Does Construal Level Affect the Development of Automaticity?

Abstract versus Concrete Mindsets and Choice Repetition

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Abstract

Through practice, erratic behaviors become consistent. However, considerable variability exists in the time it takes for newly learned relations between cues and behaviors to become automatic. The present research investigated whether construing action abstractly vs. concretely moderates the development of automaticity. In combination with a construal-level manipulation, participants completed a speeded response-time task in which they repeatedly chose between two possible choices (e.g., “business” or “visitors”) as descriptors of a target word (e.g., “company”). We tested two pre-registered hypotheses that participants in the concrete (vs. abstract) group would (1) show a greater speed-up in response times across repetitions; (2) more quickly settle on a consistent preference. Despite strong evidence of the efficacy of our construal-level manipulation, neither hypothesis was supported.

Keywords: automaticity; construal level; habits

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In recent years, considerable effort has been made to understand the extent to which behavior, judgment, and decision-making are guided by controlled vs. automatic processes. The construct of automaticity has been applied across a wide variety of domains, including stereotyping, attitudes, impression formation, and health behavior (Devine & Sharp, 2009; Fazio, 1986; McCulloch, Ferguson, Kawada, & Bargh, 2008; Orbell & Verplanken, 2010). To explain how mental processes become automatic, past research has focused primarily on the role of behavioral repetition and consistency. That is, many processes may start as controlled, requiring deliberate effort and attention; with consistent and frequent practice, such processes can become automatic, efficiently transpiring without conscious awareness, control, or intent (e.g., Greenwald & Banaji, 1995).

Automaticity long has been used as a framework for understanding practice effects. Specifically, research on practice effects has found that as a task is repeated, the time it takes to perform that task decreases as a power function (Logan, 1992; Newell & Rosenbloom, 1981). Automaticity is inferred, then, from the speed up of response times (i.e., that one can carry out an action more efficiently, with less attention or effortful processing, with successive repetitions). Given that this pattern characterizes learning across a wide variety of tasks, including cigar rolling (Crossman, 1959), retrieving facts from memory (Pirolli & Andreson, 1985), and making lexical decisions (Logan, 1988), this pattern is referred to as a power *law* (Newell & Rosenbloom, 1981). However, there is considerable variability in the number of repetitions it takes for a behavior to become automatic. For example, one study found that among individuals seeking to establish a new health-related behavioral pattern, it took between 18 to 254 days for participants to reach their peak level of automaticity (Lally, Van Jaarsveld, Potts, & Wardle, 2010). Accordingly, there remains some uncertainty regarding the critical component(s) that give rise to automaticity, and relatively little is known about why the development of automaticity varies across individuals and situations. Addressing this issue, the present research investigated whether thinking in an abstract vs. concrete manner about action is a potential moderator of the development of automaticity.

Among studies of behavioral habits, automaticity is presumed to develop through learned associations between environmental cues and specific behaviors (Orbell & Verplanken, 2010; Neal, Wood, Labrecque, & Lally, 2012). In experimental studies of habit formation, for example, participants are instructed to link behaviors to a salient environmental cue, such as time of day (e.g., “eat fruit with lunch”; Lally et al., 2010). Habits are distinguished from frequent intentional behaviors, then, by automatic activation, such that when an individual encounters a conditioned environmental cue, the associated behavior unfolds without considerable effort or attention.

In a related vein, pre-deciding how to act in response to specific, situational cues, a strategy known as forming implementation intentions, promotes efficient goal attainment (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006). By increasing the accessibility of anticipated situational cues, implementation intentions help people to detect good opportunities in their environment to act (Aarts, Dijksterhuis, & Midden, 1999; Webb & Sheeran, 2004). Once a cue is detected, implementation intentions guide action in an effortless manner because control of the behavior has been transferred from the conscious will of the individual to cues in the environment (Gollwitzer, 1999; Gollwitzer & Schaal, 1998). Taken together, research on habit formation and implementation intentions suggests that thinking in a localized (rather than global) manner that promotes attention to environmental cues may play an important role in the development of behavioral automaticity. Building on those findings, we investigated whether thinking generally in a concrete (rather than abstract) manner about action moderates the development of automaticity.

People can think about their actions at varying levels of specificity. As people strive to establish new behavioral patterns, such as engaging in regular exercise, they may think about exercise in terms of the specific, concrete procedures (e.g., “How do I exercise?”) or in terms of the general, abstract purposes (e.g., “Why do I want to exercise?”). Conceptualizing a behavior in terms of its concrete vs. abstract features is referred to as a difference in construal level (Trope & Liberman, 2010). When people construe information abstractly, they are more likely to attend to the superordinate, defining features of an event, such as the general purpose of carrying out a behavior (Liberman, Sagistano, & Trope, 2002; Liberman & Trope, 1998; Vallacher & Wegner, 1989). Conversely, when people construe information concretely, they are more likely to focus on subordinate, idiosyncratic features, such as the specific procedures of carrying out a behavior. Abstract and concrete thinking can be activated as a mindset, such that leading people to think in an abstract or concrete manner in one domain impacts subsequent judgments or behaviors in other, unrelated domains (Freitas, Gollwitzer, & Trope, 2004).

Concrete and abstract thinking promote effective self-regulation in distinct ways. Whereas abstract thinking appears to be useful when people need to choose between competing goals and information (Fujita, Trope, Liberman, & Levin-Sagi, 2006; Fukukura, Ferguson, & Fujita, 2013), concrete thinking appears to be more effective when people need to focus on when and how to execute a behavior. One recent study found that, among people who formed implementation intentions for an upcoming task, those in an abstract mindset performed worse on that task than did those in a concrete mindset (Wieber, Sezer, & Gollwitzer, 2014).

Conversely, people who formed general intentions for an upcoming task performed better on the task if they were in an abstract (vs. concrete) mindset. These findings suggest that abstract thinking facilitates motivation to act through effortful top-down control, but it has a detrimental effect on the automatic bottom-up control that is needed to recognize situational cues of when and how to act. Thus, in situations where it is important to be able to detect situational cues that guide one's behavior, concrete thinking appears to be more effective than abstract thinking.

We tested the novel prediction that construal level would moderate the development of automaticity. Given the above-reviewed evidence that construal level moderates relations between environmental cues and associated actions, we reasoned that a concrete (relative to abstract) mindset would facilitate the development of consistent and efficient responses to specific environmental cues. Moreover, goal-oriented behavior can be categorized into a number of distinct action phases, including a pre-decisional phase during which people deliberate over a preference, and a post-decisional phase during which people are focused on implementing an action (Gollwitzer, 1990). The pre-decisional stage is characterized by an orientation toward comparing incentives, whereas the post-decisional stage is characterized by an orientation toward implementation (Heckhausen & Gollwitzer, 1987). Given its inherent focus on the "hows" of implementation, a concrete mindset should facilitate greater consistency and efficiency across stimulus-action repetitions than an abstract mindset, which instead has an inherent relation to the "whys" of deliberation and so leaves open the possibility of reconsidering particular courses of action. In short, then, we predicted that a concrete focus on action procedures would facilitate the development of automaticity more so than an abstract focus on actions' reasons.

There are several approaches to measuring automaticity. Among studies of behavioral change, it can be informative to measure people's self-reported subjective experiences of whether their past actions were perceived as having occurred automatically (Verplanken & Orbell, 2003). However, some authors have argued that subjective measures of automaticity can lead to inaccuracies in measurement, because individuals may not be able to report reliably on the cues and associated responses that give rise to automatic actions (Hagger, Rebar, Mullan, Lipp, & Chatzisarantis, 2015). Drawing instead on the objective measures of automaticity developed by Logan (1988), we examined the rate at which repeated responses sped up and become consistent across time, using a speeded response-time task in which participants encountered numerous repetitions of the same stimuli.

To examine automaticity, Logan (1988) used a lexical decision-making task with objectively correct responses (i.e., word or non-word), which participants could recall from memory. In contrast, the present research sought to examine the extent to which individual preferences become automatic. We reasoned that a task in which the choices were novel and ambiguous (i.e., with no clearly correct answer) would yield greater variability in responses. In combination with an embedded construal-level manipulation, participants completed a speeded response-time task in which they viewed a target word (e.g., “company”) and were asked to decide quickly which of two possible choices best describes this word (e.g., “visitors” or “business”). This task was designed so that there would be no wrong answer; participants decided based on personal preference. We tested two pre-registered hypotheses[1]: 1) the average change in response times across item repetitions would be greater in the concrete group than the abstract group; 2) the concrete group would be quicker to settle on a consistent preference, such that the average change in the number of switches across item repetitions would be greater in the abstract group than in the concrete group.

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[1] See: https://osf.io/5u2gn/?view_only=95e7cb03a21b4b9a822c5cd73e89edb5

Methods

Participants

Two hundred seventy undergraduate students participated in exchange for course credit. Prior to conducting any data analyses, data from six participants were excluded because they were not native English speakers and data from another six participants were removed because their average switch rates were 4 SDs or more from the overall sample's mean. Thus, the final sample consisted of 258 participants, (77 male), aged 17 - 27, (M = 19.89, SD = 1.72). Regarding race and ethnicity, 46.9% of participants identified as White (N = 121), 13.95% as Black or African American (N = 36), 11.63% as Latino/a (N = 30), 10.47% as East Asian (N = 27), 8.14% as more than one ethnicity or other (N = 21), and .004% as Indian American or Alaskan Native (N =1).

An a priori power analysis indicated that a sample size of 260 participants was required to achieve statistical power (1- β) of .80, with α = .05 and an estimated effect size of Cohen's d = 0.35.

Procedure

After providing informed consent, participants completed a construal level manipulation (Freitas et al., 2004), which was framed in reference to the goal, "Improving and maintaining your academic standing." In the concrete condition, the goal was listed at the top of the page with four blank boxes positioned below it. Conversely, in the abstract condition, the goal was listed at the bottom of the page, with four blank boxes positioned above it. These diagrams were structured so that those in the concrete condition give increasingly specific responses, whereas those in the abstract condition give increasingly broad responses. Additionally, to maintain the efficacy of the construal-level manipulation throughout the response-time task, each block began with five trials in which participants saw a type of behavior (adapted from the Behavior Identification Form; BIF). A behavior was presented in the center of the screen (e.g, “making a list”). Below this item, on the left and right sides, participants saw two possible reframings of the behavior that described how (in the concrete condition) or why (in the abstract condition) it is performed. Participants were asked to, “Quickly select the phrase that best describes the behavior.”

Following the five construal-level trials, in each block participants completed 60 trials in which they made similar judgments about single words. A target word was presented in the center of the screen (e.g., “company”). Below this item, on the left and right sides, participants saw two possible descriptions for the target word (“visitors” or “business”). Participants were instructed to quickly decide which of the two words best described the target word, by pressing the left or right shift keys. Participants completed a total of 520 trials (8 blocks with 65 trials per block). Each of the behavior items was presented twice, and each of the target words was presented eight times (once per block). Within each block, the stimuli were presented in a randomly selected order.

Next, to confirm that the concrete and abstract trials induced differences in construal level, participants completed a manipulation check. The manipulation check consisted of a series of 10 items (adapted from Libby, Shaeffer, & Eibach, 2009; based on Vallacher & Wegner, 1989) in which participants were presented with a behavior (e.g., “Donating blood”) and asked to choose between a concrete (e.g., “ getting stuck with a needle”) or an abstract (“helping someone in need”) description of that behavior. If the manipulation of construal level was successful, people in the abstract group should have selected more why-focused (abstract) answers, whereas people in the concrete group should have selected more how-focused (concrete) answers.

Fourth, participants completed several questions about the response-time task, including: “How difficult was the response time task?”, “How boring was the response time task?”, “How well do you think you performed on the response time task?” Participants also indicated their current moods using the valence and arousal scales of the Self-Assessment Manikin (Bradley & Lang, 1994). These items were included to rule out alternative explanations and to examine aspects of participants’ experience with the response time task (in the event of null results).

Stimuli

As part of the experimental manipulation of construal level, 25 items from the Behavior Identification Form (BIF; Vallacher & Wegner, 1989) served as the concrete or abstract items. For each item, participants viewed the target behavior (e.g., “making a list”), along with two descriptions of how (e.g., “writing things down” or “getting a paper and pencil”) or why (“getting organized” or “reaching a goal”) that behavior is performed. These items were derived from two sources: 1) the how and why responses from the original version of the BIF and 2) open-ended responses collected as part of an unpublished dissertation study by the first author (reference removed to assure blind review) in which participants were asked to indicate how or why to perform behaviors from the BIF.

To measure participants’ repeated preferences, 60 target nouns were selected from the English Lexicon Project (Balota et al., 2007), a web-based database that generates lexical stimuli based on lexical characteristics. For each target noun, two alternate meanings (descriptors) were generated using a standard thesaurus. Target words range from 3 to 8 letters in length (M = 5.13), and the descriptors range from 3 to 13 letters (M = 6.68).

Piloting

Two separate piloting samples were recruited (*N*s = 30 and *N* = 32, respectively). Participants in the pilot studies completed the response-time task without the construal-level manipulation (8 blocks with 75 trials each for a total of 600 trials). The goals of piloting the response-time task were: 1) to identify at least 50 target items with sufficient variability in initial reframing among the descriptors; 2) to assess people's tendency to develop consistent preferences; and 3) to assess general degrees of response-time speedup across repetitions in this task. First, to confirm whether there was sufficient variability between participants' preferences for particular descriptors (i.e., that people vary in their initial preference for particular descriptors), we selected items in which participants displayed at most a 75/25 split for the first presentation of an item, which yielded a total of 60 items. Second, we examined the total number of instances in which participants' preference for a particular descriptor changed across blocks. The mean switch rate was 21.37% (SD = 10.35%) in Pilot 1 and 21.86% (SD = 13.44%) in Pilot 2. Third, we examined the pattern of participants' response times across repetitions. In both Pilots 1 and 2, mean response times sped up across repetitions, (Pilot 1: $B = -126.250$, $SE = 2.69$, $t = -46.98$, $p < .001$; Pilot 2: $B = -149.630$, $SE = 3.26$, $t = -45.92$, $p < .001$).

Statistical Analysis Plan

The hypotheses, methods, and data analysis plans were pre-registered prior to data collection. Data analysis proceeded in five stages. First, the response time (RT) data was checked for outliers, such that trials with values that were more than 3 standard deviations above the grand mean or less than 200 msec were excluded from data analysis. This criterion led to the exclusion of 2.7% of trials. Additionally, RTs were excluded for trials in which participants expressed a change in preference from their previous presentation of a particular item. This decision was guided by our aim to assess the speed-up of responses as decisions become automatic; a change in preference suggests that a decision was not yet consistent. This criterion led to the exclusion of an additional 13.22 % of trials.

Second, participants' average switch rate (total number of times a participant's response changed from a previous presentation of a given stimulus) was examined for outliers. The average switch rate (18.66%) was similar to that of the two pilot samples. As stated in the pre-registered analysis plan, we had planned to remove participants with a switch rate that was 3 SDs or more from the overall sample's mean. However, this criterion resulted in losing what we concluded were too many participants (n = 32), which would have yielded a sample size that was substantially lower than that specified by the power analysis. Instead, participants with a switch rate that was 4 SDs or more from the overall sample's mean were excluded from analysis (n = 6).

Third, participants in the abstract and concrete conditions were compared on all variables that should be unaffected by the experimental manipulation to ensure the randomization was successful, and the manipulation-check scores were examined to confirm the effectiveness of the manipulation. Fourth, to test whether there was a significant difference between groups in RT speedup across repetitions, a linear contrast score was computed to examine the mean change in RT across repetitions, using the following equation:

MEAN(mean RT Block 2 - mean RT Block 1, mean RT Block 3 - mean RT Block 2,
mean RT Block4 - mean RT Block3, mean RT Block5 - mean RT Block4,
mean RT Block6 - mean RT Block5, mean RT Block7 - mean RT Block6,
mean RT Block8 - mean RT Block7).

An independent samples t-test (1-tailed, alpha = .05) was used to test whether the concrete group displayed a greater mean change in RT across blocks relative to the abstract group. Next, to test whether the concrete group was quicker to settle on a consistent preference, we computed a linear contrast using the same equation, but with mean switches per block instead of mean RT. Again, an independent samples t-test (1-tailed, alpha = .05) was used to test whether the concrete group displayed a greater mean change in the number of switches across blocks relative to the abstract group.

Results

Randomization Check and Manipulation Checks

There was no significant difference between groups by age ($t(255) = -.655$, $p = .513$), handedness ($\chi^2(2) = 4.12$, $p = .127$), ethnicity ($\chi^2(6) = 4.15$, $p = .657$), or sex ($\chi^2(2) = 1.99$, $p = .369$). Thus, the randomization of participants to conditions appears to have been successful. Regarding the manipulation check, participants in the abstract group ($M = 11.62$, $SD = 2.36$) selected significantly more why-focused (abstract) answers than did participants in the concrete group ($M = 9.25$, $SD = 2.68$), $t(256) = 7.61$, $p < .001$, $d = .473$. Thus, the experimental manipulation appears to have been successful. Furthermore, as expected, participants' average response time decreased across blocks (see Table 1). The mean change in reaction time across blocks ($M = -177.17$, $SD = 111.83$) was significantly different from zero, ($t(257) = 25.45$, $p < .001$). Consistent with the pilot studies, then, these findings suggest that the experimental task was successful at creating the intended response-time speedup.

Response Times across Blocks

The concrete group displayed a numerically greater speed-up in response times across blocks ($M = -185.94$, $SD = 121.05$) than did the abstract group ($M = -169.39$, $SD = 101.48$), but this difference did not reach statistical significance, $t(256) = -1.26$, $p = .104$, $d = -.078$.

Switches across Blocks

The concrete group ($M = .127$, $SD = 1.60$) showed a numerically greater change in the number of switches across blocks than the abstract group (M = .034, SD = 1.41), but this difference did not reach significance, $t(256)$ = .50, p = .311, d = .031.

Responses to the Task

A MANOVA revealed that there was no difference between experimental groups in terms of task difficulty or engagement, no difference in terms of how well they thought they performed, and no difference in affect (univariate tests: Fs(1, 255) = .06 - 2.70, ps = .172 -.777).

Bayesian Analyses

To complement the planned hypothesis testing, a series of Bayesian independent samples t-tests were conducted using JASP (JASP Team, 2016). Given the null results, Bayes Factors (BF) can help quantify the extent to which the data favor the null hypothesis relative to the alternative hypothesis. According to Wetzels and Wagenmakers (2012), a BF of 1 - 3, 3 - 10, 10 - 30, 30 - 100, and 100 or greater are considered to be weak, substantial, strong, very strong, and decisive evidence, respectively. For the difference in the speedup of response times between groups, there was a numerically greater BF for the null (BF_{01} = 1.94) than for the research hypothesis (BF_{10} = .517), although the evidence in favor of the null over the research is considered weak according to the above-stated conventions. Regarding the difference in the switch rate between groups, the evidence in favor of the null was strong (BF_{01} = 10.356), whereas the evidence in favor of the research hypothesis was very weak (BF_{10} = .097). Finally, further confirming the effect of the manipulation check, there is decisive evidence that the manipulation induced differences in concrete vs. abstract thinking between the two groups (BF_{10} = 2.39^10).

Discussion

Although participants in the concrete group displayed a numerically faster speedup of responses than did participants in the abstract group, the difference between groups was not statistically significant. Furthermore, contrary to expectations, participants in the concrete group were not quicker to settle on a consistent preference than were participants in the abstract group. The addition of Bayesian independent samples t-tests helped to confirm that there was strong evidence in favor of the null hypothesis for the switch-rate prediction and weak evidence in favor of the null for the response-time prediction. Null results sometimes may be difficult to interpret. However, the results of the manipulation check suggest that the experimental manipulation was successful in this study[2], thereby suggesting that the present results cannot be accounted for by a weak experimental manipulation. Furthermore, given that the experiment had a relatively large sample size, we propose that the present results cannot be accounted for by weak statistical power. Taken together, these findings suggest that if construal level impacts the speed at which repeated judgments become automatic, it is likely a very small effect.

Although historically repetition has been viewed as a critical component of automaticity, there remains some debate around this assumption. For example, in a seminal debate, Fazio (1986) proposed that attitudes guide behavior automatically when people have a strong, pre-existing attitude to draw upon, developed through many repeated exposures to an attitude object. Alternatively, Bargh, Chaiken, Govender, and Pratto (1992) argued that automatic evaluation is more general and unconditional. More recently, in light of failures to replicate social priming effects (e.g., Doyen, Klein, Simons, & Cleemans, 2014), there has been an increased interest in the extent to which the automatic activation of attitudes depends upon the strength of the association between attitude objects (i.e., whether people have developed strong associations

[2] Indeed, this is the first pre-registered evidence of which we are aware of the effectiveness of an abstract vs. concrete mindset manipulation on general level of construal (as assessed on items in the manipulation check that were different in content from those included in the manipulations).

through repeated exposures; Salomon & Kraus, 2015). The present lack of evidence that construal level moderates the development of automaticity leaves repetition itself as the single well-understood determinant of automaticity.

Conclusion

Building on previous studies highlighting the importance of sensitivity to environmental cues in developing cue-response associations, we reasoned that concrete vs. abstract thinking was a viable moderator of the development of automaticity. The present findings contribute to the extant literature, then, by providing new evidence that people's general construal levels (i.e., focusing on the concrete how-aspects vs. the abstract why-aspects) do not appear to impact the speed at which repeated behaviors become automatic. Given that many of one's daily actions are guided by automatic behavioral tendencies (Wood, Quinn, & Kashy, 2002), including a number of behaviors with important health implications (Brug, de Vet, de Nooijer, & Verplanken, 2006; Gardner, de Bruijn, & Lally, 2012; Orbell & Verplanken, 2010), understanding the conditions that give rise to automaticity is of notable practical importance. By drawing further attention to the lack of knowledge about why automaticity varies across situations and individuals, we hope that the present findings will encourage future research elucidating the conditions that give rise to automaticity.

References

Aarts, H., Dijksterhuis, A., & Midden, C. (1999). To plan or not to plan? Goal achievement or interrupting the performance of mundane behaviors. *European Journal of Social Psychology, 29*, 971–979.

Balota, D. A., Yap, M. J., Hutchison, K. A., Cortese, M. J., Kessler, B., Loftis, B., ... & Treiman, R. (2007). The English lexicon project. *Behavior Research Methods*, *39*, 445-459.

Bargh, J. A., Chaiken, S., Govender, R., & Pratto, F. (1992). The generality of the automatic attitude activation effect. *Journal of Personality and Social Psychology*, *62*, 893-912.

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: the self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry*, *25*, 49-59.

Brug, J., de Vet, E., de Nooijer, J., & Verplanken, B. (2006). Predicting fruit consumption: cognitions, intention, and habits. *Journal of Nutrition Education and Behavior*, *38*, 73-81. doi: 10.1016/j.jneb.2005.11.027

Crossman, E. R. F. W. (1959). A theory of the acquisition of speed–skill. *Ergonomics*, *2*, 153-166.

Devine, P. G., & Sharp, L. B. (2009). Automaticity and control in stereotyping and prejudice. In T.D. Nelson (Ed). *Handbook of Prejudice, Stereotyping, and Discrimination*, (pp. 61–87). New York, NY: Psychology Press

Doyen, S., Klein, O., Simons, D. J., & Cleeremans, A. (2014). On the other side of the mirror: Priming in cognitive and social psychology. *Social Cognition*, *32*, 43-63.

Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C, & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology*, *50*, 229-238.

Freitas, A., Gollwitzer, P., & Trope, Y. (2004). The influence of abstract and concrete mindsets on anticipating and guiding others' self-regulatory efforts. *Journal of Experimental Social Psychology*, *40*, 739-752. doi: 10.1016/j.jesp.2004.04.003

Fujita, K., Trope, Y., Liberman, N., & Levin-Sagi, M. (2006b). Construal levels and self-control. *Journal of Personality and Social Psychology*, *90*, 351-367. doi: 10.1037/0022-3514.90.3.351

Fukukura, J., Ferguson, M. J., & Fujita, K. (2013). Psychological distance can improve decision making under information overload via gist memory. *Journal of Experimental Psychology: General*, *142*(3), 658-665. doi: 10.1037/a0030730

Gardner, B., de Bruijn, G. J., & Lally, P. (2012). Habit, identity, and repetitive action: A prospective study of binge- drinking in UK students. *British Journal of Health Psychology*, *17*, 565-581. doi: 10.1111/j.2044-8287.2011.02056.x

Gollwitzer, P. M. (1990). Action phases and mind-sets. In E. T. Higgins & R. M. Sorrentino (Eds.), *Handbook of motivation and cognition* (Vol. 2, pp. 53-92). New York: Guilford Press.

Gollwitzer, P. M. (1999). Implementation intentions: strong effects of simple plans. *American Psychologist*, *54*(7), 493-503. doi: 10.1037/0003-066X.54.7.493

Gollwitzer, P. M., & Schaal, B. (1998). Meta-cognition in action: The importance of implementation intentions. Personality and Social Psychology Review, 2, 124–136. doi: 10.1207/s15327957pspr0202_5

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta- analysis of effects and processes. *Advances in Experimental Social Psychology*, *38*, 69-119.

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: attitudes, self-esteem, and stereotypes. *Psychological Review*, 102, 4-27. doi: 10.1037/0033-

Hagger, M. S., Rebar, A. L., Mullan, B., Lipp, O. V., & Chatzisarantis, N. L. (2015). The subjective experience of habit captured by self-report indexes may lead to inaccuracies in the measurement of habitual action. *Health Psychology Review*, *9*, 296-302.

Heckhausen, H., & Gollwitzer, P. M. (1987). Thought contents and cognitive functioning in motivational versus volitional states of mind. *Motivation and Emotion, 11*, 101-120. doi: 10.1007/BF00992338

JASP Team. (2016). JASP (Version 0.7.0.0) [Computer software]. Retrieved from https://jasp-tats.org/

Lally, P., Van Jaarsveld, C. H., Potts, H. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*, *40*, 998-1009. doi: 10.1002/ejsp.674

Libby, L. K., Shaeffer, E. M., & Eibach, R. P. (2009). Seeing meaning in action: a bidirectional link between visual perspective and action identification level. *Journal of Experimental Psychology: General*, 138, 503-516.

Liberman, N., & Trope, Y. (1998). The role of feasibility and desirability considerations in near and distant future decisions: A test of temporal construal theory. *Journal of Personality and Social Psychology*, *75*(1), 5-18. doi: 10.1037/0022-3514.75.1.5

Liberman, N., Sagristano, M., & Trope, Y. (2002). The effect of temporal distance on level of mental construal. *Journal of Experimental Social Psychology*, *38*, 523-534. doi: 10.1016/S0022-1031(02)00535-8

Logan, G. D. (1988). Toward an instance theory of automatization. *Psychological Review*, *95*, 492-527. doi: 10.1037/0033-295X.95.4.492

Logan, G. D. (1992). Shapes of reaction-time distributions and shapes of learning curves: a test of the instance theory of automaticity. Journal of Experimental Psychology: Learning, Memory, and Cognition, *18*, 883-914.

Mc Culloch, K. C., Ferguson, M. J., Kawada, C. C., & Bargh, J. A. (2008). Taking a closer look: On the operation of nonconscious impression formation.*Journal of Experimental Social Psychology*, *44*(3), 614-623.

Neal D.T., Wood W., Labrecque J.S., Lally P. (2012) How do habits guide behavior? Perceived and actual triggers of habits in daily life. *Journal of Experimental Social Psychology*, *48*, 492–498.

Newell, A., & Rosenbloom, P. S. (1981). Mechanisms of skill acquisition and the law of practice. In J.R. Anderson (Ed.), *Cognitive Skills and their Acquisition* (pp 1-55). Hillside, NJ: Erlbaum.

Orbell, S., & Verplanken, B. (2010). The automatic component of habit in health behavior: habit as cue-contingent automaticity. *Health Psychology*, *29*, 374-383. 10.1037/a0019596

Pirolli, P. L., & Anderson, J. R. (1985). The role of practice in fact retrieval. *Journal of*

Experimental Psychology: Learning, Memory, & Cognition, *11*, 136-153

Salomon, E., & Kraus, M. (2015). *Priming effects rely on strong concept associations*. Poster presented at the 16th Annual Meeting for the Society for Personality and Social Psychology, Long Beach, CA.

Trope, Y. & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, *117*, 440-463. doi: 10.1037/a0018963

Vallacher, R., & Wegner, D. (1989). Levels of personal agency: Individual variation in action I dentification. *Journal of Personality and Social Psychology*, *57*, 660e671. doi: 10.1037/0022-3514.57.4.660.

Verplanken, B., & Orbell, S. (2003). Reflections on Past Behavior: A SelfReport Index of Habit Strength. *Journal of Applied Social Psychology*, *33*(6), 1313-1330. doi: 10.1111/j.1559-1816.2003.tb01951.x

Webb, T., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin, 132,* 249–268. doi:10.1037/0033-2909 .132.2.249

Wetzels, R., & Wagenmakers, E. J. (2012). A default Bayesian hypothesis test for correlations and partial correlations. *Psychonomic Bulletin & Review*, *19*(6), 1057-1064. doi: 10.3758/s13423-012-0295-x

Wieber, F., Sezer, L. A., & Gollwitzer, P. M. (2014). Asking "why" helps action control by goals but not plans. *Motivation and Emotion*, *38*(1), 65-78. doi: 10.1007/s11031-013-9364-3

Wood, W., Quinn, J. M., & Kashy, D. A. (2002). Habits in everyday life: thought, emotion, and action. *Journal of Personality and Social Psychology*, *83*, 1281-1297. doi: 10.1037/0022-3514.83.6.1281

Table 1. *Response times by block.*

	M	*SD*
Block 1	2235.40	842.96
Block 2	1625.63	590.64
Block 3	1384.78	526.00
Block 4	1244.91	470.18
Block 5	1186.88	484.02
Block 6	1097.28	461.81
Block 7	1021.74	425.55
Block 8	989.69	399.28