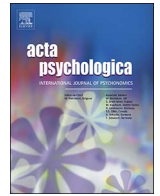




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## Communicated beliefs about action-outcomes: The role of initial confirmation in the adoption and maintenance of unsupported beliefs<sup>☆</sup>

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### ABSTRACT

As agents seeking to learn how to successfully navigate their environments, humans can both obtain knowledge through direct experience, and second-hand through communicated beliefs. Questions remain concerning how communicated belief (or instruction) interacts with first-hand evidence integration, and how the former can bias the latter. Previous research has revealed that people are more inclined to seek out confirming evidence when they are motivated to uphold the belief, resulting in confirmation bias. The current research explores whether merely communicated beliefs affect evidence integration over time when it is not of interest to uphold the belief, and all evidence is readily available. In a novel series of on-line experiments, participants chose on each trial which of two options to play for money, being exposed to outcomes of both. Prior to this, they were exposed to favourable communicated beliefs regarding one of two options. Beliefs were either initially supported or undermined by subsequent probabilistic evidence (probabilities reversed halfway through the task, rendering the options equally profitable overall). Results showed that while communicated beliefs predicted initial choices, they only biased subsequent choices when supported by initial evidence in the first phase of the experiment. Findings were replicated across contexts, evidence sequence lengths, and probabilistic distributions. This suggests that merely communicated beliefs can prevail even when not supported by long run evidence, and in the absence of a motivation to uphold them. The implications of the interaction between communicated beliefs and initial evidence for areas including instruction effects, impression formation, and placebo effects are discussed.

Human beings, like the majority of animals, have the capacity to learn how to interact with an environment through first-hand experience of action-outcome relationships. Although some animals have developed the limited ability to communicate these relationships, such as primates, dolphins and bees (Bradbury & Vehrencamp, 1998; Frisch, 1950), humans have taken this ability to much higher levels. This transfer of knowledge can be highly adaptive - we can for instance be informed that having a coffee will cause us to feel more awake, and from this information choose to have a coffee to realize this outcome, without having to start from scratch in working out what might reduce our tiredness. Hence, the development of language has allowed us to transfer information about action-outcomes with an unparalleled capacity and flexibility.

However, despite this communicative capacity, people still seem to hold erroneous beliefs (e.g. the unsupported belief that vaccines cause autism, or homeopathy), whether due to misinterpretations or perceptions of evidence in the communicator, or wilful deception. This combination of erroneous or unsupported beliefs, and the capacity to

transfer (a capacity that is ever-increasing with the development of technology, from the printing press to most recently the internet) creates dangerous, viral effects (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012), such as believing an otherwise treatable disease should instead be treated homoeopathically. Such phenomena provoke an obvious and critical question; why are such fallacious beliefs adopted and maintained?

In the present paper, we provide one possible explanation. We argue that when the truth value of a communicated belief is unclear, people use experienced evidence to validate the belief. We demonstrate that in such cases, evidence that is initially encountered will determine whether a belief is consolidated or not, leading to potential bias when this initial evidence is not representative in the long run. Consequently, we believe the present work to be of particular relevance to the literature on persuasion (Briñol & Petty, 2009; Petty & Cacioppo, 1984; Wood, 2000), source credibility (Briñol & Petty, 2009; Hahn, Harris, & Corner, 2009), and instruction effects (Doll, Jacobs,

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Sanfey, & Frank, 2009; Liefoghe, De Houwer, & Wenke, 2013; Liefoghe, Wenke, & De Houwer, 2012; Mertens & De Houwer, 2016; Roswarski & Proctor, 2003; Van Dessel, De Houwer, Gast, & Smith, 2015; Van Dessel, Gawronski, Smith, & De Houwer, 2016), given their focus on the impact of *communicated* information.

## 1. Learning via communication

While information about action-outcome relations has been widely regarded to be represented in terms of associations (Hommel, Müseler, Aschersleben, & Prinz, 2002). This does not necessarily mean that such representations are always formed by slow associative processes (i.e., Hebbian learning), which are, for instance, thought to underlie habit formation (Custers & Aarts, 2010). They can also result through propositional processes (Mitchell, De Houwer, & Lovibond, 2009), including deduction, inference, and instruction. These allow for fast and flexible changes in associations as these propositions are hypotheses about the state of the world that have a “truth value” and can therefore be confirmed or disconfirmed. Hence, while people may form action-outcome representations slowly through repeated experiences, or via deductive and inferential processes, they may also evaluate the truth value of beliefs about these relations that are communicated by others.

Normative accounts, such as the Bayesian approach, argue that such as evidence is experienced, the belief (and its truth value) is updated to eventually reflect the “true” state of the evidence (Fischhoff & Beyth-Marom, 1983). Within such an approach, a communicated belief, if regarding a new hypothesis, may be considered a “prior”. If such a prior is not reflected by the distribution of evidence (i.e. the belief is erroneous), then with sufficient evidence, the effect of the prior would be gradually overruled by experienced evidence. Critically, this highlights the two, interlinked elements that might explain recipients still possessing an erroneous belief: Either the recipient is yet to experience *sufficient* evidence, or the individual is *overconfident* in the prior (although the latter makes the former more likely). Importantly, Bayesian accounts would predict, provided sufficient evidence, that not only should beliefs converge on the “truth” (dictated) by evidence, but that once converged, beliefs should remain there.

However, humans have been found to deviate from this normative standard of learning. Research into cognitive biases has instead shown systematic misinterpretations of evidence (Bar-Eli, Avugos, & Raab, 2006; Gilovich, 1983; Gilovich, Vallone, & Tversky, 1985; Tversky & Kahneman, 1971), and failures to adjust beliefs accurately (Abbott & Sherratt, 2011; Dave & Wolfe, 2003; Dennis & Ahn, 2001; Rozin, Millman, & Nemeroff, 1986; Tversky & Kahneman, 1973) across many domains of learning (for a review, see Pohl, 2004). In particular regard to erroneous belief maintenance, one explanation is an overweighting of belief-congruent evidence, known as a confirmation bias (Klayman, 1995; Nickerson, 1998).

## 2. Communication and confirmation bias

Confirmation bias is an umbrella term that covers a number of both cognitive and motivational processes (Hahn & Harris, 2014). The impact of these processes is functionally equivalent in terms of the topic of the present paper; it is the retention of an erroneous belief through the overweighting of belief-congruent evidence. We now briefly highlight some of these (at times competing) motivational and cognitive explanations, with a view to demonstrate the importance of assessing the impact of beliefs in the absence of such motivations and cognitive strategies. In doing so, we forward an account of confirmation bias in (erroneous) belief maintenance that is at its heart a consequence of an asymmetry in the way evidence is *integrated*. This integrative bias occurs irrespective of directional motivation (e.g. Kunda, 1990) or skewed evidence exposure (see Klayman & Ha, 1987; Nickerson, 1998) explanations commonly associated with erroneous belief acquisition. Such effects are instead shown to be dependent upon evidence order in

the immediate attempted validation of the belief.

### 2.1. Motivated reasoning

Research in motivated reasoning has argued that *directional* motivations, such as social conformity (Asch, 1955; Cialdini & Goldstein, 2004) and self-concept preservation (Cialdini & Trost, 1998) play a role in confirmation bias effects (Klein & Kunda, 1989; Kunda, 1990). For example, were asked to evaluate the effectiveness of arguments either in favour of, or opposed to, the death penalty (Lord, Ross, & Lepper, 1979). Participants pre-existing political, ethical, and social motivations behind their particular opinion, led to more positive evaluations of arguments that favoured their prior opinion. This was taken as evidence that people are motivated to uphold their personal beliefs when evaluating arguments.

When focusing on the effects of communicated beliefs regarding action-outcome relationships, many of these directional motivations contribute to the confirmation bias effect (Klayman, 1995; Pyszczynski & Greenberg, 1987) in a complex fashion that raises problems for an experimental setting. That is, a communicated belief (e.g., a homeopathic medicine works) may bias evidence integration because it interacts with other needs (such as self-preservation). In other words, the resulting confirmation bias may not directly reflect the communicated belief, but be motivated by the individual's associated needs. Although motivations may attribute to greater degrees of bias, and granted the difficulty in removing all elements of motivated reasoning from real world situations (Yarritu, Matute, & Vadillo, 2013), we posit that merely hearing about a belief is enough to bias evidence integration. Accordingly, such an argument rests on a cognitive explanation.

### 2.2. Cognitive account

How could a communicated belief lead to confirmation bias effects even in the absence of these motivations? The removal of directional motivations can help clarify the remaining mechanisms at the heart of belief biasing effects. Such a removal has been posited, through work investigating the interaction between motivated reasoning and cognitive processes (Hahn & Harris, 2014; Kunda, 1990), to result in less use of sub-optimal cognitive processes, which might otherwise be selectively employed to favour the motivated outcome. These (biasing) processes can be divided into two camps, first order (or *input* based) and second order (or *integration* based) accounts (MacDougall, 1906).

First order accounts of confirmation bias can be categorized in terms of selective *choices*, such as positive test strategies (Klayman & Ha, 1987; Wason, 1960), selective search (an asymmetry in the scrutiny applied to arguments; see Lord et al., 1979) based, or natural asymmetries in exposure, such as illusory correlations (Fiedler & Freytag, 2004; Fiedler & Krueger, 2011). In all such cases, as an individual learns action-outcomes from experiences, if the evidence *seen* favours confirmation (whether through purposeful strategy, or a naturally skewed environment), any resultant bias could be in part (or entirely) due to this asymmetry in evidence exposure. In other words, if selective information intake is possible within an environment, one cannot discern whether the biasing effect of a communicated belief is due to an asymmetry in the *valuation* of confirmatory evidence over contradictory (Klayman, 1995), or due to the asymmetrical *exposure* to confirmatory evidence (or a combination of the two). Importantly, if selective exposure is the result of one's own actions (rather than pre-determined by the environment), it can be argued that the asymmetry of selection is due to the asymmetry in *evaluation* (i.e. integration; Klayman, 1995; MacDougall, 1906). Accordingly, by precluding selective exposure explanations, it is possible to determine if confirmation bias effects in erroneous belief maintenance may depend upon the skewed *integration* of evidence alone.

Second order (integrative) accounts of confirmation bias have been

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