplanken et al. 2007). Although a habit mechanism is not directly observable, it may be inferred from precursors to and consequences of habit formation—for instance, habit performance contexts (Wood et al. 2005), reaction time measures of context-response associations (Neal et al. 2012) or speed of response switching (Luque et al. 2020), and self-reports of qualities of habitized behavior (Verplanken & Orbell 2003) or habit slips (de Wit et al. 2012) (see also Rebar et al. 2018). Habitized behavior has qualities such as persistence and insensitivity to new information and alternative choice options

(Verplanken et al. 1998). These qualities render unwanted habits difficult to change, but they are advantageous qualities for desirable habits to possess or acquire.

Does Changing Attitudes Change Behavior?

How strong is the power of persuasion? A vast literature exists on the attitude–behavior relation; much of this research is guided by subjective expected utility models and dominated by studies merely observing the relationship of attitude to behavior. However, inferring a causal association of attitude to behavior from observational studies presents significant difficulties. Consequently, effect sizes observed from correlational data may overestimate the extent of behavior change that might be expected from manipulating attitudes and intentions (Hornsey et al. 2016, Rhodes & Dickau 2012).

Recent syntheses of findings from experimental studies in which participants were randomized to a control group or to a group receiving an intervention designed to change their attitudes have provided reliable evidence that attitudes can be changed. Albarracín & Shavitt (2018, p. 303) report that “attitude change based on interventions or messages delivered at a particular time hovers around $d_+ = 0.22$, which is a small effect.” Targeting attitudes can also change behavior. In an analysis in the health behavior domain, Sheeran et al. (2016) reported that interventions that successfully changed attitudes had a small-to-medium effect on behavior change ($d_+ = 0.38$). Although it is evident that attitude change can lead to behavior change, these and other syntheses also show that changes in attitude have highly variable (i.e., heterogeneous) consequences for behavior change and particularly for sustained behavior change (Wakefield et al. 2010).

Three broad approaches to explaining variability in the attitude–behavior relation can be discerned. First, people may not be sincere in reporting their attitudes, may not be aware of their attitudes, or may change them on the fly so that they are relatively unimportant for guiding behavior. Second, some attitudes acquire more resilience and therefore guide action more reliably than others. These differences in resilience have been referred to as attitude strength. Third, there are circumstances in which attitudes’ influence on action is attenuated because existing behavior is controlled by alternative mechanisms that are characterized as habit and are consequently insensitive to fluctuations in attitude.

The first concern, regarding the veridicality of attitude reports, prompted a specification of measurement conditions, including the important principle of compatibility between measures of attitude and behavioral criteria in terms of action, target, time, and context (Ajzen 2011). The development of implicit measures reinvigorated methodological inquiry with the promise to examine people’s “real” attitudes, even those that they might not have conscious access to or that they might not want to report truthfully in socially sensitive domains. These implicitly measured attitudes, it was supposed, might more faithfully predict behavior and represent suitable targets for intervention. However, syntheses of a substantial body of work examining the ability of implicitly measured attitudes to incrementally increase behavioral prediction (Greenwald et al. 2009, Kurdi et al. 2018, Oswald et al. 2013) suggest minimally consequential and highly heterogeneous effects (Albarracín & Shavitt 2018, Blanton et al. 2016, Oswald et al. 2013); nor is there evidence that implicitly measured attitudes offer superior prediction of behavioral criteria characterized by lack of controllability and awareness or even by social sensitivity, calling a key assumption of implicit measurement into doubt.

A second approach to understanding variability in the attitude–behavior relation concerns attitude strength. Explicit attitudes may vary not only in evaluative positivity or negativity but also in properties collectively referred to as attitude strength. Strongly held attitudes are stable over time (durable), resistant to persuasion (difficult to change), and have an impact on behavior (Howe &

Krosnik 2017). Persuasive interventions that not only target the valence of attitudes but also ensure that they become integrated, crystallized, accessible, and stable are most likely to lead to sustained intentions and behavior. If behavior is subsequently repeated in stable contexts, strong attitudes might also promote habit formation. Glasman & Albarracín (2006) synthesized evidence from experimental studies in which novel attitudes were formed, as it might occur, for example, when a new consumer product or vaccination is introduced. The direct, unambiguous experience of an attitude object and the frequent expression of an attitude each strengthened the attitude–behavior relation via increases in attitude accessibility (i.e., how easily an attitude can be recalled or reported) and attitude stability. The link between accessible attitudes and behavior is not fully understood. More accessible attitudes may drive people to seek motivational consistency in their actions. Alternatively, perhaps because of passive or active attitude-consistent information search, strong attitudes may bolster knowledge of related behavioral information, such as self-efficacy to act. Interestingly, the idea that strong elaborated attitudes might include behavior-relevant information beyond attitude itself has recently gained some traction. For example, Dalege et al. (2019) show that highly connected attitude networks (i.e., networks of causally connected evaluative reactions) are more stable and more likely to relate to behavior compared to weakly connected networks.

A third important boundary condition to the attitude–behavior relation derives from Triandis’s (1977) theory of interpersonal behavior, and it has been discussed since the emergence of renewed interest in habits in the late 1990s (Aarts et al. 1998, Gardner et al. 2020, Ouellette & Wood 1998, Verplanken & Aarts 1999, Verplanken & Wood 2006, Wood & Neal 2007, Wood & Rüniger 2016). Triandis proposed that if people repeatedly enact behaviors in the same contexts, those actions will gradually come to be guided by habit mechanisms. Consequently, changes in attitude and intention will be relatively ineffective in changing subsequent behavior. However, tests of this hypothesis that rely upon correlational data and a negative intention \times past behavior interaction coefficient are problematic for many reasons, including restriction of range effects; the use of self-reports if, for instance, participants infer an intention from their habit (Mazar & Wood 2021, Neal et al. 2012); and the inadequate sampling of participants with strong habits and counter-habitual intentions, particularly in studies of desired behaviors such as exercise (Rebar et al. 2019). An alternative approach is to classify the types of behavior according to whether they can be performed frequently in stable contexts and might therefore be capable of becoming habits (Ouellette & Wood 1998, Sheeran et al. 2016, Webb & Sheeran 2006). For example, Sheeran et al. (2016) reported that for behaviors that are infrequently performed, the effect of attitude change on behavior obtained in experimental studies was $d_+ = 0.48$. For frequent behaviors, however, the relation was attenuated to $d_+ = 0.36$. Perhaps stronger evidence was the observation that the effect of attitude change on behavior change was limited to interventions that sought to “increase” behavior. Attitude change was ineffective in “decreasing” existing behavior, consistent with the hypothesis that behavior is controlled by counter-attitudinal habits that are not susceptible to changes in attitude. In sum, habitized past behavior does seem to place powerful limits on the influence of attitudes on behavior.

The observation derived from Triandis (1977) that attitudes are less predictive of behavior when people have acquired strong habits deserves further comment, because it may be seen as inconsistent with the idea that attitudes derived from direct experience are stronger and more likely to predict subsequent behavior. However, the two insights become more reconcilable from a process perspective: Initially, direct experience with a novel behavior strengthens one’s attitude toward that behavior, so that attitude is the primary driver; over time, if the behavior is repeatedly performed in a stable context, the influence of the attitude diminishes and habit becomes the more consistent determinant of action (Sheeran et al. 2017). The diminishing relevance of motivation as the strength of habit increases can be reliably seen in studies that examined the

accessibility of attitudes versus habits in memory. For instance, Neal et al. (2012, study 1) revealed the inverted-U-shape relationship of attitude to behavior using a word recognition task with experimentally manipulated subliminal primes. They found that participants who had not yet formed strong habits recognized action words faster when primed with words related to motives, whereas participants with established habits recognized habit-related action words faster when primed with words referring to the performance context (habit cues), but not when primed with habit-related motives. This study demonstrated a shift from the mental availability of a motive as that which initiates behavior to the heightened mental association of the context with which the habitually performed behavior is associated.

Four Key Relationships Between Attitudes, Habits, and Behavior Change

In the past two decades, heterogeneity in the attitude–behavior relation and the modest effects of attitude change on behavior change have spurred renewed interest in habits and in the potential for effective behavior change that might be afforded by habit cueing processes as well as motivational attitude change processes. The remaining sections of this review are devoted to taking stock of the accumulated evidence in this regard. We organize our discussion around four broad themes. **Figure 1** provides a schematic overview.

First, attitude change can be an important starting point for behavior change. If successful, such change may be consolidated and become enduring by turning the newly formed behavior into a habit. This may occur spontaneously—for instance, when someone decides to start regular exercising—or may benefit from interventions aimed at habit formation. The section titled Attitudes Can Lead to Habits addresses factors that foster this process.

Second, we consider features, operation, and persistence of habits once these have been established. Many initiatives such as exercising are discontinued when times get busy or stressful, or motivation wanes. Evidence that habits are relatively resilient against persuasion suggests they can

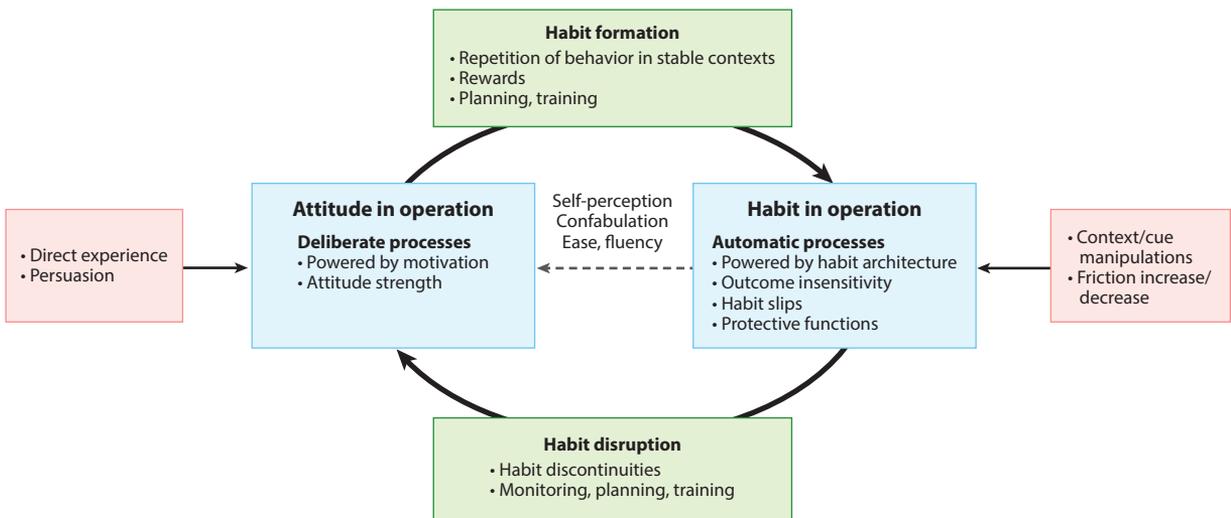


Figure 1

Schematic representation of ways in which attitudes and habits may relate. The upper larger arrow represents how attitudes may initiate habit formation and a transition from attitude-driven to habit-driven behavior. The lower larger arrow represents how habit disruption may initiate a transition from habit-driven to attitude-driven behavior. The boxes on the far left and right represent influences on attitudes and habits, respectively. The dotted arrow in the middle represents attitudinal inferences from habitual processes.

persist despite the vicissitudes of daily life and, importantly, that habits can serve to regulate and protect behavior in times of stress or distraction. The section titled *Do Habits Shield Against the Operation of Attitudes?* considers evidence for the resilience of habits and discusses the benefits of habitizing behavior.

Evidence that changes in attitude are often not sufficient to change established habits raises the question as to how and when it might be possible to break existing unwanted habits and increase the power of behavior change interventions. In the section titled *Motivated Habit Change* we consider how motivation might form the starting point for habit change and explore deliberative strategies to change habitized behavior, such as replacing the habit of taking the lift with stair climbing.

Finally, the section titled *Leveraging Habit Architecture to Create or Change Habits* focuses on the context where habits are performed: the habit architecture. Cues in those contexts, rather than attitudes or willpower, elicit and maintain habitual action. Habit change may be accomplished by directly changing the habit architecture—e.g., features of the built environment that may foster exercising—thus changing behavior with relatively little regard to attitudes.

ATTITUDES CAN LEAD TO HABITS

Attitudes can be the starting point of habit formation. When we do something new and it works or we like it, this behavior might be repeated and ultimately become habitual. This may occur spontaneously, and it sometimes leads to what are considered as bad habits associated with unhealthy or unsustainable lifestyles. The same principles govern the formation of desirable good habits and can be exploited in the context of behavior change interventions. The goal of behavior change interventions is usually long-term change. However, apart from the fact that most research stops short of evaluating whether behavior change remains detectable beyond the short term, consolidation of new behavior is seldom formulated explicitly as an intervention goal, and few (if any) tools have been developed to specifically promote the maintenance of new behavior. Consequently, interventions could maximize long-term behavior change by making new desirable behaviors habitual, so that they acquire features such as persistence or insensitivity to counter-information (Orbell & Verplanken 2020). Habit formation might be a way to consolidate behavior change and, more generally, to align behavior change with the attitudes that originally motivated it (Aarts & Dijksterhuis 2000).

Antecedents of Habit Formation

What determines habit formation? If the behavior is something a person really wishes to establish, a positive, strong, and stable attitude is a good starting point. Likely candidate variables for habit formation are the frequency of a behavior, its consistency over time, its simplicity or complexity, the positive affect or satisfaction with the behavioral outcome, the selection of suitable cues and their salience, and the stability of the performance context (Lally & Gardner 2013). To the degree that these factors are present, behavior may evolve into a habit over time. This process was observed over 1 year in a longitudinal study on the introduction and use of tablet devices in a secondary school (Courtois et al. 2014). Pupils and teachers were given tablets to use in place of paper for much of their usual work. The researchers found that during a school year, attitudes and intentions initially predicted the uptake of tablet use. Some difficulties were encountered mid-intervention, as people mastered the tablets and perceived control was a dominant predictor of use. In the end phase, the frequency of tablet usage during the previous 9 months was the main predictor of subsequent use, suggesting the development of a habit. Although cue consistency

was not directly assessed, the highly structured and integrated nature of the intervention gauged opportunities to cue tablet use and made frequent and consistent usage likely. The study demonstrated how, in a study with sufficient duration of observation, an initially attitude-driven behavior may be seen to become habit driven over time.

Some studies investigated the factors influencing habit formation more explicitly. Kaushal & Rhodes (2015) followed new gym members for 12 weeks and observed the habitization of exercise behavior. Habits formed in approximately 6 weeks among participants who exercised at least 4 days a week. This was most strongly predicted by consistent attendance at the same time each day, followed by low behavioral complexity (perceived effort), a supporting physical environment, and positive affect. McCloskey & Johnson (2019) assessed the relationships between the perceived automaticity of 25 behaviors and perceptions of frequency, reward, context stability, and complexity. Frequency, reward, and context stability were positively associated with perceived automaticity, whereas complexity was negatively associated with it.

Lally et al. (2010) asked participants to perform a new behavior once each day and to submit daily entries of self-reported habit. There was wide variation in the time it took for habits to be established, ranging from approximately 3 weeks to over 8 months. Two parameters of individuals' habit formation curves were observed. The first was the steepness of the curve, that is, the length of time it takes to reach maximum habit strength. In other words, how fast does a behavior habitize? The second parameter was the degree to which a behavior can become habitized and cue contingent: To what extent can the behavior be elicited with minimal conscious awareness and deliberation? This study demonstrated that habit formation can be modeled at the intra-individual level. The relationship of habit formation (frequency, complexity, context stability, and cue salience) to these two parameters of the habit curves is still open to investigations and requires systematic scrutiny across behaviors and contexts in longitudinal and experimental designs.

The Role of Rewards

The classical mechanism for habit formation explored extensively in the behaviorist tradition is the use of rewards to promote action repetition in a given cue context. A distinction can be made between extrinsic and intrinsic motivation (Deci & Ryan 1985). Externally motivated behavior is instrumental in obtaining rewards such as money or other people's approval. Extrinsic rewards may be particularly effective in prompting action initially, and they promote habit formation by engaging dopamine systems (Amaya & Smith 2018). Provision of financial incentives has been used to promote behavior and form new habits. Such incentives can positively influence health behaviors (e.g. smoking cessation, physical activity), although these effects declined after the incentive was removed (Giles et al. 2014, Mantzari et al. 2015). Maki et al. (2016) showed that financial rewards promoted specific pro-environmental behaviors, some of which (energy conservation, travel) persisted after removal of the incentive, perhaps because they de facto saved participants' money. However, few studies in this domain have assessed long-term effects or the formation of habits.

Intrinsically motivated behavior is considered an end in itself because it is inherently rewarding (Kruglanski et al. 2018). Gardner & Lally (2013) found that people whose frequent physical activity was autonomous experienced exercising in their leisure time as more fluent, which is a characteristic of habitual behavior. Intrinsic motivation may be present for some but not all behaviors. Behaviors that are aligned with the self-concept may have the rewarding properties that ensure repetition and habit formation. The relation between habit and self-identity may stem from the fact that habits may be based on important values that can be considered as long-term motivations. This may pertain to personal identities as well as shared social identities (Udall et al. 2021). Verplanken & Sui (2019, study 2) provided experimental evidence that the association of habits with self-identity is stronger if habits are linked to values. Participants were presented with 80 behaviors

covering 10 value domains. For each behavior, they rated habit strength and the extent to which it represented their “true self.” In the experimental condition, participants’ values were primed by being asked to indicate how much each behavior was linked to the value domains, whereas in the control condition participants indicated at what time of day the behavior would typically occur. A within-participant correlation between the 80 habit and true-self ratings was calculated for each participant. These correlations were larger in the experimental condition, when values were primed, compared with the control condition. Values may thus form a bridge between habits and (parts of) one’s self-concept by framing the intrinsic rewards gained from a behavior. In a 2-month habit formation study containing four measurement points, habit strength was initially predicted by consistent and frequent behavioral repetition (B. Verplanken, M. Yang, J. Sui, J. Bentley & A. Min, unpublished data). At the final measurement, habit strength was predicted by the degree to which participants associated the new habit with their identity, suggesting a process of internalization.

Habits may also be intrinsically rewarding because they make life easier by eliminating the need for new learning or decision making. The process of action repetition may in and of itself be rewarding as a consequence of the sense of ease, fluency, and reduced mental effort that accrues as habit develops. This may lead the individual to enjoy their habit (Reber et al. 2004).

Planning to Create Habits

An intuitively appealing vehicle in promoting habit formation is to supplement positive attitudes with deliberate self-regulation strategies such as planning to act in specific cue contexts (Hagger & Luszczynska 2014). For example, implementation intentions are specific plans of action in the form of “When encountering cue X, I will do Y” (Gollwitzer 1993). These simple self-instructions increase the likelihood of action by ensuring that intentions are not forgotten or opportunities missed (Adriaanse et al. 2011b). An implementation intention involves a single consciously formed plan to act when an imagined future performance cue is encountered. This type of planning increases the mental accessibility of situational cues, thereby installing a mechanism that, like a habit mechanism, automatically activates a representation of the associated behavior. Whereas in the case of habit the automatic propensity to act in response to cues is forged over a great many repetitions in stable contexts, an implementation intention forges the link via a single act of planning (Gollwitzer 1993, Holland et al. 2006).

If the action specified in a plan is sufficiently specific, if it remains functional and feasible beyond a single planned instance, and if the cue specified occurs in an ongoing stable context, it is possible that by extended repetition, the cue–response link initially forged by an implementation intention may gradually become directly cued by habit (Holland et al. 2006, Keller et al. 2021). Orbell & Verplanken (2010, study 3) showed that participants who formed an implementation intention to use dental floss were more likely to initiate and repeat the behavior during the next 4 weeks and began to habitize flossing more rapidly compared to controls. Implementation intentions seem to be efficient strategic vehicles to promote repeated behavior by mentally anticipating a habit architecture. Although attitudes may play an important role in initiating the formation of an implementation intention (Milne et al. 2002), the translation of action into habit will ultimately depend upon repetition in stable cue contexts over prolonged time periods.

Conclusion

Habit formation may serve to consolidate behavior change achieved via interventions that produce changes in attitudes and intentions. It is unfortunate if behavior change interventions, which usually require major resources, leave the hard-fought new behavior decaying over time or

vulnerable to waning motivation or counter-persuasion. Habit formation should be incorporated as a goal of behavior change interventions, and the outcomes should be assessed for a sufficient duration in order to truly evaluate habit formation. What strategies foster habit formation? Given that a new behavior has been specified and accomplished, a primary tool should be to analyze and possibly design the environments that foster habit formation so as to establish an optimal habit architecture. Key features of habitization—its being repetitive, automatic, and cue-driven—can become guiding principles to inform the design phase of interventions so that they target simple behaviors, optimize cue-specific repetition of the behavior, provide a stable performance context, and employ plans that are mapped onto the future habit architecture. Clearly, attitudes—especially strong attitudes—and motivation can be active ingredients in the initial phases of habit formation. Once established, however, control over behavior gradually shifts to the performance context.

DO HABITS SHIELD AGAINST THE OPERATION OF ATTITUDES?

We know that attitudes and motivation play a role in the formation of habits; but what is their relation once habits are established and behavioral control has shifted to the performance context? Why does evidence suggest limits to the effects of attitude change interventions, particularly in changing established habits? When attitudes are in operation, people are sensitive to available behavioral options and outcomes. In this section we explain what happens when habits are in place and a deliberate mode of functioning, in which an open mind to alternative courses of action is available, changes to a mode that instead fosters direct cue-driven action. We discuss different manifestations of the habit mode and the different paradigms employed to investigate habit mechanism: outcome insensitivity and habit slips, habit as protector of self-regulatory goals, and habit as a source of behavioral persistence.

Insensitivity to Outcome Devaluation

When engaged in evaluating options, attitude-driven systems are in operation. Habits, on the other hand, deal with regularity. In habit mode, people do not engage in passive or active information search (Verplanken et al. 1997) and are less sensitive to possible fluctuations in outcome values. A person who chooses a new tasty pizza may order this again next time. Upon repetition, ordering this pizza may become a habit, and the person may become less sensitive to quality fluctuations. In other words, if the value of an outcome diminishes, or if better alternatives become available, once a habit has formed the individual may not change their behavior. This has been denoted devaluation insensitivity (de Wit et al. 2009, Dickinson & Balleine 1995). For instance, Lattarulo et al. (2019) demonstrated that commuters may stick to their travel mode even if it becomes a suboptimal option due to temporary restrictions. In testing insensitivity to the devaluation of outcomes, an individual is trained to obtain a valued outcome, which is then devalued. If the individual subsequently adapts their action accordingly by avoiding the devalued option, the operation of a goal-directed system is assumed, whereas sticking to the original devalued outcome indicates that a habit system is in operation. Originating from animal learning research, this paradigm has been employed in research with humans (de Wit et al. 2009), including for the study of pathological conditions (Gillan et al. 2016). Neal et al. (2011, study 1) used the outcome devaluation paradigm in a field experimental study by presenting either stale or fresh popcorn during a cinema performance. Participants with weak cinema popcorn habits showed behavioral flexibility by eating less stale popcorn, whereas strong habit participants ate equal amounts of stale popcorn despite reporting that they did not like it. In a non-cinema context, however, both strong and weak habit participants adapted their intake to the taste. This study demonstrated how context trumps attitudes in influencing behavior when strong habits are present.

Devaluation insensitivity as a feature of habitization has been studied to explain societal problems such as obesity. For instance, Horstmann et al. (2015) conducted a devaluation experiment among participants differing in weight status. They used a selective satiation procedure whereby participants were first trained to learn associations between abstract stimuli and two rewarding food items and were then rewarded with one of the two. Participants were then given ad libitum access to that item, which was thus devalued through satiation. Subsequently, responses to the abstract stimuli representing the two food items were reassessed. The researchers found a reduced devaluation effect among those with higher body mass indexes, suggesting that these individuals did not adequately adapt to the lower outcome values brought about by satiety but continued to operate in habit mode, that is, performing a behavior that contributes to weight gain.

Devaluation insensitivity is not unequivocally demonstrated in humans. Participants have been found to be sensitive to devalued outcomes even after receiving extensive habit training (de Wit et al. 2018). Possibly the laboratory context cannot replicate the everyday distractions that facilitate habit responding in real life. Also, it is not always easy to attribute behavioral inflexibility observed in the outcome devaluation paradigm to habitization alone. Devaluation insensitivity can be related to a compromised goal-directed system (Gillan et al. 2016). This may occur under conditions like stress (Fournier et al. 2017) or pathologies such as attention-deficit/hyperactivity disorder (Ceceli et al. 2020). Finally, the outcome devaluation paradigm itself has been criticized. For instance, evidence is based upon the hypothesis of a null effect—i.e., that behavior will not change following devaluation (De Houwer et al. 2018, Hogarth 2018). Such hypotheses are hard to test. There are also alternative interpretations of devaluation insensitivity, such as a switch to an alternate goal from the one linked to the devalued option (De Houwer et al. 2018). This touches upon the wider question of whether habits can be performed independently of a goal (Aarts & Dijksterhuis 2000, Hommel 2019, Kruglanski & Szumowska 2020, Trafimow 2018, Wood & Neal 2007, Wood et al. 2021).

Habit Slips

Another signature of habitization is the occurrence of habit slips. Occasional habit slips are familiar, such as when we find ourselves mistakenly setting off to drive toward work on a Sunday instead of driving to the countryside for a walk. A tendency to slip back into old habits occurs once behavior has become controlled by cues and is less sensitive to changes in the desirability of behavioral outcomes. The cue-contingent behavioral inflexibility conferred by habits represents a challenge for attempts to change behavior via attitudes, such as campaigns by governments or companies wishing to introduce new products to consumers (Labrecque et al. 2017). However, resistance also protects desired behavioral habits against the vicissitudes of daily attitudes or counter-attitudinal persuasion attempts (Itzhakov et al. 2018).

Habit slips are consequences of the habit cuing process. As habits gain strength, the cue context automatically activates the associated response in memory (i.e., brings it to mind), thereby provoking the behavior habitually performed in that context. Thus, instead of consciously deciding which street to turn onto at the crossing, one automatically takes the route toward work. The power of context in contributing to habit slips despite people's intentions has been demonstrated in a few field studies. Orbell & Verplanken (2010, study 2) observed naturally occurring habit slips following the introduction of a ban on smoking in public places. Smokers who had strong habits for lighting up inside pubs measured before the smoking ban were more likely to make smoking slips after the ban came into force, despite intending to comply with the law and step outside. The study also revealed the nature of habits that comprise action sequences: Once the habit sequence was initiated (picking up a cigarette), it ran on to its conclusion (lighting up) even if individuals

intended and expected to be able to interrupt the sequence and step outside before the final act. In a consumer context, Labrecque et al. (2017) report that a habit slip (“I fell back on my old habit and did what I used to do”) was the most frequent reason given by consumers for rarely using new products they had intentionally purchased.

Habit slips occur as a consequence of the passive, automated cueing of actions performed in that context in the past. They are distinct from an active decision not to adopt a novel behavior, perhaps because the new behavior requires a learning curve (Murray & Häubl 2007) as well as from passivity that might result from lack of awareness of alternatives or lack of personal relevance. In other words, habit slips do not occur as a function of unfavorable attitudes or lack of motivation. Habit slips are more likely to occur when an individual is distracted or acting mindlessly (Labrecque et al. 2017, Orbell & Verplanken 2010). The smokers in Orbell & Verplanken’s (2010) field study reported that they found themselves lighting cigarettes indoors when they were distracted in conversation.

Protective Functions of Habits

Habits are cognitive structures that preserve responses to recurring situations. Often habits align with the attitudes and goals from which the behavior originated yet keep us on track via mechanisms (i.e., automatic responses to context cues) that are independent of attitudes or motivation. When mental resources are depleted and an individual is less capable of exerting willpower to accomplish valued or desired outcomes, habits become the default behavior. Although we may fall back on bad or undesirable habits, if constructive habits are in place, the operation of these good habits will protect goal accomplishment at times when they might otherwise be derailed (Lin et al. 2016). Neal et al. (2013) demonstrated the operation of good and bad habits at times of resource depletion. These authors found that naturally occurring and experimentally induced depletion of resources increased the performance of existing habits. For instance, students with preexisting healthy eating habits were more likely to enact these habits during a stressful exam period, but equally, students with unhealthy eating habits fell back on those bad habits during that period.

Habits may also be functional in counteracting persuasion attempts when people are in a vulnerable condition. Itzhakov et al. (2018) found that when participants were resource depleted, they were more susceptible to persuasion. However, depleted participants with strong habits performed their habits rather than acting on the newly formed attitudes. While unsuccessful persuasion attempts are unfortunate if the target behavior is desirable and the existing habit undesirable, the opposite is true when good habits keep an individual on track in the light of attempts to derail them. Habits therefore protect behavior that was originally established for good reasons.

Habit formation also plays an important role as a self-regulatory tool. Behaviors that serve desired goals such as eating a plant diet, writing an article, or minimizing one’s carbon footprint may be derailed by tempting or easier alternatives that require willpower and effortful control to be ignored, avoided, or resisted. However, an alternative effective strategy is to create and rely upon functional habits that serve these goals. When a useful behavior (e.g., starting to study immediately after breakfast) that fulfills a goal (e.g., preparing for an exam) has become habitized, procrastination can be avoided. Without the habit the individual is vulnerable to producing excuses and rationalizations. Rather than engage in effortful inhibition, individuals who form habits can pursue desired outcomes with minimal effort (Hofmann et al. 2012). Galla & Duckworth (2015) found that students with strong study habits experienced fewer study–leisure conflicts and continued their study habits under difficult circumstances. Forming strong habits protects against the need to fight off obstacles. In other words, smartly developed habits are ways to make life work better for the individual (Orbell & Verplanken 2018) and are particularly useful under conditions

of depleted mental resources (Allom et al. 2018). Lin et al (2016) showed that experimentally acquired habit cues induced habitual snacking behavior even when presented with a tempting alternative under resource depletion.

The Longevity of Habitual Behavior

Habits are structures for the long haul. This is a reason that problematic behaviors such as those associated with obesity or environmental damage are difficult to overcome. In other cases, longevity of behavior is desirable and habitization might be crucial. This holds for behaviors that serve important goals, such as adhering to medication, or behaviors that are the end product of behavior change interventions. If those behaviors have not been turned into habits they are vulnerable to attitudinal fluctuations, temptations, or rationalizations.

Anecdotal evidence suggests that in the natural course of life some habits persist for long periods of time, whereas others are not maintained. Habits may decay when they are no longer activated or are replaced by other actions. As long as the performance context remains stable, so that contextual cues are consistent, habits are likely to be protected by strong cue–response associations. However, habits may cease to operate when cue–response links are not strongly established—for instance, when the performance of behavior is not sufficiently frequent or consistent. Performance contexts may change or individuals may change contexts, as discussed in more detail in the next section. Individuals may also prioritize new goals and the associated behaviors. When a new habit replaces an old one, habit maintenance is also endangered by the presence of the old habit memory traces, which only fade slowly. This slow decay was illustrated among employees in an organization that relocated (Walker et al. 2015). Some employees embarked on an organized scheme to promote sustainable commuting. Although the new commuting habit gained strength, the old habit became weaker but still existed over a period of 4 weeks.

What factors foster longevity of habits? The strength of cue–response links and the stability of the performance context are paramount. The former is, for instance, indicated by the speed of responding to habit cues (Neal et al. 2012) or the time it takes to switch to a non-habitized option (Luque et al. 2020) or a newly learned response (Hardwick et al. 2019). Context stability can be safeguarded by legislation, such as traffic regulations controlling motorists' behaviors. Longevity may also increase if the habit is linked to long-lasting structures such as another established habit—e.g., linking dental flossing with teeth brushing (Judah et al. 2013)—or to a social practice (Kurz et al. 2015).

Although habits function primarily through the strength of the cue–response link in memory and the stability of the performance context, it is not unreasonable to suggest that in order for desirable habits to survive in the long run, at least some habits benefit from motivational support. Those habits may originate from significant events, external threats, or issues that bring important values to the fore. For instance, coping habits may be instigated by illness (Orbell & Phillips 2019), prosocial habits by the COVID-19 pandemic (Wolf et al. 2020) or the desire to challenge gender stereotypes (Croft et al. 2021), and pro-environmental habits by worry about global warming (Verplanken et al. 2020). A habit may thus become intrinsically motivated and be internalized as an end in itself (Kruglanski et al. 2018). This internalization process may involve an element of self-perception: That is, people can observe their own habits, reflect on their meaning, and infer that they serve a purpose. Such attributions may be misguided (Adriaanse et al. 2018, Mazar & Wood 2021, Wood & Runger 2016) and amount to confabulations. However, it is not inconceivable that such reflections may form or strengthen a genuine intrinsic motivation. Charging for plastic carrier bags in the United Kingdom resulted not only in the customers' development of a habit of bringing their own bags but also in their support for other initiatives

to reduce the use of plastic, thus signaling a spillover effect indicative of an enhanced intrinsic motivation (Thomas et al. 2019). Slovinec D'Angelo et al. (2014) monitored physical exercise among coronary heart disease patients and found that self-efficacy and autonomous motivation were predictors in the short term (6 months), whereas autonomous motivation continued to predict engagement in physical exercise in the longer term (12 months). A long-term habit may become part of one's identity (i.e., be felt as "one's own") and may thus implicate the self (Udall et al. 2021). Verplanken & Sui (2019, study 1) showed that the degree to which participants associated habits with their true selves correlated with self-integration, self-esteem, and an orientation toward an ideal self. Given the relative stability of the self, these results support the notion that linking a habit and the self may contribute to the stability and longevity of the habit.

Conclusion

Habits are more than simple responses to a recurrent situation. Once established, habitized behavior may proceed without being influenced by fluctuations in attitudes caused by changing outcome structures, stress, or diminished willpower. Habits negate the need for self-control. This rigidity is unfortunate when people miss out from obtaining better outcomes or persist after the original benefits of action have diminished. However, habits also foster stability and predictability. They shield against indecisiveness, attitude change, and the distraction caused by tempting alternative courses of action or stress. Habits can thus be important ingredients of successful self-regulation. The long-term survival of at least some habits may be optimized by support from values, intrinsic motivation, or connections to self-identity.

MOTIVATED HABIT CHANGE

Habits may develop because they are instrumental or pleasant, and changing them is notoriously challenging (Orbell & Verplanken 2020, Wakefield et al. 2010). The cue-action memory traces that constitute habits cannot be suddenly erased and are difficult to override. Also, it is not easy to be aware of the cues that trigger habits (Adriaanse et al. 2011a, Lin et al. 2016), given that many of these are part of everyday contexts and actions. Relatedly, people may lack opportunities to change the action associated with a particular context. Yet, given sufficient motivation and opportunities, habits may change or be overcome. Habitization attenuates the role of attitudes and motivation in the operation of habits and, consequently, the ability of attitude-based interventions to change behavior. Yet it is possible to effortfully discontinue or not perform a habit, if a situation calls for it. That ability is important in the process of overcoming habits. In this section we discuss several avenues to motivated habit change that augment attitudinal strategies or emphasize the use of a targeting strategy in their implementation.

Monitoring Unwanted Habits

Intuitively, the most straightforward strategy to avoid or change an unwanted habit is to be alert, monitor the behavior and the circumstances of its occurrence, and effortfully inhibit the performance of the habit. Quinn et al. (2010) identified vigilant monitoring as the most frequently used and most effective strategy to inhibit unwanted habits. Other strategies, in particular removing oneself from the performance situation and distracting oneself, were ineffective, consistent with observations that regression to habit (or habit slip) is more likely when people are distracted (Orbell & Verplanken 2010). In order for a vigilant monitoring strategy to succeed, a person needs to be sufficiently and consistently motivated and to have the mental resources needed to execute

the strategy, conditions that can easily be compromised. Also, vigilant monitoring is likely to be more effective if one intends to replace the inhibited habit by an alternative behavior (Labrecque et al. 2017). For instance, in habit reversal training, which is used to treat nervous habits such as nail biting and hair pulling (Bate et al. 2011), a first step is to monitor cues that trigger the habitual response and the context in which it occurs. Heightened awareness of one's habit is then combined with the practice of competing responses, that is, responses to the cue that are antagonistic to the original habitized behavior (Mancuso & Miltenberger 2016).

Retraining Cue–Action Links

A potential intervention route to change habits might be to target the cue–response links in memory that constitute habits. To what extent is it possible to retrain habitual responses? Habitized behaviors may have associated cognitive biases, that is, above-average likelihoods to attend to, approach, or avoid certain types of stimuli (Greenwald & Lai 2020). Such biases are particularly ingrained in behaviors with addictive properties, such as the consumption of unhealthy but rewarding food, alcohol, cigarettes, or drugs. Hence, an intriguing question is whether modification of these biases can lead to behavior change.

A few studies have reported behavior changes in response to cognitive bias modification. However, while cognitive biases are malleable, there is no convincing evidence that cognitive bias modifications have profound effects on behaviors such as food consumption, substance use relapse, or smoking cessation (Turton et al. 2016). Results are more encouraging with respect to approach bias modification (Kakoschke et al. 2017) and the use of cognitive bias modification as part of larger treatment packages in clinical populations (Batschelet et al. 2020). For instance, Rinck et al. (2018) found that combining the regular treatment of alcohol-dependent patients with the retraining of attentional and approach biases resulted in higher abstinence rates 1 year later. However, retraining programs are only effective through long and intensive application, which poses questions of feasibility and cost-benefit balances.

Planning to Change

Is it possible to plan to willfully inhibit or disrupt habitized responding? As long as a habit cue can be correctly identified—which is by no means certain, given that people often acquire habits linked to co-incidental cues (Lin et al. 2016) or misattribute habits to internal states such as stress (Adriaanse et al. 2018, Mazar & Wood 2021)—it is plausible to supplement motivation to a change in behavior by planning a reaction to the cue other than the unwanted habit response. For example, an individual may plan to ignore the habit cue as soon as it is perceived or to resist acting upon the cue. In general, the use of implementation intentions to support the adoption of a new behavior has been associated with larger effect sizes than their use to decrease or inhibit an unwanted behavior ($d_+ = 0.51$ versus $d_+ = 0.29$; Adriaanse et al. 2011c). This is commensurate with habit theory; it can be argued that ignoring or not performing is less likely to forge a cue–response link in memory compared with training linking a cue with a tangible response.

Alternatively, an individual might replace an undesirable habit, such as throwing waste paper in the garbage, with a new desirable habit, such as recycling the paper. The idea that an established habit might be replaced by a new response to an existing cue has rarely been examined in the field (Holland et al. 2006, Labrecque et al. 2017) and requires evidence of a preexisting strong habit together with evidence that a plan results in behavior change. If a new habit is to replace an old one, further evidence is required to establish that the new habit is enduring and the previous habit has been consistently attenuated (Holland et al. 2006). This has been demonstrated for mental as well as behavioral habits. For instance, Thürmer et al. (2013) successfully used implementation

intentions to replace self-handicapping thoughts and behaviors in anxiety-evoking test situations with positive self-talk. Targeting one of the toughest habits, Armitage (2016) had smokers form individually tailored implementation intentions to replace lighting a cigarette with alternative actions. In a follow-up 1 month later, a significantly larger proportion of smokers who had formed implementation intentions had avoided lighting up a cigarette (15%), whereas only 2% had done so in the control group. This effect was mediated by a reduced sense of smoking automaticity in the implementation intention condition, consistent with the idea that the act of lighting up had become more mindful, at least over a 4-week period.

In a laboratory context, Adriaanse et al. (2011b) employed a word recognition task to provide insight into the cognitive processes underlying implementation intentions that target unwanted habits. The authors hypothesized that due to the nature of implementation intentions, the planned automatic cue–response links may directly compete with existing habitized cue–response links in memory. By taking away the mental accessibility advantage of the existing habit over the new behavior, a level playing field is created. This paves the way for an attitude-driven choice process, which may then establish a new behavior if there is sufficient and consistent motivation to do so and if relapse is avoided while the new habit is being established (Walker et al. 2015).

Holland et al. (2006) and Labrecque et al. (2017) provided elegant tests of planning to adopt new desired habits that directly compete with existing habits. Holland et al. (2006) showed that over a 2-month period during which behavior was objectively and unobtrusively monitored, participant employees of an organization who planned how, where, and when to dispose of their waste paper in a recycling bin were more likely to establish a new consistent behavior compared to controls. In a study of the use of a novel laundry product, Labrecque (2017) showed that it was necessary to supplement an implementation intention to use the new product with a plan to monitor and inhibit the existing habit in order to establish a new behavior.

Habit Discontinuities

Habits function as long as the performance context remains intact and stable. However, there are times when contexts are disrupted, enabling attitude-led strategies to direct behavior change. This may occur by choice, such as when an individual is relocating or changing jobs. Other disruptions come from natural life course changes, such as leaving school, starting a family, or retiring. External events such as the COVID-19 pandemic may also cause disruptions, as may legislation, such as the ban on smoking in pubs (Orbell et al. 2009) or the introduction of a charge on plastic bags (Thomas et al. 2019). When a disruption alters the performance context, and habit cues are disorganized or removed so that habitual behavior is no longer feasible, this may, in Lewin's (1947) terms, “unfreeze” existing habits. This means a disruption of the smooth operation of a habit, such as the one caused by changes in a computer platform (Anderson & Wood 2021). These authors demonstrated that a change in the design of Facebook impeded the posting of material among habitual Facebook users due to the disruption of habit cues. Disruption may initiate a shift to deliberate processing and a more open mindset, contrary to the tunnel vision mindset that characterizes strong habits (Verplanken et al. 1997). In order to adapt to the new situation, the individual may consider goals, acquire information, and form new attitudes that then guide new behavior. For instance, when a person retires, the cue for going out for a drink with colleagues on Fridays after work is removed, and this habit is disrupted. If socializing is important for this person, they need to consider new ways of fulfilling that goal.

In some instances a disruption is known to be temporary. Individuals may endure the disturbance, cope with its immediate consequences, and return to the old habits once the situation is restored. This happened, for instance, when travel mode behaviors were temporarily distorted

in London by the 2012 Olympic Games (Parkes et al. 2016). In those cases, old habits remain activated but are temporarily blocked from execution. Discontinuities that are the result of life course changes may lead to more permanent changes and new habits. Such discontinuities may include transitioning from education to work (Busch-Geertsema & Lanzendorf 2017), changing jobs (Clark et al. 2016), relocating businesses (Walker et al. 2015), changes in family circumstances (Janke & Handy 2019), or retirement (Barnett et al. 2012).

Although an individual may find familiar cues in the new environment that trigger an existing habitual response (Wood et al. 2005), major discontinuities more often than not require the replacing of old habits with new behaviors. By becoming temporarily more mindful and deliberate, individuals form attitudes toward available new courses of action. In this process, important goals and values may come to the fore and guide the new choices (Verplanken et al. 2008). For instance, Clark et al. (2016) found that in the context of employment changes and residential relocations, environmental values predicted switches to public transport or active commuting. A discontinuity may also change the priority of certain values, as in the case of new parents who prioritize security over environmental values (Thomas et al. 2018).

Discontinuities provide unique opportunities for behavior change interventions. Given that discontinuities pave the way for more deliberate processes, behavior change interventions are more likely to attract attention and effectively convey information when contexts are disrupted. This habit discontinuity hypothesis (Verplanken et al. 2008) was tested in a field experiment among 800 households (Verplanken & Roy 2016). Half the households received an intervention designed to promote more sustainable behaviors, whereas the other half served as a control group. Half of the households in each condition had relocated in the previous 6 months. The intervention was found to be more effective among those who had relocated than among those who had not, compared with no-intervention control groups. A more detailed analysis revealed that the effect was confined to those who had relocated in the previous 3 months, raising two questions: What makes a window of opportunity last, and when does such a window open? The latter may be well in advance of an expected discontinuity—for instance, when people start planning how to commute prior to moving to a new house (Haggar et al. 2019).

Conclusion

There are several routes to support deliberate efforts to control unwanted habitual behavior by augmenting and strategically targeting attitude change. These include monitoring and willfully changing a habit, retraining cue–action links, and creating plans that are tied to the cues activating the unwanted habit and supplemented by efforts to inhibit the previous habits. Habit discontinuities provide interesting windows of opportunity to initiate change, both for individuals and for larger attitude-based behavior change programs. Insights from this research provide important boundary conditions for situating effective attitude-based interventions. Strong attitudes are likely an important additional facilitator in persistent efforts to inhibit strong habits (Sheeran et al. 1999). In the next section we turn to change processes in which attitudes play a minimal or no role.

LEVERAGING HABIT ARCHITECTURE TO CREATE OR CHANGE HABITS

People who are effective at controlling their consumption, managing their recycling, or staying in regular contact with older relatives do so by outsourcing action control so that their actions are triggered automatically by recurring contexts in their environment. These established habits are broadly insensitive to vicissitudes of attitude, and they protect action even under conditions of stress or distraction, or when the originating goals of action are less salient, as long as the

context remains intact and stable. By outsourcing behavioral control to the environment, habits are maintained by the habit architecture that supports them.

Certain environments are more prone to elicit habits, in particular environments that are stable, contain consistent cues, and deliver positive outcomes for an individual. This section considers the features of context that might be functional in the creation, maintenance, and disruption of habits. These features relate to the management of action cues, and to the management of the feasibility of actions associated with those cues, by increasing or decreasing action friction. In these processes the role of attitudes is minimal or absent.

Cue Contexts

The prerequisite for habit development is a stable environment that contains available and consistently recurring cues. Habit cues may take many forms, including locations, visual cues, or preceding actions. However, when strong habits are established, people are usually not aware of the actual cues that govern their habitual behavior. Consequently, an individual may incorrectly identify reasons for their automatically cued actions or attribute automated habitized behavior to internal motivations such as stress relief (Adriaanse et al. 2018, Mazar & Wood 2021, Wood & R nger 2016). This lack of awareness of context–cue contingency in habit may diminish strategic efforts to identify and design the optimum architecture required to develop a new habit, and it may limit effective context-based public health intervention. For example, reliance upon sticky notes or mobile phone alerts as cues may provoke a single act—e.g., phoning mum or getting up in time to eat breakfast—but will fail as a contextual tool for long-term habit development because the contingency of the relation between the reminder and the action does not meet the requirements of a consistent and stable contextual cue. Devices such as these may instigate action but will impede automaticity. Medical interventions that promote adherence by employing text message reminders, for example, may similarly have limited capacity to create enduring habits cued by the patient’s own environment. Consequently, when the intervention texts cease, so may adherence (Stawarz et al. 2015).

How might context be leveraged to promote habit development? Effective habit development necessitates repetition of action in relation to context cues that naturally and reliably occur with an appropriate frequency. Piggybacking on existing daily routines by inserting new actions may be a solution (Labrecque et al. 2017, Orbell & Verplanken 2020). For example, if tooth brushing is a reliable activity, a flossing habit may be established as a new action to be performed after—but not before—brushing (Judah et al. 2013). Potent cues also exist at naturally occurring boundaries between action sequences, such as upon arrival home in the evening. Interventions that build upon existing practices and cue contexts, be they individual or cultural, will facilitate habit development (Orbell & Phillips 2019).

Consumer habits and the accompanying tendencies to resist change can be a powerful source of passive resistance to trying new products (Heidenreich & Kraemer 2016). If supermarkets seek to increase new sales, they may choose to capitalize upon the habit discontinuity effect by disrupting the existing layout and location of products, thereby forcing customers to look around, deliberate, and attend to different products.

The cues themselves may be manipulated in order to modulate behavior. A demonstration is the so-called portion size effect, which describes the tendency to consume relatively more from larger portions of food and less from smaller ones. People acquire a habit to clear their plate or finish their drink during childhood irrespective of the amount consumed and consider it appropriate behavior (Herman et al. 2015). When presented with smaller portions, glasses, or spoons in a variety of contexts, people consume less food (Zlatevska et al. 2014), alcohol (Kersbergen et al. 2018), and sugar (Venema et al. 2020). Hollands et al. (2015) concluded that the portion size effect would

equate to a 12–16% change in adult daily energy consumption. The effect is robust and occurs even after participants are informed about this phenomenon (Cavanagh et al. 2014), consistent with the habitual and automatic nature of clearing one's plate, particularly when distracted by a simultaneous activity.

Feasibility of Action in Context

Habits rely upon the possibility of their frequent, consistent execution in the environment context. An important tool to promote or diminish the likelihood of repeated behavior is to increase friction for a less desired course of action by making it seem more difficult or to reduce friction for a more desired course of action by making it seem simpler, more readily available, or the default course of action. In both cases the environment is manipulated to decrease or increase, respectively, the likelihood of frequent and consistent execution. This can be accomplished in microenvironments such as one's house or office (e.g., by not stockpiling unhealthy snacks), by organizations (e.g., by creating open-plan offices), by governmental bodies (e.g., by closing city centers to automobiles), or by legislation (e.g., through smoking bans in public places).

Increases in friction might include the imposition of waiting times. For example, the introduction of a 16-second time delay in closing an elevator door was more effective in prompting employees to take the stairs, leading to a one-third reduction in electricity use, than a persuasive message posted on a sign. Moreover, the stair climbing habit persisted after the study ended (Houten et al. 1981). Appelhans et al. (2018) retrofitted snack vending machines such that unhealthy snacks were announced to be delivered with a 25-second delay, whereas healthy snacks were delivered immediately. This led to an increase in the purchase of the healthier snacks. Smoking bans inside public buildings, restaurants, and pubs increase friction for smokers, forcing more mindful processing and search for alternative arrangements. Studies suggest that this results in a decline in smoking among those who regularly visit those places (Anger et al. 2011, Orbell et al. 2009). Ejlerskov et al. (2018) demonstrated that habitual purchases of small packages of less-healthy food for immediate consumption could be readily disrupted by increasing friction. Purchase of these products was more than 70% lower if supermarkets adopted a policy of presenting those items not at checkout but elsewhere in the store. Friction may be altered by manipulating default choices or actions. For example, people are more likely to grab food items that are nearer to them, even if preferred items are available further away. If the nearby items constitute low-calorie food and the less proximate high-calorie food, this arrangement promotes healthier habits (Privitera & Zuraikat 2014).

Habit acquisition is also more likely and faster if the required action is simple rather than complex (Kaushal & Rhodes 2015). Policies can reduce friction by simplifying behavior into small achievable actions (Sanghvi et al. 2016). Behaviors requiring multiple actions can be habitized but require extended action repetition. In an experimental study, participants practiced making sushi in an online game so as to acquire a habit (J.S. Labrecque, K. Lee & W. Wood, unpublished manuscript). The authors showed that this multiple-action sequence could not be automatized merely by conscious mental rehearsal but had to be repeatedly performed to create strong cue–action links in memory. Similarly, an opera singer must rehearse by singing their words. Once the word sequences are habitized, they are free to think about the acting performance once on stage.

The built environment has considerable potential to facilitate habit formation by reducing friction. Nicosia & Datar (2018) used the quasi-experimental variation in the environments of adolescents' military families who regularly had to relocate to demonstrate how the presence or absence of fitness and recreation facilities in those locations affected physical exercise frequencies. Particular districts may affect the development of a walking habit in everyday life through the presence of footpaths or through the proximity to a preferred school, shop, or bus stop (Fleig et al. 2016, Le et al. 2019). Interventions to reduce friction by addressing the built environment

and its services may also need to address affordability and equality of provision. Similarly, at a microenvironment level, the development of a habit to consume fruit and vegetables requires the availability of these items in the home environment, which may be limited by financial cost (Daniel 2016).

Conclusion

The notion of habit architecture refers to features of the performance context that foster specific cue–action links. Whether by personal choice, a group intervention, or an organizational or public policy, it is possible to intervene to create or modify habit through context cueing. Manipulations can target the occurrence, salience, or features of cues and can manipulate behavior in context by increasing or decreasing action friction. Increased friction passively dissuades action, whereas reduced friction passively induces it.

CONCLUSIONS

Relying upon attitude-based strategies to accomplish behavior change without paying attention to habit mechanisms diminishes the likely impact of the strategy. Attitude-based strategies will have limited impact on behavior change if they fail to translate temporary behavior into new long-term habits, or if they are employed to try to change existing habits that are insensitive to changes in attitude. However, approaches that recognize the context-dependent operation of habits are able to exploit the potential of both attitude-based and habit-based strategies.

The creation of new habits requires attention to those features that lead to cue-contingent automaticity—namely, consistent repetition in a stable, friction-minimizing context. Once formed, habits protect behavior against fluctuating attitudes and are resilient under stress or fatigue. Habit change may be assisted by strong attitudes and effortful monitoring, but slips are inevitable as long as strong cues to the original habit remain in place. Awareness of this contingency permits behavior change efforts to be targeted to exploit habit discontinuities or interruptions in existing habits due to changes in the performance context (e.g., life course transitions, changes in the external environment). Such habit discontinuities may put deliberative strategies in the driving seat and provide prospects for more effective interventions. Finally, understanding the role of habit architecture provides the opportunity to manipulate cue contexts, to introduce or reduce friction, or to embed new habits in old cue contexts.

It should be noted that even when habits are strong and a habit is automatically brought to mind by a cue, habitual action is not unavoidable. If a situation calls for it, we are often (unless distracted, stressed, or fatigued) able to effortfully discontinue a habitized action and think about alternatives. Moreover, habitual action does not prevent us from thinking about it, even for a split second. The origins of habits often leave them attitude aligned. Thus, in real life it may not be possible to draw as strict a distinction between habit-based and attitude-based behavior as the models may suggest.

How might habit research progress? Much research effort to date relies upon correlational observational studies in the field, using self-reported explicit measures of habit, attitude, and behavior. Laboratory-based work, on the other hand, while providing an opportunity to examine the mechanics of habit, may not be conducive to testing the slow development of realistic human habits nor their destruction via various strategies. Prior research has established the necessity to manipulate distraction or ego depletion in order to distinguish habit from deliberate processes. Advancing knowledge of the relations between attitudes and habits requires research that combines controlled laboratory work with field studies investigating real-life behaviors (Marien et al. 2019). Further work is required that employs longitudinal and experimental designs as well as

techniques such as experience sampling and within-person statistical analyses. Whereas a multitude of measurements are available in the attitude domain, this is less the case in habit research. The available self-report measures are limited to reporting experiences that arise from habitual processes. Reaction time-based and cognitive neuroscientific methods are confined to laboratory-based contexts. Therefore, more work on developing valid and reliable habit measures is needed.

Further work is also needed to identify optimal techniques to change attitudes and habits (Hagger et al. 2020, Kok et al. 2015), capitalizing on the integrative approaches outlined in this review. Taken together, consideration of the separate and interacting functions of attitudes and habits will provide powerful new perspectives on how people behave and how behavior may change. We hope that this review will offer further inspiration to attitude and habit researchers to combine forces and develop this intriguing field.

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