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Reports

How do habits guide behavior? Perceived and actual triggers of habits in daily life

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ABSTRACT

What are the psychological mechanisms that trigger habits in daily life? Two studies reveal that strong habits are influenced by context cues associated with past performance (e.g., locations) but are relatively unaffected by current goals. Specifically, performance contexts—but not goals—automatically triggered strongly habitual behaviors in memory (Experiment 1) and triggered overt habit performance (Experiment 2). Nonetheless, habits sometimes appear to be linked to goals because people self-perceive their habits to be guided by goals. Furthermore, habits of moderate strength are automatically influenced by goals, yielding a curvilinear, U-shaped relation between habit strength and goal influence. Thus, research that taps self-perceptions or moderately strong habits may find habits to be linked to goals.

Introduction

Having cast off the strictures of behaviorism, psychologists are showing renewed interest in the psychological processes that guide everyday habits (Verplanken & Aarts, 1999; Webb & Sheeran, 2006; Wood & Neal, 2007). This interest is fueled partly by the recognition that automaticity is not a unitary construct. Hence, different kinds of automatic responses may be triggered and controlled in different ways (Bargh, 1994; Moors & De Houwer, 2006). However, the field has not yet converged on a common understanding of the psychological mechanisms that underlie habits.

Habits can be defined as psychological dispositions to repeat past behavior. They are acquired gradually as people repeatedly respond in a recurring context (e.g., performance settings, action sequences, Wood & Neal, 2007, 2009). Most researchers agree that habits often originate in goal pursuit, given that people are likely to repeat actions that are rewarding or yield desired outcomes. In addition, habit strength is a continuum, with habits of weak and moderate strength performed with lower frequency and/or in more variable contexts than strong habits (e.g., Danner, Aarts, & de Vries, 2008; Lally, Van Jaarsveld, Potts, & Wardle, 2010).

This consensus aside, it remains unclear how goals and context cues influence habit automaticity. Goals are motivational states that (a) define a valued outcome that (b) energizes and directs action (e.g., the goal of getting an A in class energizes late night studying; Förster, Liberman, & Friedman, 2007). In contrast, context cues for habits reflect features of the performance environment in which the response typically occurs (e.g., the college library as a setting for late night studying). Some prior research indicates that habits are activated automatically by goals (e.g., Aarts & Dijksterhuis, 2000), whereas others indicate that habits are activated directly by context cues, with minimal influence of goals (e.g., Neal, Wood, Wu, & Kurlander, 2011).

In the present experiments, we first test the cognitive associations guiding habits (Study 1) and then evaluate the influence of contexts and goals on actual habit performance (Study 2). As a secondary focus, we try to resolve past conflicting findings by disentangling the influence of goals and context cues in the perceived and actual control of habitual responding.

How do goals and context cues influence habits?

Evidence that habits are activated outside of awareness by context cues with minimal influence of goals comes from correlational research on everyday behavior, including *behavior prediction* (Triandis, 1977) and *habit discontinuity* (Verplanken, Walker, Davis, & Jurasek, 2008). Across a range of everyday behaviors – from bus travel, to fast food consumption, to exercise – motivational factors (e.g., attitudes, intentions, self-concept) predicted future performance for nonhabitual behaviors but had limited predictive power for strong habits (Ouellette & Wood, 1998). Furthermore, consistent with the idea that habits are cognitively represented as context–response associations, habit strength had these effects only when habits were assessed from frequent performance in stable contexts—the specific conditions that enable the formation of habit associations in memory (Aldrich, Montgomery, & Wood, 2011; Danner et al., 2008; Ji & Wood, 2007). Discontinuity studies that assess naturally-occurring context changes find that participants continue to perform habits with minimal influence from goals, but only so long as they continue to live in the same context and so are exposed to cues that activate the behavior (Verplanken et al., 2008; Wood, Tam, & Witt,

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2005). When participants move house to a new location without cues to habit performance, their goals begin to drive actions. Thus, these studies of natural habit performance suggest that strong habits become tied to contexts and are not well predicted by reports of behavioral goals.

A competing view of the mechanisms that guide habitual behavior comes from research linking habits with automatic goal pursuit (e.g., Aarts & Dijksterhuis, 2000). In this perspective, explicit goals might recede in influence as habits form, but implicit goals become more strongly linked to the response. Such a strengthening of implicit goal–behavior associations is plausible given the extensively studied mechanisms of automatic goal pursuit (Bargh, Gollwitzer, Lee-Chai, Barndollar & Trötschel, 2001; Kruglanski et al., 2002). Support comes from experimental paradigms in which, for example, participants gave faster judgments about whether to use a habitual mode of transportation when they had a goal to get to a given location (Aarts & Dijksterhuis, 2000; see also Sheeran et al., 2005).

The present research first tests the influence, outside of awareness, of context cues and goals on habit performance. It then tests two possible ways to reconcile the evidence that habits are triggered automatically by context cues versus goals. One possibility is that people perceive their habits to be guided by goals, despite that goals do not influence actual habit mechanisms. Because habits are activated largely through procedural knowledge, people have access to few internal cues to performance (Beilock & Carr, 2001; Poldrack et al., 2001). In the absence of internal cues, people perceive their actions to be due to corresponding attitudes and goals (Bem, 1972), perhaps because of a tendency to favor purposive explanations for their behavior (Nisbett & Wilson, 1977). A second possibility is that automated goals are important at certain stages of habit formation. That is, automatic associations with goals may develop as weak habits become moderate in strength, but then decrease in impact as stronger habits form that are tied to context cues. These two accounts are not mutually exclusive, and we test both in the present studies.

The present research

In two experiments and an initial pilot study, we tested the inferred and actual influence of goals and performance contexts on habits of differing strength. In Study 1, we tested the implicit cognitive associations underlying the behavior of jogging/running in order to determine whether goals and context cues become more or less strongly associated with behavior as it increases in habit strength. Study 1 and the pilot study also tested participants' perceptions of the causes of their habits. Study 2 examined actual performance of a behavior that can be habitual—the tendency to speak loudly at sports stadiums—to test how goal priming and context priming influenced the likelihood of enacting this response.

The target behavior in the first study, jogging, is one that participants were likely to have thought about deliberatively, whereas participants may not have consciously considered the behavior in the second study, talking loudly at sports stadiums. By using these two very different behaviors, we provided a broad test of our hypotheses.

Pilot study

To explore the perceived influence of goals and context cues, we conducted an initial survey with 105 students (62 women) who participated for course credit in their psychology class. For the two target behaviors, running/jogging and speaking loudly in sports stadiums, participants rated on 7-point scales (*not at all important*, "1", to *extremely important*, "7"), "How important are your motivations and goals in causing you to perform this action" (if you ever do), and "How important is the external context in causing you to perform this action?" (if you ever do). They also rated the habit strength of each behavior on 5-point scales by indicating the frequency (*never/almost never* to *everyday*) and context stability (*never in the same place* to *always in the same place*) of past performance. Following Wood et al. (2005), frequency and context stability were then multiplied to yield the habit strength of each behavior (range = 0 to 16). Question order was counterbalanced but did not affect the results, and the analyses collapsed across order.

Bivariate correlations were computed to test whether perceived dependence on goals and on external contexts varied with habit strength (see Table 1). Greater habit strength was associated with greater perceived influence of goals for both running and speaking loudly at sports stadiums. Similarly, greater habit strength was associated with greater perceived influence of context cues. Thus, behaviors were judged to be influenced more by context cues and by goals as habit strength for those behaviors increased. It is noteworthy that this pattern emerged across two very different behavioral domains—jogging and running, which involve some conscious awareness, and speaking loudly, which may occur without much thought.

Study 1

Study 1 examined the actual causes of participants' habits as reflected in automatic associations in memory, in addition to the self-perceived causes of performance. Specifically, we used a lexical decision task (LDT) and subliminal priming to measure the strength of cognitive associations between pairings of contexts, goals, and a behavior (running/jogging) that varied in habit strength across participants. This task should be particularly suited to assess implicit habit associations because it involves simple word/nonword judgments and the priming procedure was subliminal and thus required no conscious introspection.

We tailored the task to each participant's idiosyncratic associations by specifying each participant's personally relevant goals and contexts. Our central prediction was that, when habits are strongly established, the primary mental association would be between contexts and the habitual response. Goal associations should not be present for strong habits. Thus, the primary analyses on LDT judgments should yield an interaction between habit strength and type of mental association (i.e., context–behavior vs. goal–behavior).

The first study also evaluated two possible roles for goals in habit performance. First, we assessed whether goals are important in self-perceptions of habits. For this, participants reported on their introspections about their habits via self-reports and a speeded inference task (see Aarts & Dijksterhuis, 2000). If goals are perceived to drive habits, then strongly habitual runners might readily infer that their running is goal dependent. Second, we assessed whether goals are important in guiding habits of moderate strength. To test this, we constructed nonlinear tests in which automatic associations with goals are influential for participants with moderate running habits but not for strong habit runners (who are guided by context cues)

Table 1
Relationships between habit strength, perceived goal dependence, and perceived context dependence: pilot study.

	Mean habit strength (*SD*)	Mean goal dependence (*SD*)	Mean context dependence (*SD*)	Correlation between habit strength and goal dependence	Correlation between habit strength and context dependence
Running	10.81 (5.78)	4.97 (1.95)	4.80 (2.04)	.37**	.41**
Speaking loudly at sports stadiums	6.12 (3.81)	3.64 (2.27)	3.84 (2.31)	.32*	.42**

* $p<.05$.
** $p<.01$.

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or weak habit runners (who have not had a chance to develop any automatic associations).

Study 1: method

Initial recruitment

As part of a larger battery, 65 undergraduate students (34 males) rated on 5-point scales the frequency (*never/almost never* to *everyday*) and context stability (*never in the same place* to *always in the same place*) of their running/jogging in the past 6 months. In line with the pilot study and with prior research (e.g., Wood et al., 2005), habit strength was the product of behavior frequency and context stability ratings (range = 0 to 16).[1] Participants ranged in habit strength from non-runners to sporadic runners to strongly habitual runners who ran every day in the same context.

Participants also provided a single word to describe the physical location/context in which they typically (or ever) ran/jogged (e.g., gym, forest) and two more words to describe their primary goals/motivations for running if/when they ever did so (e.g., weight, relax). Finally, to measure inferred causes of behavior, participants rated on 5-point scales how important each of their two personal goals was in motivating them to run (*not at all important* to *extremely important*).

Main study

Fifty-three participants (27 males) completed the main study, which supposedly assessed language processing. In the LDT task, participants made word/non-word judgments regarding 96 target stimuli (50% words, 50% non-words) after being subliminally primed with a word stimulus. Each trial proceeded as follows: (a) a row of asterisks at fixation for 2 s, (b) a forward mask (XXXXXX) for 100 ms, (c) a prime word for 33 ms, (d) a backward mask (XXXXXX) for 100 ms, (e) a variable delay (160 ms to 240 ms), and (f) a target stimulus for a maximum of 3 s or until response. To disguise the task's purpose, 24 of the 48 word trials used filler targets and primes unrelated to exercise. Across the remaining 24 critical trials, 6 prime–target combinations were assessed, with 4 trials per combination: (a) context–behavior, (b) context–goal, (c) goal–behavior, (d) behavior–goal, (e) control word–goal, and (f) control word–behavior. Context and goal terms were participant-specific and were derived from the recruitment survey, and behavior words were "running" and "jogging" for all participants. The control trials (e and f), which provided a baseline speed of responding, used unrelated words matched in length ("monitor", "drapes", "curtain", "thermos"). Reaction times to the three types of goal associations (context–goal, goal–behavior, and behavior–goal) were correlated, with a Cronbach's alpha of .79.

To assess explicit inferences about goals, participants were presented with a behavior and then a goal and inferred whether the behavior was a realistic means to attain that goal. The sequence and duration of stimuli within trials were identical to the LDT, except that behaviors were presented for 200 ms (rather than 33 ms) and thus were consciously visible. Four different behavior–goal combinations were assessed over a total of 12 trials: (a) running–goal, (b) control behavior–goal, (c) running–control goal, and (d) control behavior–control goal. For the control combinations (b, c, and d), control behaviors were "copying" and "printing", and control goals were "investing" and "saving."

Results: Study 1

Implicit associations underlying habit performance

Association strengths in the LDT were calculated by subtracting mean RTs for each experimental prime–target combination (i.e., context–behavior, goal–behavior, context–goal, behavior–goal) from the mean RTs for control trials.[2] Thus, positive scores represent faster responding to a given experimental prime–target combination, relative to control trials. Following common practice for reaction time data (see Fazio, 1990), computing difference scores in this way controlled for individual differences in reaction time speed. However, we also replicated the analysis for each goal trial type using the raw RTs for critical trials as the dependent variable and control trials as covariates, producing an identical pattern of results to the differences score analyses reported below.

To test the associations that underlie habits, context–behavior associations and goal–behavior associations were analyzed with a general linear model regression, with association type (context–behavior vs. goal–behavior associations) as a repeated factor and habit strength as a continuous predictor. The only significant effect was the predicted interaction between habit strength and association type, $F(1, 53) = 4.10$, $p = .048$, $MSE = 1855$, partial $\eta^2 = .072$. Consistent with expectations, participants with stronger running habits recognized the words, running and jogging, more quickly after subliminal priming with participants' personal context words, $B = 3.50$, $SE = 1.75$, $t(53) = 2.00$, $p = .05$. Critically, habit strength was unrelated to the speed of recognizing the behavior after priming with participants' personal goals for running ($t < 1$). This interaction is depicted in Fig. 1a.

Although our primary aim was to evaluate the influence of goals versus contexts in activating strong habits, for completeness we also conducted analyses on an average of all three goal associations together ($\alpha = .79$). Again, the only significant effect was the predicted interaction between habit strength and association type, $F(1, 51) = 4.31$, $p = .043$, $MSE = 963.22$, partial $\eta^2 = .078$. Decomposition of this interaction again revealed that participants with stronger habits were faster at recognizing the behavior after priming with contexts ($p = .05$), whereas habit strength did not influence recognition speed for associations with goals ($t < 1$).

Explaining the influence of contexts and goals

Possibility 1: goal associations are important for habits of moderate strength. Curve fitting analyses tested the nonlinear prediction that goal associations would be absent for weak and strong habit runners, but present for moderate habit runners (i.e., a quadratic effect).[3] A variety of goal associations might be involved, given that the contexts of running might activate participants' goals for running, goals might activate their behavior, and the behavior might remind participants of their goals. The quadratic effect using the composite goal measure was significant, $B = -2.16$, $SE = 0.77$, $t(34) = 2.80$, $p = .03$. As depicted in Fig. 1b, this represents an inverted U-shaped relation in which weak and strong habit participants were not faster at reporting on associations with goals, whereas moderate habit participants showed speeded associations involving their goals for running.

Possibility 2: goals influence self-perceptions. Replicating the pilot study, participants with stronger habits reported that their running was influenced more by their goals, $r(51) = .54$, $p = .01$. Additionally, those with stronger habits made marginally faster inferences that

[1] In the first and second study, we also conducted analyses that included frequency and context stability as main effect predictors in addition to the interaction. As anticipated, only the interaction and not the main effects significantly predicted association strength (Study 1) and behavioral responses (Study 2). However, due to low power in both studies, we were not able to include these main effects (or their interactions with other predictors) in the full analysis.

[2] Incorrect responses and responses exceeding 2 s were excluded (2% of trials). Remaining data were Winsorized by trimming values to 2 standard deviations from a participant's mean RT if they exceeded that value (less than 1% of trials, Wilcox, 1997).

[3] We conducted these analyses after removing participants who never ran. Their RTs to implicit goal associations were highly variable, apparently due to their limited direct experience.

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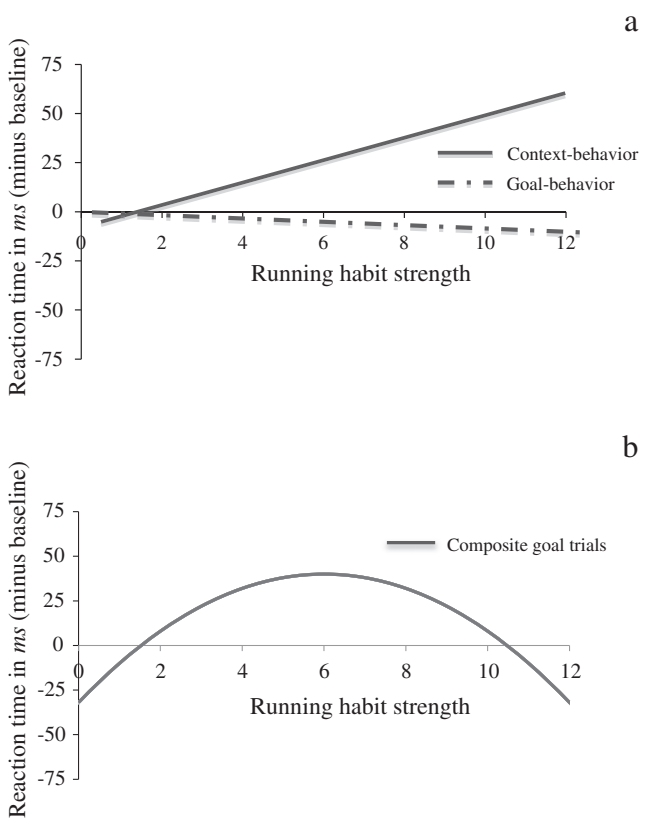

Fig. 1. Study 1. (a) shows the significant interaction between habit strength and association type (context–behavior vs. goal–behavior) in predicting reaction times (ms) in the lexical decision task. Positive scores reflect faster responding to a given association type relative to baseline reaction times. (b) shows a significant quadratic pattern for the composite measure of all goal association types (goal–behavior, context–goal, and behavior–goal). Positive scores again reflect faster responding to goal associations relative to baseline reaction times.

running served their goals than did participants with weaker habits (i.e., with speed calculated by subtracting the mean RT on behavior–goal trials from the mean RT on control trials), $t(48) = 2.24$, $p = .06$.[4]

We also explored whether participants' self-reports and speed of making inferences were related to their implicit associations to jogging, as assessed through the LDT. Suggesting that self-perceptions and habit associations reflect different types of knowledge, inferences about goals were not correlated with the LDT measure of strength of goal associations, $r(51) = .07$, *ns*. Similarly, speeded inference RTs were not correlated with the LDT measure of strength of goal associations, $r(51) = .07$, *ns*. This dissociation reflects that participants who strongly believed and quickly inferred that their running was influenced by goals did not respond any faster to the implicit goal–behavior, behavior–goal, and context–goal trials in the LDT.

Discussion: Study 1

This first study provided evidence of the implicit mental associations underlying habit performance. For participants with stronger running habits, perceiving the contexts in which they typically ran/jogged automatically brought this behavior to mind. That is, subliminal presentation of the relevant context facilitated recognition of the words, running and jogging. This facilitation was not evident among participants with weaker habits. Furthermore, participants with stronger habits did not show stronger goal associations—despite that they had nominated these goals as responsible for habit performance. In the linear analysis, goals did not automatically facilitate the behavior regardless of habit strength. These findings suggest that performance contexts, with minimal influence of goals, automatically trigger mental representations of associated habitual responses.

This first study also provided insight into the discrepant findings concerning habit mechanisms in past research. First, moderately strong habits, but not strong or weak ones, revealed automatic associations to goals. Although habit strength is relative, many everyday activities are likely performed by people with sufficient frequency in stable contexts to achieve direct context cuing without influence of goals (e.g., morning grooming, eating). Second, goals were important for judgments about habits. That is, more habitual runners strongly believed and rapidly inferred that their running was influenced by their goals.

Study 2

In the second study, we evaluated overt performance of a simple habit amenable to investigation in the laboratory—the tendency to speak loudly in a sports stadium. We reasoned that people who frequently and consistently attend sports stadiums will have acquired a habitual tendency to increase the volume of their speech in that context.

In the study, we primed participants with images of sports stadiums or with control images of kitchens and assessed changes in their speech volume relative to a pre-priming baseline level. Exposure to context cues – images of stadiums – should elicit louder speech among participants who habitually attended sports stadiums. This pattern would emerge in an interaction between context priming and habit strength on speech volume.

Study 1 and Study 2 tested two possible roles of implicit goals, activated outside of awareness, in habit performance. Study 1 demonstrated that the implicit cognitive associations for strong habits did not include goals but did include contexts. Study 2 directly manipulated goals in order to test whether people are influenced by a current goal to act on a habitual response once it is activated by the stadium context. That is, it tested whether context–response associations depend on goals to be performed.

Study 2 used a standard manipulation of nonconscious goals that involved telling participants that they would visit a campus sports stadium for the final part of the study (e.g., Joly, Stapel, & Lindenberg, 2008). This manipulation was used in a prior study demonstrating that frequent cycling can be goal-dependent (Aarts & Dijksterhuis, 2000). It also was used to demonstrate that the norm to speak quietly in libraries is goal-dependent, given that participants primed with images of libraries spoke more softly, but only when expecting to visit a library (Aarts & Dijksterhuis, 2003). We used precisely the same manipulation here and predicted that expecting to go to a sports stadium would activate goals relevant to speaking loudly. If this goal is necessary for habit performance, then stadium contexts will trigger loud speech among participants with strong habits only when goals are activated. If this goal is not necessary, then the interaction between habit strength and context priming will not be moderated by goal activation.

Method: Study 2

Participants

102 undergraduate students enrolled in introductory psychology (52 males) participated for course credit. Five additional participants were excluded for suspicion or refusing to visit the stadium.

Procedure

Fig. 2 provides a schematic overview of the procedure. Participants completed all measures individually in a small room, with other participants ostensibly in nearby rooms.

[4] In order to replicate Aarts and Dijksterhuis's (2000) analysis, we dichotomized habit strength for this comparison.

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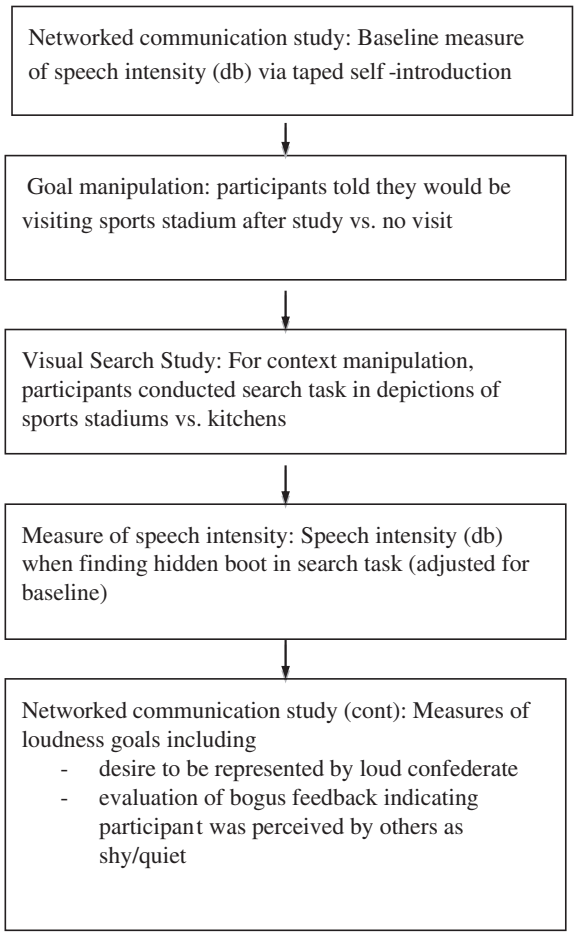

Fig. 2. Schematic overview of Study 2 design.

In brief, the research supposedly involved two separate studies. The first, *networked communication study*, provided a rationale for obtaining a baseline measure of participants' speech volume intensity. The second, *visual search study*, provided a means of priming contexts and measuring participants' loudness of speech. Finally, participants resumed the *communication study*, which provided a guise to measure participants' goals.

Specifically, as part of the communication study, participants first introduced themselves on tape. While supposedly waiting for others' introductions to be taped, the goal manipulation was delivered. Half of the participants were informed that they would briefly visit the campus sports stadium in order to complete the study and half were not (taken from Aarts & Dijksterhuis, 2000, 2003).

All participants then switched to the visual search study. On each of seven trials, they said "boot" into the microphone upon locating a boot hidden in a photograph. This was the context prime, with the photo background of *kitchens* for some participants and *sports stadiums* for others. Speech volume was assessed via mean intensity (*db* using PRAAT software for phonetic analysis, Boersma and Weenink, 2011), adjusted for an individual's baseline intensity. Immediately, participants reported their feelings on three semantic differential scales (*calm–excited*, *tired–energetic*, *sedate–aroused*), which were averaged to form an arousal index ($\alpha = .73$).

Finally, participants resumed the communication study and heard the recorded self-descriptions of two confederates of the same sex as the participant. The *loudness goal measures* were embedded in this task. One individual was quiet and reserved and the other was loud and ebullient. Participants selected one of them to "best convey and represent you as you currently are" in a subsequent interaction. Three scales assessed whether participants primed with the stadium visit preferred the confederate who could meet their loudness goals (see Fitzsimons & Shah, 2008). Loudness goal activation was further assessed through participants' reactions to goal-inconsistent feedback indicating that they were perceived (from their recorded introduction) as shy and reserved (see Bargh et al., 2001). All goal measures were combined to form a single measure of loudness goal activation ($\alpha = .80$).

Habit strength measure. Habit strength for attending sports stadiums was assessed through two measures similar to Study 1. On 5-point scales ranging from 0 to 4, participants rated how frequently they had been to a stadium in the past 6 months and whether they visited other stadiums, off campus, or the ones in the priming task. Habit strength was the product of behavior frequency and context stability (range = 0 to 16).

Results

Our primary hypotheses were tested with regression models in which the predictors were context prime (kitchen vs. stadium), goal prime (stadium destination vs. no destination), habit strength for visiting the sports stadiums (centered), and all interactions, with gender as a control.

Goal manipulation

Replicating prior work (e.g., Aarts & Dijksterhuis, 2000), participants expecting to visit a campus sports stadium after the study reported significantly stronger loudness goals than those without that expectation, $B = 0.67$, $SE = 0.24$, $t(89) = 2.81$, $p < .01$. The analysis also revealed that goals did not vary with context priming, habit strength, or the interactions (all $ts < 1$).

Influence of context cues on speech habits

Demonstrating the influence of environmental cues on habit performance, the model predicting speech volume yielded the expected Context × Stadium Habit Strength interaction, $B = 0.97$, $SE = 0.44$, $t(87) = 2.22$, $p = .03$. No other main effects or interactions approached significance (all $ts < 1.5$). Fig. 3 presents the simple slopes analysis for this interaction. As indicated by the relatively flat slope for kitchen context primes, speech intensity did not vary as a function of habit strength to visit sports stadiums (*simple slope* = .06, *ns*). However, for those primed with sports stadiums, habit strength was positively related to speech volume (*simple slope* = 1.01, $p < .001$).

We also tested whether participants with strong habits spoke more loudly given stadium primes because of confounds such as heightened arousal or other factors (e.g., familiarity) that might increase response

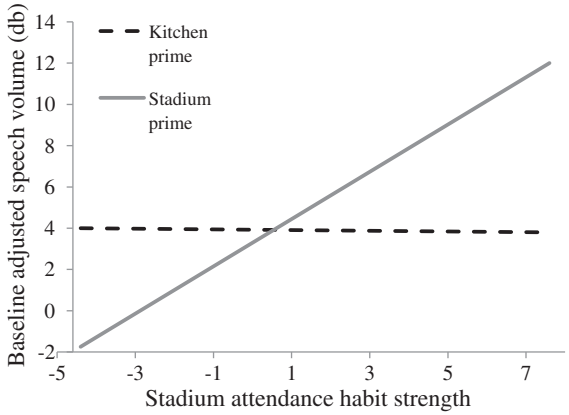

Fig. 3. Study 2. Decomposition of 2-way interaction predicting baseline adjusted speech volume (*db*) in the visual search task. Simple slopes represent speech volume as a function of context priming condition (kitchen versus sports stadium) and the strength of participants' habits to visit sports stadiums in the preceding 6 months. Slopes control for participants' reaction time in detecting the boot.

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volume. Specifically, regression models predicted arousal ratings and RT—as an indicator of general intensity, from context (kitchen vs. stadium prime), habit strength, and their interaction. The only effect was on RT, with faster responses in the kitchen context, $B = 0.61$, $t(87) = 5.29$, $p < .001$, perhaps because the kitchen images were somewhat simpler than the stadium images. Thus, the lack of effects for habit strength suggests that the habit results are not due to arousal or other factors that can plausibly cause loud responding.

Goal associations are important for habits of moderate strength

To explore the curvilinear effects of goal priming on speech volume, we tested for a quadratic relation between habit strength and speech volume separately within each of the four conditions (stadium-goal, stadium-no goal, kitchen-goal, kitchen-no goal). As anticipated, a marginal quadratic pattern emerged within the stadium-goal condition, $B = -.19$, $SE = 0.032$, $t(16) = 2.80$, $p = .08$. This inverted U-shaped pattern reflects louder speech for stadium-primed participants of moderate habit strength, but not for participants with weaker or stronger habits. The fact that this quadratic pattern did not approach significance in the kitchen-goal condition replicates Aarts and Dijksterhuis (2003) and indicates that the goal of visiting stadiums activated loud speech only when participants were primed with a goal-relevant context (i.e., stadiums but not kitchens).

Discussion: Study 2

Study 2 revealed the differential influence of goals and context cues on actual habit performance. Specifically, participants who habitually visited the sports stadiums at their school spoke more loudly when primed with pictures of this context, and this effect occurred regardless of whether or not they had a goal to visit stadiums after the study. Thus, the influence of context cues on behavior increased as a linear function of habit strength and was not influenced by goals.

This study also provided some insight into the influence of goals in habit performance. When participants with moderately strong habits expected to visit a stadium, and thus goals were activated outside of awareness, they spoke marginally more loudly, at least when they were primed with stadium images. This nonlinear pattern echoes the implicit cognitive associations in Study 1 and suggests that goals trigger habits (given appropriate contexts) only when habits are moderately strong. Once habits are strong, goals have little influence, and performance is activated by context cues regardless of current goals.

General discussion

When you drag yourself to the gym each morning, is the behavior due to your ardent hope of fitting back into your favorite jeans or to myriad environmental cues that keep you locked into your morning habit? The present research suggests that strong habits – although perceived to be purposive and goal-dependent – are actually influenced by recurring triggers in the performance context.

Yet goals did emerge as important in several ways. Across both studies, goals showed a highly flexible pattern in guiding moderately strong habits, including directly influencing them (Study 1), being activated by both the habitual behavior and the performance context (Study 1), and motivating performance when the behavior is brought to mind by the context (Study 2). This variability is part of the power of goals, as they activate responding through a variety of associative mechanisms (Förster et al., 2007).

The limited influence of goals on strong habits helps to distinguish habits from other automatic dispositions. Our results are consistent with decompositional models in which automatic processes exhibit separable features in various combinations. That is, habits represent a *goal-independent* form of automaticity (Moors & De Houwer, 2006), that is performed in a manner similar to learned, nonmotivated ideomotor priming effects (see Bargh, 1994).

Unlike implicit goals and implementation intentions that flexibly guide behavior depending on people's explicit goals (e.g., Sheeran et al., 2005), participants in the present studies were influenced by their habits even when they did not hold a congruent goal.

Discontinuity between habit mechanisms and self-perceptions

The discontinuity between perceived and actual triggers of habits has both methodological and substantive, theoretical implications. Methodologically, it highlights the need to study mechanisms of actual habitual control using methods that do not rely on introspection (see Neal & Wood, 2009). Theoretically, the discontinuity plausibly arises from introspection illusions that may be especially likely when people are acting in an explanatory vacuum (Oettingen, Grant, Smith, Skinner, & Gollwitzer, 2006) given the absence of introspective information about the causes of their habits. Perhaps because of a tendency to view their behavior as purposive, people make especially strong, fast inferences about goals. This finding complicates interpretation of habit experiments—it suggests that research on the actual mechanisms of habit performance cannot rely on judgments and inferences as tests of underlying mechanisms. Research that taps subjective experience of habits is especially likely to find that habit performance depends on goals, despite that in Study 1 goals were not implicitly linked with habitual responses in memory (see Neal & Wood, 2009).

Given the illusory nature of goals in habit performance, people wishing to change these behaviors may be drawn to techniques that invoke goal setting and internal motivation. However, the ineffectiveness of such strategies is highlighted by the present findings, and also by a meta-analysis of 47 studies that used persuasive appeals and other interventions that changed people's behavioral intentions but changed behaviors primarily when they were not habitual (Webb & Sheeran, 2006). More successful habit change strategies likely target the specific contextual triggers of habitual behavior. These include vigilant monitoring of the unwanted response (Quinn, Pascoe, Wood & Neal, 2010), environmental re-engineering (e.g., Verplanken & Wood, 2006), and stimulus control techniques to reduce exposure to the triggers (Sobal & Wansink, 2007).

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