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## Priming Effects on Behavior and Priming Behavioral Concepts: A Commentary on Sherman and Rivers (2020)

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Several failures to replicate underpowered priming studies conducted by social psychologists in the 2000s have been used to argue that priming effects on behavior cannot be reproduced (Harris, Coburn, Rohrer, & Pashler, 2013; Shanks et al., 2013). Exchanges surrounding these arguments have often been heated and aggressive, with frequent innuendo if not direct attacks on the integrity of social psychologists or the value of the field of social psychology. These exchanges have generally not resulted in a conversation that moves the field forward. In particular, these exchanges have failed to disentangle problems with the theory about the processes of priming from problems with the data from problems with the handful of studies chosen for replication. Sherman and Rivers (this issue) bring much-needed clarity to this picture. They begin with questioning the nomenclature and then discuss the likely reasons why certain effects do not reproduce. Implied in their analysis is the notion that the conversation surrounding priming effects on behavior has created and stereotyped a new, derogatory category of research labeled “social priming.” This caricature has been compounded by a narrow selection of the evidence that “social priming” encompasses and inflexibility in the methods to better understand the phenomena. Rather than considering a population of effects produced across methods, populations, and times, the prescribed method to settle the debate has been to replicate well-cited “social priming” work and a selection of papers published in *Psychological Science* or the *Journal of Personality and Social Psychology* in 2008.

Sherman and Rivers (this issue) tell us why “social priming” is a misnomer. They find clear examples of so-called “social priming” that are not social (e.g., Bargh, Chen, & Burrows, 1996), as well as clear examples of social effects that are not labeled “social priming” (e.g., Fazio, Jackson, Dunton, & Williams, 1995; Payne, 2001). They also tell us that the social nature (or label) of the category cannot be the reason why certain priming studies have not reproduced and highlight more plausible reasons why they do not: their low power and reliance on between-subjects design.

Sherman and Rivers’ (this issue) article makes at least two important contributions. First, proper conceptual and operational definitions of variables and effects ought to be at the foundation of any scientific field, including meta-science. Assessing the state of the evidence for an effect requires

knowing what studies comprise that evidence. Which studies will help us to determine if a social prime, like the picture of a group, influences perceptions, judgments, or behaviors? Which studies should we consider to determine if a prime can influence behavior? What theory explains the effect of interest, and how is the validity of that theory assessed?

A second key contribution of Sherman and Rivers’ (this issue) article is calling attention to the social processes surrounding the difficulties reproducing priming and any other effects in science. Clearly, many of the researchers involved in discussions about reproducibility have gotten carried away and many have engaged in *ad hominem* attacks that should have been avoided. However, Sherman and Rivers’ analysis sheds light on the possibility that the social and communicative strategy of labeling the phenomenon by using the name of the field of social psychology was damaging. In this article, we contribute to this important debate by expressing our agreement with Sherman and Rivers, proposing a set of labels that helps to characterize the phenomenon, discussing the importance of theory in moving the field forward, and closing with a historic interpretation of the sense of distrust that has permeated the social interactions about the reproducibility of priming.

### Social Priming, Behavioral Priming, and Priming of Behavioral Concepts Versus Ideas

With respect to the term “social priming,” we wholeheartedly agree that it is neither an appropriate label for the phenomenon nor an existing keyword in the literature. With respect to the term “behavioral priming,” we note that, according to PsycInfo, it has been used 119 times but only 9 of those entries correspond to social psychology. One of us (Albarracín) has used the term as an abbreviated way of referring to what was described as the effect of primes on behaviors in a meta-analysis published in 2016 (Weingarten et al., 2016). More importantly, we have wrestled with the need to separate the behavioral and nonbehavioral nature of the dependent measure from the behavioral and nonbehavioral nature of the prime itself. In our minds, retaining and refining some combination of “behavioral” and “priming” is useful.

New attention to scientific terminology often sheds light on phenomena that we have ignored. We have distinguished

primes that denote *behavioral concepts* from primes that evoke broader *ideas* (Dai et al., 2020). *Priming behavioral concepts* involves introducing stimuli, often verbal, that denote a behavior or a goal, thus providing clear behavioral guidance for an upcoming task (Dai et al., 2020). For example, Bargh et al. (1996) introduced the concept *rude* with adverbs like *impolitely* and *bluntly*. As another example, Albarracín et al. (2008) introduced the concept *action* with words like *doing*, *engage*, and *go* and the concept *inaction* with words like *pause*, *freeze*, and *stop*. In contrast to priming behavioral concepts, *priming general ideas* involves introducing stimuli that are not closely connected to a behavior or goal. For example, Shariff and Norenzayan (2007) primed *God* with words like *spirit* and *divine*, and Vohs, Mead, and Goode (2006) primed the concept *money* with words like *salary* and *dollar*. Whereas *bluntly* and *doing* are likely to have implications for a clearly defined task in an experimental context, the concepts of *God* and *money* are not.

Up to this point, the priming of behavioral concepts or general ideas has not been distinguished theoretically. However, we (Dai et al., 2020) recently meta-analyzed priming effects on behavior and made predictions about these two types of primes. Our results suggest that priming behavioral concepts elicits goal mediated effects, a mechanism not present for priming ideas. Thus, Sherman and Rivers are correct that the labels are not trivial and that understanding a phenomenon requires tracing its boundaries. Greater granularity in our predictions gives way to new predictions.

### Synthesizing Research Requires Estimating Effects Broadly, Beyond Limited Labels and Research Groups

Best practices in research synthesis entail performing a complete and unbiased survey of a literature (Albarracín et al., 2018; Albarracín, 2015; Borenstein, Hedges, Higgins, & Rothstein, 2009). Meta-analysts, for example, are advised against selecting studies based on a limited set of keywords, labels, outlets, countries, or authors, precisely because it is necessary to ensure good coverage of the literature. Characterizing a scientific effect involves finding *all studies* about a problem and ensuring unbiased and broad searches of the literature. Unbiased searches typically require going beyond a single keyword to incorporate all keywords that may have been used to archive reports, often reviewing citations and consulting with experts on ways to track elusive literatures that have evolved organically without a clear or homogeneous terminology. From this standpoint, characterizing a phenomenon like priming on the basis of a handful of papers in which researchers used a word search task to introduce the primes and then observed walking behavior or intellectual performance is severely limiting. A small handful of studies will not represent the broad priming population.

Best practices to synthesize the effects of priming require finding all studies testing the effects of social primes or the effects of primes on behavior, depending on researchers' interests. Research syntheses are never restricted to a

research group, nor are they typically used to attack authors, universities, or fields of research. One exception would be synthesizing an effect that has been studied by a single research team, but such syntheses are rarely of interest to the scientific community. Another exception is study-level meta-analysis in which authors simply summarize their findings to estimate effect sizes from a series of studies.

Consider how the “social priming” replication strategies deviate from research synthesis practices. Old (e.g., from 2008), single studies are selected based on unclear criteria and slated for replication. The researchers conducting the replication do not take the time to ensure that the primes will have effects on the population under study. Null results from these replications are then used to declare “social priming” or “behavioral priming” as a whole irreproducible. Against this backdrop, a well-conducted research synthesis seems like a necessity.

### Findings From Meta-Analysis

The largest available synthesis of the effects of priming on behavior was published by Weingarten et al. in 2016. A random-effects meta-analysis showed a  $d = 0.352$ . Granted, the effect is not large: It corresponds to  $r = .173$  and OR (Odds Ratio) = 1.894. This magnitude of effect implies that in the contrived situation of a lab, a participant exposed to a prime is close to twice as likely to perform a behavior than a participant not exposed to the prime. The variability of the effect was  $I^2 = 62.5\%$ , and the distribution of effects suggested mild publication bias (Weingarten et al., 2016b). However, no correction for bias eliminated the priming effect and the meta-analysis included an unprecedented high proportion of unpublished studies (Weingarten et al., 2016b).

The 0.352 priming effect on behavior is comparable to many other effects in psychology. For example, we can compare this effect with various meta-syntheses summarizing multiple meta-analyses of behavioral and clinical interventions. A meta-meta-analysis of behavioral interventions yielded  $d = 0.21$  and  $I^2 = 93\%$  (Johnson, Scott-Sheldon, & Carey, 2010). A meta-meta-analysis of the effects of parent-based interventions for the treatment of children’s externalizing behavior showed  $d = 0.46$  and  $I^2 = 85\%$  (Mingebach, Kamp-Becker, Christiansen, & Weber, 2018). A meta-meta-analysis of the effect of physical activity on anxiety and depression in nonclinical populations produced  $d = -0.50$ ,  $I^2 = 4\%$  (Rebar et al., 2015). In this context,  $d = 0.352$  seems credible.

Alternatively, we can compare the results from Weingarten et al.’s meta-analysis with meta-analyses of other effects studied with experimental paradigms in the laboratory. The effect size for disruptions of memory for an ongoing task when people are preoccupied with a prospective intention is  $d = .51$ ,  $I^2 = 87\%$  (Anderson, Strube, & McDaniel, 2019). The greater accuracy of delaying judgments of learning relative to making them immediately after the presentation of stimuli is  $d = 0.93$ ,  $I^2 = 81\%$  (Rhodes & Tauber, 2011). The effect of presenting misinformation tabula rasa on attitudes and beliefs is  $d = 3.08$ ,  $I^2 = 99\%$

(Chan, Jones, Hall Jamieson, & Albarracín, 2017). The effect of debunking this misinformation is  $d = 0.68$ ,  $I^2 = 98\%$  (Chan et al., 2017). The delayed effect of a message that has initially been discounted is  $d = 0.29$ ,  $I^2 = 26\%$  (Kumkale & Albarracín, 2004). In this context,  $d = 0.352$  seems reasonable and modest.

The conclusion from this comparison is that the results from the meta-analysis by Weingarten et al. (2016b) can then be placed in the context of other psychological effects. The  $d$  for the effect of priming on behavior does not appear to be particularly anomalous in either magnitude or variability. The effect is not strikingly different from either the effects of behavioral and clinical interventions or the effects in other types of laboratory experiments in cognitive or social psychology.

Weingarten et al.'s meta-analysis also contributed to pinpoint the theoretical mechanisms of the effect. If goals are responsible for all or at least some priming effects, then goal theory should inform the conditions for the effect. Accordingly, higher goal value (Förster, Liberman, & Higgins, 2005), higher goal expectancy (Locke & Latham, 2002), and lack of opportunity for goal satisfaction (Bargh, Lee-Chai, Barndollar, Gollwitzer, & Trötschel, 2001) should each produce greater motivation and therefore stronger effects on behavior. Consistent with these possibilities, the more valued a goal was, the stronger the priming effects on behaviors (Weingarten et al., 2016b). The lesser the opportunity for goal satisfaction, the stronger the priming effects on behavior (Weingarten et al., 2016b). More recently, Chen, Latham, Piccolo, and Itzchakov (2021) found similar evidence of goal activation in their own meta-analysis, which was circumscribed to priming performance and work related behavior. Specifically, the priming effect was stronger when the delay between the prime and the behavior was longer, presumably because delays heighten the tension and thus the motivation to fulfill the goal (Bargh & Gollwitzer, 1994; Bargh et al., 2001).

## A Process Model of Priming

A great call made by Sherman and Rivers (this issue) is for the field to shift its energy from debating the reliability of specific effects as tested in specific papers with specific methods at specific time points to building general theories about the mechanisms and moderators of priming. There is nothing mysterious about priming. Any concept that is "top of the head" has the potential to drive information processing and ultimately decisions and behaviors. Theories about goal activation and perception-behavior effects (Albarracín, 2020; Bargh et al., 2001; Weingarten et al., 2016a, 2016b) are already available to understand the possible effects of a prime. However, before going into the influence of a prime, activation of the right concept must be ensured. For example, Albarracín et al. (2008) used word completion as a method to study the possible activation of general goals of action and inaction, which were hypothesized to control a variety of behaviors. In this work, they first validated the priming methods with a LDT (Lexical Decision Task)

administered to undergraduate students in Gainesville Florida in 2006. This validation study showed that the presentation of the action words used in the word completion task activated action concepts and deactivated inaction concepts, whereas the opposite was the case for inaction concepts (Albarracín et al., 2008). Recent replications in the context of Many Labs 4 did not perform this validation even though 13 years had passed since the original study had been conducted in a specific place. However, the team in charge of the effort needed a validation that could be easily performed at the same time as the replication (Albarracín, 2016). Unfortunately, the validation they used in lieu of the LDT failed to show that the right concepts were activated.

Assuming that the right concept is activated, the prime can have a myriad influences. Primes may influence behavior directly when a behavior is simple and automatic enough to follow the prime as behaviors initiated automatically in response to conditioning (Albarracín, 2020). Primes may also evoke goals (Bargh et al., 2001), which assume valuing the goal and perceiving the behavior as fitting the goal (Aarts & Dijksterhuis, 2003; Hart & Albarracín, 2009). Primes may affect emotions, our understanding of the experimental situation, our attitudes toward the experimenter, and the perceived meaning of our own behavior. As Sherman and Rivers mentioned, the psychological mechanisms underlying priming effects are also likely to vary temporally, thus suggesting that we need to understand both upstream and downstream processes.

Still looking upstream but following the necessary conceptual activation, whether primes ultimately influence emotion, goals, or behaviors depends on the processing goal of a participant at a time (Loersch & Payne, 2011; Lohmann, Jones, & Albarracín, 2019) and which mental contents in working memory provide a context for the prime at a particular time (Albarracín, Noguchi, & Fischler, 2011; Albarracín, Hart, & McCulloch, 2006; Albarracín, Noguchi, & Earl, 2006; Senay, Albarracín, & Noguchi, 2010). That is, words and other stimuli become part of our stream of thoughts, and, in part due to the order in which they appear, create propositions in the form of attitudes, intentions, or beliefs (Albarracín et al., 2011; Albarracín, Hart, et al., 2006; Albarracín, Noguchi, et al., 2006; Senay et al., 2010). For example, the string of words "Will I" correspond to a question, whereas the string of words "I will" corresponds to an assertion. Accordingly, being primed with "Will I" has been shown to produce different effects on performance than has being primed with "I Will" (Dolcos & Albarracín, 2014). In other studies, participants who had played turns of a mixed-motive game were less cooperative after an explicit propositional suggestion that they *had been nice* in prior turns but were more cooperative after the suggestion that they *should be nice* in upcoming turns (Albarracín et al., 2011). More importantly, participants who had played turns of a mixed-motive game were also less cooperative after being primed with the string *nice act*, implying that actors respond to the implicit suggestion that they *had been sufficiently nice* already (Albarracín et al., 2011). In contrast, participants were more cooperative after

being primed with the string *act nice*, implying that actors respond to the implicit suggestion that *they should try to be nicer* in upcoming turns (Albarracín et al., 2011). In other words, primes acquire meaning in a particular mental context that is not easy to calibrate and reproduce.

Looking downstream, there are additional complications for the behavioral effects of primes, particularly stemming from people's awareness of influence and the controllability of their behavior. It is well established that people who identify an external source of influence often attempt to counter its influence (Schwarz & Clore, 1983; Sparrow & Wegner, 2006). By the same token, people who become aware that they are being primed will try to counter this influence. If the prime is not subtle enough, or if psychology textbooks have been discussing priming effects for two decades, participants who can control their behavior are likely to attempt to do so. The success of those attempts will be greater when a single behavior is requested than when researchers use more difficult, event-level trials in which the behavior is fast, repetitive, and error-prone.

## The Social Context of the Social Priming Narrative

We thank Sherman and Rivers (this issue) for reminding us that the inability to reproduce priming effects from the 1990s and 2000s must be clearly differentiated from both fraud cases like Stapel and poorly conducted research. Even though the issue of reproducibility is often explicitly distinguished from both malfeasance and questionable research practices, the tone and rigid strategies designed to assess and improve reproducibility in psychology have sometimes been disappointing. Examples involve mocking and attacking colleagues on social media, as well as denying the validity of meta-analytic or experimental results that support priming.

However unfortunate, we believe that the social processes observed during the replication crisis are part of a Zeitgeist of distrust. Consider that Stapel's fraud was detected around 2010–2011, during some of the worst years of an international “housing bubble” and widespread use of dishonest lending practices in the United States. Seeing how the absence of checks and balances for subprime mortgages feeding a housing market that was too good to be true could have prepared (i.e., primed) the field to also detect inflation in our research results. But almost 10 years have gone by since Simmons, Nelson, and Simonsohn (2011) recommended changes to our research practices. These and many other changes have been implemented widely and fully, so what is the rationale for continuing to replicate studies published in 2008, before these practices were implemented and when the participants of the earlier studies lived in an entirely different world and provided data in entirely different experimental contexts? As a field, social psychology has championed all recommendations, and it continues to thrive and inspire new generations of psychologists and overwhelm admissions to social psychology graduate programs. Today then, the responsibility of research psychologists is to conduct and administer science and to implement all ethical standards. At the same time though, our responsibility is to

avoid cynicism while pursuing a positive impact on society in the years to come.

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