Social Cognition, Vol. 32, Special Issue, 2014, pp. 109–123

UNDERSTANDING PRIME-TO-BEHAVIOR EFFECTS: INSIGHTS FROM THE ACTIVE-SELF ACCOUNT

S. Christian Wheeler
Stanford University

Kenneth G. DeMarree
University at Buffalo, SUNY

Richard E. Petty
Ohio State University

In this paper, we provide a brief review of prime-to-behavior effects and discuss our theoretical model for such effects: the Active-Self Account. We also address recent discussions in the literature regarding the replicability of prime-to-behavior effects and outline features that can affect their existence and the likelihood of detecting such effects experimentally.

Behavioral priming refers to the phenomenon whereby exposure to a stimulus (e.g., a word or picture) or set of stimuli (e.g., sentences to unscramble) activates a concept, which in turn influences a subsequent behavioral response without awareness of the links among these elements. Put another way, priming can create a readiness to respond in particular ways without intention or awareness by the prime recipient. Researchers have known about priming effects for decades. Lashley (1951) first used the term "priming" to describe response preparedness in intentional serial behavioral sequences. Segal and Cofer (1960) were the first to demonstrate the sort of passive priming more typical of modern social psychological priming research, whereby simple exposure to a stimulus increases its use in subsequent contexts. Specifically, they showed that exposure to words in one task increased their usage in a subsequent free-association task. Primes can have effects beyond the activated construct itself, however. Constructs, when activated, can increase the accessibility of other constructs linked in memory. For example, people are quicker to identify whether a letter string is a word or not when they have previously been exposed to a semantically related word (e.g., Meyer and Sch-

Address correspondence to S. Christian Wheeler, 655 Knight Way, Stanford, CA 94305-7298; E-mail: christian.wheeler@stanford.edu.

vaneveldt, 1971). Constructs can be mentally linked in many different ways, such as through prior co-activation or even by sharing the same valence. For example, activated constructs can increase the speed with which people evaluate targets that are evaluated similarly, because exposure to an evaluative prime increases the accessibility of other similarly valenced targets (e.g., Fazio et al., 1986).

That primes can increase the accessibility of the constructs to which they refer as well as to other linked constructs in memory is beyond doubt. However, a more recent class of findings, prime-to-behavior effects, has generated more controversy. Prime-to-behavior effects refer to the phenomenon whereby primed constructs (e.g., the "elderly") affect observable behavior (e.g., walking speed). To the extent that one's active mental contents influence behavior, it should obviously be the case that primes, by affecting one's active mental contents, could also affect behavior. This effect is the focus of the present paper. Naturally, behavioral effects that are more causally distal from the prime should be more difficult to predict and obtain than more proximal effects, such as simple response facilitation. As one moves further downstream, the number of moderators and intervening processes can proliferate rapidly. A difficulty of prediction or obtaining an effect should not be confused with a lack of influence, however. In fact, behavioral priming effects can sometimes be larger than semantic priming effects, because they can activate downstream constructs (e.g., goals) that can have powerful and persistent effects on behavior. Because any one prime can activate a diversity of initial concepts, related concepts, and associated behaviors, any one study may not capture the predicted chain of events. Nonetheless, there are such a large number of reported prime-to-behavior effects in the literature from such a diverse array of scholars that their existence seems assured (see Dijksterhuis & Bargh, 2001; Loersch & Payne, 2011, 2014, this issue; Wheeler, DeMarree, & Petty, 2005, 2007, for reviews).

Our own work on priming has been focused on examining how and when primed constructs affect behavior (i.e., on what mechanisms are involved in prime-to-behavior effects and under what circumstances they operate). Early accounts of prime-to-behavior effects proposed relatively direct paths between construct activation and behavioral output. For example, the ideomotor account suggested that primed stereotypes automatically activate associated behavioral representations without any intervening processes. A similar but slightly more complex account, the auto-motive model (e.g., Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trötschel, 2001), suggested that primes directly activate motivational representations, which in turn activate relevant behavioral routines to accomplish the goal.

Our own framework, the Active-Self Account (Wheeler et al., 2005; 2007), takes a different approach. This account builds on previous findings showing that primes can both selectively activate mental contents and be used to disambiguate perceptual targets (e.g., Higgins, Rholes, & Jones, 1977). According to the Active-Self Account, primes can increase the accessibility of primed and associated constructs, which in turn can shift the active self-concept. Put simply, primed constructs and their activated associates can be viewed as self-relevant, as applying to oneself or one's ongoing reactions, and these perceptions can in turn affect the behavior that subsequently occurs. Although the framework acknowledges that primes can also affect other constructs (e.g., one's interpretation of the environment or other people when those concepts are salient; Wheeler & Petty, 2001; Wheeler, DeMarree, & Petty, 2007), because the self is an available and ambiguous entity in many situations, it often absorbs the impact of the prime (see Loersch & Payne, 2011,

2014, this issue; Smeesters, Wheeler, & Kay, 2010; Wheeler & DeMarree, 2009, for further discussion). Below, we review the basic features of the Active-Self Account and some illustrative findings in support of those features. A full description of the model and review of the relevant literature is beyond the scope of this paper, but for other, more comprehensive reviews, see Wheeler and colleagues (2005; 2007) and Smeesters and colleagues (2010).

PRIMES CAN AFFECT THE ACTIVE SELF-CONCEPT

The Active-Self Account parallels prior theory about the self-concept in distinguishing between chronic and temporarily active self-concept contents (e.g., Markus & Kunda, 1986). The chronic self-concept refers to those characteristics of the self that reside in long-term memory, including self-knowledge, goals, beliefs, values, and the like (Markus & Wurf, 1987). It is called the chronic self-concept because it contains long-term content chronically available for activation. As noted above, not all content in memory is likely to be applied to judgment or action at any given moment. The content that is most accessible, all things being equal, is more likely to be applied. The active contents of the (perceived) self-concept are more likely to affect judgment and behavior than those contents that are not active. Because priming affects the accessibility of information, it should be capable of affecting which information is in the active self-concept, insofar as the active self-concept is malleable. Extensive research supports the notion that contextual factors can affect the active contents of the self-concept (DeSteno & Salovey, 1997; McConnell, 2011).

Considerable research also shows that very subtle influences such as primed concepts, even when subliminally activated, can affect one's active self-concept. Primed constructs such as meanness, helpfulness, and dishonesty affect one's self-views just as much as one's views of another target (Skowronski, Sedikides, Heider, Wood, & Scherer, 2010). Primes of thin or overweight people affect prime recipients' body image (Kawakami et al., 2012). And primes can affect not just one's perceived traits or characteristics, but also other prime-consistent content, such as feelings of luck (DeMarree, Wheeler, & Petty, 2005; Jiang, Cho, and Adaval, 2009), aggressiveness (DeMarree et al., 2005), or self-efficacy (Hansen & Wänke, 2009), as well as attitudes toward stereotype-relevant attitude-objects (Kawakami, Dovidio, & Dijksterhuis, 2003; Steele & Ambady, 2006). Interestingly, components of the active self-concept can be highly accessible, yet reside out of consciousness (e.g., in the case of implicit self-concept shifts). As a result, primes can potentially affect behavior via the active self-concept without awareness on the part of the prime recipient (see Wheeler et al., 2007, for more discussion).

Notably, primes can lead to both prime-congruent and prime-incongruent changes in the self-concept. For example, in accord with various theories of assimilation and contrast (e.g., Markman & McMullen, 2003; Mussweiler, 2003), exposure to a "smart" stereotype, such as the professor stereotype, increases the accessibility of "intelligent" in the active self-concept, whereas exposure to a more extreme "smart" exemplar, such as Einstein, increases the accessibility of "unintelligent" in the active self-concept (e.g., Dijksterhuis et al., 1998). Papers reporting both self-concept and behavioral shifts show congruent movement between the two (e.g., Dijksterhuis et al., 1998; Hundhammer & Mussweiler, 2012; Lebouf & Es-

tes, 2004; Schubert & Häfner, 2003; Wheeler, DeMarree, & Petty, 2008; Wyer, Mazzoni, Perfect, Calvini, Neilens, 2010). That is, the prime's effect on the self-concept in one study parallels the prime's effect on behavior in other studies.

Several papers have tested self-concept and behavioral shifts within the same studies and found that primes' effects on behavior can be mediated by changes in the active self-concept. For example, young people primed with the elderly stereotype perceive themselves as more elderly stereotypic, walk more slowly, and exhibit poorer memory performance (Wyer, Neilens, Perfect, & Mazzoni, 2011). Further, self-perceptions of being like an elderly person mediated the behavioral effects. In a conceptually parallel finding, those primed with the cheerleader stereotype performed worse on an analytic test to the extent that the prime lowered self-views of intelligence (Galinsky, Wang, & Ku, 2008; for additional examples, see Hansen & Wänke, 2009; Jiang, et al., 2009; Pfeffer & Devoe, 2009). Although it is possible that behavioral shifts could occur in directions opposite to those of the active self-concept (e.g., when one successfully counteracts an undesired self-concept shift), the published effects to date have all shown active self-concept/behavior congruence, regardless of the consistency between the prime and the active self-concept shifts. These data are highly consistent with the Active-Self Account.

The reader may question how the self-concept could be involved in behavioral priming effects given that outgroup stereotypes have also been shown to affect behavior. Despite an outgroup stereotype being clearly inapplicable to a prime recipient in an objective sense (e.g., a young person is not elderly), much of the specific content of the stereotype can overlap with the self. For example, most European Americans have some degree of aggressive self-concept content, even though this content is a component of the African-American stereotype, and most young people are slow (elderly stereotype) on some occasions. As a result, outgroup stereotype primes can affect one's active self-concept by activating a biased subset of self-concept content (e.g., DeMarree et al., 2005; Wyer et al., 2011), what we call the biased activation account (Wheeler et al., 2007). Additionally, it is possible that non-self-relevant prime content could infiltrate the active self-concept. The boundaries between the self and non-self are nebulous. People are notoriously bad at identifying the sources of their own thoughts and feelings (e.g., Nisbett & Wilson, 1977), and they have limited access to their own inner states (Bem, 1967; Wilson, 2002). As a result, they could sometimes use primed constructs to disambiguate their current self-views, feelings, and attitudes, much like they use primed mental contents to disambiguate their reactions to others (e.g., Higgins et al, 1977; Srull & Wyer, 1979), what we call the expansion account (Wheeler et al., 2007). This need not be a conscious process of attribution, however. Rather, primed content could automatically be included in the construction of the active self-concept, as proposed by connectionist theories (e.g., Smith, 1996). For more on these two means of affecting the active self-concept, see discussion of the biased activation and expansion accounts in Wheeler and colleagues (2007).

MODERATORS OF PRIME-TO-BEHAVIOR EFFECTS

Many moderators of prime-to-behavior effects have been shown in the literature. A strength of the Active-Self Account is that it can make sense of these many moderators by relating those moderators to their effects on the active self-concept. A

comprehensive review of these moderators is beyond the scope of this brief paper, but below, we review some of the more prominent moderation findings and show how they relate to the Active-Self Account.

Determining the Extent of Assimilation. Many prime-to-behavior effects reported in the literature are assimilation effects. That is, the prime leads behavior to be more similar to that implied by the primed content. A number of moderators determine the *extent* of assimilation that occurs. According to the active-self account, one way to understand these moderators of extent is to understand how those moderators relate to the extent of active self-concept change. Specifically, features that affect the extent to which primes can shift the active self-concept should likewise affect the magnitude of prime-to-behavior effects. Indeed, as noted earlier, a number of studies have shown that the degree of self-concept change mediates the impact of a prime on behavior change. In addition to these mediational studies, a number of other findings in the literature support the active-self account.

First, those with prime-relevant self-concept inconsistencies show larger priming effects on behavior. For example, people who believe they have both African-American stereotype-consistent (e.g., lazy) and stereotype-inconsistent (e.g., industrious) attributes subsequently express more stereotype-consistent attitudes (e.g., supporting affirmative action) following an African-American stereotype prime (DeMarree, Morrison, Wheeler, & Petty, 2011). Similarly, those made self-uncertain also show larger priming effects on the self-concept (Morrison, Johnson, & Wheeler, 2012). Presumably, ambiguities in the self-concept render it more subject to construction and, hence, make the prime more influential in guiding behavior.

Second, individual differences in the way primed content is processed can also moderate the extent of prime-to-behavior effects. Private self-consciousness can either increase or decrease prime-to-behavior effects, depending on which facet of self-consciousness (self-reflectiveness or internal state awareness) is dominant in that context (see Dijksterhuis & van Knippenberg, 2000; Hull, Slone, Meteyer, & Matthews, 2002). Specifically, self-reflectiveness, which is associated with self-relevant processing directed towards obtaining self-understanding, magnifies prime-to-behavior effects (Wheeler, Morrison, DeMarree, & Petty, 2008). This is because processing primed content in self-relevant ways increases prime-to-behavior effects (e.g., Hull et al., 2002; Wheeler, Jarvis, & Petty, 2001). Internal state awareness, which by contrast is associated with greater awareness of one's internal states and resistance of the self-concept to change, reduces prime-to-behavior effects (Wheeler et al., 2008).

Low self-monitors show larger prime-induced shifts in the active self-concept and behavior than do high self-monitors (DeMarree, Wheeler, & Petty, 2005). Low and high self-monitors do not appear to differ in their access to their actual internal states, but low self-monitors are more *responsive* to information believed to be diagnostic of them (e.g., Fiske & von Hendy, 1992). Hence, subtle primes are more likely to shift the active self-concepts of low self-monitors because they are perceived as self-relevant. Additionally, because low self-monitors act consistently with their internal states and use them to guide behavior, these shifts in the active self-concept are more likely to be reflected in resulting behavior.

Last, actively relating primed content to the self can increase priming effects on the active self-concept and behavior. For example, taking the perspective of an

elderly person, as opposed to remaining objective, makes participants walk more slowly and act more conservatively, consistent with the elderly stereotype (Ku, Wang, & Galinsky, 2010). Writing about an African American from the first-person perspective (vs. third-person perspective) makes one perform more poorly on a math test (Wheeler, Jarvis, & Petty, 2001).

In summary, structural features and processing orientations that make the active self-concept susceptible to change increase the magnitude of prime-to-behavior effects. Additionally, those most likely to act consistently with their active self-concepts exhibit the largest prime-to-behavior effects. These findings point to the key role of the active self-concept in determining the effects of primes on behavior.

Determining Assimilation versus Contrast. Initially, most of the prime-to-behavior effects published in the literature were assimilation effects. Now, however, a large number of contrast effects, whereby primes lead to more prime-*inconsistent* behavior, have been shown. Contrast effects are difficult for many models of prime-to-behavior effects to explain, and those that do predict contrast effects do not generally handle the wide variety of known contrast effects very well.

According to the active-self account, primed constructs can cause contrast in behavior due to the activation of contrasting content in the self-concept. For example, as noted above, exposure to a "smart" stereotype, such as the professor stereotype, increases the accessibility of "intelligent" in the active self-concept, whereas exposure to a more extreme "smart" exemplar, such as Einstein, increases the accessibility of "unintelligent" in the active self-concept (e.g., Dijksterhuis et al., 1998). The latter effect occurs because "Einstein" is more concrete and/or discrepant from the self than "professor" (Mussweiler, 2003). Features of the prime that make it likely to be viewed as a discrepant comparison standard increase the likelihood of contrast (Sherif, Taub, & Hovland, 1958). Similarly, a processing orientation that promotes looking for dissimilarities (Mussweiler, 2003) or evaluating oneself against a comparison standard (Markman & McMullen, 2003) increase the likelihood of contrast in self-perceptions.

These well-established social comparison phenomena are borne out in prime-to-behavior effects as well, supporting the role of the active self-concept in such phenomena. For example, salience of one's self-identity (Schubert & Häfner, 2003) or one's group-identity (Spears, Gordijn, Dijksterhuis, & Stapel, 2004) can foster viewing oneself as distinct from outgroup primes and hence lead to contrast in behavior. Identifying strongly with the ingroup leads to the same effects (Hall & Crisp, 2008). Similarly, disliking (Cesario, Plaks, & Higgins, 2006) and feeling distant from outgroups (Ledgerwood & Chaiken, 2007) promote contrast from outgroup primes. Independence (Bry, Follenfant, & Meyer, 2008) and dissimilarity (Haddock, Macrae, & Fleck, 2002) mindsets, both of which emphasize differences from others, do the same. These findings are remarkably consistent in showing that features that emphasize oneself as distinct, distant, or different from prime content facilitate contrast in the active self-concept and in behavior. Without understanding how the moderating variables affect the direction of active self-concept change, one would be ill equipped to predict most of these effects.

OTHER MECHANISMS FOR PRIME-TO-BEHAVIOR EFFECTS

The active-self account is a perception-based account in that primes are proposed to bias the prime recipient's ongoing conception or construal of him- or herself in the moment. As we and others have written elsewhere (e.g., Loersch & Payne, 2011, 2014, this issue; Smeesters et al., 2010; Wheeler & DeMarree, 2009; Wheeler & Petty, 2001), other types of perceptions, such as construals of the situation or of others, can sometimes be biased by primes, particularly when they are ambiguous to the perceiver and are the focus of the perceiver's attention. Shifts in perceptions of these other targets should follow the same basic principles as shifts in the perceptions of the self, and they could occur through both the biased activation and expansion model mechanisms described above. For example, a prime could bias the specific subset of chronically available information about a situation or another person that is currently accessible. Similarly, the representation of a situation or another person could be expanded to include content activated by the prime. Nonetheless, given the chronic availability of self-related content and the importance of self-related thoughts in directing behavior, regardless of the situation, we believe that the active-self account can hold explanatory power in a wide variety of contexts.

REPLICABILITY OF PRIMING EFFECTS

Recently, the replicability of prime-to-behavior effects has come under question (e.g., Shanks et al., 2013), though priming effects are not alone in receiving such scrutiny (see e.g., opensciceframework.org; psychfiledrawer.org), and concerns even extend to presumably more established areas, such as medical research (Ioannidis, 2005). Why are priming effects sometimes difficult to reproduce? Like many other effects in social psychology and other fields, there are a number of potential reasons. First, as discussed above with respect to prime-to behavior effects, there are many moderators that have been established. With so many moderators, it is now clear that behavioral priming effects are most likely to occur under specific conditions or among specific people, and this was not always clear from the initial research. That is, any initial study reporting an effect might have contained certain "background" conditions for the preponderance of the subjects (e.g., a focus on the self), whereas replication efforts might not, making them less likely to obtain the effect.

Although well-known papers have found main effects of primes on relevant outcomes (Bargh, Chen, & Burrows, 1996; Dijksterhuis & van Knippenberg, 1998), ignoring the studies that find moderation patterns (or just remembering the conditions under which significant effects emerged) might lead people to overestimate the generalizability of prime-to-behavior effects across all people and settings. Notably, many of the moderation studies do not find significant overall effects of the primes, instead finding effects only among some subset of the sample or under certain conditions. Ignoring potential moderating factors will make it more difficult to detect effects.

Further, many factors can intervene to limit prime-to-behavior effects. For example, even those who would otherwise be affected by a prime may not be so if

their current motivations or concerns do not align with the primed concepts (e.g., Loersch, Durso, & Petty, 2013; Macrae & Johnston, 1998; Strahan, Spencer, & Zanna, 2002). Additionally, if people lack confidence in their thoughts (such as if they are feeling low in power or are depressed), primes will fail to affect behavior even when they do affect the prime-recipient's thoughts (e.g., DeMarree et al., 2012; see Briñol & Petty, 2009, for a review). Of course, not all moderators are necessarily relevant to all studies, but researchers should do their best to identify the individual difference variables that are most relevant as well as the situational factors most likely to maximize the intended effects, and include these in their research.

In addition, it is important to pay attention to what the various moderators tell us about the conditions under which priming effects are likely to occur. Most notably, factors that influence people's explanations for the activated content are particularly important. As we have noted, one key reason that a prime can influence a person's judgment is because a behaviorally relevant perceptual target (such as the self) is mistakenly seen as the source of a primed concept (e.g., Wheeler et al., 2007; Wheeler & DeMarree, 2009; see also Loersch & Payne, 2011, 2014, this issue). Classic research on attribution as well as contemporary work in social cognition more generally (Higgins, 1996) has identified ambiguity, applicability, and salience as key factors that drive such attributions.

So, if factors such as self-ambiguity or self-focused attention are present, activated concepts may be used to disambiguate self-perceptions, resulting in self-concept assimilation (DeMarree et al., 2011; Wheeler, DeMarree et al., 2008; Wheeler, Morrison et al., 2008). These changed self-perceptions will then influence behavior to the extent that the self is relevant for and used to guide action. If, instead, there are salient and/or ambiguous social or situational targets available or salient in one's mind, activated concepts may be used to disambiguate these targets (e.g., DeMarree & Loersch, 2009; Kay, Wheeler, Bargh, & Ross, 2004; Loersch et al., 2013). However, if these targets are not relevant for behavior, no behavioral changes are expected (DeMarree & Loersch, 2009). Hence, primes may or may not affect behavior depending on the prime recipient's focus, the availability and ambiguity of a relevant perceptual target, and the relevance of that target for behavior.

This highlights several key implications for the replication of priming effects. Most critically, researchers should not assume that a given prime can only have one particular type of effect (Bargh et al., 2001; DeMarree & Loersch, 2009; Schwarz, 2004). Activating the concept of *competitive*, for example, could influence people's self-perceptions, their perceptions of another person, their perceptions of the situation, their goals, and so forth (Wheeler et al., 2007; Wheeler & DeMarree, 2009). Any number of features of the experimental setting or study materials could influence participants' explanations of the activated content. For example, if the experimenter remains visible to participants and behaves in a sufficiently ambiguous manner, he or she could be viewed as the source of the accessible competitive content. If the dependent measure in such a study were to involve the competitiveness of negotiation offers between two participants, the prime would be less likely to have a behavioral effect, as it would have been used to form an impression of the experimenter whose competitiveness may have been seen as irrelevant to participants' behavior. That is, a null effect on the intended dependent measure is not necessarily a sign that the prime did not affect participants' judgments or behavior in any way.

Interestingly, in a complex social world, one implication is that a diversity of potential effects of an activated concept can emerge. Several factors (e.g., a person's focus of attention, the availability of ambiguous self-conceptions, social targets, or situational factors) can determine the target to which this activated concept is attributed, and the relevance of that target for action will determine whether the effects are entirely cognitive (e.g., seeing a passerby as more intelligent) or if they have implications for one's own behavior (e.g., deciding not to compete with a debate partner who is seen as more intelligent).

With this in mind, it becomes critical to carefully manage the experimental situation. Indeed, the social psychology laboratory is desirable as a context in which a researcher can gain control over many irrelevant features of the situation and maximize the chances that the independent variable will have the intended effect. Researchers should take care to make sure that the intended judgment target is salient to people. This can be done, in part, by limiting their interactions with other people (unless the other people are the intended target) during the study (Wyer et al., 2011). Just as researchers typically select contexts and participants that will maximize demonstration of an effect if it exists, a careful experimenter will also choose dependent measures that are likely to be influenced by the prime *given the experimental context*. For example, if the lab setup is such that participants will always be able to see the experimenter, researchers could consider using primed constructs and dependent measures that are relevant to people's perceptions of the experimenter.

In addition to the above reasons, which are derived from our theoretical perspective on prime-to-behavior effects, there are a number of very general methodological considerations that researchers should keep in mind when attempting to replicate *any* research finding. Ideally, all study materials should be pretested to determine their suitability for the target population and situation. Each participant pool, experimental context, mode of study delivery, and so forth can have different characteristics which might make study materials more or less likely to work in a given setting. Our presumption here is that most experimental social psychology research is driven by showing the relationship among conceptual variables (e.g., primes of various sorts can influence behavior of various sorts) as well as mediators and moderators of those relationships. Such research is not generally aimed at testing hypotheses about how large such effects are. Stated differently, independent and dependent variables are deliberately chosen to maximize the chances of showing an effect and are not chosen to represent the pool of exemplars that could or do represent these variables in the real world.

Thus, on the independent variable side of the study, the prime induction should be pretested to determine whether it leads to an increase in accessibility of the intended construct (e.g., using a lexical decision task following the prime induction) and that the induction is not too blatant. If a prime is too blatant and people identify its true source and attempt to correct for it (Wegener & Petty, 1997), priming effects can be eliminated or even reversed (Loersch & Payne, 2012; Mussweiler & Neumann, 2000; Strack, Schwarz, Bless, Kubler, & Wänke, 1993). In addition, sample differences, such as in people's motivation to think carefully (in general or about the experiment), could lead participants to be more likely to identify and correct for a potential biasing agent such as a prime (Petty, DeMarree, Briñol, Horcajo, & Strathman, 2008). Finally, variation in the racial, ethnic, age, or gender composition of a given university or national sample could cause the same prime

induction to produce differing degrees of concept activation or even to the activation of different content (e.g., if different participant populations have different prime associations; Wheeler & Berger, 2007).

On the dependent variable side of the study, it is of central importance to make sure that the dependent variable is likely to be sensitive to any prime-induced effects. The dispersion of participants' responses to the dependent variable should be examined. If participants' responses are very uniform or are subject to ceiling or floor effects, then the dependent variable is less likely to be affected by a prime. For example, if a researcher at a junior college attempts to replicate an intelligence priming effect initially observed at an Ivy League institution, using the original dependent measure might not be appropriate, as floor effects might likely occur. Instead, researchers should endeavor to create a dependent variable that has similar properties *in the population* to the original study materials (e.g., if participants in the initial study answered 60% of trivia questions correctly with a standard deviation of 15%, researchers should attempt to develop a measure with a similar distribution).

Of course, characteristics of the population are important to consider, but even seemingly irrelevant characteristics of the setting might also matter. It is important to consider that just as primes or other independent variables can have many outcomes other than the intended one, so too are dependent variables influenced by many factors other than the intended one. For example, the length of a hallway or the average time or distance between classes at a particular university could affect the speed at which students walk down the hallway after an experiment. Thus, even if two samples have the same average walking speed and variance, it could be that in one sample 70% of the walking speed is determined by the short time and long distance between classes but in another sample these factors account for only 50% of the variance, leaving more to be affected by a prime. Although it is likely impossible to determine all of the relevant factors that might influence the presence or magnitude of a priming effect in a given context, careful construction of an experimental setting, accompanied by open-minded consideration of possible influences should a failure to replicate emerge, could help not only explain a successful or unsuccessful study, but also lend additional insight into the nature of prime-to-behavior effects.

Together, these considerations suggest that replications of priming studies might at best hope to replicate the direction of an effect (or effects) observed in an original study, but not the effect size. In fact, because of the considerations above, effect sizes are likely to be considerably smaller even in so-called "exact" replications. This is because even a replication study using the same independent variable (IV) (e.g., unscrambling sentences about the elderly) and the same dependent variable (DV) (e.g., walking speed) as an original study, though using the exact same materials, cannot be exact in its other features (the participants, the time, the background features of the experimental context, the meaning of the IV in the participants' minds, other possibly unique influences on the DV, etc.). These uncontrolled extraneous factors that likely enhanced the effect size in an original study, if not present in the replication study, will lead to a smaller effect, thus requiring a larger sample to produce a significant result. Researchers finding non-significant results in the same direction as the original result could test whether the addition of their studies in a meta-analysis enhances or diminishes the likelihood that an initial effect was reliable.

Because the purpose of much social psychological research is theory testing rather than application, priming researchers should be encouraged if their direction of effects replicates in new populations and settings. It should not be too surprising (or discouraging) if effect sizes do not generalize (Petty & Cacioppo, 1996). This is not to say that prime-to-behavior effects have no practical utility. Rather, it means that when one wishes to use primes to influence behavior for a particular group in a particular domain, the same kind of pretesting that occurred for the original study should begin anew to determine how the independent and dependent variables need to be modified for the particular purpose of interest. Ultimately, however, as a basic science, social psychologists are often interested in *how* and *why* various factors influence people's judgments and behavior. Priming is one tool that psychologists can use to investigate these questions, and the exploration of these questions should not be limited to a specific experimental paradigm. Researchers may want to find procedures that work in their experimental context, and then use those procedures to further probe the nature of human thought and behavior.

CONCLUSION

At first glance, prime-to-behavior effects may seem incredible. How could something as simple as exposure to mere words affect one's overt behavior? Much of our work in this domain has been aimed at taking something that appears magical and revealing that it actually has a rather mundane mechanism. That primes can affect one's mental processes is beyond question at this point. That one's mental processes can drive behavior seems similarly so. Through understanding these linkages more fully, one can better isolate when and how primes will affect behavior and see that sometimes ordinary processes can have surprising consequences.

REFERENCES

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology, 71*, 230-240. doi:10.1037/0022-3514.71.2.230

Bargh, J. A., Gollwitzer, P. M., Lee-Chai, A., Barndollar, K., & Trötschel, R. (2001). The automated will: Nonconscious activation and pursuit of behavioral goals. *Journal of Personality and Social Psychology, 81*, 1014-1027. doi:10.1037/0022-3514.81.6.1014

Bem, D. J. (1967). Self-Perception: An alternative interpretation of cognitive dissonance phenomena. *Psychological Review*, *74*(3), 183-200. doi:10.1037/h0024835

Briñol, P., & Petty, R. E. (2009). Persuasion: Insights from the self-validation hypothesis. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 41, pp. 69-118). New York: Elsevier.

Bry, C., Follenfant, A., & Meyer, T. (2008). Blonde like me: When self-construals moderate stereotype priming effects on intellectual performance. *Journal of Experimental Social Psychology*, *44*(3), 751-757. doi:10.1016/j.jesp.2007.06.005

Cesario, J., Plaks, J. E., & Higgins, E. T. (2006). Automatic social behavior as motivated preparation to interact. *Journal of Personality and Social Psychology*, *90*(6), 893-910. doi:10.1037/0022-3514.90.6.893

DeMarree, K. G., & Loersch, C. (2009). Who am I and who are you? Priming and the

influence of self versus other focused attention. *Journal of Experimental Social Psychology, 45*, 440-443. doi:10.1016/j.jesp.2008.10.009

DeMarree, K. G., Loersch, C., Briñol, P., Petty, R. E., Payne, B. K., & Rucker, D. D. (2012). From primed construct to motivated behavior: Validity perceptions in automatic goal pursuit. *Personality and Social Psychology Bulletin, 38*, 1659-1670. doi: 10.1177/0146167212458328

DeMarree, K. G., Morrison, K. R., Wheeler, S. C., & Petty, R. E. (2011). Self-ambivalence and resistance to subtle self-change attempts. *Personality and Social Psychology Bulletin, 37*, 674-686. doi:10.1177/0146167211400097

DeMarree, K. G., Wheeler, S. C., & Petty, R. E. (2005). Priming a new identity: Self-monitoring moderates the effects of nonself primes on self-judgments and behavior. *Journal of Personality and Social Psychology, 89*, 657-671. doi:10.1037/0022-3514.89.5.657

DeSteno, D., & Salovey, P. (1997). Structural dynamism in the concept of self: A flexible model for a malleable concept. *Review of General Psychology, 1*, 389-409. doi: 10.1037/1089-2680.1.4.389

Dijksterhuis, A., & Bargh, J. A. (2001). The perception-behavior expressway: Automatic effects of social perception on social behavior. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 33, pp. 1-40). San Diego, CA: Academic Press. doi:10.1016/S0065-2601(01)80003-4

Dijksterhuis, A., & Van Knippenberg, A. (2000). Behavioral indecision: Effects of self-focus on automatic behavior. *Social Cognition*, *18*(1), 55-74. doi:10.1521/soco.2000.18.1.55

Dijksterhuis, A., & van Knippenberg, A. (1998). The relation between perception and behavior, or how to win a game of Trivial Pursuit. *Journal of Personality and Social Psychology, 74*, 865-877. doi:10.1037/0022-3514.74.4.865

Dijksterhuis, A., Spears, R., Postmes, T., Stapel, D., Koomen, W., Knippenberg, A. V., & Scheepers, D. (1998). Seeing one thing and doing another: Contrast effects in automatic behavior. *Journal of Personality and Social Psychology*, *75*(4), 862-871. doi:10.1037/0022-3514.75.4.862

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. doi:10.1037/0022-3514.50.2.229

Fiske, S. T., & von Hendy, H. M. (1992). Personality feedback and situational norms can control stereotyping processes. *Journal of Personality and Social Psychology, 62*(4), 577-596.

Galinsky, A. D., Wang, C. S., & Ku, G. (2008). Perspective-takers behave more stereotypically. *Journal of Personality and Social Psychology*, *95*(2), 404–419. doi:10.1037/0022-3514.95.2.404

Haddock, G., Macrae, C. N., & Fleck, S. (2002). Syrian science and smart supermodels: On the when and how of perception-behavior effects. *Social Cognition*, *20*(6), 461-479. doi:10.1521/soco.20.6.461.22976

Hall, N. R., & Crisp, R. J. (2008). Assimilation and contrast to group primes: The moderating role of ingroup identification. *Journal of Experimental Social Psychology*, *44*(2), 344-353. doi:10.1016/j.jesp.2007.07.007

Hansen, J., & Wänke, M. (2009). Think of capable others and you can make it! Self-efficacy mediates the effect of stereotype activation on behavior. *Social Cognition, 27*, 76-88. doi: 10.1521/soco.2009.27.1.76

Higgins, E. T. (1996). Knowledge activation: Accessibility, applicability, and salience. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 133-168). New York: Guilford.

Higgins, T. E., Rholes, W. S., & Jones, C. R. (1977). Category accessibility and impression formation. *Journal of Experimental Social Psychology*, *13*(2), 141-154.

Hull, J. G., Slone, L. B., Meteyer, K. B., & Matthews, A. R. (2002). The nonconsciousness of self-consciousness. *Journal of Personality and Social Psychology*, *83*(2), 406-424. doi:10.1037/0022-3514.83.2.406

Hundhammer, T., & Mussweiler, T. (2012). How sex puts you in gendered shoes: Sexuality-priming leads to gender-based self-perception and behavior. *Journal of Personality and Social Psychology*, *103*(1), 176-193. doi:10.1037/a0028121

Ioannidis, J. P. A. (2005). Why most published research findings are false. *PLoS Med, 2*, e124. doi: 10.1371/journal.pmed.002012

Jiang, Y., Cho, A., & Adaval, R. (2009). The unique consequences of feeling lucky: Implications for consumer behavior. *Journal of Consumer Psychology*, *19*(2), 171-184. doi:10.1016/j.jcps.2009.02.010

Kawakami, K., Dovidio, J. F., & Dijksterhuis, A. (2003). Effect of social category priming on personal attitudes. *Psychological Science*, *14*(4), 315-319.

Kawakami, K., Phills, C. E., Greenwald, A. G., Simard, D., Pontiero, J., Brnjas, A., et al. (2012). In perfect harmony: Synchronizing the self to activated social categories. *Journal of Personality and Social Psychology*, *102*(3), 562–575. doi:10.1037/a0025970

Kay, A. C., Wheeler, S. C., Bargh, J. A., & Ross, L. (2004). Material priming: The influence of mundane physical objects on situational construal and competitive behavioral choice. *Organizational Behavior and Human Decision Processes, 95*, 83-96. doi:10.1016/j.obhdp.2004.06.003

Kay, A. C., Wheeler, S. C., & Smeesters, D. (2008). The situated person: Effects of construct accessibility on situation construals and interpersonal perception. *Journal of Experimental Social Psychology, 44*, 275-291. doi:10.1016/j.jesp.2007.05.005

Ku, G., Wang, C. S., & Galinsky, A. D. (2010). Perception through a perspective-taking lens: Differential effects on judgment and behavior. *Journal of Experimental Social Psychology, 46,* 792-798. doi: 10.1016/j.jesp.2010.04.001

Lashley, K. S. (1951). The problem of serial order in behavior. In L. A. Jeffress (Ed.), *Cerebral mechanisms in behavior: The Hixon symposium* (pp. 112-136). New York: Wiley.

LeBoeuf, R. A., & Estes, Z. (2004). "Fortunately, I'm no Einstein": Comparison relevance as a determinant of behavioral assimilation and contrast. *Social Cognition*, *22*(6), 607-636. doi:10.1521/soco.22.6.607.54817

Ledgerwood, A., & Chaiken, S. (2007). Priming us and them: Automatic assimilation and contrast in group attitudes. *Journal of Personality and Social Psychology*, *93*(6), 940-956. doi:10.1037/0022-3514.93.6.940

Loersch, C., Durso, G. R. O., & Petty, R. E. (2013). Vicissitudes of desire: A matching mechanism for subliminal persuasion. *Social Psychological and Personality Science*, *4*, 624-631.

Loersch, C., & Payne, B. K. (2011). The situated inference model: An integrative account of the effects of primes on perception, behavior, and motivation *Perspectives on Psychological Science, 6*, 234-252. doi:10.1177/1745691611406921

Loersch, C., & Payne, B. K. (2012). On mental contamination: The role of (mis)attribution in behavior priming. *Social Cognition, 30*, 241-252.

Macrae, C. N., & Johnston, L. (1998). Help, I need somebody: Automatic action and inaction. *Social Cognition, 16*, 400-417.

Markman, K. D., & McMullen, M. N. (2003). A reflection and evaluation model of comparative thinking. *Personality and Social Psychology Review*, *7*(3), 244-267. doi:10.1207/S15327957PSPR0703_04

Markus, H., & Kunda, Z. (1986). Stability and malleability of the self-concept. *Journal of Personality and Social Psychology*, *51*(4), 858-866. doi:10.1037/0022-3514.51.4.858

Markus, H. R., & Wurf, E. (1987). The dynamic self-concept: A social psychological perspective. *Annual Review of Psychology, 38*, 299-337. doi: 10.1146/annurev.ps.38.020187.001503

McConnell, A. R. (2011). The Multiple Self-Aspects Framework: Self-concept representation and its implications. *Personality and Social Psychology Review, 15*, 3–27. doi:10.1177/10888.

Meyer, D. E., & Schvaneveldt, R. W. (1971). Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. *Journal of Experimental Psychology*, *90*(2), 227-234. doi:10.1037/h0031564

Morrison, K. R., Johnson, C. S., & Wheeler, S. C. (2012). Not all selves feel the same certainty: Assimilation to primes among individualists and collectivists. *Social Psychological and Personality Science, 3*(1), 118-126. doi:10.1177/1948550611411310

Mussweiler, T. (2003). Comparison processes in social judgment: Mechanisms and consequences. *Psychological Review*,

110(3), 472-489. doi:10.1037/0033-295X.110.3.472

Mussweiler, T., & Neumann, R. (2000). Sources of mental contamination: Comparing the effects of self-generated versus externally provided primes. *Journal of Experimental Social Psychology, 36*, 194-206. doi:10.1006/jesp.1999.1415

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, *84*(3), 231-259. doi:10.1037/0033-295X.84.3.231

Petty, R. E., & Cacioppo, J. T. (1996). Addressing disturbing and disturbed consumer behavior: Is it necessary to change the way we conduct behavioral science? *Journal of Marketing Research, 33*, 1-8.

Petty, R. E., DeMarree, K. G., Briñol, P., Horcajo, J., & Strathman, A. J. (2008). Need for cognition can magnify or attenuate priming effects in social judgment. *Personality and Social Psychology Bulletin, 34*, 900-912. doi:10.1177/0146167208316692

Pfeffer, J., & DeVoe, S. E. (2009). Economic evaluation: The effect of money and economics on attitudes about volunteering. *Journal of Economic Psychology*, *30*(3), 500-508. doi:10.1016/j.joep.2008.08.006

Schubert, T. W., & Häfner, M. (2003). Contrast from social stereotypes in automatic behavior. *Journal of Experimental Social Psychology*, *39*(6), 577-584. doi:10.1016/S0022-1031(03)00034-9

Schwarz, N. (2004). Metacognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology, 14*, 332-348.

Segal, S. J., & Cofer, C. N. (1960). The effect of recency and recall on word association. *American Psychologist*, *15*, 451.

Shanks, D. R., Newell, B. R., Lee, E. H., Balakrishnan, D., Ekelund, L., Cenac, Z., et al. (J. Daunizeau, Ed.). (2013). Priming intelligent behavior: An elusive phenomenon. *PLOS ONE*, *8*(4), e56515. doi:10.1371/journal.pone.0056515.s001

Sherif, M., Taub, D., & Hovland, C. I. (1958). Assimilation and contrast effects of anchoring stimuli on judgments. *Journal of Experimental Psychology, 55*(2), 150-155. doi:10.1037/h0048784

Skowronski, J. J., Sedikides, C., Heider, J. D., Wood, S. E., & Scherer, C. R. (2010). On the road to self-perception: Interpretation of self-behaviors can be altered by priming. *Journal of Personality*, *78*(1), 361-391. doi:10.1111/j.1467-6494.2009.00619.x

Smeesters, D., Wheeler, S. C., & Kay, A. C. (2010). Indirect prime-to-behavior effects. In M. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 42, pp. 259-317). New York: Elsevier. doi:10.1016/S0065-2601(10)42005-5

Smith, E. R. (1996). What do connectionism and social psychology offer each other? *Journal of Personality and Social Psychology*, *70*(5), 893-912. doi:10.1037/0022-3514.70.5.893

Spears, R., Gordijn, E., Dijksterhuis, A., & Stapel, D. A. (2004). Reaction in action: Intergroup contrast in automatic behavior. *Personality and Social Psychology Bulletin*, *30*(5), 605-616. doi:10.1177/0146167203262087

Srull, T. K., & Wyer, R. S. (1979). The role of category accessibility in the interpretation of information about persons: Some determinants and implications. *Journal of Personality and Social Psychology*, *37*(10), 1660-1672. doi:10.1037/0022-3514.37.10.1660

Steele, J. R., & Ambady, N. (2006). "Math is Hard!" The effect of gender priming on women's attitudes. *Journal of Experimental Social Psychology*, *42*(4), 428-436. doi:10.1016/j.jesp.2005.06.003

Strack, F., Schwarz, N., Bless, H., Kubler, A., & Wänke, M. (1993). Awareness of the influence as a determinant of assimilation versus contrast. *European Journal of Social Psychology, 23*, 53-62.

Strahan, E. J., Spencer, S. J., & Zanna, M. P. (2002). Subliminal priming and persuasion: Striking while the iron is hot. *Journal of Experimental Social Psychology, 38*, 556-568. doi: 10.1016/S0022-1031(02)00502-4

Wegener, D. T., & Petty, R. E. (1997). The flexible correction model: The role of naive theories of bias in bias correction. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol., 29, pp. 141-208). San Diego, CA: Academic Press.

Wheeler, S. C., & Berger, J. (2007). When the same prime leads to different effects. *Journal of Consumer Research, 34*, 357-368.

Wheeler, S. C., & DeMarree, K. G. (2009). Multiple mechanisms of prime-to-behavior

effects. *Social and Personality Psychology Compass*, *3*(4), 566-581. doi:10.1111/j.1751-9004.2009.00187.x

Wheeler, S. C., & Petty, R. E. (2001). The effects of stereotype activation on behavior: A review of possible mechanisms. *Psychological Bulletin*, *127*(6), 797-826. doi:10.1037/0033-2909.127.6.797

Wheeler, S. C., DeMarree, K. G., & Petty, R. E. (2005). The roles of the self in priming-to-behavior effects. In A. Tesser, J. V. Wood, & D. A. Stapel (Eds.), *On building, defending, and regulating the self: A psychological perspective* (pp. 245-271). New York: Psychology Press.

Wheeler, S. C., DeMarree, K. G., & Petty, R. E. (2007). Understanding the role of the self in prime-to-behavior effects: The active-self account. *Personality and Social Psychology Review*, *11*(3), 234-261. doi:10.1177/1088868307302223

Wheeler, S. C., DeMarree, K. G., & Petty, R. E. (2008). A match made in the laboratory: Persuasion and matches to primed traits and stereotypes. *Journal of Experimental Social Psychology, 44*, 1035-1047. doi:10.1016/j.jesp.2008.03.007

Wheeler, S. C., Jarvis, W. B. G., & Petty, R. E. (2001). Think unto others: The self-destructive impact of negative racial stereotypes. *Journal of Experimental Social Psychology*, *37*(2), 173-180. doi:10.1006/jesp.2000.1448

Wheeler, S. C., Morrison, K. R., DeMarree, K. G., & Petty, R. E. (2008). Does self-consciousness increase or decrease priming effects? It depends. *Journal of Experimental Social Psychology, 44*, 882-889. doi:10.1016/j.jesp.2007.09.002

Wilson, T. D. (2002). *Strangers to ourselves*. Cambridge, MA: Harvard University Press.

Wyer, N. A., Mazzoni, G., Perfect, T. J., Calvini, G., & Neilens, H. L. (2010). When not thinking leads to being and doing. *Social Psychological and Personality Science*, *1*(2), 152-159.

Wyer, N. A., Neilens, H., Perfect, T. J., & Mazzoni, G. (2011). Automatic and ironic behavior are both mediated by changes in the self-concept. *Journal of Experimental Social Psychology, 47*, 1300-1303. doi:10.1016/j.jesp.2011.05.008

Wyer, N. A., Perfect, T. J., Neilens, H., Mazzoni, G., & Roper, J. (2011). With or without you: Determinants of postsuppression behavior. *Social Psychological and Personality Science, 2*, 272-276. doi:10.1177/1948550610389081