

Mind over bias: How is cognitive control related to politically motivated reasoning?

Authors

Olaf Borghi*^{1,2} olaf.borghi@rhul.ac.uk

Ben M. Tappin³ b.tappin@lse.ac.uk

Kaat Smets⁴ kaat.smets@rhul.ac.uk

Manos Tsakiris^{1,2} manos.tsakiris@rhul.ac.uk

*Correspondence: olaf.borghi@rhul.ac.uk, Royal Holloway, University of London, Egham, Surrey, TW20 0EX

¹Department of Psychology, Royal Holloway, University of London, UK

²Centre for the Politics of Feelings, School of Advanced Study, University of London, UK

³Department of Psychological and Behavioural Science, London School of Economics and Political Science, UK

⁴Department of Politics, International Relations and Philosophy, Royal Holloway, University of London, UK

Abstract

People often favour information aligned with their ideological motives. Can our tendency for directional motivated reasoning be overcome with cognitive control? It remains contested whether cognitive control processes, such as cognitive reflection and inhibitory control, are linked to a greater tendency to engage in politically motivated reasoning, as proposed by the “motivated reflection” hypothesis, or can help people overcome it, as suggested by cognitive science research. In this pre-registered study ($N = 504$ UK participants rating $n = 4963$ news messages), we first provide evidence for motivated reasoning on multiple political and non-political topics. We then investigated the associations of the two cognitive control variables cognitive reflection and inhibitory control with motivated reasoning. We find that associations between cognitive control processes and motivated reasoning are likely small. On political topics specifically, we find that a negative association with cognitive reflection is more likely than a positive association. This finding is contrary to predictions from the popular motivated reflection hypothesis. Results for inhibitory control are inconclusive. We discuss how these findings relate to interdisciplinary literature from cognitive and political psychology.

Revision 1, updated on June 3rd, 2025

Funding: This research was conducted as part of the IP-PAD doctoral network. IP-PAD is funded by the European Union, under the Horizon Europe MSCA Doctoral Networks programme (Call HORIZON-MSCA-2021-DN-01, Grant Agreement No. 101072992) with participation from the UKRI Horizon Europe guarantee' scheme. M.T. is supported by a NOMIS Foundation Grant for the Centre for the Politics of Feelings.

Introduction

Rather than being truth seekers, people often evaluate the veracity of information in line with non-truth seeking motives, and their reasoning is directionally motivated towards desired or identity-protective conclusions (Kahan, 2016; Kunda, 1990). In today's political landscape, it is not just opinions that differ along ideological lines, but also beliefs about factual questions (Rekker & Harteveld, 2022; Van Bavel & Pereira, 2018). Politically motivated reasoning can lead people away from accurate judgements, resulting in polarised (Su, 2022) or misinformed beliefs (Ecker et al., 2022). One key question that remains unanswered is whether cognitive control processes, such as cognitive reflection and inhibitory control, can allow people to better resist politically motivated reasoning, or on the contrary, make them more likely to engage in it (e.g., Tappin et al., 2020b). Two alternative hypotheses have been put forward.

According to the “motivated reflection” hypothesis, people use cognitive control processes to construct reasonable justifications that lead them towards desired conclusions. In other words, they are better at coming up with rational arguments to justify their directional biases (Kahan, 2013; Kahan et al., 2017). A series of studies provide evidence for this in the political domain where people higher in cognitive sophistication appear more susceptible to motivated reasoning. In one seminal study (Kahan, 2013), participants who scored high on the Cognitive Reflection Test, a measure of the ability to suppress intuitive but incorrect answers in favour of more deliberate reasoning (Frederick, 2005), were also more prone to motivated reasoning when the information they received conflicted with their beliefs about climate change. A similar pattern for higher motivated reasoning on different political issues (e.g., effects of gun control, CO₂ emissions, immigration) was found for participants high in numerical ability (Kahan et al., 2017; Kahan & Peters, 2017; Nurse & Grant, 2020; Sumner et al., 2023).

However, recent studies have challenged this “motivated reflection” hypothesis. First, the relationship between cognitive control processes and motivated reasoning varies across topics (Strömbäck et al., 2024), and the aforementioned seminal finding has proven difficult to replicate (Bago et al., 2023; Persson et al., 2021; Stagnaro et al., 2023). Furthermore, when accounting for differences in the prior beliefs between opposing partisans, the “motivated reflection” effect is not well-evidenced (Tappin et al., 2021). In one study, those with higher cognitive reflection were even found to update their beliefs closer to the (rational) Bayesian ideal (Tappin et al., 2020a). After all, could it be that the effect is in the opposite direction, and cognitive control processes are associated with less motivated reasoning?

An alternative hypothesis from cognitive sciences that focuses on specific components of executive functioning, such as cognitive flexibility and inhibitory control (i.e., the ability to inhibit automatic responses; Diamond, 2013) suggests that cognitive control processes should be

associated with less ideological and dogmatic thinking (Zmigrod, 2021; Zmigrod et al., 2021). Neuroscientific evidence offers complementary support of the view that cognitive control processes can mitigate ideological biases (Németh et al., 2024; Zmigrod, 2021). Prefrontal brain regions implicated in cognitive control play a crucial role in regulating habitual, impulsive, and affective responses (Mevel et al., 2019; Németh et al., 2024). When judging political content, stronger engagement of these regions, resulting in the ability to override automatic responses, may make people less susceptible to the automatic influences of motivated reasoning (Zmigrod, 2022). Connecting these insights from cognitive psychology and neuroscience to recent developments in the literature on politically motivated reasoning offers a promising interdisciplinary framework to disambiguate the often conflicting findings.

We here test these two alternative hypotheses using a “Fake News Task” to assess motivated reasoning (Thaler, 2024b). Previous work examining the association between cognitive control processes and motivated reasoning has used tasks that are confounded with prior beliefs and provided mixed results (Stagnaro et al., 2023; Tappin et al., 2021). People can favour information aligned with their prior beliefs (e.g., existing beliefs about immigration prevalence), which is consistent with normative models of Bayesian reasoning (Thaler, 2024b). However, people may also favour information aligned with their motives (e.g., information that protects one's identity or advances political aims; Williams, 2023). Prior beliefs and motives are often confounded, but only the latter constitutes motivated reasoning. To draw clear inferences about the association between cognitive control and motivated reasoning, it is thus important to isolate motivated reasoning from mere belief-congruent reasoning (Tappin et al., 2020b). The task we use is immune to this confounding (see Figure 1). Participants provide a median guess about a numerical quantity (e.g., the number of immigrants in the UK). They then receive a news message randomly telling them that the correct answer is higher or lower than what they had guessed, and rate how likely it is that this message is true. “Higher” and “lower” news messages are equally likely true in reference to participants’ median guesses (prior). Therefore, “unbiased” Bayesian agents should not rate some messages as more true than others, irrespective of whether they are aligned with their motives. Thus, systematic differences in the ratings for messages that are aligned vs. conflicting with participants (political) stances can be attributed to motivational influences. This design provides a much cleaner foundation and a more stringent test of the association between cognitive control processes and politically motivated reasoning, thereby helping to resolve the mixed findings in the existing literature (see Tappin et al., 2020b).

As a measure of cognitive control processes, we use both the Cognitive Reflection Test and the Go / No-Go task. These two tasks allow us to assess the inhibition of automatic responses at different levels. The Cognitive Reflection Test, commonly used in previous research, taps

into cognitive control in complex reasoning. The Go / No-Go task, a neurocognitive inhibitory control task, can provide a more fine-grained understanding of which cognitive control processes are linked to motivated reasoning. This is important because how a cognitive variable is measured likely contributes to the mixed findings in the literature (Sultan et al., 2024), and we explicitly address this heterogeneity using two established measures. As we derived the two cognitive control measures from different lines of research and as they might operate at different levels of abstraction, we analyse their associations with motivated reasoning separately. This helps us clarify whether the effects are consistent across different aspects of cognitive control: If the results diverge, it highlights how sensitive findings are to the specific cognitive measures used, but if they converge, this can help us bridge insights from political psychology and cognitive science.

In summary, we investigate how cognitive control processes are associated with motivated reasoning. There are three reasons why we deem our study and its findings as important beyond what is already covered in the literature. First, while the evidence for the motivated reflection hypothesis is mixed at best (e.g., Tappin et al., 2021), the hypothesis continues to receive attention and be referenced widely in research across domains (e.g., Nurse & Grant, 2020; Cassario et al., 2024; Sultan et al., 2024; Bayrak et al., 2025). Second, findings of previous studies might be inconclusive because the designs they used to assess motivated reasoning confound prior beliefs with motives, while we draw on recent methodological developments to better isolate motivated reasoning. That is, confounding of prior beliefs and political motives could cut both ways: generating spurious motivated reasoning effects and/or masking “real” effects, particularly when conditioning on third variables like cognitive reflection/intelligence which are likely to covary with both motives and prior beliefs (e.g., Tappin & McKay 2021). Finally, how cognitive control is measured could also lead to heterogeneous findings, and insights from cognitive and political psychology remain to be bridged. In what follows, we will first investigate the overall prevalence of motivated reasoning on different topics among young adults from the UK, and then compare the relative evidence for the following competing cognitive hypotheses:

H1a. Cognitive reflection is associated with more motivated reasoning

H1b. Cognitive reflection is associated with less motivated reasoning

H2a. Inhibitory control is associated with more motivated reasoning

H2b. Inhibitory control is associated with less motivated reasoning.

Methods

Participants

We recruited $N = 504$ participants from Prolific (<https://www.prolific.com/>). Participants were from the United Kingdom and stratified across three age groups (18-24, 25-31, and 32-38 yrs.). This decision was guided by two considerations: First, the focus on young people aligns with the scope of the larger research program this study contributes to is concerned with the development of political attitudes in adolescence and youth. Second, we aimed to minimise differences potentially linked to age-related decline in cognitive control, as performance on relevant tasks tends to be more stable within this age range compared to later adulthood (Tervo-Clemmens et al., 2023). We acknowledge the implications of this design choice for the generalisability of our findings in the Discussion section. The sample was further balanced in political ideology (left/right-wing) to ensure a broad distribution of political opinion. The final sample comprised 42.7% women, with age $M = 28.1$ years ($SD = 6.1$, range: 18–51) and political ideology distributed as 52.6% left-leaning, 4.6% moderate, and 42.8% right-leaning. Detailed demographics are provided in the Supplementary Materials.

Procedure

Tasks were administered online using Gorilla Experiment Builder (<https://www.gorilla.sc>). After providing informed consent, participants completed demographic questionnaires, followed by the Cognitive Reflection Test, Go/No-Go Task, and Fake News Game. As pre-registered, we excluded two participants who failed an initial attention check. While not pre-registered, four additional participants had to be excluded due to technical issues causing missing or duplicate trials in the main tasks. In line with our pre-registered protocol, we thus recruited six new participants to maintain a sample size of $N = 504$. This sample size was determined by resource constraints. However, an a-priori power simulation indicated 80% power to detect medium effects ($\beta = .30$) on the logit scale to detect main effects of motivated reasoning (details in pre-registration). The study received ethical approval from the Research Ethics Committee of Royal Holloway, University of London (Reference ID: 342).

Measures

Cognitive Reflection Test

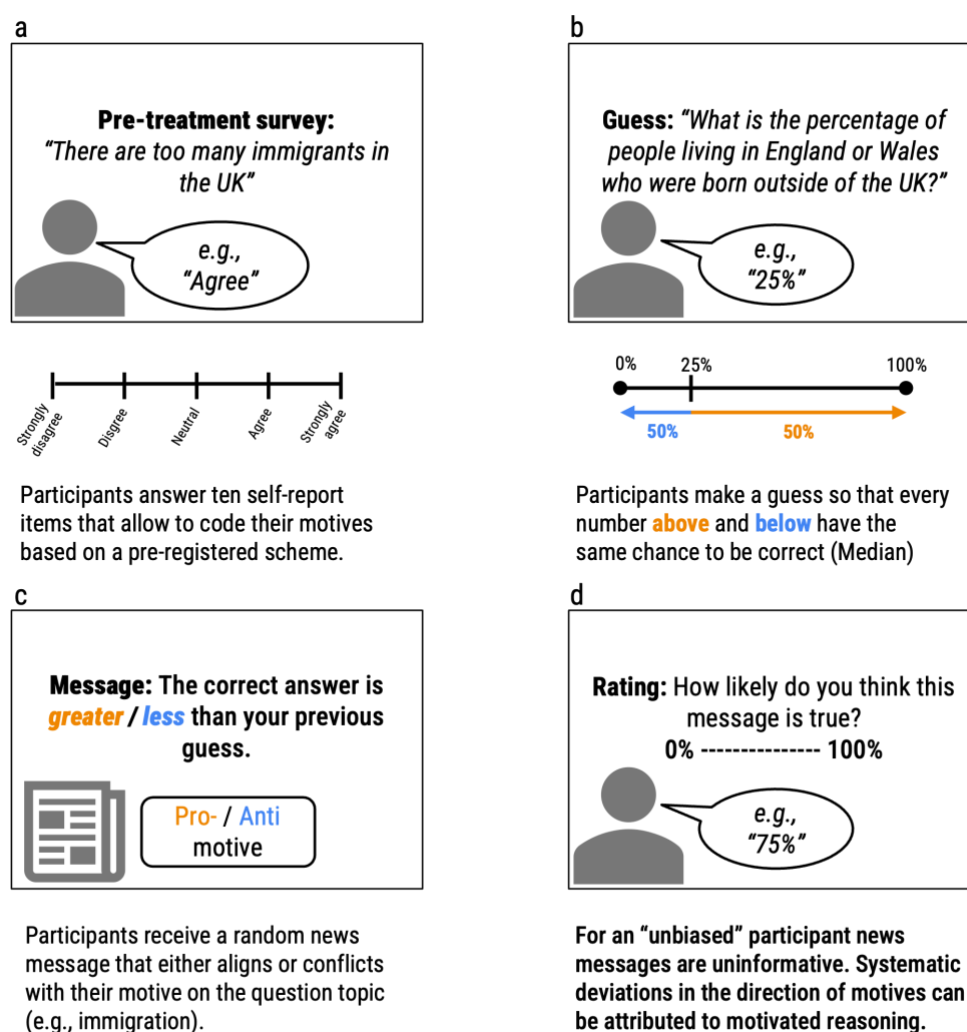
Participants completed a 3-item version of the Cognitive Reflection Test (Frederick, 2005), which measures the capacity to inhibit intuitive, but incorrect, in favour of deliberative correct answers. The predictive validity of the Cognitive Reflection Test appears robust to repeated testing (Bialek & Pennycook, 2018), and to have high test-retest reliability (Stagnaro et al., 2018). To further ensure our online sample was not overly familiar with the items, we used a

less common set of problems (for items see OSF). We summed the number of correct answers to a score ranging from 0 to 3, with higher scores indicating higher cognitive reflection.

Go / No-Go Task

We used a fast-paced Go/No-Go task to measure inhibitory control (Wessel, 2018). Participants had to press the spacebar in response to frequent Go stimuli (letters “M” or “P”; 80% of trials) and withhold responses to infrequent No-Go stimuli (letters “W” or “R”; 20% of trials), resulting in an automatic tendency to respond that had to be inhibited during No-Go trials. The task comprised two runs with different letter combinations, counterbalanced across participants, with practice trials before each run. Stimuli were presented briefly (250 ms) with a short response window (500 ms) and inter-trial interval (1000 ms; see Supplementary Materials). Our main measure of interest was the reverse-coded number of commission errors (false alarms during No-Go trials), with higher scores indicating greater inhibitory control.

Figure 1. Schematic display of the Fake News Game



Note. (a) Participants' motives on different topics are assessed through pretreatment self-report items (e.g., "There are too many immigrants in the UK"). Participants who agree with this item are classified

as holding anti-immigration motives and assumed to be more likely to perceive messages indicating higher immigrant numbers as true, as this would allow them to protect their political identity or advocate for their political party's goals (Kahan, 2016; Williams, 2023). (b) In the Fake News Game, for each topic, participants first provide their median guess to a numerical question, i.e., a guess for which they believe that it is equally likely that the correct answer falls above or below. (c) Participants then receive a news message randomly stating that the correct answer is greater or less than their guess. This random assignment serves as the primary experimental manipulation, as it determines whether a message aligns with (Pro), conflicts with (Anti), or is neutral regarding the participant's inferred motives. (d) Finally, participants rate the likelihood of the message being true on a slider from 0-100%. For "unbiased" Bayesian observers the news messages provided no new information. Systematic deviations in ratings between "Pro" and "Anti"-motive messages can thus be attributed to motivated reasoning.

Fake News Game

We developed a gamified task (see Figure 1) based on a validated experimental paradigm to assess motivated reasoning (Thaler, 2024b).

Participant instructions. Participants played the role of "Fake News Detectives". On each round of the game, they first guessed the answer to a factual numerical question. Participants were instructed to guess the answer so that it is as likely that the correct answer is greater than their guess, as it is that the correct answer is less than their guess. (see Figure 1b). This instruction had the goal to elicit median responses in an accessible way. We provided a concrete example for this guessing strategy and reminded them of this instruction throughout the task (see Supplementary Materials). After providing their guess, participants received a news message (Figure 1c) and should "detect the deception" by indicating how likely it is that this news message is true on a continuous slider from 0% to 100% (Figure 1d). Participants were informed that this news message only tells them whether the correct answer is greater or less than their guess, and that each message randomly either comes from a True News source, which always tells the truth, or from a Fake News source, which never tells the truth.

Task procedure. In total, participants played 11 rounds: a practice trial (excluded from analysis), six political trials (questions on climate change, immigration, reconviction of criminals, racial discrimination, gender stereotypes, and adoption by same-sex partners), two trials asking about their performance in the Go / No-Go Task and the current Fake News Game compared to 100 other participants, and two trials with more general topics (questions about grey matter proportion in the brain and tea with milk preferences). The order of trials was randomised, aside from the trial on the performance of the Fake News Game, which was always presented last, to ensure all participants rated the question based on the same amount of knowledge.

Motive coding. For each question topic, we coded the motive of participants through a survey administered at the beginning of the study (Figure 1a). Participants indicated their level of

agreement to items such as “*There are too many immigrants in the UK*”. In this example, participants who agreed with this statement were coded to hold anti-immigration motives, and in turn to be more likely to endorse messages stating that there are many immigrants in the country, as this would allow them to protect their political identity or to advocate for their political goals (Kahan, 2016; Williams, 2023). We pre-registered and openly share all items and the motive coding scheme.

Motivated reasoning. The primary experimental manipulation in the task was the random assignment of news messages telling participants that the correct answer is greater or less than their guess. Through this random assignment, news messages were also randomly aligned (Pro) or against (Anti) the motives of participants. Motivated reasoning was operationalised as systematic differences in the ratings between pro- and anti-motive messages, with higher veracity ratings for pro-motive messages. Importantly, whether a message is True or Fake News is not relevant in the task: The interest is not news discernment (i.e., how accurate participants are in detecting True News), but simply on whether participants rate pro-motive messages as more true than anti-motive messages, averaged over news messages randomly coming from a True News or a Fake News source.

Theoretical model of the task. The task is designed to differentiate between the congruence of news messages with prior beliefs from the congruence of news messages with the motives of participants, with only the latter reflecting motivated reasoning. The paradigm does so by setting up a task environment that allows to distinguish between normative Bayesian reasoning from motivated reasoning: As median guesses are elicited, for Bayesian agents the randomly assigned news messages should be equally likely in reference to their prior. Bayesian agents should thus report their prior irrespective of whether a news message is aligned or against their motives, and no systematic differences based on inferred motives should be apparent (for details of the theoretical model, see Thaler, 2024b).

Limitations and robustness of the task. The task has been extensively validated (Thaler, 2024b) and used in research across disciplines (e.g., Eytting, 2022; Lois et al., 2024; Thaler 2024a, 2024b). However, while overcoming limitations of previous tasks, it is also not without limitations. First, participants may find it hard to report median guesses. This could lead to systematic differences between pro- and anti-motive messages even in the absence of motivated reasoning if participants prior belief distributions are skewed and covary with their motives. However, the task appears empirically robust against deviations from the median in participants’ guesses (Thaler, 2024b). Participants may also not understand that True News and Fake News have the same probability in this task. While this would shift participants prior belief about the probability of the event True News, it should not differentially shift the prior of the event True News for pro- and anti-motive messages, and systematic differences in ratings

can still be attributed to motivated reasoning. We thus use the average treatment effect of pro- vs. anti-motive messages as our primary operationalisation of motivated reasoning.

Statistical analyses

We fit separate Bayesian ordered beta regression models in R 4.4.1 (R Core Team, 2024) using the `ordbetareg` package (Version 0.7.2; Kubinec, 2023) for three vignette types (political, performance-related, general) and three parameter specifications: (1) the main effect of motivated reasoning (Pro-motive > Anti-motive), (2) its interaction with cognitive reflection, and (3) its interaction with inhibitory control. This modelling approach takes the upper and lower bounds of response variables into account, a particularly useful feature shown to be more efficient than common alternatives (e.g., linear probability model) for 0-100% slider ratings as used in this study (Kubinec, 2023). We used `marginalEffects` to compute posterior predictions and comparisons on the percentage scale (Arel-Bundock et al., 2024).

In all pre-registered models, motivated reasoning was operationalized as the difference between Pro- and Anti-motive message ratings using a dummy-coded predictor. Our primary inferential estimate of interest was the interaction of the assessed cognitive variables (cognitive reflection, inhibitory control) with motivated reasoning. We also modelled varying intercepts by participant and question topics, and varying slopes for motive by participant and topic.

In secondary analyses (reported in the Supplementary Materials), we investigated whether motivated reasoning increases with motive strength, provide insights from an alternative motive-coding scheme, and on polarisation in the numerical guesses of participants in the factual questions before the news message ratings. Finally, we conducted post-hoc robustness checks excluding participants with low accuracy (< 50%) on the Go/No-Go Task, failing a post-treatment attention check, or reporting being inattentive or dishonest. Results from this robustness analysis were highly similar to those reported in the main text.

Open practices

The study was pre-registered at

https://osf.io/x6fkm/?view_only=55c86c8c19a74e8ebfcb005c045af686. We openly provide all task materials, raw and cleaned data, and analysis scripts at https://osf.io/uztn7/?view_only=8d4e1fd66352460b88105b4193bda889.

Deviations from pre-registered protocol

The preregistered models for performance and general topics faced computational issues (e.g., divergent transitions, max treedepth limits) due to insufficient factor levels and data to estimate the variance components. To address this, we deviated from the preregistration by removing varying intercepts and slopes by question topic and instead modeled question topic

as a scaled sum-coded binary fixed effect (-0.5, 0.5). This resolved the issues and improved model robustness.

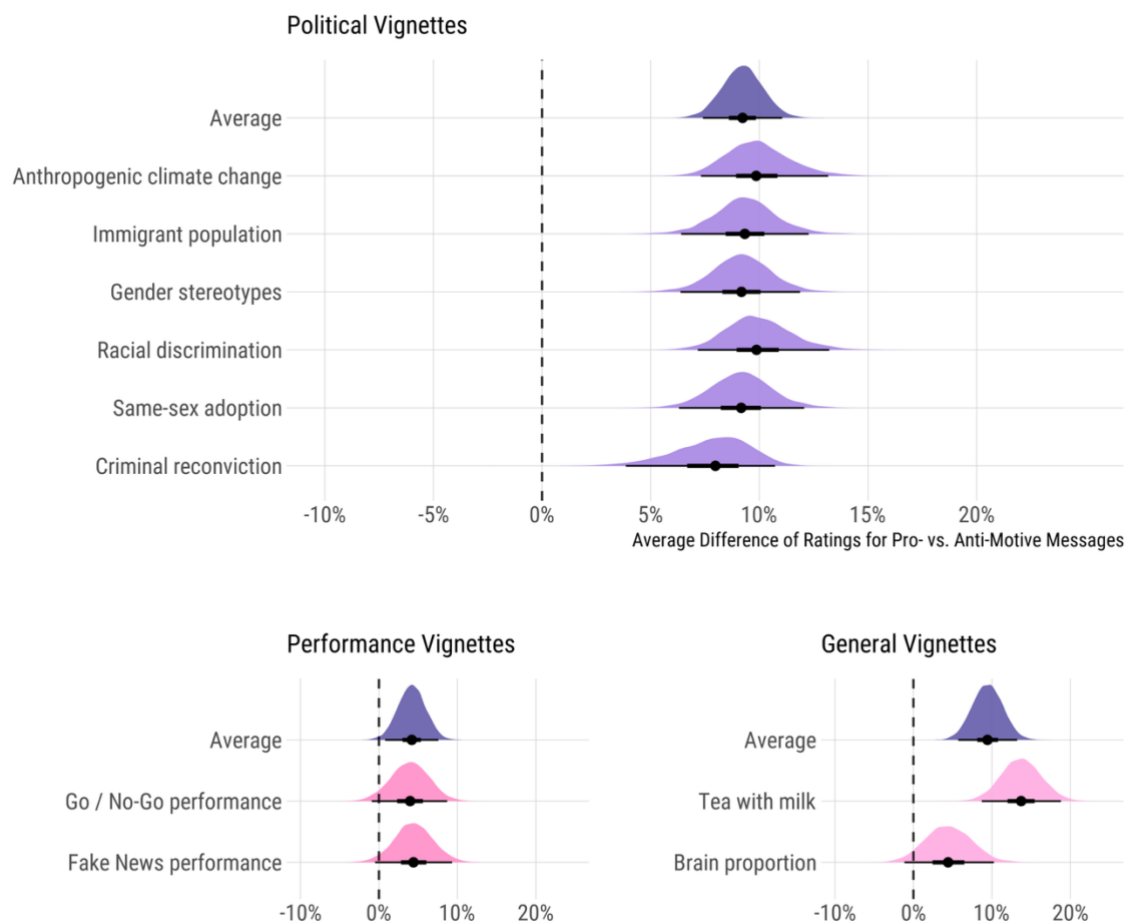
Results

In total, we analysed the ratings of $N = 4963$ news messages (Pro-motive: 41.0%, anti-motive: 40.2%, general: 18.8%), of which $n = 3018$ were for political questions $n = 1008$ for performance questions, and $n = 937$ for general questions.

We start by presenting results for the basic motivated reasoning effect – to establish its presence – before moving onto examining whether and how it is associated with our cognitive performance variables.

Motivated reasoning on political, performance, and general questions

Figure 2. Motivated reasoning on different topics



Note. Visualisation of posterior predicted comparisons between ratings of Pro- and Anti-motive messages in percentage. For political topics, differences between topics are modelled with a variance term (motive | topic). For performance and general topics, we modelled a fixed effect interaction between

motive and topic. Thick error bars indicate 50% CIs, thin bars 95% CIs, dots the median, and slabs the distribution of the posterior draws.

Models predicting message ratings based on motives converged well ($R\text{-hat} < 1.01$ for fixed effects, $R\text{-hat} < 1.05$ for random effects). On political topics, participants rated pro-motive messages as more true than anti-motive messages (see Table 1), with an average predicted effect of motivated reasoning of 9.2 percent (95% CI [7.4, 11.1]). This effect is consistent across political topics (see Figure 2) and increases monotonically with the strength of participants' motives (see Supplementary Materials).

For performance topics, the predicted average effect of motivated reasoning was 4.2 percent (95% CI [0.8, 7.6]). The effect was again consistent across the two items (see Figure 2). On general topics, the predicted average effect was 9.4 percent (95% CI [5.7, 13.2]). However, in this case there was a large difference between items: While the effect of motivated reasoning about the proportion of grey matter in the brain was small and not credibly different from 0, the effect was large on a vignette about the prevalence of the preference of tea with milk in the UK (see Figure 2). Overall, these results indicate strong evidence of directional motivated reasoning across topics, with particularly consistent effects on political questions.

Table 1. Parameter estimates from ordered beta regression models

Parameter	Median	95% CI		Evidence Ratio	
		LL	UL	$\beta > 0$	$\beta < 0$
<i>Political Questions</i>					
Motive (Pro > Anti)	0.363	0.258	0.475	Inf	0.000
Motive x Cognitive Reflection	-0.063	-0.139	0.010	0.049	20.333
Motive x Inhibitory Control	0.024	-0.049	0.100	2.714	0.368
<i>Performance Questions</i>					
Motive (Pro > Anti)	0.169	0.025	0.312	90.954	0.011
Motive x Cognitive Reflection	-0.033	-0.180	0.116	0.499	2.005
Motive x Inhibitory Control	-0.075	-0.232	0.075	0.191	5.245
<i>Neutral Questions</i>					
Motive (Pro > Anti)	0.361	0.209	0.517	Inf	0.000
Motive x Cognitive Reflection	-0.097	-0.261	0.060	0.130	7.696
Motive x Inhibitory Control	0.173	0.012	0.329	63.000	0.016

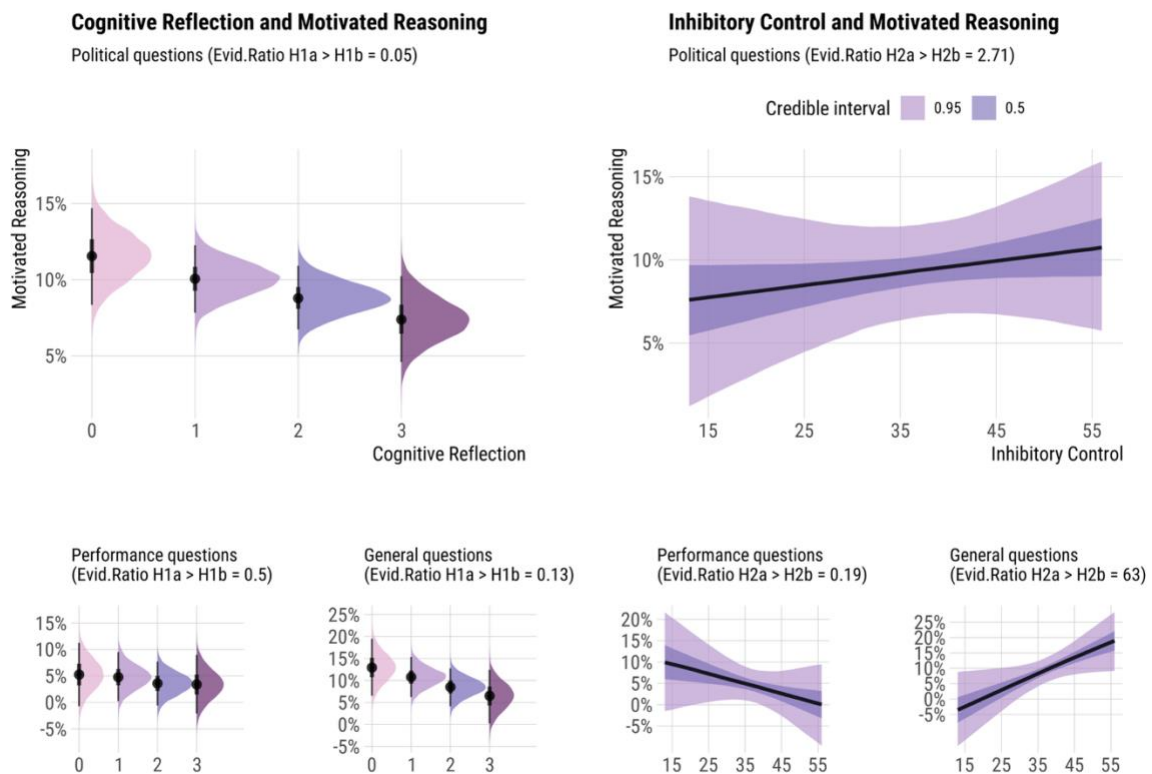
Note. We fit separate ordered beta regression models, each corresponding to a combination of three vignette types (political, performance-related, and general) and three parameter specifications: (1) the main effect of motivated reasoning (Motive (Pro > Anti)), (2) its interaction with cognitive reflection, and (3) its interaction with inhibitory control. All estimates are reported on the logit scale. 95% CI are equal

tail intervals. Evid.Ratio indicates the posterior probability of the direction of an effect compared to its alternative.

Cognitive Variables and Motivated Reasoning

Models investigating the interaction between cognitive variables and motivated reasoning converged well ($R\text{-hat} < 1.01$ for all fixed effects, $R\text{-hat} < 1.05$ for all random effects).

Figure 3. Cognitive Reflection, Inhibitory Control, and Motivated Reasoning



Note. Association of cognitive reflection (left) and inhibitory control (right) with motivated reasoning across different question types (political, performance, general).

On political questions, the interaction between motive and cognitive reflection was negative on average (see Table 1 and Figure 3), although null and very small positive effects also are credible according to the 95% CI [-0.139, 0.010]. To better contrast the relative evidence for the two competing directional hypotheses even if we can't rule out a null-effect based on the 95% CI, we then calculated the evidence ratio for the hypothesis that higher cognitive reflection is associated with less, compared to more motivated reasoning.

The evidence ratio is the ratio of the posterior probabilities under each hypothesis, and thus different from Bayes Factors that compare posterior probabilities with the prior probability under the null hypothesis (Makowski et al., 2019). While providing limited information about the null, the evidence ratio is particularly useful for distinguishing between competing directional hypotheses and is equivalent to a directional Bayes Factor: values above 1 favour

a negative association, and values between 0 and 1 favour a positive association. Here, the evidence ratio of 20.33 indicates relative evidence in favour of a negative, rather than a positive (“motivated reflection”) association.

To make this finding more intuitive, for participants high in cognitive reflection (i.e., three correct answers on the Cognitive Reflection Test) the predicted effect of politically motivated reasoning was on average 4.2 percent (95% CI [-0.6, 9.2]) smaller than for participants with a low Cognitive Reflection Test score of 0. Effects were smaller but directionally consistent for performance-related and general questions (see Table 1). Overall, based on our model and data, moderate-to-large positive interactions are unlikely, and participants higher in cognitive reflection may engage less in politically motivated reasoning, but small and null effects remain plausible.

The interaction between motive and inhibitory control was positive, but both small negative and small positive effects sizes were credible. The evidence ratio also provided only inconclusive evidence in favour of a positive vs. negative effect direction (Evid. Ratio $_{\beta > 0}$ = 2.71). For general questions, the model indicated that participants high in inhibitory control engaged in more motivated reasoning, and here a positive effect was more likely than a negative one (Evid. Ratio $_{\beta > 0}$ = 63). In turn, for performance questions, the effect was inconclusive, but negative on average (see Table 1). It is thus unclear whether and to what extent inhibitory control is associated with motivated reasoning, and the effect may differ depending on the context of reasoning.

Follow-up analyses

As the estimates for the interaction effects between the cognitive variables and motivated reasoning on performance and general questions were imprecise, we ran follow-up models across all question types (political, performance, and general) including question type as a sum-coded main effect and its interactions. Interaction coefficients represent the average interaction across all three question types. For cognitive reflection, the interaction across topics was slightly weaker than for just political topics ($\beta_{\text{logit}} = -0.06$, 95% CI [-0.131, 0.015], Evid. Ratio $_{\beta < 0}$ = 15.95). For inhibitory control, the interaction became more positive ($\beta_{\text{logit}} = 0.05$, 95% CI [-0.019, 0.127], Evid. Ratio $_{\beta > 0}$ = 12.51). This pattern suggests results may be sensitive to the specific cognitive control measure used and highlights the overall trends across topics; cognitive reflection is more likely associated with less, and inhibitory control with more motivated reasoning, but interactions remain small, and 95% CIs include 0.

Finally, in the Supplementary Materials, we provide insights on polarisation based on participants’ motives in the numerical guesses on the factual questions and the association with the two cognitive control variables. While our models and data indicated differences in the factual beliefs aligned with the direction of participants’ motives (see Supplementary Figure 5),

associations between the extent of polarisation and the two cognitive variables were likely small and not credibly different from null based on the 95% CIs (see Supplementary Table 5). This suggests that the factual beliefs of young adults in the UK are overall polarised in the direction of their motives. However, the extent of factual belief polarisation appears largely unrelated to cognitive control processes.

Discussion

We set out to understand whether cognitive control processes are linked to greater motivated reasoning, as some political psychology theories would suggest, or, on the contrary, to less motivated reasoning as cognitive science theories would suggest. Our results indicate that people engage in directionally motivated reasoning on both political and non-political topics. Turning to the association between cognitive control processes and motivated reasoning, according to our models and data, associations are unlikely to be strong. We find that people high in cognitive reflection on average engaged less in politically motivated reasoning, which is contrary to the prediction from the popular “motivated reflection” hypothesis. Rather than using cognitive reflection processes to construct reasonable justifications for desired conclusions, cognitive reflection may help people to resist automatic and affective response tendencies that underlie motivated reasoning – though caution is required when interpreting the findings, as null- or small positive associations also remain credible. We attempted to bridge findings to a related line of research on ideological thinking from cognitive psychology, and with the Go/No-Go task also used a neurocognitive measure of inhibitory control. However, for inhibitory control, our findings are somewhat conflicting with findings on cognitive reflection, and overall inconclusive.

We developed a novel gamified version of an experimental task originally designed by Thaler (2024b) to assess politically motivated reasoning. Participants take on the role of “Fake News Detectives” to “detect the deception” in news messages randomly telling them that the correct answer on factual questions is either greater or less than what they had previously guessed. From the information they have, participants cannot infer whether the messages are more likely true or false. Thus, if people were rational Bayesians, there should be no systematic deviations in their veracity ratings. Nonetheless, our UK-based participants, in line with past studies conducted in the US (Thaler, 2024b, 2024a), showed systematic deviations in their veracity ratings, indicative of motivated reasoning. Specifically, they rated messages that align with their political stances and motives as more likely to be true, than messages going against their political stances.

We then compared the relative evidence for two competing hypotheses on the link between motivated reasoning and cognitive control processes. Contrary to the influential “motivated reflection” hypothesis, our model and data suggest that the relationship between cognitive reflection and motivated reasoning is more likely negative than positive – in other words, those who are more reflective, might even engage in less motivated reasoning. This result is all the more compelling given the clear evidence of motivated reasoning observed with our design. At the first look, this is in line with cognitive science theories that suggest cognitive control processes can mitigate ideological biases (Németh et al., 2024). However, our results are not all that in clear in this interpretation, and a null or very small positive effect remains plausible. Further, with the Go / No-go task, we also used a well-established neuroscientific paradigm to assess the ability to inhibit prepotent and impulsive responses (Wessel, 2018), inspired by cognitive science perspectives. However, for inhibitory control, our analyses yielded inconclusive results, and it remains to be clarified if and how it is linked to motivated reasoning. The diverging findings on cognitive reflection and inhibitory control highlight that it is not just how motivated reasoning is assessed (e.g., Tappin et al., 2020b), but also how cognitive variables are measured that likely accounts for the mixed findings in previous studies (Sultan et al., 2024). This complexity highlights the challenge in bridging the literature on politically motivated reasoning (Kahan, 2016) with cognitive science research on ideological thinking (Zmigrod, 2021).

Recent work has shown that good performance in reaction-time-based cognitive control tasks can be driven by accurate intuitive processing rather than controlled correction of automatic responses (Voudouri et al., 2023). While the Cognitive Reflection Test primarily reflects strategic information processing on a longer timeframe, showcasing the ability to override intuitive responses in favour of more deliberative reasoning, the Go / No-Go task could thus assess speeded information processing (Eisenberg et al., 2019). These two cognitive factors, strategic and speeded information processing, could be differentially linked to motivated reasoning. While strategic and careful information processing could generally be related to more accurate judgments, the role of speeded information processing remains to be clarified. Future research should leverage computational models of decision-making to isolate specific components of the decision process (e.g., Lin et al., 2023), providing insights into how fast, accurate responding interacts with other factors, such as on different topics, to contribute to motivated reasoning. Additionally, employing multiple cognitive tasks to derive latent cognitive factors could provide robust insights into the differential effects of strategic and speeded information processing, as demonstrated in an investigation of the cognitive correlates of ideological attitudes (Zmigrod et al., 2021).

Importantly, as the design of our study focused on the association between cognitive control processes and motivated reasoning irrespective of the mechanisms through which they might be linked, we can't draw the conclusion that it is cognitive reflection – in the sense of overriding intuitive responses – but instead another construct related to cognitive reflection that accounts for the negative association with motivated reasoning. For example, cognitive reflection correlates with numerical and general cognitive ability, and it is unclear to what extent these constructs are separable from the get-go (Otero et al., 2022). One more problematic limitation could also be that participants high in cognitive reflection show less motivated reasoning merely because they better comprehend the numerical aspects of the motivated reasoning. However, we deem this as unlikely as we provided accessible instructions that do not necessarily require participants to be familiar with the median, and the task was also empirically shown to be robust to various misunderstandings of the instructions (Thaler, 2024b). Ultimately, it remains a challenge for future research to provide more mechanistic insights on the link between cognitive control and motivated reasoning.

These investigations can build on the foundations we provide here. The task we used to assess motivated reasoning overcomes limitations of previous study designs that likely contributed to inconclusive findings (for review, see Tappin et al., 2020b). Specifically, the task avoids confounding the influence of prior beliefs with motivated reasoning by having participants judge news messages that directly refer to their own, individually-elicited beliefs. (Thaler, 2024b). Importantly, our design and analysis also allow better generalisation of our effects, as we included a variety of political and non-political topics, in contrast to classical studies that mainly focused on the same climate- and gun-control-related stimuli (Kahan, 2013; Kahan et al., 2017; Kahan & Peters, 2017). However, while our results allow a better generalisation across topics, our sample consisted of young adults from the UK recruited via Prolific. Prolific samples of young adults typically show high response quality, which was important given the length and demands of our tasks (Stagnaro et al., 2024). However, this can come with trade-offs in representativeness, and our findings may not generalise to older samples more representative of the general population, or to other national contexts such as the US where many previous studies were conducted.

In conclusion, we provide novel insights into the link between cognitive control processes and motivated reasoning by synthesising interdisciplinary perspectives. We challenge the influential hypothesis that cognitive control processes are linked to more motivated reasoning, as we find that cognitive reflection is more likely linked to less, rather than more motivated reasoning. Understanding the foundations of motivated reasoning is crucial, as it can drive politically polarised (Su, 2022) and misinformed beliefs (Ecker et al., 2022; Thaler, 2024b). The key question going forward is not whether highly reflective individuals can set aside their

ideological biases, but rather which, when and how cognitive factors mitigate or reinforce politically motivated reasoning.

Limitations

Several further limitations should be acknowledged. We did not experimentally manipulate cognitive control processes. While other studies have attempted such manipulations (e.g., limiting response time), it remains unclear how such manipulations affect the specific cognitive strategies participants use. For example, time pressure did not have an effect on motivated reasoning, whereas trait measures did (Strömbäck et al., 2024). It remains a challenge for future research to manipulate specific cognitive control processes and investigate the effects on motivated reasoning. Second, motivated reasoning effects depend on how well participants' motives can be inferred. We used self-reported opinions and stances as indices of motives, and this appeared to work well on political topics. Smaller effects for certain topics could also be attributed to these motives being harder to assess, or our items or coding being inadequate. Overall, we think this is only of limited concern for our results, as for most topics effects go in the expected directions. However, our estimates may be considered as lower bounds of motivated reasoning effects. Testing which items or strategies are best to capture motives is an interesting avenue for future research that can build on the analyses and open materials we provide here. Finally, the higher variance observed in motivated reasoning on general and performance questions may be due to the limited number of items per question type. Using more items could enable more systematic investigation of these effects.

References

- Arel-Bundock, V., Greifer, N., & Heiss, A. (2024). How to interpret statistical models using margineffects for R and Python. *Journal of Statistical Software*, 111(9), 1–32.
<https://doi.org/10.18637/jss.v111.i09>
- Bago, B., Rand, D. G., & Pennycook, G. (2023). Reasoning about climate change. *PNAS Nexus*, 2(5), pgad100. <https://doi.org/10.1093/pnasnexus/pgad100>
- Bayrak, F., Boyacioglu, I., & Yilmaz, O. (2025). Does reflection increase accuracy rather than bias in the assessments of political fake news? *Current Psychology*, 1–18.
<https://doi.org/10.1007/s12144-025-07578-5>
- Bialek, M., & Pennycook, G. (2018). The cognitive reflection test is robust to multiple exposures. *Behavior Research Methods*, 50(5), 1953–1959.
<https://doi.org/10.3758/s13428-017-0963-x>
- Cassario, A. L., Vallabha, S., Thompson, J. L., Carrillo, A., Solanki, P., Gnall, S. A., Rice, S., Wetherell, G. A., & Brandt, M. J. (2024). Registered report: Cognitive ability, but not cognitive reflection, predicts expressing greater political animosity and favouritism. *British Journal of Social Psychology*, n/a(n/a). <https://doi.org/10.1111/bjso.12814>
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, 64(Volume 64, 2013), 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Ecker, U. K. H., Lewandowsky, S., Cook, J., Schmid, P., Fazio, L. K., Brashier, N., Kendeou, P., Vraga, E. K., & Amazeen, M. A. (2022). The psychological drivers of misinformation belief and its resistance to correction. *Nature Reviews Psychology*, 1(1), 13–29. <https://doi.org/10.1038/s44159-021-00006-y>
- Eisenberg, I. W., Bissett, P. G., Zeynep Enkavi, A., Li, J., MacKinnon, D. P., Marsch, L. A., & Poldrack, R. A. (2019). Uncovering the structure of self-regulation through data-driven ontology discovery. *Nature Communications*, 10(1), Article 1.
<https://doi.org/10.1038/s41467-019-10301-1>
- Eyting, M. (2022). *Why do we Discriminate? The Role of Motivated Reasoning* (SSRN Scholarly Paper No. 4210315). Social Science Research Network.

- <https://doi.org/10.2139/ssrn.4210315>
- Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic Perspectives*, 19(4), 25–42. <https://doi.org/10.1257/089533005775196732>
- Kahan, D. M. (2013). Ideology, motivated reasoning, and cognitive reflection. *Judgment and Decision Making*, 8(4), 407–424. <https://doi.org/10.1017/S1930297500005271>
- Kahan, D. M. (2016). The politically motivated reasoning paradigm, part 1: What politically motivated reasoning is and how to measure it. In *Emerging Trends in the Social and Behavioral Sciences* (pp. 1–16). John Wiley & Sons, Ltd.
<https://doi.org/10.1002/9781118900772.etrds0417>
- Kahan, D. M., & Peters, E. (2017). *Rumors of the 'nonreplication' of the 'motivated numeracy effect' are greatly exaggerated* (SSRN Scholarly Paper No. 3026941). Social Science Research Network. <https://doi.org/10.2139/ssrn.3026941>
- 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>
- Kubinec, R. (2023). Ordered beta regression: A parsimonious, well-fitting model for continuous data with lower and upper bounds. *Political Analysis*, 31(4), 519–536.
<https://doi.org/10.1017/pan.2022.20>
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, 108(3), 480–498. <https://doi.org/10.1037/0033-2909.108.3.480>
- Lin, H., Pennycook, G., & Rand, D. G. (2023). Thinking more or thinking differently? Using drift-diffusion modeling to illuminate why accuracy prompts decrease misinformation sharing. *Cognition*, 230, 105312. <https://doi.org/10.1016/j.cognition.2022.105312>
- Lois, G., Tsakas, E., Yuen, K., & Riedl, A. (2024). Tracking politically motivated reasoning in the brain: The role of mentalizing, value-encoding, and error detection networks. *Social Cognitive and Affective Neuroscience*, 19(1), nsae056.
<https://doi.org/10.1093/scan/nsae056>
- Makowski, D., Ben-Shachar, M. S., Chen, S. H. A., & Lüdtke, D. (2019). Indices of Effect

- Existence and Significance in the Bayesian Framework. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.02767>
- Mevel, K., Borst, G., Poirel, N., Simon, G., Orliac, F., Etard, O., Houdé, O., & De Neys, W. (2019). Developmental frontal brain activation differences in overcoming heuristic bias. *Cortex*, 117, 111–121. <https://doi.org/10.1016/j.cortex.2019.03.004>
- Németh, D., Vékony, T., Orosz, G., Sarnyai, Z., & Zmigrod, L. (2024). The interplay between subcortical and prefrontal brain structures in shaping ideological belief formation and updating. *Current Opinion in Behavioral Sciences*, 57, 101385. <https://doi.org/10.1016/j.cobeha.2024.101385>
- Nurse, M. S., & Grant, W. J. (2020). I'll see it when I believe it: Motivated numeracy in perceptions of climate change risk. *Environmental Communication*, 14(2), 184–201. <https://doi.org/10.1080/17524032.2019.1618364>
- Otero, I., Salgado, J. F., & Moscoso, S. (2022). Cognitive reflection, cognitive intelligence, and cognitive abilities: A meta-analysis. *Intelligence*, 90, 101614. <https://doi.org/10.1016/j.intell.2021.101614>
- 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>
- R Core Team. (2024). *R: a language and environment for statistical computing* [Manual]. R Foundation for Statistical Computing. <https://www.R-project.org/>
- Rekker, R., & Hartevel, E. (2022). Understanding factual belief polarization: The role of trust, political sophistication, and affective polarization. *Acta Politica*. <https://doi.org/10.1057/s41269-022-00265-4>
- Stagnaro, M. N., Druckman, J., Berinsky, A. J., Arechar, A. A., Willer, R., & Rand, D. (2024). *Representativeness versus Response Quality: Assessing Nine Opt-In Online Survey Samples*. OSF. <https://doi.org/10.31234/osf.io/h9j2d>
- Stagnaro, M. N., Pennycook, G., & Rand, D. G. (2018). Performance on the Cognitive Reflection Test is stable across time. *Judgment and Decision Making*, 13(3), 260–

267. <https://doi.org/10.1017/S1930297500007695>
- 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*, 120(32), e2301491120. <https://doi.org/10.1073/pnas.2301491120>
- Strömbäck, C., Andersson, D., Västfjäll, D., & Tinghög, G. (2024). Motivated reasoning, fast and slow. *Behavioural Public Policy*, 8(3), 617–632. <https://doi.org/10.1017/bpp.2021.34>
- Su, S. (2022). Updating politicized beliefs: How motivated reasoning contributes to polarization. *Journal of Behavioral and Experimental Economics*, 96, 101799. <https://doi.org/10.1016/j.socec.2021.101799>
- Sumner, C., Scofield, J. E., Buchanan, E. M., Evans, M.-R., & Shearing, M. (2023). The role of personality, authoritarianism and cognition in the United Kingdom's 2016 referendum on European Union membership. *Frontiers in Psychology*, 14. <https://doi.org/10.3389/fpsyg.2023.1077354>
- Tappin, B., & McKay, R. (2021). *Estimating the causal effects of cognitive effort and policy information on party cue influence*. OSF. <https://doi.org/10.31234/osf.io/tdk3y>
- 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>
- Tervo-Clemmens, B., Calabro, F. J., Parr, A. C., Fedor, J., Foran, W., & Luna, B. (2023). A

- canonical trajectory of executive function maturation from adolescence to adulthood. *Nature Communications*, 14(1), Article 1. <https://doi.org/10.1038/s41467-023-42540-8>
- Thaler, M. (2024a). *Good news is not a sufficient condition for motivated reasoning* (No. arXiv:2012.01548). arXiv. <http://arxiv.org/abs/2012.01548>
- Thaler, M. (2024b). The Fake News Effect: Experimentally identifying motivated reasoning using trust in news. *American Economic Journal: Microeconomics*, 16(2), 1–38. <https://doi.org/10.1257/mic.20220146>
- Van Bavel, J. J., & Pereira, A. (2018). The partisan brain: An identity-based model of political belief. *Trends in Cognitive Sciences*, 22(3), 213–224. <https://doi.org/10.1016/j.tics.2018.01.004>
- Voudouri, A., Bago, B., Borst, G., & Neys, W. D. (2023). Reasoning and cognitive control, fast and slow. *Judgment and Decision Making*, 18, e33. <https://doi.org/10.1017/jdm.2023.32>
- Wessel, J. R. (2018). Prepotent motor activity and inhibitory control demands in different variants of the go/no-go paradigm. *Psychophysiology*, 55(3), e12871. <https://doi.org/10.1111/psyp.12871>
- Williams, D. (2023). The case for partisan motivated reasoning. *Synthese*, 202(3), 89. <https://doi.org/10.1007/s11229-023-04223-1>
- Zmigrod, L. (2021). A neurocognitive model of ideological thinking. *Politics and the Life Sciences*, 40(2), 224–238. <https://doi.org/10.1017/pls.2021.10>
- Zmigrod, L. (2022). A psychology of ideology: Unpacking the psychological structure of ideological thinking. *Perspectives on Psychological Science*, 17(4), 1072–1092. <https://doi.org/10.1177/17456916211044140>
- Zmigrod, L., Eisenberg, I. W., Bissett, P. G., Robbins, T. W., & Poldrack, R. A. (2021). The cognitive and perceptual correlates of ideological attitudes: A data-driven approach. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 376(1822), 20200424. <https://doi.org/10.1098/rstb.2020.0424>