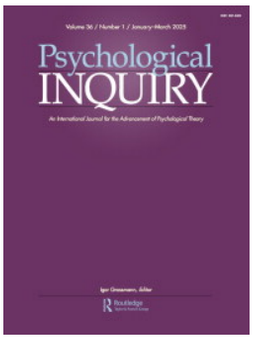

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REPLY

Beliefs and Belief-to-Behavior Inferences: Clarifications, Rebuttals, and Extensions

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The study of beliefs has always held an important place in the quest to understanding the mind and its operations. However, recent trends in the field—including increasing interest in the study of misinformation, conspiracy beliefs, and mindsets, among others—have placed an even greater emphasis in understanding the nature of beliefs. Although belief formation has received considerable treatment in the literature and yielded well-developed theoretical models (McGuire, 1982; Sloman & Lagnado, 2015; Tappin & Gadsby, 2019; Wyer & Hartwick, 1980), a general framework of the processes connecting beliefs to behavior has been noticeably absent. The primary purpose of our target article was to take an initial step toward introducing such a theoretical framework into the literature. We aimed to construct a framework that integrates a wide variety of domains in psychology, guided by our own social psychological lens. Our hope was to ignite a discussion about our proposed framework and belief-behavior correspondence more broadly, among a diverse group of psychologists. We are grateful to those who commented on our target article for highlighting additional supportive evidence, pointing to areas of contention, and allowing us to further develop our conceptualization. We organize our response to the commentaries in three sections. First, we provide clarifications regarding terminology and the perspective of the model on central issues. Next, we provide rebuttals to criticisms of the model. Lastly, we discuss extensions and crucial next steps to develop empirical tests of the phenomena at hand.

Clarifying Key Terms

Several commenters expressed a desire for greater elaboration on the definition of key constructs. For instance, Imhoff and Oeberst (this issue) noted that our manuscript defined beliefs and claimed a distinction between beliefs and attitudes "without further elaborating" (p. 36). Under the heading "Distinguishing Between Beliefs and Related Constructs," our target article defined attitudes as "evaluations of an entity as good or bad" and noted that the chief distinction between beliefs and attitudes is that "beliefs are not evaluative" (this issue, p. 4). Although our target article does touch on the difference between beliefs and attitudes, our treatment of the topic could have delved deeper into this crucial distinction. We define beliefs as a probability judgment that links a referent entity (e.g., person, place, object, or behavior) to an attribute or outcome (Albarracín, 2021; Eagly & Chaiken, 1998; Fishbein & Ajzen, 1975). We align ourselves with the dominant consensus in the field of social psychology by defining attitudes as summary evaluations of a referent entity as good or bad (Albarracín et al., 2005; Bizer et al., 2003; Fazio, 2007; Fishbein & Ajzen, 2010). To be clear, then, the chief distinction between beliefs and attitudes is that attitudes are fundamentally evaluative in nature—i.e., they place an object along a dimension that can be characterized as good-bad, favorable-unfavorable, etc. (Fishbein & Ajzen, 1975, 2010). In terms of the organization of these constructs, prominent theoretical models have conceptualized attitudes as being a function of people's beliefs regarding a target object (Anderson, 1971, 1973; Fishbein, 1963; Fishbein & Ajzen, 1975, 2010).

Further, Imhoff and Oeberst (this issue) questioned the utility of the taxonomy of beliefs proposed in the target article, but their complaint seems to arise from confusing beliefs with attitudes. By introducing an example cognition of "Japanese cars are good," Imhoff and Oeberst suggest that there is no difference between our proposed category of descriptive beliefs and attitudes and wonder why descriptive beliefs cannot concern evaluative qualities. We counter that "Japanese cars are good" is an attitude, not a descriptive belief, because the placement of an object along a positive-negative dimensions fits the consensus that evaluative judgments are attitudes.

Relatedly, Macnamara and Burgoyne (this issue) also call for greater specificity in defining what is meant by "behavior" in an effort to avoid conflation with related concepts like performance on a task. Accordingly, we wish to clarify that our theoretical framework conceptualizes behavior as outwardly observable acts like studying, attending an event, or taking a medication (Fishbein & Ajzen, 1975, 2010). Certainly, measuring performance (e.g., grades on a test) can be of great interest, but from the perspective of the

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model, such measures concern an outcome of behavioral performance rather than performance itself. We thank Macnamara and Burgoyne (this issue) for bringing awareness to this important issue and note that the conclusions drawn based on the review of meta-analyses in the target article remain substantively unchanged when removing work focused on mindsets and academic achievement.

In the target article, we use the term "belief-behavior correspondence" to refer to the degree to which beliefs predict their behavior. Imhoff and Oeberst (this issue) suggest that in "the attitude-behavior literature, correspondence refers to the question of whether attitude and behavior refer to the same target, same action, same context and same time" (p. 36). It is true that early writings on the topic used the term "correspondence" in this manner: "An attitudinal predictor is said to correspond to the behavioral criterion to the extent that the attitudinal entity is identical in all four elements with the behavioral entity" (Ajzen & Fishbein, 1977, p. 890). For at least a quarter century, however, the idea that there is a stronger relation between a predictor and a criterion when these measures are compatible in terms of specificity has been referred to as the *principle of compatibility* (Ajzen & Fishbein, 2000). In Fishbein and Ajzen (2010) book *Predicting and changing behavior: The reasoned action approach,* they described the idea in the following manner:

> According to the principle of compatibility (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), an intention is compatible with a behavior if both are measured at the same level of generality or specificity—that is, if the measure of intention involves exactly the same action, target, context, and time elements as the measure of behavior.

In sum, the contemporary term to describe this idea is *compatibility*. To avoid confusion and follow the tradition, we retain the use of the term "correspondence" for the degree to which there is a relation between beliefs and behavior and reserve the term "compatibility" for the match between predictor and criterion along the four key dimensions (action, target, context, and time).

Focusing on the proposed mechanism linking beliefs and behavior, Westaby et al. (this issue) suggested a lack clarity regarding the nature of practical reasoning and its relation to belief processing as outlined in Behavioral Reasoning Theory (Westaby, 2005; Westaby & Fishbein, 1996). We conceptualize practical reasoning as reasoning directed at arriving at behavioral decisions (Atkinson et al., 2006; Macagno et al., 2017). In Behavioral Reasoning Theory, people are believed to process their beliefs to arrive at reasons for and against a behavior. Importantly, "reasons more narrowly focus on the cognitions people use to *explain* [emphasis added] their behavior" (Westaby, 2005, p. 100). Future research should seek to conclusively disentangle practical reasoning from belief processing. In the meantime, we suggest that one potential distinction between practical reasoning and belief processing may be that practical reasoning involves syllogisms that initially link a belief to a behavior, leading to the formation of behavioral attitudes and intentions, after which reasons for and against a behavior can be conjured to rationalize the behavior.

Criticisms of the Model

Effect Size Benchmarks

Having discussed matters related to terminology, we wish to focus on the perspective of the model on higher-level issues related to belief-behavior correspondence. First, Imhoff and Oeberst (this issue) cast doubt on our characterization of the size of the relation between beliefs and behavior as small: "Interpreting these correlations would first require a benchmark of what we should expect was there a larger correspondence between beliefs and behavior." (p. 36). In the target article, we demonstrate that average belief-behavior correlations derived from meta-analyses often—although not always—fail to exceed the threshold set for medium correlations by established guidelines (Cohen, 1988; Funder & Ozer, 2019). That is, we indeed label the effect sizes in question against well-validated and commonly used benchmarks. With respect to the belief-behavior relation itself, Imhoff and Oeberst suggest that the single-observation nature of measures of behavior may translate to low reliability, thereby creating a low ceiling for belief-behavior relations. However, a comparison of the size of the relation between behavior and beliefs relative to other psychological constructs suggests that associations with behavior need not be small. For example, flu vaccination habit—operationalized as having a history of receiving the flu vaccine—strongly predicts flu vaccination during the current year ($OR = 11.0$, $r = .55$), while belief in misinformation that the flu shot causes the flu shows a weaker, albeit medium-sized, association with (OR = 0.31, r = −.30; Nowalk et al., 2010). Similarly, a review of meta-analyses involving behavior prediction by Albarracín et al. (2024) demonstrated that habits had stronger average associations with behavior ($OR = 6.17$, $r = .45$) than beliefs ($OR = 1.89$, $r = .17$). What these observations suggest is that although the nature of measuring behavior could limit the size of correlations of behavior in principle, the evidence does not support this as a problem undermining the conclusions of our review regarding the relation between beliefs and behavior.

Behavior is Multiply-Determined

One reason for the modest link between beliefs and behavior is that behavior is influenced by multiple factors. Several commenters suggested that the target article gave insufficient treatment to the idea that behavior is multiply-determined. For example, Sommer and Oktar (this issue) noted that "there are a host of other factors that may interrupt straightforward belief-behavior connections, many of which SA occasionally gesture at… [including] physiological needs (e.g., fatigue, hunger), psychological constraints (cognitive load), affective considerations (mood, emotions, evaluative attitudes), and perceived behavioral control." Similarly, Pierre (this issue) suggested that "[t]here is no doubt that much of our behavior occurs less due to conscious belief and intention than to both conscious and unconscious instinct, intuition, whim, reflex, and reaction." We wholeheartedly agree. The target article attempted to acknowledge this matter on page 2:

> A possible explanation for the discrepancy between the intuitive view and the evidence above may be researchers' tendency to ignore behavior determinants they are not considering. For instance, environmental factors and compliance with the requests of others often drive behavior.

Indeed, many individual-level factors including beliefs, emotions, attitudes, skills, and habits shape behavior to some extent. In fact, we would go beyond factors existing at the level of the individual mentioned by commenters to note that social and systemic factors like trust, incentives, sanctions, and access affect behavior to differing degrees (Albarracín et al., 2024). Along these lines, we argue against ascribing beliefs more behavioral influence than they have and bring data and theory to understand belief-behavior correspondence empirically.

In demonstrating that belief-behavior associations are small on average, however, we do not mean to suggest that beliefs are unimportant for understanding and studying behavior—a concern articulated by Ecker et al. (this issue). We are in agreement that beliefs can be powerful drivers of behavior, and are worthy of study in many contexts, including contexts in which the belief holder has power to enact policies. Indeed, we developed the theoretical model outlined in the target article precisely because we regard understanding the processes by which beliefs influence behavior as a critical psychological question.

While some regarded our view as veering too far in the direction of suggesting that beliefs do not matter for understanding behavior, others felt the opposite was true: "our disagreement is effectively that SA do not go *far enough* in untethering belief from behavior" (Sommer & Oktar, this issue, p. 60). Sommer and Oktar (this issue) contend that our theoretical framework implicitly concedes that all beliefs entail a behavior (ontological entailment), that behavioral implications of beliefs should be acted on regardless of outside factors (normative entailment), and that beliefs are stable mental constructs that can shape behavior over time (descriptive entailment). Regarding the issue of normative entailment, as mentioned in the target article, our theoretical framework is not blind to the many forces that shape behavior. We have already discussed the many factors—individual, social, and systemic—that shape behavior (Albarracín et al., 2024). However, we contend that a model that seeks to explain how beliefs impact behavior should start by analyzing that very issue.

On the matter of ontological entailment, our model makes no claims that beliefs necessarily imply behaviors in people's minds. The very point of our framework is that, for example, an existence belief like "God exists" *can* but *need not* imply anything about behavior. The key link between beliefs and behavior are belief-to-behavior inferences. Thus, beliefs can imply behaviors if people reason through their implications for action, but that potential is not always realized. Lastly, we would like to add nuance to the characterization of beliefs as "often unstable constructions based on only a limited set of people's knowledge" (Sommer & Oktar, this issue, p. 63). Much of the evidence marshaled by Sommer and Oktar concerns attitudes, not beliefs (see distinction above). With regard to attitudes, some attitudes are more durable (persistent over time and resistant to persuasion) and impactful (shaping information processing and behavior), whereas others are not. This quality that differentiates these two kinds of attitudes is referred to as *attitude strength* (Petty & Krosnick, 1995). Although attitudes have been broadly painted as "temporary constructions" in the past (Schwarz & Bohner, 2001; Wilson & Hodges, 1992), the current understanding is that stronger attitudes are stored in memory and evaluative judgments associated with weaker attitudes are the product of constructive processes (Fazio, 2007; Nayakankuppam et al., 2018).

More to the point, we suggest that although beliefs can certainly be unstable, they can also be quite stable over time. In a study by Pelham (1991), participants reported a number of beliefs about themselves and the certainty and importance associated with those beliefs over a ten-week period. The results revealed very strong test-retest correlations among those self-beliefs held with the greatest certainty (r = .91, 95% CI [.86-.94]) and importance (r = .76, 95% CI [.62-.84]). Interestingly, test-retest correlations were large even among those beliefs that were least certain (r = .66, 95% CI [.50-.78]) and important (r = .69, 95% CI [.54-.80]). Along the same lines, when measured over the period of two months, outcome (r = .91), normative (r = .75), and control beliefs (r = .85) evidenced high levels of stability (Blue et al., 2008). We do not mean to suggest that all beliefs are highly stable, only that they can be. In sum, we suspect that much like attitudes, beliefs will differ in the degree to which they show persistence over time (Moè, this issue).

Redundant and Obvious?

Perhaps the most pointed critique of the theoretical framework proposed is that it is redundant:

> While this model has the appeal of face validity backed by some evidentiary support, the notion that belief and action are most likely to be linked when an "outcome belief" is considered in the service of an intention or "a goal to act" veers close to tautology. Is this not simply a claim that beliefs lead to actions when we are deliberating about what we want to do—that is, how to act? And that they don't when we aren't? (Pierre, this issue, p. 57)

We appreciate the encouragement to steer away from circular explanations. It is certainly possible to generate redundant accounts to explain when beliefs will most strongly impact behavior. For instance, we could instead have proposed that there are two kinds of beliefs—those that predict behavior and those that do not. In this scenario, the first kind of beliefs would be those that predict behavior and the second kind of beliefs would be those that do not, making the difference between beliefs a definitional certainty. However, our theoretical model presents principles that make testable predictions about the *processes* that strengthen the relation between beliefs and behavior and the conditions that facilitate such processes. That is, our framework does what good scientific models ought to do—it makes testable predictions. Specifically, our model predicts that the relative strength of the relation between beliefs and behavior will differ as a function of a unique combination of goals, motivation, and cognitive capacity because of their impact on practical reasoning.

In critiquing perceived limitations of our theoretical framework, Pierre (this issue) suggests that a promising alternative is "characterizing beliefs in terms of intensity according to quantitative cognitive dimensions like conviction, preoccupation, and associated emotional distress" (p. 58). We agree that a focus on the qualities of beliefs is worthwhile venture. In the target article, we speculate that the emotionality of beliefs may lead people to more readily form belief-to-behavior inferences through an impact on the activation of behavioral goals. Similarly, the importance of a belief or the degree of confidence with which it is held may also impact belief-behavior correspondence via similar mechanisms. Whether such qualities of beliefs have an influence on the strength of the belief-behavior relation by impacting the formation of belief-to-behavior inferences or via independent mechanisms, we regard this as an interesting avenue for future research. However, a belief property approach does not answer the question of what processes leave to what properties, which is our focus.

Beyond redundancy, some readers might find the idea belief-to-behavior inferences amplify the impact of beliefs on behavior so self-evident as to be axiomatic. However, there is no compelling reason to believe that belief-to-behavior inferences are necessary to explain the relation between beliefs and behavior. In particular, some have argued that the brain is fundamentally wired for action (Pezzulo et al., 2017). From this perspective, all beliefs could, by their nature, influence behavior, as individuals automatically integrate cognition with action. If this were always the case, practical reasoning based on beliefs would occur without any meaningful moderating effects on the belief-behavior relation.

To begin to move past these arguments, we conducted an experiment that serves as the first direct test of our theoretical framework (Granados Samayoa & Albarracín, this issue). Principle 1 of our theoretical framework states that people can form a belief or belief-to-behavior inference. As we suggested in the target article, one method of testing this idea is inducing beliefs and then either focusing participants on the information itself or promoting the formation of belief-to-behavior inferences via practical reasoning. The formation of belief-to-behavior inferences should amplify the effect of beliefs on behavioral attitudes and intentions. Using a 2×2 within-subjects design, 102 participants read four different articles about fictitious products, two of which conveyed information about qualities of the product in question intended to induce positive attitudes and two of which conveyed information about qualities about the product in question intended to induce negative attitudes (belief content factor). Moreover, we manipulated how people processed that information to focus them on informational value for two articles versus behavioral implications for two articles (processing factor). Specifically, two articles were preceded by instructions that focused their attention on the truth value of the content and followed by three text boxes in which they listed the information they would need to verify the information they just read. By contrast, the other two articles were preceded by instructions that focused their attention on the implications of the content for their behavior and followed by three text boxes in which participants listed how the information they read might impact their behavior. Following each trial, participants reported their attitudes toward using the product in question, their attitudes toward supporting policies that seek to restrict the product, and their intentions to support such policies. The results revealed the predicted interaction between the belief content and processing conditions such that the impact of the beliefs on attitudes and intentions was greater when people explicitly formed belief-to-behavior inferences. That is, the formation of belief-to-behavior inferences amplified the impact of beliefs on attitudes and intentions as predicted by the theoretical framework.

On Taxonomies and Their Utility

The last critique of the theoretical framework we wish to highlight concerns our taxonomy of beliefs and the review of meta-analyses on behavior prediction and change (Albarracín et al., 2024). As noted above, Imhoff and Oeberst (this issue) question the utility of this taxonomy, with their concern being whether "the postulated three types of beliefs can really be clearly distinguished from one another on the conceptual level rather than its rhetoric form" (p. 37). They go on to describe various ways in which the phrasing of beliefs can be manipulated to challenge the taxonomy proposed. Moreover, Imhoff and Oeberst (this issue) suggest that applying the principle of compatibility would yield greater returns in understanding belief-behavior correspondence. However, as mentioned by Osman (this issue), our target article explicitly incorporates the ideas of the principle of compatibility into the theoretical framework. Alternatively, Pierre (this issue) questions not the boundaries of the categories of beliefs but rather their breadth: "it would be helpful to acknowledge the considerable heterogeneity of belief beyond existence, descriptive, and outcome subtypes and to further differentiate these belief variants from the likes of opinions, hypotheses, faiths, attitudes, values, and morals" (p. 58).[1]

The taxonomy presented in the target article represents our best effort to organize the landscape of beliefs. We not only propose categories of beliefs—as others have done in the past—but we provide a test of their differential associations with behavior by reviewing relevant data provided by meta-analyses—an exercise that is not often carried out. In many ways, the results of this exercise align with our predictions about belief-behavior correspondence. However, this supportive evidence does not entirely validate the proposed belief taxonomy. Such validation can only come via extensive tests conducted by a variety of scientists. However, we view this as a starting point for others to conduct additional tests and, if necessary, modify the taxonomy. For those who do not find value in the taxonomy we propose, we would encourage them to more fully meta-analyze the empirical evidence to provide contradictory evidence and develop their own taxonomy.

[1]As discussed above, social psychologists have cast attitudes as a construct that is distinct from beliefs rather than being a kind of belief.

Extensions of the Theoretical Framework

Having provided our perspective on some of the critiques contained in the commentaries, we now focus on extensions of the model. To begin, we discuss an extension of the theoretical framework in the form of novel supporting evidence. In response to our assertion that prior research had yet to directly test the idea advanced by Fishbein and Ajzen of an inferential chain linking beliefs to intentions through an intervening influence on attitudes, Hamilton and Hagger (this issue) conducted a re-analysis of existing data to conduct such a test. Using hierarchical regression models that approximate a causal steps approach to mediation (Baron & Kenny, 1986) and statistical mediation models (Hayes, 2009), Hamilton and Hagger find evidence that the influence of beliefs on intentions is mediated by attitudes, providing evidence consistent with the idea that people infer behavioral attitudes and intentions to arrive at behavior in belief-to-behavior inferences. We thank Hamilton and Hagger for their effort in testing this idea and bringing it to our attention.

The commentaries on our target article offered many promising ideas for theoretical extensions of the model. Although we are unable to delve into all such ideas, we wish to highlight a few that we found particularly valuable.

Numerous commenters pointed out that beliefs do not exist in isolation, a point clearly recognized by Fishbein and Ajzen's (1980) model and Norman Anderson's (1981) information integration theory, among others. One variation of this idea advanced is that beliefs are organized into networks (Imhoff & Oeberst, this issue; Westaby et al., this issue). The current iteration of our theoretical framework focuses on specific beliefs and their relation to behavior because this simplest case is a situation that is often of interest to psychologists and other behavioral scientists. For instance, some of the earliest research on conspiracy theories sought to test whether conspiracy beliefs about the origin of HIV predicted health behavior (Bogart & Thorburn, 2005)—a tendency that remains popular to this day in relation to COVID-19, among other topics. That said, extending the current theoretical framework or developing a novel one to understand the influence of belief networks is a fascinating and worthwhile enterprise.

Perhaps the most common response to our target article encouraged greater consideration of recursive processes in which behaviors feedback to influence beliefs (Imhoff & Oeberst, this issue; Macnamara & Burgoyne, this issue; Moè, this issue; Pierre, this issue). The target article acknowledged the existence of such recursive processes: "people's behavioral attitudes, intentions, and behaviors should also be able to reinforce their beliefs" (p. 9). Yet, much more could be done to unpack this idea. In their commentary, Westaby et al. (this issue) acknowledge our model's nod to recursive processes (see also Albarracín, 2021) and specifically discuss how people reason about behavior. We welcome additional theorizing that makes the recursive relation between beliefs and behavior more explicit, potentially by integrating insights from the literature on Bayesian learning (Gunji et al., 2017; Sloman & Lagnado, 2015).

Conclusions

The inspiration for our model was a dissatisfaction with the mismatch between the role of beliefs in psychology and the limited understanding of the mechanisms by which they influence behavior (Macnamara & Burgoyne, this issue; Westaby et al., this issue). While many popular areas of psychology—including mindsets, stereotypes, misconceptions, and conspiracy beliefs—concern beliefs, the processes by which such beliefs impact behavior have received less attention. Certainly, existing models like those in the reasoned action approach tradition incorporate beliefs and provide a source for our contribution. However, such models are often focused on mathematical prediction of behavior at the cost of exploring cognitive processes. Thus, we present principles to explain why a belief may not influence behavior while others do. Our central insight is that belief-to-behavior inferences link beliefs to behavior via practical reasoning that leads to the formation of behavioral attitudes and intentions. Moreover, the model explores how factors like the length of an inferential chain, processing goals, and cognitive capacity influence belief-to-behavior inferences. Lastly, the model discusses how different constructs in the inferential chain may be independently stored and activated from memory and how such inferences may become proceduralized. We sincerely thank the commenters of our article for taking the time to consider our framework. These commentaries have allowed us to more clearly see areas of potential confusion and avenues forward. As discussed above, we have begun the journey of directly testing different aspects of our theoretical model. We hope that we have generated interest in using the proposed principles to test these and competing ideas to better describe the belief-behavior association in the future.

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