Thinking & Reasoning

ISSN: 1354-6783 (Print) 1464-0708 (Online) Journal homepage: www.tandfonline.com/journals/ptar20

Political belief bias: the role of analytic thinking and valuing epistemic rationality

Sinem Yilmaz & Tomas Ståhl

To cite this article: Sinem Yilmaz & Tomas Ståhl (14 Nov 2025): Political belief bias: the role of analytic thinking and valuing epistemic rationality, Thinking & Reasoning, DOI: 10.1080/13546783.2025.2585801

To link to this article: https://doi.org/10.1080/13546783.2025.2585801

THINKING & REASONING
https://doi.org/10.1080/13546783.2025.2585801

Political belief bias: the role of analytic thinking and valuing epistemic rationality

Sinem Yilmaz and Tomas Ståhl

Department of Psychology, University of Illinois at Chicago, Chicago, IL, USA

ABSTRACT

We examined in two studies how analytic thinking and valuing epistemic rationality contribute to political belief bias – an inclination to judge politically congruent conclusions as valid (vs. invalid) or to judge politically incongruent conclusions as invalid (vs. valid), regardless of their actual validity. Study 1 established that people exhibit political belief bias, although unexpectedly it was only observed among liberals (vs. conservatives). As hypothesised, analytic thinking was associated with less political belief bias. In Study 2, we measured political belief bias by assessing participants' political beliefs about each conclusion directly, rather than relying on their general political orientation as a proxy. Analytic thinking as well as how much people value epistemic rationality predicted less political belief bias. These findings highlight the importance of analytic thinking as well as motivation to form beliefs based on logic and evidence in mitigating political belief bias.

ARTICLE HISTORY Received September 20, 2024; Accepted October 31, 2025

KEYWORDS Belief bias; analytic thinking; importance of rationality

People frequently hold epistemically suspect beliefs (i.e., beliefs that are not supported by scientific evidence; Lobato et al., 2014). Indeed, many Americans still do not believe that anthropogenic climate change is an important problem despite the fact that they can access this information just by googling (Annenberg Public Policy Center of the University of Pennsylvania, 2019). A significant number of people believe conspiracy theories about the role of the US government in the 9/11 terrorist attacks, the death of Princess Diana, and climate change (e.g., Brotherton & French, 2014; Gardiner & Thompson, 2012; Stempel et al., 2007; Williams, 2013; Wood et al., 2012). Consequently, conspiracy theories can (and do) arise and spread quickly, leading to detrimental consequences (e.g., Abad-Santos, 2013; Holpuch, 2013). For example, being exposed to conspiracy theories

CONTACT Sinem Yilmaz syilma2@uic.edu University of Illinois Chicago, 1007 W. Harrison St., Chicago, IL 60607, USA

Supplemental data for this article can be accessed online at https://doi.org/10.1080/13546783.2025.2585801.

has been shown to reduce intentions to vote (Jolley & Douglas, 2014), as well as the intention to vaccinate one's children (Jolley & Douglas, 2014). Additionally, paranormal beliefs are associated with a preference towards alternative medicine (Van den Bulck & Custers, 2009), contributing to higher mortality rates among cancer patients (Johnson et al., 2018). During the COVID-19 pandemic, the misinformation and fake news about the virus led some people to believe the virus was a hoax or that the vaccines did not work (Bierwiaczonek et al., 2022); causing unnecessary injury and death.

Despite their detrimental, and sometimes deadly consequences, why are these beliefs[1], so prevalent? Why do people hold beliefs that have little to no empirical support? In the present studies, we examined how individual differences in epistemic values and analytic thinking contribute to the quality of people's logical reasoning and adoption of epistemically suspect beliefs using the belief bias paradigm.

Analytic thinking

According to dual process models of cognition, human thinking involves two fundamentally different types of information processing: Type 1 processes, which are fast and frugal "intuitive" processes, and Type 2 processes, which are slow and deliberative "analytic" processes that are effortful (e.g., De Neys, 2012). Consequently, intuition is the output of a Type 1 process that can either be overridden or rationalised *via* Type 2 processing (Bago et al., 2023; Pennycook, 2023; Pennycook et al., 2015). Notably, there are individual differences in the inclination to rely on intuitive versus analytic thinking, generally referred to as thinking dispositions or cognitive styles. Having a more analytic cognitive style—being more inclined to override intuitive responses with a deliberate response—is associated with disbelief in a variety of epistemically suspect beliefs (Gervais & Norenzayan, 2012; Pennycook et al., 2012, 2020; Shenhav et al., 2012) and increased capacity to discern between low and high-quality information (Ross et al., 2021)

Despite analytic thinking's seemingly protective properties against epistemically suspect beliefs, other research has suggested that reflective thinking can enhance biased processing through motivated system 2 reasoning (Kahan et al., 2017). Indeed, Kahan et al. (2012) have found that the most (vs. least) reflective liberals are more inclined to believe the risks associated with climate change, but that the opposite pattern was obtained among conservatives (see also Bolsen et al., 2015; Drummond & Fischhoff, 2017; Hamilton et al., 2012; Kahan, 2013; Kahan et al., 2012). These findings suggest that, under certain circumstances, reflective thinkers may be better

[1] In this paper, we used Oeberst and Imhoff (2023) definition of beliefs. They defined beliefs as hypotheses about some aspect of the world that are associated with the idea of accuracy – either because people examine beliefs' truth status or because they already have an opinion about the accuracy of the beliefs (Studies **1** and **2** – convictions; motivated beliefs).

equipped to use their reasoning skills to align their evaluation of evidence with their political identity.

It is important to note that previous research on motivated reasoning has often overlooked the role of prior beliefs in their statistical control or design. In line with this reasoning, Pennycook and his colleagues (2023) have argued that *prior beliefs* that are associated with one's political identity are likely to be more developed and detailed among analytic (vs. intuitive) thinkers, and this difference could be the factor explaining the observation that partisan reasoning biases are sometimes accentuated among more (vs. less) analytic thinkers (Bago et al., 2023; Tappin et al., 2020a, 2020b, Tappin et al., 2021). In this case, deliberation should magnify differences based on prior beliefs, but not based on political identities per se. Notably, more recent studies have failed to replicate the motivated system 2 reasoning effect, and there is a growing consensus that analytic thinking typically improves reasoning or, at the very least, does not accentuate bias (see Baker et al., 2020; Persson et al., 2021; Stagnaro et al., 2023).

Valuing epistemic rationality

A possible way to further reduce the influence of ideology/identity or prior beliefs when evaluating new evidence would be to have the pursuit of truth as a highly salient goal. The goal to pursue the truth could help people evaluate the quality of arguments and evidence in a more objective fashion, rather than favouring information that is consistent with one's identity, ideology, or prior beliefs (Ståhl & Cusimano, 2024). Supporting this argument, valuing forming beliefs based on logic and evidence has been found to be positively associated with belief in science, and negatively associated with belief in paranormal phenomena and conspiracy theories (Ståhl & Van Prooijen, 2018). In a similar vein, Pennycook and his colleagues (2020) found that believing that beliefs should change according to evidence was positively associated with pro-science beliefs. Notably, this association was stronger for liberals than conservatives.

In addition, consistent with research on attitude change (Petty & Cacioppo, 1986), people may need sufficient ability *and* motivation to form beliefs based on logic and evidence to prevent their reasoning from being biased by their political beliefs or preferences. Indeed, how much people value being epistemically rational has been found to moderate the relationship between analytic thinking and unfounded beliefs, such as conspiracy theories and paranormal phenomena (Ståhl & Van Prooijen, 2018). Specifically, among those who strongly value epistemic rationality, analytic thinking was associated with a lower inclination to believe such epistemically suspect beliefs, whereas this relationship was weaker among people who valued epistemic rationality less. In short, when people are motivated to be epistemically rational, analytic thinking predicts more epistemically rational beliefs (see also Adam-Troian et al., 2019; Ståhl et al., 2024; Yilmaz & Ståhl, 2025).

Although the results of these previous studies are suggestive, some limitations of this literature are worth mentioning. In particular, none of these studies have directly examined the quality of people's reasoning, but merely looked at the output of reasoning (beliefs). Indeed, no studies to date have examined directly if analytic cognitive style and valuing epistemic rationality predict the quality of people's reasoning, and thereby influence the *formation* of epistemically suspect beliefs. The purpose of the present research is to fill this gap in the literature by studying political belief bias.

Belief bias

Consider the following example and determine whether the conclusion follows logically from the two premises:

Premise 1: All flowers need light,
Premise 2: Roses need light,
Conclusion: Therefore, roses are flowers.

Most people consider this syllogism[2] logically valid. However, a closer examination would tell us a different story.[3] Our prior knowledge, that roses are flowers, interferes with our ability to judge the argument's overall validity. Thus, despite its invalidity, we are inclined to evaluate it as logically valid. This tendency to be influenced by how plausible the conclusion sounds to us based on prior knowledge or beliefs when judging the logical validity of a syllogistic inference is a common phenomenon known as belief bias (Evans et al., 1983; Stanovich, 2021).

Notably, belief bias is not restricted to the influence of facts. Logical reasoning is also influenced by whether the conclusions are consistent with our ideological beliefs and values (Aspernäs et al., 2023; Calvillo et al., 2020; Gampa et al., 2019; Stanovich, 2021). Thus, just as we are inclined to evaluate new information in a way that aligns with our prior knowledge, we also evaluate new information in a way that is consistent with our prior opinions, attitudes, and convictions (Janis & Frick, 1943; Morgan & Morton, 1944).

Relevant to our main argument, previous research has also shown that analytic thinking is negatively associated with belief bias (De Neys, 2006; Evans & Curtis-Holmes, 2005; Trippas et al., 2015). For example, when people do not have enough time or cognitive resources to reflect, they are more strongly influenced by their prior beliefs, and more prone to misjudge the validity of the conclusions (Evans & Stanovich, 2013; Handley & Trippas, 2015; Kahneman, 2011; Pennycook et al. 2013; Trippas et al. 2013).

[2]We use syllogism and argument interchangeably.

[3]Premise 1 says that all flowers need light, but it does not claim that everything that needs light is a flower. Thus, the fact that roses need light does not logically lead to the conclusion that roses are flowers.

Additionally, recent work has investigated the association between belief bias and analytic thinking in the political context (Aspernäs et al., 2023; Calvillo et al., 2020; Gampa et al., 2019). As with more neutral facts, people exhibit belief bias when prior beliefs are politically motivated. Calvillo et al. (2020) and Aspernäs et al. (2023) further investigated the association between analytic cognitive style and political belief bias. They found no evidence to suggest that analytic thinking accentuated (or attenuated) political bias, as there was no three-way interaction between participant ideology, analytic thinking, and whether the conclusion was consistent with conservative or liberal ideology. However, analytic thinking interacted with the *validity* of the conclusion; people with higher (vs. lower) analytic thinking disposition showed a greater difference between acceptance rates of valid and invalid conclusions (Calvillo et al., 2020). Aspernäs et al. (2023), on the other hand, found that analytic thinking predicted better performance on syllogisms with conclusions consistent with a liberal ideology. In summary, this pattern of results demonstrates that prior (real-world) knowledge about the world, and our personal convictions, can impact and bias our logical reasoning, and that analytic thinking can reduce these biases. However, when prior beliefs are politically relevant, the evidence is mixed with regard to the relationship between analytic thinking and belief bias.

The present research

The present research aims to examine the role of analytic thinking and valuing epistemic rationality in political belief bias. Previous studies have looked at the impact of analytic thinking on political belief bias, but not the impact of motivation to form beliefs based on logic and evidence, or the interaction between these two variables. Thus, it is unclear whether the combination of analytic thinking and valuing epistemic rationality reduces the influence of prior political beliefs and thus promotes objective reasoning. We address this gap in the literature in two studies.

The purpose of Study 1 was to determine the extent to which analytic thinking and value given to rationality protect logical reasoning against interference from politically related beliefs that are consistent (vs. inconsistent) with one's political orientation. In Study 2, we went a step further by directly measuring people's political beliefs about each syllogism conclusion, instead of using their political orientation as a proxy, and examined the extent to which analytic thinking and valuing epistemic rationality predicted less influence of political beliefs on logical reasoning.

Study 1[4]

This study was pre-registered (https://aspredicted.org/G7Q_33G). The purpose of Study 1 was to demonstrate that people exhibit political belief bias, and

[4]See supplementary materials for the summary of a belief bias study results investigating value-neutral belief bias.

to examine whether analytic thinking and valuing epistemic rationality predict less belief bias. Based on previous research on belief bias (Stanovich et al., 2016), we hypothesised that analytic thinking would predict less political belief bias (H1). In addition, we also tested a set of competing hypotheses. On the one hand, it could be argued that valuing epistemic rationality should play an important role in protecting objective reasoning when political beliefs are involved, as political beliefs should serve as a strong temptation to depart from objective reasoning in favour of a preferred conclusion. To the extent that it can serve as a counterweight against this temptation, how much people value epistemic rationality should be negatively associated with political belief bias (H2), and moderate the negative association between analytic thinking and political belief bias (H3). However, it could also be the case that political beliefs exert a stronger influence on our reasoning than even the highest value ascribed to epistemic rationality could counter. To the extent that that is the case, we should not expect how much people value epistemic rationality to be negatively associated with political belief bias (H2alt), or to moderate the association between analytic thinking and political belief bias (H3alt).

Methods

Participants and sample size estimation

Participants who reside in the US were recruited from Cloud Research. We conducted a power analysis to estimate our required sample size. We generated a simulation to determine the sample size at a power of 0.8 and an effect size of odds ratio = 1.43 using the "makeGlmer" function from the "simr" package. Based on our simulation, we determined the required sample size to be at least 500 to detect a four-way interaction in a model with a total of 5 fixed effects (Conclusion Ideology*Political ideology*Analytic Thinking*Importance given to rationality+Validity) at a power of 0.8. To compensate for potential subject dropout and exclusions, we decided on 600 participants as an appropriate sample size. To ensure that we have equal numbers of Democrats and Republicans, we set a quota for the number of Democrats (N_D = 300) and Republicans (N_C = 300). Participants were presented with a question asking, 'Which political party are you a member of' and asked to choose from three options (Republican, Democrat, and Other). 300 people who chose Republican and 300 people who chose Democrat were our participants. People who selected Other as their party were excluded. 551 participants (N_D = 280, N_C = 271) began the study. After excluding participants who failed the attention check or did not complete the survey, the resulting sample (N = 535, N_D = 270, N_C = 265, *Mean* age = 44.0) consisted of 239 men, 291 women, and 5 non-binary participants. The majority of the participants (59.2%) had university degrees or higher, of which 219 were bachelor, 89 were masters, 2 were professional and 7 were doctoral.

Procedure

Upon completing the informed consent, participants were presented with the questionnaires. Below, we describe all of the measures. All the study materials are available on OSF (https://osf.io/6hvmf/). Data were analysed using R (R Core Team, 2024).

Materials

Political syllogisms

A test of logical reasoning consisting of 16 political syllogisms was presented to the participants (Calvillo et al., 2020). Half of the arguments were valid, and the other half were invalid. Half of the syllogism conclusions were aligned with liberal ideological beliefs (e.g., "Abortion is not murder"), whereas the other half were aligned with conservative ideological beliefs (e.g., "Tax increases harm the economy"). Participants were instructed to evaluate the validity of each conclusion assuming that all the premises were true. Specifically, they were asked to evaluate if each conclusion logically followed from its premises. The response options were "valid" and "invalid."

Political ideology

Participants indicated their stance on social, economic, and general issues on a scale from 1 (very liberal) to 7 (very conservative). All three items were averaged together to create a reliable political ideology scale ($\alpha = 0.96$).

Analytic thinking (AT)

Participants completed the 3-item Cognitive Reflection Test (CRT; Frederick, 2005) and 4-item CRT 2 (Thomson & Oppenheimer, 2016). These tests contain a total of seven problems that cue intuitive but wrong answers. An example item is: "A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?" Overriding the intuitive answer and giving the correct answer is considered to be an indicator of analytic thinking. Questions were presented in open-ended format with correct responses coded as 1. The 7 items were averaged together to create a reliable analytic thinking scale (AT) on which higher scores represent greater analytic thinking ($\alpha = 0.79$).

Importance of rationality scale (IRS; Ståhl et al., 2016)

The 6-item IRS measures the extent to which people value forming their beliefs based on evidence and logic. As such, it assesses how motivated people are, in general, to be epistemically rational. The IRS is positively related to belief in science ($r = .48$, Ståhl et al., 2016), actively open minded

thinking about evidence AOT-E (r = .4, Ståhl et al., submitted), and weakly positively related to analytic cognitive style (e.g., rs < .2 in the present studies). The IRS includes statements such as: "It is important to me personally to examine traditionally held beliefs using logic and evidence." Items are rated on a scale from 1 (strongly disagree) to 7 (strongly agree), with higher scores representing more highly valuing being epistemically rational. The 6 items were averaged together to create a measure of personal importance attached to being rational (α = 0.86).

Additional measures

For exploratory purposes, the Numeracy test (Schwartz et al., 1997), the Moralised Rationality Scale (MRS; Ståhl et al., 2016), the Belief in Conspiracy Theory Inventory (BCTI; Swami et al., 2017), and a scale measuring belief in true conspiracies (Pennycook et al., 2025) were also presented to the participants. Participants were also asked a set of demographic questions, including gender, age, level of education, and political orientation.

Pre-registered analysis

We pre-registered to conduct a logistic mixed-effects analysis to predict perceived validity (participants' judgement of the syllogism's conclusion as valid vs invalid) using validity (valid vs invalid), conclusion ideology (conservative vs liberal), analytic thinking (AT), valuing epistemic rationality (IRS), political ideology, and their interactions as predictor variables.

Deviations from pre-registration

Our pre-registration specified a complex model (Model 3 in Supplementary Materials Table 1) that included a five-way interaction among validity, conclusion ideology, analytic thinking, valuing epistemic rationality, and political ideology. However, because this high-order interaction was not central to our theoretical aims and was difficult to interpret meaningfully, we opted to simplify the model for clarity and interpretability.

Specifically, in the main text, we report a model (Model 2 in SM Table 1) that includes only the key predictors: a four-way interaction among conclusion ideology, participant ideology, AT, and IRS, along with the main effect of validity and its interactions with AT and IRS. For comparison, we also report a baseline model (Model 1 in SM Table 1) that includes only the main validity effect and the 4-way model. Importantly, the main findings were consistent across models. However, we focus on Model 2 in the main text because it provides a more direct and interpretable test of our primary hypotheses. For transparency, we report all three models in the Supplementary Materials.

Table 1. Means, standard deviations, and correlations with 95% confidence intervals (Study 1).

Variable	*M*	*SD*	1	2	3
1. AT	4.20	2.09			
2. IRS	5.70	0.96	.16** [.08, .24]		
3. Accuracy	9.74	2.46	.36** [.29, .44]	.16** [.07, .24]	
4. Political Ideology	3.97	2.03	−0.18** [−0.26, −0.10]	−0.24** [−0.32, −0.16]	−0.17** [−0.25, −0.09]

Note. AT: Analytic Thinking; IRS: Importance of Rationality Scale.
Higher scores on political ideology indicate a more conservative ideology, whereas lower scores indicate a more liberal ideology.
*$p < .05$.
**$p < .01$.
***$p < .001$.

Additionally, in response to a reviewer's suggestion, we tested whether participants exhibited general political belief bias - a tendency to judge politically congruent conclusions as more valid than incongruent ones, regardless of participant ideology. To do that, we created a new variable representing believability as congruence vs incongruence with one's political ideology, collapsing across both political ideologies. This analysis confirmed the effect of political congruence on perceived validity: participants rated congruent (vs. incongruent) conclusions as more valid, $b = .35$, $SE = .037$, $z = 9.28$, $p < .001$.

Reported main analysis plan

In the reported model, conclusion ideology (liberal vs. conservative[5]), analytic thinking, valuing epistemic rationality, political ideology, and validity were entered as fixed effects. Participants were entered as a random effect with random slopes of validity and conclusion. Syllogisms were entered as a crossed random effect. All continuous variables (AT, IRS, and political ideology) were standardised. The final reported model included: a four-way interaction (among conclusion ideology, participant ideology, AT, and IRS) and a three-way interaction (validity, AT, and IRS).

In these models, political belief bias refers to the impact of conclusion ideology on perceived validity, depending on participant ideology: i.e., a tendency to judge an ideology-consistent conclusion as valid rather than invalid (or to judge an ideology-inconsistent conclusion as invalid rather than valid), regardless of its actual validity. Thus, evidence of political belief bias requires a conclusion ideology (conservative vs. liberal) x participant ideology interaction. The hypothesis that valuing epistemic rationality will predict less political belief bias corresponds to a conclusion

[5]Conclusion ideology was coded as follows: liberal conclusions as "-1" and conservative conclusions as "1." Validity was coded as follows: invalid arguments as "-1" and valid arguments as "1."

ideology x political ideology x IRS interaction. The hypothesis that analytic thinking will predict less political belief bias corresponds to a conclusion ideology x political ideology x AT interaction. Lastly, the hypothesis that the negative association between analytic thinking and political belief bias will be stronger among people who strongly (weakly) value epistemic rationality corresponded to a conclusion ideology x political ideology x AT x IRS interaction.

Exploratory analyses plan

We also conducted exploratory analyses examining the main effect of conclusion validity and its interactions with IRS and AT (Model 2), and with political ideology (Model 3). These analyses were done to determine if IRS and AT are associated with improved accuracy, and whether political ideology was associated with accuracy.

Results and discussion

Table 1 presents the means, standard deviations, and zero-order correlations.

Due to the size of the tables, we opted to report the complete results of the mixed-effects analysis in Supplementary Materials, and to report only the primary findings here.

Exploratory analysis: the role of argument validity on validity judgements

We examined the impact of logical validity on people's judgments to determine if our participants were sensitive to the actual validity of the arguments. There was a significant main effect of validity (b = .68, SE = .22, z = 3.06, p = .002), with participants judging valid conclusions as valid (Mean Probability = .75) more frequently than invalid conclusions (Mean Probability = .44)[6].

The validity by analytic thinking interaction was also significant (b = .34, SE = .039, z = 8.814, p < .0001). Simple slopes analyses revealed that the effect of validity was significant among people with high analytic thinking skills (+1 SD AT) (b = 1.04, SE = .22, z = 4.76, p < .0001), but not among people with low analytic thinking skills (−1 SD AT) (b = .34, SE = .22, z = 1.54, p = .12). Thus, analytic thinking was associated with higher accuracy on the reasoning task (see Figure 1(a)).

[6]The overall pattern of valid judgments closely mirrors that reported in previous studies using the same materials (Calvillo et al., 2019). Participants in our studies were more likely to endorse valid than invalid arguments (Study 1: .75 vs. .44; Study 2: .78 vs. .43), similar to Calvillo et al.'s findings (Study 1: .61 vs. .52; Study 2: .72 vs. .47). This similarity indicates that our participants approached the task in a comparable way and that the results align well with established belief bias patterns.

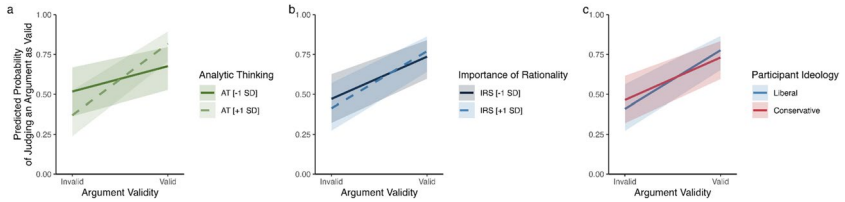

Figure 1. Predicted probability of judging arguments as valid based on argument validity and three predictors (AT, IRS, and Participant Ideology) (Study 1).

The validity by IRS interaction was also significant (b = .11, SE = .039, z = 2.7, p = .007). Simple slopes analyses revealed that the effect of validity was stronger among people who strongly value epistemic rationality (+1 SD IRS) (b = .78, SE = .22, z = 3.49, p < .0001), than among people who only weakly value epistemic rationality (−1 SD IRS) (b = .57, SE = .22, z = 2.56, p = .01). Thus, value given to being epistemically rational was also associated with higher accuracy on the reasoning task (see Figure 1b).

Finally, we also looked at the interaction between participants' political ideology and validity to see if there were ideological differences in accuracy in the reasoning task. Notably, there was a significant interaction between validity and political ideology (b = −0.11, SE = .04, z = −2.85, p = .004) (see Model 3 in SM Table 1). As seen in Figure 1c, simple slopes analyses revealed that the effect of validity was stronger among liberals (−1 SD) (b = .81, SE = .22, z = 3.66, p = .0002), than among conservatives (+1 SD) (b = .57, SE = .22, z = 2.62, p = .01), indicating that liberals were more accurate than conservatives in their validity judgments.

Hypotheses testing: political belief bias

Consistent with our initial analysis conducted while collapsing across the political ideology spectrum, participants exhibited belief bias, as the conclusion ideology by political ideology interaction was highly significant (b = .37, SE = .038, z = 9.60, p < .001). As depicted in Figure 2, simple slope analysis revealed that liberals (−1 SD) showed the expected belief bias (b = −0.91, SE = .22, z = −4.17, p < .0001). Unexpectedly, however, conservatives (+1 SD) did not show any significant belief bias (b = −0.19, SE = .22, z = −0.87, p = .39). We will get back to this unexpected finding below.

Hypothesis 1: moderation by analytic thinking (AT)

Consistent with Hypothesis 1, there was a significant interaction between conclusion ideology, political ideology, and analytic thinking (b = −0.12, SE = .037, z = −3.31, p = .001). Importantly, as seen in Figure 3, the interaction between conclusion ideology and political ideology was significant among people with low levels of analytic thinking skills (−1 SD) ($X^2(1)$ = 83.86,

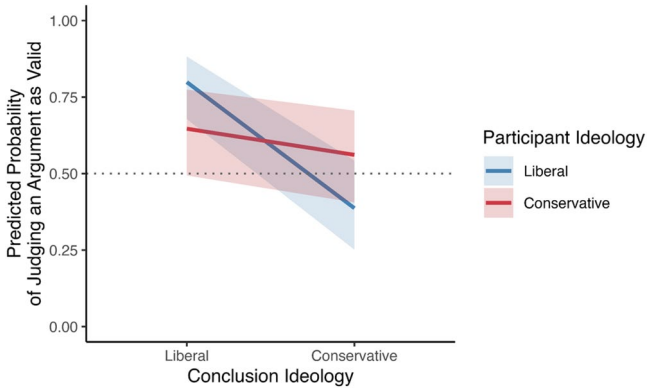

Figure 2. Predicted probability of judging arguments as valid based on participant ideology and conclusion ideology (Study 1). Higher scores on the *Y*-axis indicate a greater likelihood of participants perceiving the syllogism as valid. A perfectly accurate participant would rate 50% of the arguments as valid since half are valid and half are invalid.

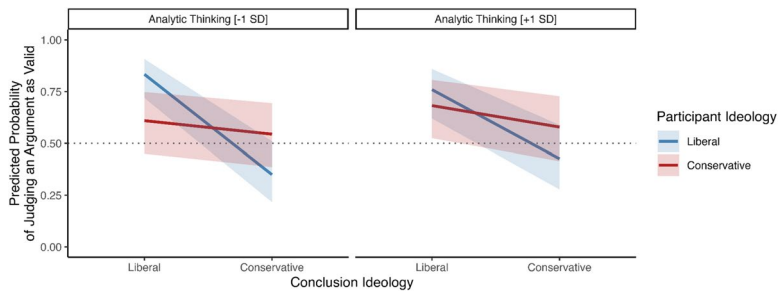

Figure 3. Predicted probability of judging arguments as valid based on participant ideology, conclusion ideology, and analytic thinking (AT) (Study 1).

$p < 0.001$). Simple slopes analysis showed that among people with low levels of analytic thinking skills, the effect of conclusion ideology was significant among liberals ($b = -1.09$, $SE = .23$, $z = -4.84$, $p < .0001$), but not among conservatives ($b = -0.15$, $SE = .22$, $z = -0.67$, $p = .50$). The interaction between conclusion ideology and political ideology was also significant among people with high analytic thinking skills (+1 SD) ($X^2(1) = 20.25$, $p < 0.001$), suggesting that the interaction effect was similar, yet smaller than among people with low analytic thinking skills. As was the case among people with low analytic thinking skills, the effect of conclusion ideology was significant among liberals ($b = -0.72$, $SE = .22$, $z = -3.23$, $p = .001$), but not among conservatives ($b = -0.23$, $SE = .22$, $z = -1.01$, $p = .31$). Thus, we found some support for our hypothesis by showing that analytic thinking predicted less political belief bias among liberals. However, we observed no belief bias among conservatives, regardless of their level of analytic thinking skills.

Hypothesis 2: moderation by importance of rationality (IRS)

Contrary to hypothesis 2, the interaction between conclusion ideology, political ideology, and value given to being epistemically rational (IRS) was not significant (b = .019, SE = .037, z = .51, p = .60). Thus, we found no support for our hypothesis that valuing epistemic rationality should predict less political belief bias.

Hypothesis 3: interaction by analytic thinking and importance of rationality

There was a four-way interaction between conclusion ideology, political ideology, analytic thinking, and valuing epistemic rationality (b = −0.11, SE = .037, z = −2.82, p = .004). To follow up on this interaction, we looked at the interaction between conclusion ideology, political ideology, and analytic thinking among people who valued being epistemically rational weakly (- 1 SD) vs strongly (+1 SD). The three-way interaction was significant among people who strongly valued being epistemically rational (b = −0.22, SE = .05, z = −4.60, p < .0001), whereas it was nonsignificant among people who only weakly valued being epistemically rational (b = −0.01, SE = .05, z = −0.20, p = .84). Thus, we zoomed in on the three-way interaction among participants who strongly valued being epistemically rational, and broke it down by looking at the two-way interaction between conclusion ideology and political ideology among people high (vs. low) on analytic thinking. The two-way interaction was stronger among people with low levels of analytic thinking skills (−1 SD), $X^2(1) = 61.04$, $p < .0001$) than among people with high levels of analytic thinking skills (+1 SD), $X^2(1) = 6.17$, $p = .01$), indicating that lower analytic thinking skills were associated with greater political belief bias among people who strongly valued being epistemically rational. As seen in Figure 4, simple slopes analysis revealed that among people who strongly valued being epistemically rational (+1 SD on IRS), but had low levels of analytic thinking skills (−1 SD on AT), the effect of conclusion ideology remained significant among liberals (b = −1.41, SE = .24 z = −5.8, $p < .0001$) and non-significant among conservatives (b = −0.21, SE = .23, z = −0.90, p = .37). Among people who strongly valued being epistemically rational, and had high levels of analytic thinking, the effect of conclusion ideology was significant among liberals (b = −0.70, SE = .22, z = −3.12, p = .002), but not significant among conservatives (b = −0.37, SE = .24, z = −1.55, p = .12). Taken together, these results indicate that liberals high in IRS exhibited political belief bias across the board, though it was more pronounced among those low (vs. high) on analytic thinking.

An alternative breakdown of this four-way interaction was suggested by a reviewer: testing whether importance given to rationality (IRS) moderates the interaction between analytic thinking and conclusion ideology among liberals (vs. conservatives). We found that the IRS moderated the

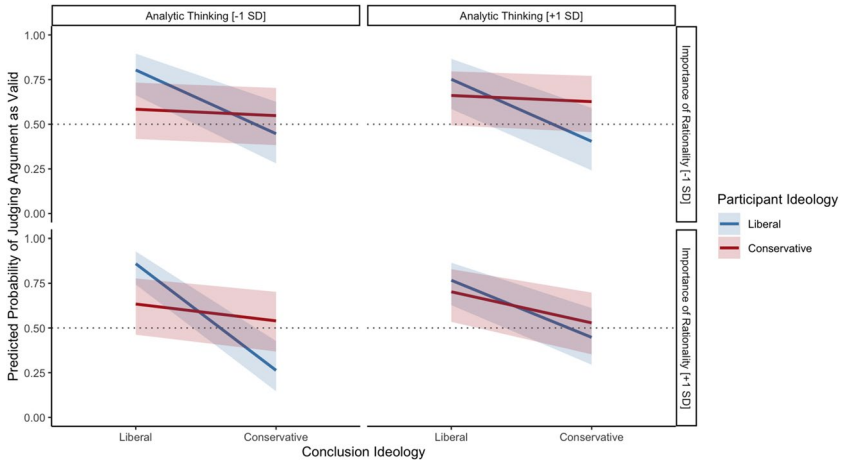

Figure 4. Predicted probability of judging arguments as valid based on participant ideology, conclusion ideology, analytic thinking (AT), and the importance of rationality (IRS) (Study 1).

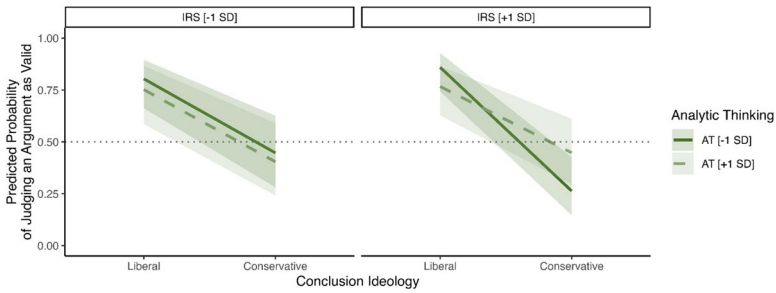

Figure 5. Predicted probability of judging arguments as valid based on conclusion ideology, analytic thinking (AT), and the importance of rationality (IRS) among liberals (Study 1).

relationship between analytic thinking and conclusion ideology among liberals, (b = .14, SE = .07, z = 2.10, p = .03), but not among conservatives, (b = −0.03, SE = .04, z = −0.69, p = .49). Among liberals, the interaction between analytic thinking and conclusion ideology was significant among people high on IRS (+1 SD) (b = 1.10, SE = .38, z = 2.86, p = .004), but not among people low on the IRS (−1 SD) (b = −0.07, SE = .41, z = −0.18, p = .86). Simple slope analyses showed that, among liberals high on the IRS, the effect of conclusion ideology was stronger among people with low levels of analytic thinking skills (−1 SD) (b = −1.15, SE = .36, z = −3.22, p = .001), than among people with high levels of analytic thinking skills (+1 SD) (b = −0.82, SE = .35, z = −2.36, p = .02) (see Figure 5). This pattern suggests that, among liberals, valuing epistemic rationality amplified

political belief bias among people low in analytic thinking. Thus, in contrast to our prediction that high IRS should consistently be associated with less bias, these findings imply that strong motivation without sufficient analytic thinking may exacerbate ideologically motivated reasoning.

Summary

Consistent with previous findings (see Gampa et al., 2019 and Calvillo et al., 2020), the results of this study suggest that people show political belief bias. Specifically, liberals (but not conservatives) were more likely to judge a political conclusion as valid when it was congruent (vs. discongruent) with their political ideology. Additionally, and consistent with our hypothesis, high analytic thinking skills were associated with reduced belief bias among liberals. Notably, value given to rationality affected political belief bias as well, but the observed pattern did not support our predictions. Instead, among liberals low on analytic thinking, strongly (vs. weakly) valuing rationality was associated with more political belief bias. We discuss this result in more detail in the General Discussion.

One question raised by these findings is why we only observed political belief bias among liberals. One possibility is that liberals simply are more biased in their political reasoning than conservatives. However, previous research suggests that asymmetric political bias among liberals is highly implausible (see Crawford & Pilanski, 2014 and Jost et al., 2003 for evidence supporting the ideological symmetry hypothesis, and the rigidity of the right hypothesis, respectively).

A more plausible explanation for the asymmetry observed in this study is that it stems from features of the materials themselves rather than from ideological differences in reasoning. Specifically, it is possible that the liberal conclusions were generally more believable than the conservative conclusions, thereby preventing belief bias among conservatives. Relatedly, liberals might have had stronger political agreement (vs. disagreement) with the syllogism conclusions than conservatives, which could have magnified belief bias among liberals. Ultimately, because we did not measure participants' levels of political agreement with the syllogism conclusions, we cannot determine whether ideological differences in belief strength explain the asymmetry in belief bias observed.

In Study 2, we measure participants' agreement with each statement used as a syllogism conclusion. We refer to these measures as political beliefs, which allowed us to assess the influence of participants' actual political beliefs on reasoning directly, rather than relying on general political ideology as a proxy. By doing so, we sought to clarify whether the asymmetry in belief bias observed in Study 1 reflects ideological differences in susceptibility to political belief bias, or differences between liberals and conservatives in the strength of their political beliefs about the specific political statements used as conclusions in these studies.

Study 2

This study was pre-registered (https://aspredicted.org/9DM_J16), and all research materials and data are provided in the supplementary materials. The purpose of Study 2 was to test our hypotheses more directly by relying on participants' specific political beliefs rather than their general political ideology to measure political belief bias. Our hypotheses were the same as those in Study 1.

Methods

Participants and sample size estimation

Participants who reside in the US were recruited from Cloud Research. We conducted a power analysis to estimate our sample size. We generated a simulation to determine the sample size at a power of 0.8 and an effect size of odds ratio = 1.43 using the "makeGlmer" function from the "simr" package. Based on our simulation, we determined the required sample size to be at least 500 to detect a four-way interaction in a model with a total of 7 fixed effects (Conclusion Ideology*Political Beliefs*Analytic Thinking*Importance given to rationality + Validity + Participant Political Ideology) at a power of 0.8. Compared to Study 1, this model included additional fixed and random effects (e.g., political beliefs), which may increase variability and model complexity, potentially reducing power. To account for these factors and compensate for potential subject dropout and exclusions, we decided on 700 participants as an appropriate sample size. To ensure that we have equal numbers of Democrats and Republicans, we set a quota for the number of Democrats (N_D=350) and Republicans (N_C=350). Participants were presented with a question asking, 'Which political party are you a member of' and asked to choose from three options (Republican, Democrat, and Other). 350 people who chose Republican and 350 people who chose Democrat were our participants. People who selected Other as their party were excluded. 678 participants (N_D = 343, N_C =335) began the study. After excluding participants who failed the attention check or did not complete the survey, the resulting sample (N=649[7], N_D = 332, N_C = 317, Mean age = 44.9) consisted of 265 men, 381 women, and 3 non-binary participants. The majority of the participants (57%) had university degrees or higher, of which 263 were bachelor, 82 were masters, 13 were professional, and 12 were doctoral.

Procedure and materials

Materials and procedures were identical to the ones used in Study 1 with the addition of the measure of participants' prior beliefs.

[7]Deviating from our preregistered exclusion criteria, we excluded one participant who used AI for the Cognitive Reflection Test items. Their exclusion/inclusion does not change the results.

Political beliefs

After being presented with the same political syllogism task as in Study 1 (Calvillo et al., 2020), the CRT 1–2 (Frederick, 2005; Thomson & Oppenheimer, 2016), the IRS (Ståhl et al., 2016), and some additional measures (overconfidence and MRS), participants were presented with the measure of their political beliefs. Specifically, they were asked to indicate their level of agreement with each of the 16 statements used as syllogism conclusions (e.g., "Immigrants have damaged American culture" and "Homosexuals can have healthy marriages"). They were asked to rate their level of agreement with each statement on a scale from 1 (strongly disagree) to 7 (strongly agree). Their agreement (or disagreement) with each syllogism conclusion was treated as their issue specific political beliefs, unlike in Study 1, where we used political ideology as a proxy for their issue specific political beliefs. Thus, the extent to which a participant agrees with a particular syllogism conclusion is a direct measure of political alignment. Greater agreement with a conclusion indicates a stronger alignment between the conclusion and the participants' political beliefs. It is important to note that because their political beliefs were measured post-treatment, it is possible that encountering the reasoning task influenced participants' reported political beliefs (for further discussion, see General Discussion).

Pre-registered analysis

We pre-registered to conduct a logistic mixed-effects analysis to predict perceived validity (participants' judgement of the syllogism's conclusion as valid vs invalid) using validity (valid vs invalid), participants' agreement with the conclusion (political belief rating), the conclusion ideology (conservative vs liberal), analytic thinking (AT), valuing rationality (IRS), and their interactions as predictor variables, while controlling for participant political ideology.

Deviations from pre-registration

In our pre-registration, we specified a more complex model (Model 2 in SM Table 2) that included higher-order interactions, including a four-way and a five-way interaction. However, because these interactions were not central to our research goals and added unnecessary complexity, we deviated from the pre-registration by reporting a simplified model (Model 1 in SM Table 2) that focuses on the predictors and interactions most relevant to our hypotheses.

Specifically, this model includes only the key predictors: a two-way (between conclusion ideology and participant ideology), a three-way interaction (between political beliefs, AT, and IRS), and a three-way interaction (between validity, AT, and IRS). Importantly, the main results were

Table 2. Means, standard deviations, and correlations with 95% confidence intervals (Study 2).

Variable	*M*	*SD*	1	2	3
1. AT	3.90	2.11			
2. IRS	5.65	0.88	.14** [.7, .22]		
3. Accuracy	9.89	2.61	.39** [.32, .45]	.12** [.04, .19]	
4. Political Ideology	4.01	1.92	−0.06 [−0.14, .02]	−0.18** [−0.25, −0.11]	−0.13** [−0.21, −0.06]

Note. AT: Analytic Thinking; IRS: Importance of Rationality Scale.
Higher scores on political ideology indicate a more conservative ideology, whereas lower scores indicate a more liberal ideology.
*$p < .05$.
**$p < .01$.
***$p < .001$.

consistent across both models. For transparency, we report both models in Table 2 in the Supplementary Materials.

Reported analysis plan

Participants' political beliefs, analytic thinking, valuing epistemic rationality, political ideology, conclusion ideology, and conclusion validity were entered as fixed effects. Participants were entered as a random effect with random slopes of validity, conclusion ideology, and political beliefs. Syllogisms were also entered as a crossed random effect. All continuous variables (political beliefs, AT, IRS, and political ideology) were standardised. In this final reported model, two three-way interactions (political beliefs x AT x IRS and validity x AT x IRS) were included.

In these models, belief bias refers to the impact of political beliefs on perceived validity. Our hypotheses corresponded to the interaction of political beliefs with the specified variable. The hypothesis that valuing epistemic rationality will predict less belief bias corresponded to a political beliefs x IRS interaction. The hypothesis that analytic thinking will predict less belief bias corresponded to a political beliefs x AT interaction. Lastly, the hypothesis that the negative association between analytic thinking and belief bias will be stronger among people who strongly (weakly) value epistemic rationality corresponded to a political beliefs x AT x IRS interaction.

Exploratory analyses plan

Based on findings from Study 1, we also conducted exploratory analyses examining the effect of validity and its interactions with IRS and AT (Model 1 in SM Table 2). This was to determine if IRS and AT were associated with improved accuracy.

Although not pre-registered, we also examined the role of political ideology in belief bias and objective reasoning[8]. First, we tested the participant ideology × validity interaction to examine whether participant ideology predicted better reasoning - specifically, whether individuals with certain political ideologies were more likely to make validity judgements based on the actual validity of the argument (i.e., perceiving valid arguments as more valid than invalid ones). We also tested the participant ideology × conclusion ideology interaction on perceived validity to assess the replicability of results from Study 1. Lastly, we examined the participant ideology x political beliefs interaction to explore whether the influence of political beliefs on perceived validity varied as a function of political ideology. Full results from this exploratory model with political ideology are reported in Table 3 in the Supplementary Materials.

Results and discussion

Table 2 presents the means, standard deviations, and zero-order correlations. As in Study 1 and 2, we used logistic mixed-effect analysis to test our hypotheses.

The complete results of the mixed-effects analysis are presented in Table 2 in the Supplementary Materials.

Exploratory analysis: the role of argument validity on validity judgements

As in Study 1, there was a significant main effect of validity (b = .75, SE = .21, z = 3.47, p = .001), suggesting that people were sensitive to logical validity, as they were more likely to endorse valid (vs. invalid) conclusions as valid (Mean Probability = .78 for valid vs. Mean Probability = .43 for invalid conclusions).

There was also a significant interaction between validity and analytic thinking (b = .44, SE = .04, z = 10.54, p < .001). As in Study 1, the effect of validity on validity judgments was significant among people with high analytic thinking skills (+1 SD) (b = 1.15, SE = .20, z = 5.82, p < .0001), but not among people with low analytic thinking skills (−1 SD) (b = .27, SE = .20, z = 1.38, p = .17) (see Figure 6). Thus, analytic thinking predicted more accurate logical reasoning.

[8]These analyses should be interpreted with caution, but they may offer useful insights into how belief bias may differ based on political ideology. Our central aim was to investigate belief bias—specifically, how reasoning is influenced by political beliefs, and how individual differences in analytic thinking and endorsement of rationality values shape this process when beliefs are either politically motivated or politically neutral. However, given that our stimuli involved political content and that participant ideology shaped their responses, our results in both studies led us to explore potential differences between liberals and conservatives more broadly. We explore these patterns not to make any strong claims about any specific ideological asymmetry in reasoning quality, but to contribute to the ongoing debate about ideological symmetry versus asymmetry in motivated reasoning.

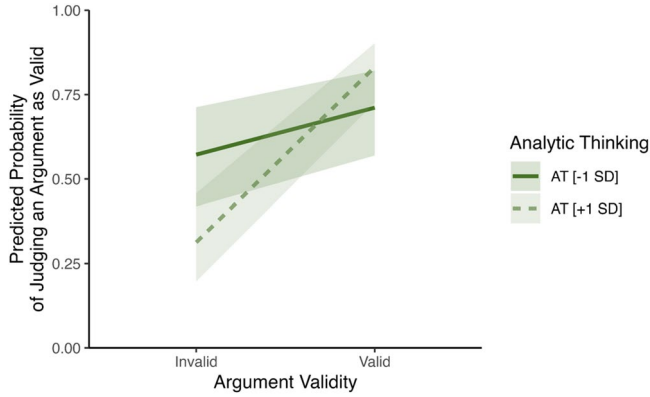

Figure 6. Predicted probability of judging arguments as valid based on argument validity and analytic thinking (AT) (Study 2).

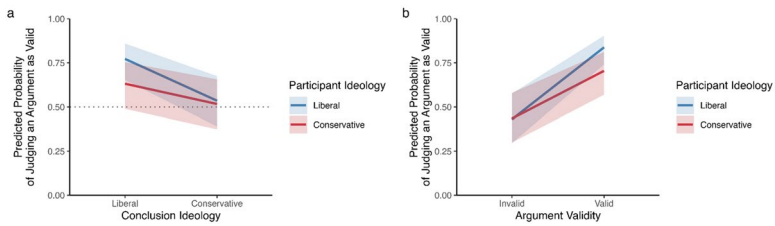

Figure 7. Predicted probability of judging arguments as valid based on participant ideology (Study 2). (a) Based on conclusion ideology and participant ideology. (b) Based on argument validity and participant ideology.

Exploratory analysis: participant ideology and sensitivity to validity

As in Study 1, there was a significant interaction between participant ideology and conclusion ideology, $b = .15$, $SE = .04$, $z = 4.17$, $p < .001$, with liberals exhibiting political belief bias ($b = -0.49$, $SE = .20$, $z = -2.39$, $p = .01$), whereas conservatives did not ($b = -0.22$, $SE = .20$, $z = -1.09$, $p = .28$) (see Figure 7a).

Additionally, as in Study 1, there was an interaction between validity and participant political ideology ($b = -0.20$, $SE = .04$, $z = -4.42$, $p < .001$), with the effect of validity being stronger among liberals (−1 SD) ($b = .90$, $SE = .22$, $z = 4.08$, $p < .0001$), than among conservatives (+1 SD) ($b = .60$, $SE = .22$, $z = 2.75$, $p = .006$). That is, liberals were more sensitive to the conclusion's validity than conservatives when forming validity judgments (see Figure 7b).

Hypotheses testing: belief bias and its moderators

As in Study 1, participants *did* exhibit belief bias, as the main effect of political beliefs on validity judgments was highly significant ($b = .79$, $SE = .04$, $z = 17.13$, $p < .001$) (see Figure 8a).

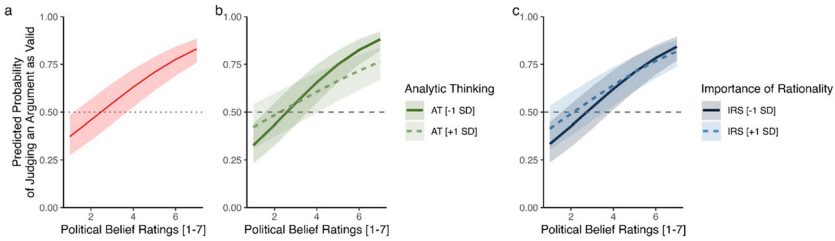

Figure 8. Predicted probability of judging arguments as valid based on political beliefs (8a), AT (8b), and IRS (8c) (Study 2).

Hypothesis 1: moderation by analytic thinking

There was also a significant interaction between political beliefs and analytic thinking ($b = -0.23$, $SE = .04$, $z = -5.41$, $p < .001$). As seen in Figure 8b, simple slopes analysis showed that the effect of political beliefs on validity judgments was stronger among people with lower levels of analytic thinking skills (−1 SD) ($b = 1.02$, $SE = .06$, $z = 16.06$, $p < .0001$) than among people with higher levels of analytic thinking skills (+1 SD) ($b = .56$, $SE = .06$, $z = 8.97$, $p < .0001$). Thus, we found support for our hypothesis that high analytic thinking skills should be associated with reduced belief bias.

Hypothesis 2: moderation by the importance of rationality (IRS)

There was also a significant interaction between political beliefs and the value given to being epistemically rational ($b = -0.10$, $SE = .04$, $z = -2.36$, $p = .01$). As seen in Figure 8c, simple slopes analysis showed that the effect of political beliefs on validity judgments was stronger among people who weakly value rationality (−1 SD) ($b = .88$, $SE = .06$, $z = 13.58$, $p < .001$) than among people who strongly value rationality, (+1 SD) ($b = .68$, $SE = .06$, $z = 10.89$, $p < .001$). Thus, we found support for our hypothesis that the value given to being rational should be associated with reduced belief bias.

Hypothesis 3: interaction by analytic thinking and the importance of rationality

There was no 3-way interaction between the value given to being epistemically rational, analytic thinking, and political beliefs ($b = -0.030$, $SE = .04$, $z = -0.74$, $p = .46$). Thus, in contrast to Study 1, we found no support for our hypothesis that the negative association between analytic thinking and belief bias should be stronger among people who strongly (weakly) value epistemic rationality.

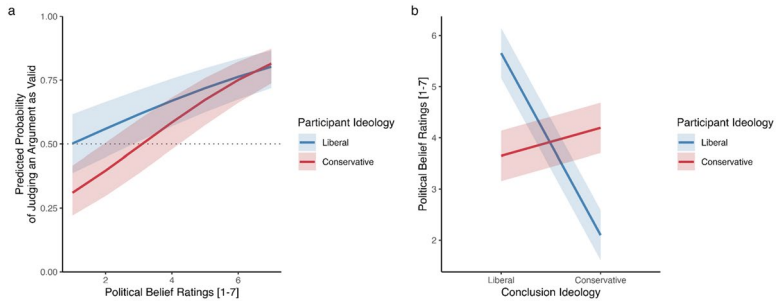

Figure 9. Political beliefs and participant ideology (Study 2). (a) Predicted validity judgement based on political beliefs and participant ideology. (b) Predicted political beliefs strength based on the conclusion ideology and participant ideology.

Political beliefs and participant ideology

We found an interaction between political beliefs and political ideology (b = .16, SE = .04, z = 3.67, p < .001), where the influence of political beliefs on perceived validity was stronger for conservatives (b = .96 to .76, SE = .07, z = 12.9, p < .001) than liberals (b = .83 to .51, SE = .08, z = 5.9, p < .001) (see Figure 9a).

To better understand this pattern, we conducted exploratory analyses with political beliefs as the outcome variable. We found a significant interaction between participant ideology and conclusion ideology (b = .45, SE = .01, z = 33.17, p < .001). A simple slopes analysis revealed that the effect of conclusion ideology on political beliefs was significant among liberals (b = −.79, SE = .01, z = −9.97, p < .001), but not among conservatives (b = .12, SE = .01, z = 1.48, p = .14) (see Figure 9b). In other words, liberals' level of political agreement with the conclusions varied dramatically depending on whether the conclusion was liberal or conservative. By contrast, conservatives agreed equally strongly with the conservative and liberal conclusions. This asymmetry likely explains why we only found belief bias among liberals (vs. conservatives) when belief bias was measured indirectly based on their general political ideology (in both studies), but we find more belief bias among conservatives (vs. liberals) when we measure belief bias directly based on their political beliefs.

Combined dataset results

As a final step, we combined the data from the two studies to explore how results held up across the two studies. For these analyses, study was added as a factor (Study 1 as 1 and Study 2 as 2). Participants who were exposed to a congruent conclusion were coded "1," and those exposed to an incongruent conclusion were coded "-1." In Study 1, congruency was defined as a match between participants' political ideology and the conclusion ideology (i.e., a Republican participant evaluating a conservative

conclusion or a Democrat evaluating a liberal conclusion). Conversely, incongruency was defined as a mismatch between the participant's ideology and the conclusion ideology (i.e., a Republican participant evaluating a liberal conclusion or a Democrat participant evaluating a conservative conclusion). In Study 2, congruency was defined as a participant's agreement with a statement (i.e., a participant rating their agreement as 4 or higher on the 1–7 Likert scale). In contrast, incongruency was defined as a participant's disagreement with a statement (i.e., a participant rating their agreement as below 4 on the scale).

Consistent with previous analyses of each study separately, participants exhibited belief bias, as they were more likely to perceive an argument as valid if it was congruent (vs. incongruent) with their political ideology (b = .53, SE = .025, z = 21.01, p < .001). Congruency also interacted with analytic thinking (b = −0.12, SE = .024, z = −5.24., p < .001). However, the interaction between congruency and value given to being epistemically rational (IRS) was not significant (b = −0.002, SE = .024, z = −0.10, p = .92), and there was no significant three-way interaction between congruency, AT, and IRS (b = −0.03, SE = .023, z = −1.46, p = .14).

Participants were also sensitive to the validity of the arguments, as they were more likely to judge valid (vs. invalid) arguments as valid (b = .73, SE = .17, z = 4.26, p < .001). The validity by analytic thinking interaction was also significant (b = .39, SE = .028, z = 13.66, p < .001), as was the validity by IRS interaction (b = .10, SE = .028, z = 3.34, p < .001). Thus, across studies, both analytic thinking and valuing epistemic rationality predicted more accurate logical reasoning, but only analytic thinking predicted less political belief bias.

Summary

Consistent with previous research (see Gampa et al., 2019 and Calvillo et al., 2020), and with Study 1, the results of this study provide further evidence of political belief bias: individuals' judgments of an argument's logical validity are influenced by their own political beliefs. Notably, when political belief bias was operationalised as the effect of congruency between conclusion ideology and participant ideology on validity judgements, we found political belief bias among liberals, but not among conservatives, just as in Study 1. However, the primary aim of Study 2 was to directly assess the influence of participants' political belief ratings—rather than using political ideology as a proxy—on validity judgments. Using this operationalisation of belief bias, we found belief bias across the political spectrum, and it was actually stronger among conservatives than among liberals. Taken together, these findings highlight the importance of examining political belief bias using both political/ideological congruency and issue specific political beliefs. The results from this study also support our hypotheses that analytic thinking and the value given

to being epistemically rational mitigate the influence of political beliefs. However, unlike in Study 1, we did not find any support for the hypothesis that valuing epistemic rationality and analytic thinking interactively affect political belief bias. As in previous studies (e.g., Calvillo et al., 2020; Toplak et al., 2011), analytic thinking was also associated with better logical performance in our reasoning task; individuals with strong (vs. weak) analytic thinking abilities were more strongly influenced by the actual validity of the argument when making their validity judgments.

General discussion

Previous work suggests that analytic thinking can reduce the likelihood that people adopt various epistemically suspect beliefs, especially among those who are highly motivated to be rational (see Adam-Troian et al., 2019; Ståhl et al., 2024; Ståhl & Van Prooijen, 2018). However, in these previous studies, people merely reported their existing beliefs, or their evaluations of bullshit-statements (i.e., statements that imply, but do not contain, any intended meaning or truth, Pennycook et al., 2015). Therefore, it remains unclear whether analytic thinking and motivation to be rational reduce biases in reasoning, or whether they predict scepticism of certain ideas based on some other process. The purpose of the present research was to examine directly how analytic thinking and valuing epistemic rationality relate to the influence of political beliefs on logical reasoning. We hypothesised that analytic thinking and valuing epistemic rationality would predict less political belief bias. Additionally, we expected that valuing epistemic rationality would moderate the relationship between analytic thinking and political belief bias. In Study 1, we measured politically motivated beliefs indirectly, by using general political ideology as a proxy. In Study 2, we examined whether the results from Study 1 would conceptually replicate when participants' political beliefs were measured directly.

Across both studies, we found that analytic thinking was associated with less political belief bias, as well as more accurate logical reasoning. In addition, when we measured people's political beliefs directly (Study 2), rather than their general political ideology (Study 1), we found evidence that the value given to being epistemically rational also can mitigate political belief bias. However, the predicted interaction between analytic thinking and IRS did not receive strong empirical support. In Study 1, among liberals, the value given to rationality did interact with analytic thinking to predict political belief bias, but not in the way it was stated in our pre-registered prediction. Our original hypothesis posited that people who strongly valued epistemic rationality, and scored high on analytic thinking, would show the least political belief bias. However, the results instead suggested that strongly valuing epistemic rationality can backfire, when it is combined with insufficient analytic thinking. Specifically, among

liberals low on analytic thinking, political belief bias was more pronounced for those who strongly (vs. weakly) valued epistemic rationality

While this finding aligns to some degree with Ståhl and Van Prooijen's argument (2018) that both sufficient cognitive sophistication and motivation to be rational may be required to protect against biased reasoning, it also highlights an important nuance: motivation to be epistemically rational alone can even exacerbate bias under some conditions. Our results suggest that the benefits of high motivation to be rational depend on the level of analytic thinking abilities, and that for some groups in some contexts, the combination of high motivation to be rational and low analytic thinking may be a liability. However, because this effect did not replicate in the combined dataset—the most powered analysis—these results should be interpreted with caution. Future research is needed to determine whether this effect is robust and replicable.

Some scholars have argued that cognitive sophistication can be used to reach conclusions that are consistent with one's ideology and thereby accentuate political biases (Kahan et al., 2012, 2017). Our results do not support this account. In both studies, we observed a negative association between analytic thinking and political belief bias on our reasoning tasks. Individuals with strong (vs. weak) analytic thinking abilities were more strongly influenced by the actual validity of the arguments, and less strongly influenced by their political beliefs, when making their judgments. This pattern of results is consistent with recent work suggesting that analytic thinking generally improves, and at the very least does not hurt, reasoning quality (Stagnaro et al., 2023; Tappin et al., 2021).

Notably, in Study 1, when we used political ideology as a proxy for political beliefs, we found evidence of belief bias only among liberals. We replicated these findings in Study 2. At face value, these findings could be interpreted as evidence that liberals are more susceptible to politically biased reasoning. However, it is possible that the congruence between liberals' political ideology and the liberal syllogism conclusions used in our studies was stronger or more consistent than between conservatives' ideology and conservatively-aligned conclusions. In other words, liberals (vs. conservatives) may have encountered more belief-congruent statements than conservatives did. If so, the observed asymmetry in political belief bias may have been driven more by the strength of liberals' (vs. conservatives') political beliefs rather than by an ideological asymmetry in susceptibility to political belief bias. To test this possibility, Study 2 directly measured participants' political beliefs about each conclusion rather than inferring them from their political ideology. When using this more direct approach, we found that political beliefs were a strong predictor of perceived validity for both groups - but this effect was stronger among conservatives than liberals. In other words, while only liberals showed bias when belief bias was measured indirectly based on their general political ideology, conservatives showed greater political belief

bias than liberals when it was measured directly based on their personal political beliefs.

This divergence in findings highlights the importance of distinguishing between two different conceptualizations in biased reasoning: one based on *ideological alignment* and the other based on *belief strength*. As noted by Tappin et al. (2020), political ideology and political beliefs are related, but not interchangeable. More specifically, our results suggest two possible interpretations. One is that conservatives' belief bias can be attributed primarily to the strength of their political beliefs. By contrast, liberal belief bias may be shaped both by political belief strength and by factors such as political ideology or group identity. Alternatively, the pattern of results may reflect ideological differences in the distribution of belief strength: liberals may have been in stronger agreement with the liberal conclusions than conservatives were with conservative ones. Our exploratory analyses support this latter explanation (see Supplementary Materials for a detailed visualisation of this distribution). Specifically, we found that liberal participants agreed substantially more with the liberal (vs. conservative) conclusions, whereas conservatives agreed equally with both sets of conclusions. These findings strongly suggest that the inconsistent results obtained depending on whether belief bias was measured directly or indirectly was due to ideological differences in political belief strength, not due to ideological differences in what explains political belief bias.

Moreover, these findings help us to clarify an apparent paradox: although liberals showed stronger belief bias when it was defined in terms of ideological alignment, they also demonstrated higher overall accuracy than conservatives across both studies. Specifically, in Study 1, liberals had a significantly higher average accuracy ($M = 10.1$, $SD = 2.55$) than conservatives ($M = 9.4$, $SD = 2.31$), $t(932) = 3.24$, $p = .001$. A similar pattern emerged in Study 2 ($M = 10.1$, $SD = 2.53$ vs. $M = 9.67$, $SD = 2.67$), $t(647) = 2.12$, $p = .03$ (see SM for these results). One possible explanation is that liberals reasoned more accurately overall, on average. However, when liberals made errors, these errors were more likely to align with their political beliefs, because their agreement with the liberal conclusions was stronger than conservatives' agreement with conservative conclusions. In contrast, conservatives showed lower overall accuracy but made errors in both directions, consistent with having more balanced or weaker political beliefs across the board. Together, these findings offer a more nuanced contribution to the ongoing debate on ideological symmetry vs. asymmetry in motivated reasoning - highlighting the importance of distinguishing between reasoning ability and the strength or directionality of political beliefs. Namely, observed asymmetries in political belief bias may reflect differences in belief content and strength rather than ideological differences in reasoning.

The present findings are not only of theoretical interest, but may also have important practical implications. Specifically, and in accordance with previous studies, our results suggest that both analytic thinking (Trippas

et al., 2015, 2018), and the value given to being epistemically rational (Adam-Troian et al., 2019; Ståhl et al., 2024; Ståhl & Van Prooijen, 2018; Yilmaz & Ståhl, 2025), improve reasoning and reduce bias. These findings speak to the practical importance of promoting and enhancing analytic thinking skills, and motivation to form beliefs based on logic and evidence. Notably, there is some evidence that relatively brief training sessions and subtle priming procedures can enhance analytic thinking (see Gurcay-Morris, 2016; Isler et al., 2020; Morewedge et al., 2015; Sellier et al., 2019; but also see Većkalov et al., 2024 for a failed replication of some of these methods), and increase the salience of the goal to be epistemically rational (Adam-Troian et al., 2019), thereby improving reasoning in the short-term. Future research should further explore the extent to which these variables can be bolstered, especially in longitudinal studies. In other words, how can we train or encourage people to rely more on analytic thinking? Similarly, how can we change the extent to which people value epistemic rationality in the long-term? Provided that reliable strategies for bolstering these factors can be developed, the present research suggests that they could serve as effective remedies against political belief bias. In short, the present findings open up exciting avenues for further research, and offer some hope that there are ways to reduce bias and improve reasoning about politically charged topics.

Limitations and suggestions for future research

An important question about the present research concerns stimulus generalisability. Specifically, would we have obtained similar results had we used different conclusions to assess belief bias? It is clear from the present studies that results do differ as a function of the specific conclusions used, because the strength of liberals' and conservatives' political beliefs can vary between them. Our studies thus illustrate the importance of either relying on items that are equally believable across the political spectrum or to measure participants' political belief ratings about each of the conclusions directly. Our results also suggest that current political belief bias items do not work very well. They do not consistently align with participants' political ideology, as they work better for liberals than conservatives. Specifically, for conservative participants, agreement levels were similar for both supposedly liberal and conservative items, highlighting the need to develop alternative materials for future studies.

Relatedly, we examined in a separate study whether analytic thinking and valuing epistemic rationality would predict belief bias when the conclusions were either consistent or inconsistent with politically neutral prior knowledge (e.g., all cats are animals vs. all animals are cats). Notably, we found substantially less belief bias when the measure was based on politically neutral prior knowledge than in the present studies, and none of our predictors were related to value-neutral belief bias (the materials and

data from this study are available on OSF). These findings may indicate that analytic thinking and valuing epistemic rationality primarily predict less belief bias when there is a strong temptation to engage in biased reasoning, such as when conclusions are tied to cherished political beliefs or personal values. Future studies, directly comparing the extent to which analytic thinking and valuing epistemic rationality predict political vs. apolitical belief bias is needed to answer this question more conclusively.

Another potential limitation concerns the timing of the beliefs measurements in Study 2. Specifically, we assessed participants' political beliefs after they had completed the reasoning task. Thus, it is possible that participants incorporated some elements of the task into their reported beliefs[9]. In this sense, these measures may better reflect post-task beliefs (posteriors) rather than pre-existing political beliefs (priors), which could influence interpretation of the results (see Montgomery et al. 2018). However, it is important to note that there could have been a substantial problem associated with measuring the political beliefs before the manipulations as well. Measuring participants' level of agreement with these statements at the beginning of the study, and then exposing them to the same statements as conclusions in the syllogism task might have made the participants aware of the purpose of the study, and they may thereby have reasoned and responded differently. At the end of the day, each of these approaches can produce confounds, which is in part why these studies don't allow us to draw causal conclusions.

Another reason we cannot draw causal conclusions based on these studies is the fact that they were largely correlational in nature. Specifically, differences in political beliefs, analytic thinking, and how much people value epistemic rationality were measured rather than manipulated. Future studies should experimentally manipulate analytic thinking and motivation to be epistemically rational to establish if the relationships observed here are causal in nature (cf., Adam-Troian et al., 2019, Ståhl et al., 2024).

Conclusion

The purpose of the present research was to examine the role of valuing epistemic rationality and analytic thinking in political belief bias. Our results suggest that political beliefs interfere with logical reasoning, and that analytic thinking (Studies 1–2), and valuing epistemic rationality (Study 2), are associated with less political belief bias. The present research thereby provides direct support for the importance of high analytic thinking skills and valuing epistemic rationality in mitigating political belief bias, and in facilitating objective reasoning about politically charged issues. However, some of our findings also suggest that valuing epistemic

[9]We thank an anonymous reviewer for pointing out this issue.

rationality can exacerbate political belief bias (Study 1), when combined with insufficient analytic thinking.

Disclosure statement

No potential conflict of interest was reported by the author(s). The data that support the findings of this study are openly available in the OSF at https://osf.io/6hvmf/. This research received no specific grant funding from any funding agency, commercial or not-for-profit sector.

ORCID

Sinem Yilmaz http://orcid.org/0000-0002-7111-0990

References

Abad-Santos, A. (2013, May 22). Yes, Oklahoma truthers think Obama used his anti-scandal weather magic. *The Atlantic Wire*. Retrieved May 27, 2013, from http://www.theatlanticwire.com/national/2013/05/oklahoma-tornadoconspiracy-theories/65499/

Adam-Troian, J., Caroti, D., Arciszewski, T., & Ståhl, T. (2019). Unfounded beliefs among teachers: The interactive role of rationality priming and cognitive ability. *Applied Cognitive Psychology*, *33*(4), 720–727. https://doi.org/10.1002/acp.3547

Annenberg Public Policy Center of the University of Pennsylvania. (2019, May 9). Do most Americans believe in human-caused climate change? It depends on how you ask: Three wording decisions can significantly alter estimates. *ScienceDaily*. www.sciencedaily.com/ releases/2019/05/190509133848.htm

Aspernäs, J., Erlandsson, A., & Nilsson, A. (2023). Motivated formal reasoning: Ideological belief bias in syllogistic reasoning across diverse political issues. *Thinking & Reasoning*, *29*(1), 43–69. https://doi.org/10.1080/13546783.2022.2038268

Bago, B., Rand, D. G., & Pennycook, G. (2023). Reasoning about climate change. *PNAS Nexus*, *2*(5), pgad100. https://doi.org/10.1093/pnasnexus/pgad100

Baker, S. G., Patel, N., Von Gunten, C., Valentine, K. D., & Scherer, L. D. (2020). Interpreting politically-charged numerical information: The influence of numeracy and problem difficulty on response accuracy. *Judgment and Decision Making*, *15*(2), 203–213. https://doi.org/10.1017/S193029750000735X

Barrett, J. L. (2000). Exploring the natural foundations of religion. *Trends in Cognitive Sciences*, *4*(1), 29–34. https://doi.org/10.1016/S1364-6613(99)01419-9

Bierwiaczonek, K., Gundersen, A. B., & Kunst, J. R. (2022). The role of conspiracy beliefs for COVID-19 health responses: A meta-analysis. *Current Opinion in Psychology*, *46*, 101346. https://doi.org/10.1016/j.copsyc.2022.101346

Bolsen, T., Druckman, J. N., & Cook, F. L. (2015). Citizens', scientists', and policy advisors' beliefs about global warming. *The ANNALS of the American Academy of Political and Social Science*, *658*(1), 271–295. https://doi.org/10.1177/0002716214558393

Brotherton, R., & French, C. C. (2014). Belief in conspiracy theories and susceptibility to the conjunction fallacy. *Applied Cognitive Psychology*, *28*(2), 238–248. https://doi.org/10.1002/acp.2995

Calvillo, D. P., Swan, A. B., & Rutchick, A. M. (2020). Ideological belief bias with political syllogisms. *Thinking & Reasoning*, *26*(2), 291–310. https://doi.org/10.1080/13546783.2019.1688188

Crawford, J. T., & Pilanski, J. M. (2014). Political intolerance, right *and* left. *Political Psychology*, *35*(6), 841–851. https://doi.org/10.1111/j.1467-9221.2012.00926.x

De Neys, W. (2006). Dual processing in reasoning: Two systems but one reasoner. *Psychological Science*, *17*(5), 428–433. https://doi.org/10.1111/j.1467-9280.2006.01723.x

De Neys, W. (2012). Bias and conflict: A case for logical intuitions. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *7*(1), 28–38. https://doi.org/10.1177/1745691611429354

Drummond, C., & Fischhoff, B. (2017). Individuals with greater science literacy and education have more polarized beliefs on controversial science topics. *Proceedings of the National Academy of Sciences of the United States of America*, *114*(36), 9587–9592. https://doi.org/10.1073/pnas.1704882114

Evans, J., St, B. T., Barston, J. L., & Pollard, P. (1983). On the conflict between logic and belief in syllogistic reasoning. *Memory & Cognition*, *11*(3), 295–306. https://doi.org/10.3758/BF03196976

Evans, J. S. B. T., & Curtis-Holmes, J. (2005). Rapid responding increases belief bias: Evidence for the dual-process theory of reasoning. *Thinking & Reasoning*, *11*(4), 382–389. https://doi.org/10.1080/13546780542000005

Evans, J. S., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *8*(3), 223–241. https://doi.org/10.1177/1745691612460685

Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic Perspectives*, *19*(4), 25–42. https://doi.org/10.1257/089533005775196732

Gampa, A., Wojcik, S. P., Motyl, M., Nosek, B. A., & Ditto, P. H. (2019). (Ideo)logical reasoning: Ideology impairs sound reasoning. *Social Psychological and Personality Science*, *10*(8), 1075–1083. https://doi.org/10.1177/1948550619829059

Gardiner, B., & Thompson, H. (2012). *We ask: Conspiracy theories*. Retrieved May 27, 2013, from YouGov.co.uk.

Gervais, W. M., & Norenzayan, A. (2012). Analytic Thinking Promotes Religious Disbelief. *Science (New York, N.Y.)*, *336*(6080), 493–496. https://doi.org/10.1126/science.1215647

Gurcay-Morris, B. (2016). *The use of alternative reasons in probabilistic judgment* [PhD dissertation]. Department of Psychology, University of Pennsylvania.

Hamilton, L. C., Cutler, M. J., & Schaefer, A. (2012). Public knowledge and concern about polar-region warming. *Polar Geography*, *35*(2), 155–168. https://doi.org/10.1080/1088937X.2012.684155

Handley, S. J., & Trippas, D. (2015). Dual processes and the interplay between knowledge and structure: A new parallel processing model. *Psychology of Learning and Motivation - Advances in Research and Theory*, 62, 33–58. https://doi.org/10.1016/bs.plm.2014.09.002

Holpuch, A. (2013, April 24). Boston marathon bombings: Rounding up the conspiracy theories. *The Guardian*. Retrieved May 27, 2013, from http://www.guardian.co.uk/world/us-news-blog/2013/apr/24/boston-marathon-conspiracy-theories

Isler, O., Yilmaz, O., & Dogruyol, B. (2020). Activating reflective thinking with decision justification and debiasing training. *Judgment and Decision Making*, *15*(6), 926–938. https://doi.org/10.1017/S1930297500008147

Johnson, S. B., Park, H. S., Gross, C. P., & Yu, J. B. (2018). Complementary Medicine, Refusal of Conventional Cancer Therapy, and Survival Among Patients With Curable Cancers. *JAMA Oncology*, *4*(10), 1375–1381. https://doi.org/10.1001/jamaoncol.2018.2487

Janis, I. L., & Frick, F. (1943). The relationship between attitudes toward conclusions and errors in judging logical validity of syllogisms. *Journal of Experimental Psychology*, *33*(1), 73–77. https://doi.org/10.1037/h0060675

Jolley, D., & Douglas, K. M. (2014). The effects of anti-vaccine conspiracy theories on vaccination intentions. *PloS One*, *9*(2), e89177. https://doi.org/10.1371/journal.pone.0089177

Jost, J. T., Glaser, J., Kruglanski, A. W., & Sulloway, F. J. (2003). Political conservatism as motivated social cognition. *Psychological Bulletin*, *129*(3), 339–375. https://doi.org/10.1037/0033-2909.129.3.339

Kahan, D. M. (2013). Ideology, motivated reasoning, and cognitive reflection. *Judgment and Decision Making*, *8*(4), 407–424. https://doi.org/10.2139/ssrn.2182588

Kahan, D. M., Peters, E., Dawson, E. C., & Slovic, P. (2017). Motivated numeracy and enlightened self-government. *Behavioural Public Policy*, *1*(1), 54–86. https://doi.org/10.1017/bpp.2016.2

Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L. L., Braman, D., & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature Climate Change*, *2*(10), 732–735. https://doi.org/10.1038/nclimate1547

Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.

Lobato, E., Mendoza, J., Sims, V., & Chin, M. (2014). Examining the Relationship Between Conspiracy Theories, Paranormal Beliefs, and Pseudoscience Acceptance Among a University Population: Relationship between unwarranted beliefs. *Applied Cognitive Psychology*, *28*(5), 617–625. https://doi.org/10.1002/acp.3042

Markovits, H., & Nantel, G. (1989). The belief-bias effect in the production and evaluation of logical conclusions. *Memory & Cognition*, *17*(1), 11–17. https://doi.org/10.3758/BF03199552

Montgomery, J. M., Nyhan, B., & Torres, M. (2018). How conditioning on posttreatment variables can ruin your experiment and what to do about it. *American Journal of Political Science*, *62*(3), 760–775. https://doi.org/10.1111/ajps.12357

Morewedge, C. K., Yoon, H., Scopelliti, I., Symborski, C. W., Korris, J. H., & Kassam, K. S. (2015). Debiasing decisions: Improved decision making with a single training intervention. *Policy Insights from the Behavioral and Brain Sciences*, *2*(1), 129–140. https://doi.org/10.1177/2372732215600886

Morgan, J. J., & Morton, J. T. (1944). The distortion of syllogistic reasoning produced by personal convictions. *The Journal of Social Psychology*, *20*(1), 39–59. https://doi.org/10.1080/00224545.1944.9918830

Oeberst, A., & Imhoff, R. (2023). Toward parsimony in bias research: A proposed common framework of belief-consistent information processing for a set of biases. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *18*(6), 1464–1487. https://doi.org/10.1177/17456916221148147

Pennycook, G. (2023). A framework for understanding reasoning errors: From fake news to climate change and beyond. *Advances in Experimental Social Psychology*, *67*, 131–208. https://doi.org/10.1016/bs.aesp.2022.11.003

Pennycook, G., Binnendyk, J., & Rand, D. G. (2025). Overconfidently conspiratorial: Conspiracy believers are dispositionally overconfident and massively overestimate

how much others agree with them. *Personality & Social Psychology Bulletin*, *0*(0), 1461672251338358. https://doi.org/10.1177/01461672251338358

Pennycook, G., Cheyne, J., Seli, P., Koehler, D., & Fugelsang, J. (2012). Analytic cognitive style predicts religious and paranormal belief. *Cognition*, *123*(3), 335–346. https://doi.org/10.1016/j.cognition.2012.03.003

Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. (2013). Belief bias during reasoning among religious believers and skeptics. *Psychonomic Bulletin & Review*, *20*(4), 806–811. https://doi.org/10.3758/s13423-013-0394-3

Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. (2020). On the belief that beliefs should change according to evidence: Implications for conspiratorial, moral, paranormal, political, religious, and science beliefs. *Judgment and Decision Making*, *15*(4), 476–498. https://doi.org/10.1017/S1930297500007439

Pennycook, G., Fugelsang, J. A., & Koehler, D. J. (2015). Everyday consequences of analytic thinking. *Current Directions in Psychological Science*, *24*(6), 425–432. https://doi.org/10.1177/0963721415604610

Pennycook, G., McPhetres, J., Bago, B., & Rand, D. G. (2020). Predictors of attitudes and misperceptions about COVID-19 in Canada, the UK, and the USA. *PsyArXiv*, *10*, 1–25. https://doi.org/10.1177/01461672211023652

Persson, E., Andersson, D., Koppel, L., Västfjäll, D., & Tinghög, G. (2021). A preregistered replication of motivated numeracy. *Cognition*, *214*, 104768. https://doi.org/10.1016/j.cognition.2021.104768

Petty, R. E., & Cacioppo, J. T. (1986). *The elaboration likelihood model of persuasion* (pp. 1–24). Springer New York.

R Core Team. (2024). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org

Ross, R. M., Rand, D. G., & Pennycook, G. (2021). Beyond "fake news": Analytic thinking and the detection of false and hyperpartisan news headlines. *Judgment and Decision Making*, *16*(2), 484–504. https://doi.org/10.1017/S1930297500008640

Schwartz, L. M., Woloshin, S., Black, W. C., & Welch, H. G. (1997). The role of numeracy in understanding the benefit of screening mammography. *Annals of Internal Medicine*, *127*(11), 966–972. https://doi.org/10.7326/0003-4819-127-11-199712010-00003

Sellier, A. L., Scopelliti, I., & Morewedge, C. K. (2019). Debiasing training improves decision making in the field. *Psychological Science*, *30*(9), 1371–1379. https://doi.org/10.1177/0956797619861429

Shenhav, A., Rand, D. G., & Greene, J. D. (2012). Divine intuition: Cognitive style influences belief in God. *Journal of Experimental Psychology. General*, *141*(3), 423–428. https://doi.org/10.1037/a0025391

Stagnaro, M. N., Tappin, B. M., & Rand, D. G. (2023). No association between numerical ability and politically motivated reasoning in a large US probability sample. *Proceedings of the National Academy of Sciences of the United States of America*, *120*(32), e2301491120. https://doi.org/10.1073/pnas.2301491120

Stanovich, K. E. (2021). *The bias that divides us: The science and politics of myside thinking*. The MIT Press. https://doi.org/10.7551/mitpress/13367.001.0001

Stanovich, K. E., West, R. F., & Toplak, M. E. (2016). *The rationality quotient: Toward a test of rational thinking*. The MIT Press. https://doi.org/10.7551/mitpress/9780262034845.001.0001

Ståhl, T., & Cusimano, C. (2024). Lay standards for reasoning predict people's acceptance of suspect claims. *Current Opinion in Psychology*, *55*, 101727. https://doi.org/10.1016/j.copsyc.2023.101727

Ståhl, T., & Van Prooijen, J.-W. (2018). Epistemic rationality: Skepticism toward unfounded beliefs requires sufficient cognitive ability and motivation to be rational. *Personality and Individual Differences*, *122*, 155–163. https://doi.org/10.1016/j.paid.2017.10.026

Ståhl, T., Zaal, M. P., & Skitka, L. J. (2016). Moralized rationality: Relying on logic and evidence in the formation and evaluation of belief can be seen as a moral issue. *PloS One*, *11*(11), e0166332. https://doi.org/10.1371/journal.pone.0166332

Ståhl, Digby, N., & Yilmaz, S. (submitted). *When do non-evidential considerations trump evidence as the consciously preferred foundation for belief? The role of commitment to epistemic rationality*. Manuscript submitted for publication.

Ståhl, T., Yilmaz, S., Digby, N., & Stasko, P. (2024). Valuing epistemic rationality bolsters the effect of analytic thinking on skepticism toward pseudo-profound bullshit. *Personality and Individual Differences*, *217*, 112452. https://doi.org/10.1016/j.paid.2023.112452

Stempel, C., Hargrove, T., & Stempel, G. H. (2007). Media use, social structure, and belief in 9/11 conspiracy theories. *Journalism & Mass Communication Quarterly*, *84*(2), 353–372. https://doi.org/10.1177/107769900708400210

Swami, V., Barron, D., Weis, L., Voracek, M., Stieger, S., & Furnham, A. (2017). An examination of the factorial and convergent validity of four measures of conspiracist ideation, with recommendations for researchers. *PloS One*, *12*(2), e0172617 https://doi.org/10.1371/journal.pone.0172617

Tappin, B. M., Pennycook, G., & Rand, D. G. (2020a). Bayesian or biased? Analytic thinking and political belief updating. *Cognition*, *204*, 104375. https://doi.org/10.1016/j.cognition.2020.104375

Tappin, B. M., Pennycook, G., & Rand, D. G. (2020b). Thinking clearly about causal inferences of politically motivated reasoning: Why paradigmatic study designs often undermine causal inference. *Current Opinion in Behavioral Sciences*, *34*, 81–87. https://doi.org/10.1016/j.cobeha.2020.01.003

Tappin, B. M., Pennycook, G., & Rand, D. G. (2021). Rethinking the link between cognitive sophistication and politically motivated reasoning. *Journal of Experimental Psychology. General*, *150*(6), 1095–1114. https://doi.org/10.1037/xge0000974

Thomson, K. S., & Oppenheimer, D. M. (2016). Investigating an alternate form of the cognitive reflection test. *Judgment and Decision Making*, *11*(1), 99–113. https://doi.org/10.1017/S1930297500007622

Toplak, M. E., West, R. F., & Stanovich, K. E. (2011). The Cognitive Reflection Test as a predictor of performance on heuristics-and-biases tasks. *Memory & Cognition*, *39*(7), 1275–1289. https://doi.org/10.3758/s13421-011-0104-1

Trippas, D., Handley, S. J., & Verde, M. F. (2013). The SDT model of belief bias: Complexity, time and cognitive ability mediate the effects of believability. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *39*(5), 1393–1402. https://doi.org/10.1037/a0032398

Trippas, D., Pennycook, G., Verde, M. F., & Handley, S. J. (2015). Better but still biased: Analytic cognitive style and belief bias. *Thinking & Reasoning*, *21*(4), 431–445. https://doi.org/10.1080/13546783.2015.1016450

Trippas, D., Kellen, D., Singmann, H., Pennycook, G., Koehler, D. J., Fugelsang, J. A., & Dubé, C. (2018). Characterizing belief bias in syllogistic reasoning: A hierarchical Bayesian meta-analysis of ROC data. *Psychonomic Bulletin & Review*, *25*(6), 2141–2174. https://doi.org/10.3758/s13423-018-1460-7

Van den Bulck, J., & Custers, K. (2009). Television exposure is related to fear of avian flu, an Ecological Study across 23 member states of the European Union. *European Journal of Public Health*, *19*(4), 370–374. https://doi.org/10.1093/eurpub/ckp061

Većkalov, B., Gligorić, V., & Petrović, M. B. (2024). No evidence that priming analytic thinking reduces belief in conspiracy theories: A Registered Report of high-powered direct replications of Study 2 and Study 4 from Swami, Voracek, Stieger, Tran, and Furnham. (2014). *Journal of Experimental Social Psychology*, *110*, Article 104549. https://doi.org/10.1016/j.jesp.2023.104549

Williams, J. (2013, April 2). Conspiracy theory poll results. *Public Policy. Polling*. Retrieved May 27, 2013, from http://www.publicpolicypolling. com/main/2013/04/conspiracy-theory-poll-results-.html

Wood, M. J., Douglas, K. M., & Sutton, R. M. (2012). Dead and alive: Beliefs in contradictory conspiracy theories. *Social Psychological and Personality Science*, *3*(6), 767–773. https://doi.org/10.1177/1948550611434786

Yilmaz, S., & Ståhl, T. (2025). Pro-science beliefs: The role of analytic thinking and epistemic values. *Scandinavian Journal of Psychology*, *66*(5), 702–716. https://doi.org/10.1111/sjop.13114]