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Abstract

What are the underlying cognitive mechanisms that support belief in conspiracies? Common dual-process perspectives suggest that deliberation helps people make more accurate decisions and decreases belief in conspiracy theories that have been proven wrong (therefore, bringing people closer to objective accuracy). However, evidence for this stance is i) mostly correlational and ii) existing causal evidence might be influenced by experimental demand effects and/or a lack of suitable control conditions. Furthermore, recent work has found that analytic thinking tends to increase the coherence between prior beliefs and new information, which may not always lead to accurate conclusions. In two studies, participants were asked to evaluate the strength of conspiratorial (or non-conspiratorial) explanations of events. In the first study, which used well-known conspiracy theories, deliberation had no effect. In the second study, which used relatively unknown conspiracy theories, we found that experimentally manipulating deliberation did increase belief accuracy - but only among people with a strong 'anti-conspiracy' or strong 'pro-conspiracy' mindset from the outset, and not among those with an intermediate conspiratorial mindset. Although these results generally support the idea that encouraging people to deliberate can help to counter the growth of novel conspiracy theories, they also indicate that the effect of deliberation on conspiratorial beliefs is more complicated than previously thought.

Keywords: conspiracy theories, intuition, deliberation, dual process theory, two response paradigm

Introduction

Conspiracy theories refer to the idea that there are powerful groups of capable people that are dedicated to doing evil, and that this is generally beyond the knowledge of the general population (Douglas et al., 2017; Sunstein & Vermeule, 2009). Although many of these theories are rendered impossible, or extremely unlikely to be actually true (Flynn et al., 2017; Grimes, 2016; Jolley & Douglas, 2014) conspiratorial beliefs are surprisingly common.

Conspiracy theories can also be extremely harmful. Conspiratorial beliefs have been argued to be associated with decreased intent to vaccinate (Jolley & Douglas, 2014) (particularly in the context of COVID-19, see Pennycook et al., 2021), and a lower willingness to follow public health interventions in general (Georgiou et al., 2020; Oliver & Wood, 2014), such as decreased intent to follow social distancing rules or health behaviours in the middle of the COVID-19 pandemic (Allington et al., 2020; Bierwiaczonek et al., 2020; Oleksy et al., 2020; Uscinski et al., 2020). Conspiratorial beliefs are also associated with increased intent to commit violent crimes (Rottweiler & Gill, 2020), decreased beliefs in scientific claims in general (Lewandowsky et al., 2013), and lower prosociality and reduced pro-environmental behaviour (Douglas & Sutton, 2015; Uscinski et al., 2017; Van der Linden, 2015), to mention a few (for a recent review on the apparent effects of conspiracy beliefs see: Douglas et al. 2019). It is therefore critical to begin developing interventions that undermine the pernicious effects of conspiratorial ideation and a deeper understanding of the cognitive mechanisms behind conspiratorial beliefs could help in this effort (Douglas et al., 2017, 2019).

An increasingly popular approach to understanding conspiratorial belief is through the lens of dual process theory (De Neys, 2018; Evans & Stanovich, 2013; Pennycook et al., 2015b) (Evans & Stanovich, 2013). Classical dual process theory distinguishes two types of processes, one that operates automatically and is associated with faster and less effortful responses ("System 1") and one that is effortful, controlled and slower ("System 2"), usually referred to as "intuition" and "deliberation". According to the classical dual process framework, deliberation helps people correct their intuitive mistakes. This is supported by studies showing that deliberation is associated with improved ability to correctly solve wide range of classical reasoning and decision making tasks (i.e., tasks, in which there is a logically or mathematically correct answer; Kahneman, 2011; Stanovich & West, 2000; Toplak et al., 2011). Increased deliberation is also associated with the ability to correctly distinguish true from "fake news" headlines (Bago, Rand, et al., 2020a; Pennycook & Rand, 2019b).

One promising finding in the field of conspiracy theories is that cognitive sophistication and, more specifically, the ability to engage in analytic thinking and deliberation can help people to realise the inaccuracies or the falsities in conspiracy theories, and make people less likely to endorse them (Clifford et al., 2019; Pennycook et al., 2015a; Rizeq et al., 2020; Ståhl & Van Prooijen, 2018; Swami et al., 2014; van Prooijen, 2017). Should this be true, simply having people deliberate can help reduce belief in conspiracies (Orosz et al., 2016; van Prooijen & Douglas, 2018). There are, however, reasons to contend that the connection between deliberation and conspiratorial beliefs is not as straightforward as it would seem.

Most of the support for this claim comes from correlational studies. In these studies, people are asked to rate how much they believe in a number of conspiracies, and are also

asked to answer questions that measure deliberation or analytic thinking, such as the Cognitive Reflection Test, or the Actively Open-minded Thinking scale (Clifford et al., 2019; Pennycook et al., 2015a; Rizeq et al., 2020; Ståhl & Van Prooijen, 2018; Swami et al., 2014; van Prooijen, 2017). While this evidence is indeed consistent with the predictions of dual process theory, they do not provide positive evidence that if people were made to deliberate, they would be less likely to believe in conspiracies. Nonetheless, consistent with this deliberation-accuracy account, Swami et al. (2014) manipulated thinking mode to evoke analytic thinking strategies, which in turn, decreased belief in conspiratorial explanations. However, the strength of this experimental manipulations is uncertain given that there have been some failed replications in other domains using similar manipulations (rationality priming: Sanchez et al., 2017; disfluent fonts: Meyer et al., 2015). Second, the rationality priming manipulations that were used might be prone to experimenter demand effects. That is priming people to think 'rationally' might have been interpreted as acting in a way that the research would take to be 'rational' (Orne, 1962). Third, Swami et al used no 'control' (non-conspiratorial) reasoning problems. Deliberation might have increased scepticism across the board, and so it is unclear from the present data whether deliberation selectively decreases belief in conspiracies per se.

There are also theoretical reasons to be skeptical of a simple connection between deliberation and accuracy in the context of conspiracy belief. Indeed, many people do not have access to knowledge about the issues surrounding many of these conspiracy theories (e.g., how Diana died), or technical knowledge on scientific topics (eg., climate change, or more recently, epidemiology or virus biology). Hence, with that missing or outright incorrect background knowledge, even if people try to arrive at accurate answers when met with a conspiracy, they might not be able to do so.

Indeed, research indicates that deliberation may be used to increase the coherence between new information and background knowledge or prior beliefs (an idea consistent with Bayesian updating, Cook & Lewandowsky, 2016; Hahn & Harris, 2014; Tappin et al., 2020); we will refer to this as the deliberation-coherence account. For example, although an experimental manipulation of deliberation caused people who agreed with the scientific consensus on climate change to have more positive evaluations of information that was consistent with anthropogenic global warming, the opposite effect emerged for climate change skeptics (Bago et al., 2020b). Tappin, Pennycook, & Rand (2020) also found that, in the context of political belief updating, participants who are more deliberative update less given noisy evidence signals, but do so in a way that more closely approximates Bayesian updating (as they place more weight on priors).

Here we employ the "two response paradigm" (Bago & De Neys, 2017; Thompson et al., 2011) to more directly test the potential causal roles of intuition and deliberation in conspiratorial belief. In this paradigm, participants are presented with the same conspiratorial (or official, see below) explanation twice. In the initial response phase, participants are instructed to give an intuitive response - that is, whatever first comes to their mind. To assure that this response is really intuitive, participants have to give a response under concurrent working memory load and with a strict response deadline. After this, they are presented with the explanation again and can give a final response without any constraints. Two response paradigm with its current setting (i.e., response deadline and load at the initial response phase) has been shown to successfully manipulate intuition and deliberation in a wide range of paradigms, starting from logical reasoning problems (Bago & De Neys, 2017) to fake news (Bago et al., 2020) to climate change (Bago, Rand, et al., 2020b).

Participants were also presented with three types of explanations: conspiratorial, official, and refutation (see Table 1 for examples)[1]. Conspiratorial explanations directly described a conspiracy theory, for example how the moon landings were faked. Official explanation simply gave the official account of how things happened, i.e., how the moon landings actually happened. Refutations, in contrast, simply cast shadows and point to "inconsistencies" in official explanations, without propagating a particular conspiracy theory. For example, the moon landing refutation item argued that people could not be on the moon, because in the photographs there are no stars (while there should be, if they were really on the moon). Such refutation arguments are a part of conspiracy theories, but they are nevertheless different from direct conspiratorial explanations as they do not replace doubts about "official" accounts with an alternative (conspiratorial) account. Since their content and reasoning style is different from actual conspiracy stories, we measured them with separate items. Hence, we can shed light on the possibility that people reason about these arguments in a different way. We analysed conspiracy theories and refutation arguments separately, and always compared each to the true, official explanation. This comparison of official vs conspiratorial/refutation is what we refer to as 'truth discernment' ability.

According to the deliberation-accuracy account, deliberation should simply decrease agreement with conspiratorial explanations and refutation arguments. In contrast, according to the deliberation-coherence account, deliberation should increase the coherence between one's background beliefs or knowledge and new information - and therefore only reduce agreement with conspiratorial explanations for people who are non-conspiratorial (while

[1] We tested the new items in an initial correlational study and replicated the previously observed pattern that people with higher cognitive abilities were less likely to believe in conspiracy theories and refutation arguments; while cognitive ability did not associate with belief in official explanations. Detailed methodology and analysis of this study can be found in the Supplementary Materials (section A).

potentially increasing belief in conspiratorial explanations for people who are conspiracy theorists). For this, we measured people's conspiratorial mindset using the following items (via the general conspiracist belief scale; Brotherton et al., 2013): "certain significant events have been the result of the activity of a small group who secretly manipulate world events" and "a lot of important information is deliberately concealed from the public [by people in power] out of self-interest". Such meta-level beliefs are often referred to as "conspiracy mindset" (Imhoff & Bruder, 2014), which refers to a general system of beliefs that is consistent with conspiracy ideation(e.g., large groups of people conspire to do something malevolent etc., but see also: Sutton & Douglas, 2020).

Methods

In Study 1, we use a set of relatively well-known conspiracies to test the effects of experimentally manipulating deliberation (v. intuition). In Study 2, we used conspiracy theories that are less well-known and created a different presentation format for conspiracy theories that allowed for greater time pressure on the intuitive response condition, thus further decreasing the possibility that participants could engage in deliberation in the intuitive response condition.

Participants

Study 1

In total, 1028 participants were recruited from Mechanical Turk. Participants were randomized into the the two response condition, N = 653 (229 females, 421 males and 2 others, *Mean age* = 35.5 years, *SD* = 9.8 years), or the one response baseline condition, N =

375 (135 females, 239 males and 1 other, *Mean age* = 35.7 years, *SD* = 10.7 years) participated. We set a larger target of participants for the experimental two response condition than the control condition. Preregistration for this study is available at the OSf page of the project: https://osf.io/txfbj/. Sample size was determined before data analysis on the basis that similar studies investigating the effect of deliberation on belief formation using the two response paradigm found significant effects of deliberation using similar sample sizes (Bago et al., 2020a; Bago et al., 2020b). No data analysis was performed before the data collection ended (no data collection was done after analysis).

Study 2

In total, 1000 participants were recruited from Mechanical Turk. In the two response paradigm, *N* = 646 participants (213 females, 432 males and 1 others, *Mean age* = 37.2 years, *SD* = 11.1 years) took part, while in the one response study, *N* = 354 people (102 females, 250 males and 1 others, *Mean age* = 36.8 years, *SD* = 10.9 years) participated. Preregistration for this study is available at the OSf page of the project: https://osf.io/txfbj/. Sample size was determined before data analysis on the basis that similar studies investigating the effect of deliberation on belief formation using the two response paradigm found significant effects of deliberation using similar sample sizes (Bago et al., 2020a; Bago et al., 2020b). No data analysis was performed before the data collection ended (no data collection was done after analysis).

Materials & Procedures

Conspiracy theories in Study 1. Participants were presented with a total of 9 items in three possible forms: conspiratorial, refutation and official explanation. Each item started with an explanation of an event that happened in reality, for example, the death of Princess

Diana. This was followed by an explanation, depending on which item they were randomly assigned. For official explanation arguments, they were given an explanation of how and why

Table 1. Table shows different versions of the Death of Princess Diana story that were used in Study 1 and Study 2.

Official	Diana, Princess of Wales was travelling with his boyfriend, Mohamed "Dodi" Fayed, when they died in a tragic car accident in the Pont de l'Alma tunnel in Paris. They were travelling from the Ritz Hotel, heading to Fayed's apartment. The car was driven by Henri Paul, the deputy head of Security at the Ritz Hotel. Neither Diana or Dodi wore their seat belts when the accident happened. They were travelling at an estimated speed of 105 km/h (65mph), which was twice the speed limit. Paul lost control of the vehicle at the entrance of the tunnel, and the car struck the right-hand wall and then swerved to the left lane before it collided head-on with a pillar that supported the roof, after which the car hit the stone wall of the tunnel and stopped there. After the accident, Diana was in shock but was alive when she was removed from the car, and later she went into cardiac arrest and died during the operation attempting to save her life. Fayed died right after the accident. Investigation revealed that the driver, Henri Paul, had a blood alcohol level 4 times the legal limit, and was also on antidepressants – which caused him to lose control over the vehicle and cause the tragic accident.
Refutation	Diana, Princess of Wales died along with her boyfriend, Mohamed "Dodi" Fayed, as a result of a tragic car accident in Paris. The official causes of the accident were speeding, the driver's alcohol consumption and the fact that she did not wear the seat belt. However, there have been many pieces of evidence calling this conclusion into question. First, on the remains of the Mercedes (Diana's car) police found evidence that it was in contact with a white Fiat Uno. Indeed, eyewitness testimonies suggested that there was a Fiat Uno leaving the scene of the murder. Years later, the man who was allegedly driving the Fiat Uno, James Andanson, died of suicide – the official report says. Second, years later, Diana's butler published a letter that Diana wrote in which she claimed that someone was planning an "accident in her car, brake failure and serious head injury". Third, her hospital transportation took 26 minutes instead of the usual, much shorter time period. Why did it take so much time if not to assure that Diana was dead. Fourth, Diana was told to be a faithful seat belt user. She always used seat belts. The fact that both her and Fayed's seat belts either failed or were not used was sinister and might suggest sabotage.
Conspiratorial	Diana, Princess of Wales was travelling with her boyfriend, Mohamed "Dodi" Fayed, when they died in an accident. However, the accident was no random accident, it was orchestrated by the British Royal Family, specifically Prince Philip, and was executed by the MI6. The perpetrators had several motives. It is very likely that Diana was pregnant with Fayed's child and the couple were about to get engaged. The British Royal Family hated the idea of a non-Christian Muslim within the Royal Family, therefore they could not tolerate the relationship. Moreover, Charles, Prince of Wales, could not re-marry if Diana was alive, as the religious rules that bound the Royal family did not make divorce possible. A white Fiat Uno was being used by MI6 as a means of causing Diana's car to swerve and crash into the side of the tunnel. Police indeed found evidence that the Mercedes (Diana's car) had contact with a Fiat Uno, and witnesses also suggested that they saw a Fiat Uno leaving the scene. James Andanson, a French photographer was in that Fiat Uno – which he indeed possessed. Andanson was also an MI6 agent. Andanson died shortly after, which was reported to be a suicide. He either killed himself out of guilt or were killed by other MI6 agents to cover up the tracks. Diana's body was deliberatively embalmed shortly after her death to ensure that any pregnancy test would produce a false result.

it happened according to offical sources (e.g., the accident was caused by a drunk driver). For the conspiracy arguments, they were given a direct description of a conspiracy theory (e.g., princess Diana was killed as a result of a bigger conspiracy involving the British Royal Family), For the refutation arguments, they were given a description that questioned the official explanation (e.g., why did it took unusually long to take her to the hospital?). Three of the items (Chemtrail, 9/11, water fluoridation), were taken from Mirabile and Horne (2019), while the rest (Moon landing, JFK murder, Martin Luther King assassination, Princess Diana's death, Seth Rich's murder, Roswell UFO crash) were created by the researchers. We only used conspiratorial and refutation explanations that have actually been propogated by conspiracy believers. Participants only received one version of a story (i.e., whoever received the conspiratorial explanation of the Diana story, received neither the official nor the refutation versions of the Diana story) and therefore gave evaluations of 9 items in total. Table 1 shows an example of each version of the same story. After each explanation, participants were asked: "How much do you agree with this explanation? [From 0 (absolutely disagree) to 100 (absolutely agree)]" All items can be found in the OSF page of the project: https://osf.io/txfbj/.

Conspiracy theories in Study 2. Participants were presented with 6 explanations, 2 refutation arguments, 2 conspiratorial and 2 official explanations. We used different conspiratorial theories, taken from Knight (2003), that are not as familiar as the ones in Study 1. We used the following conspiracies: Deepwater Horizon, Korean Airways flight 007 crash, "false history" conspiracy, "Big pharma" suppresses treatment, Sutherland Springs school shooting, Oklahoma bomber, death of Marilyn Monroe, death of Vincent Foster,

Jonestown mass suicide. All items used in this experiment are presented in the OSF page of the project: https://osf.io/txfbj/.

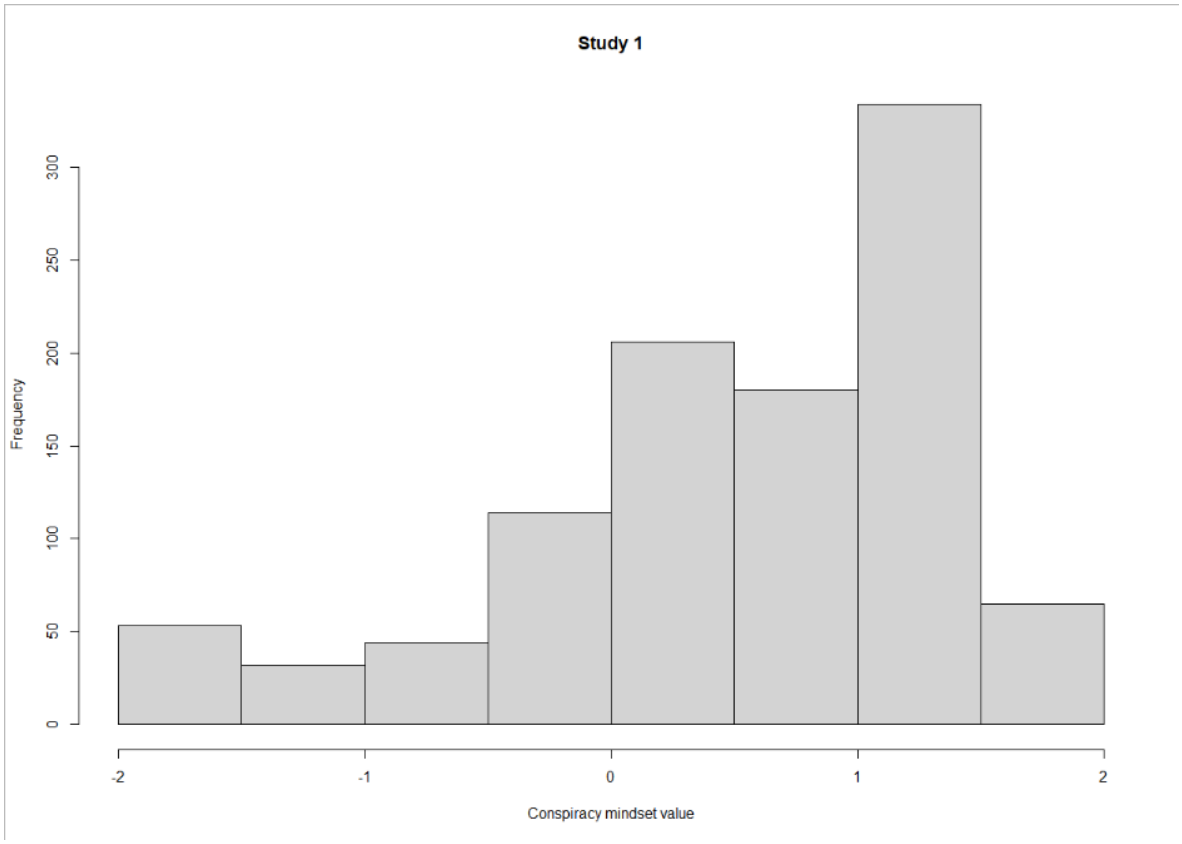
To further decrease the possibility of deliberative engagement during the initial response stage, we also used a different presentation format. First, a preamble (background story) was presented. This was kept the same for an item over all of its versions (i.e., same

Table 2. Table shows one story in all explanation conditions that was used in Study 3.

Preamble	Deepwater Horizon was an ultra deepwater, semi-submersible offshore drilling rig. It was built in South Korea and was leased to BP. On 20 April 2010, while drilling at the Macondo Prospect, it exploded, and the explosion killed 11 crewmen. The oil spill lead to a major environmental catastrophe.
Official	A blowout caused an explosion on the rig and ignited a fireball visible from 40 miles away. during the final phases of drilling the exploratory well at Macondo, a geyser of seawater erupted from the marine riser onto the rig. This was soon followed by the eruption of a slushy combination of drilling mud, methane gas, and water. The gas component of the slushy material quickly transitioned into a fully gaseous state and then ignited into a series of explosions and then a firestorm. An attempt was made to activate the blowout preventer, but it failed.
Conspiratorial	Ecoterrorists were responsible for the explosion on Deepwater Horizon. Hard-core environmentalists were opposed to an energy bill that would have increased offshore oil drilling. By blowing up this drilling rig, they wanted to achieve a decrease in offshore drilling but also wanted to head off the construction of new nuclear plants. The explosion happened 1 day before Earth Day, just to raise even more awareness for the issues the terrorists were fighting for.
Refutation	According to the official explanation, the explosion happened as a result of a blowout. However, there is evidence against this explanation. First, days before the explosion, there was huge dumping in BP's shares of stock, indicating that some people knew that something is going to happen. Second, Obama sent SWAT teams to the site. SWAT teams are never deployed for natural catastrophes, which implies that something else was going on that the administration decided to hide. The trial of BP's executives were a show trials; they were forced to say things under oath they could not possibly know.

background story about Marilyn Monroe in the official, conspiratorial and refutation explanations), and had no explanation about how the event happened. Participants were allowed to read the preamble as long as they wanted. Once they finished reading it, they were presented with the explanation and they could give an initial response. Table 2 shows an example item. Once the explanation was on screen a time limit was introduced to give a response. Participants were asked the following question: "To the best of your knowledge, how accurate is this? (from 0 [completely inaccurate] to 100 [completely accurate])".

Conspiratorial mindset. Prior to receiving the arguments, people were asked to rate how much they agree with two items, taken from Brotherton et al. (2013), that are frequently used to assess conspiratorial mindset: "Certain significant events have been the result of the activity of a small group who secretly manipulate world events" and "A lot of important information is deliberately concealed from the public [by people in power] out of self-interest". They gave a rating on a 5 point scale with options: Definitely not true / Probably not true / Not sure or cannot decide / Probably true / Definitely true. Figure 1 shows the distribution of responses to these scales. Note that the majority of participants show high levels of conspiracy prior belief. Although our results are in line with findings reported in prior work, overall levels of these scales should be interpreted cautiously as these measures are argued to overestimate levels of conspiracy belief (Brotherton et al., 2013; Clifford et al., 2019).



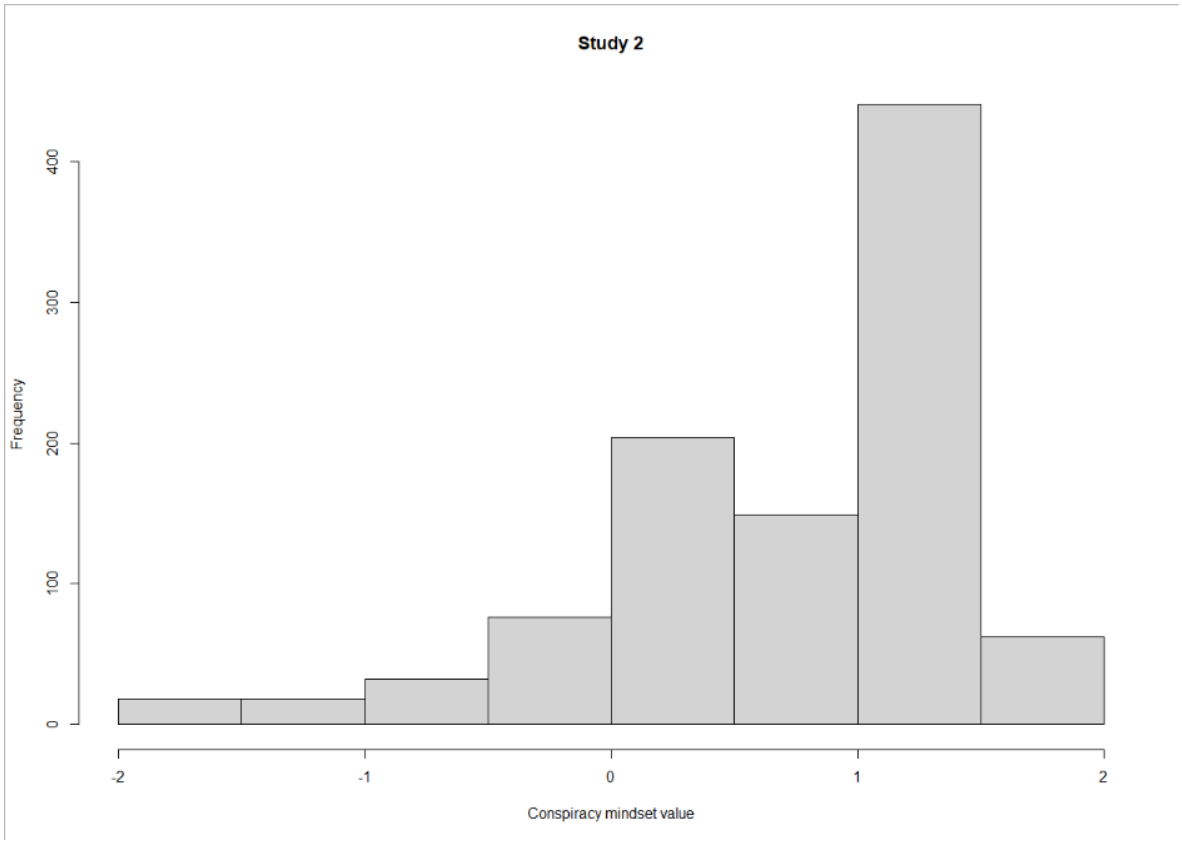


Figure 1. Distribution of conspiracy mindset values in the two studies.

Two response paradigm procedure. Participants were told that they will be presented with each explanation twice. Here is the verbatim instructions participants were presented with:

"**Welcome to the experiment!**

Please read these instructions carefully!

This experiment is composed of 9 questions and a couple of practice question. It will take about 16 minutes to complete and it demands your full attention. You can only do this experiment once.

In this experiment, you will be presented with different events and explanations. That is explanations of why and how the event happened. You will be asked to indicate how much you agree with the explanation on a scale from 0 = completely disagree to 100 = completely agree. We want to know what your initial, intuitive decision is and how you respond after you have thought about the problem for some more time. Hence, as soon as the problem is presented, we will ask you to enter your initial response. We want you to respond with the very first answer that comes to mind. You don't need to think about it. Just give the first answer that intuitively comes to mind as quickly as possible. Next, the argument will be presented again and you can take all the time you want to actively reflect on it. Once you have made up your mind you can enter your final response. You will have as much time as you need to indicate your second response.

To assure that the initial response is really intuitive, you will have a time limit to give a response. The time limit is based on the length of the text and it varies between 30 and 60 seconds. 3 second before the deadline passes, the background will turn yellow to warn you.

In sum, keep in mind that it is really crucial that you give your first, initial response as fast as possible. Afterwards, you can take as much time as you want to reflect on the problem and select your final response.

Please confirm below that you read these instructions carefully and then press the "Next" button. We will start with a couple of practice problems."

After the instructions, participants were presented with a practice problem. After this, they were presented with dot matrix (see below) practice problems in which they were only asked to memorize the dot pattern and try to select the correct one out of the four matrices presented afterwards. Then, they were presented with the same practice problem again, in which they had to give an initial response under load. Each trial started with a presentation of a fixation cross which stayed on screen for 1000 ms. After it disappeared, the dot matrix was presented for 2000 ms. Next, they were presented with the explanation. Three seconds before the deadline passed (see below), the background turned yellow, to warn people about the coming deadline. In case they did not manage to give a response before the deadline passed, they received a message saying "*You did not enter your response before the deadline. Try to respond within the deadline on the next trials. No big deal if you're not totally sure. Just enter*

your very first intuitive answer. You get more time to reflect on your answer afterwards." After the initial response or the message, they were presented with the dot matrix question and had to select the pattern they were presented with. They received feedback on whether or not they selected the correct pattern. In case they did not, they were warned to try to focus on recalling the correct pattern in subsequent rounds. After the feedback, they were presented with the same argument again and were asked to give a final response.

Load matrix. It has been argued that the main, defining feature of System 2 deliberation is that it requires costly working memory engagement (Evans & Stanovich, 2013). We wanted to minimize the impact of System 2 deliberation in the initial response stage of the two response experiment, hence, participants were presented with a cognitive load. As in other two response paradigm experiments (e.g., Bago et al., 2020) we used a dot matrix task (Miyake et al., 2001) which has been shown to decrease analytical engagement in many tasks including probabilistic reasoning (De Neys, 2006) and moral reasoning (Trémolière et al., 2012). In this task, before the headline is presented, participants are presented with a 4X4 matrix, with 5 dots in it, and they are instructed to memorise the dot pattern. After the initial response stage, participants are presented with a set of 4 matrices and they were asked to select the matrix that was presented to them in the beginning. After they made a decision, they were given feedback regarding whether they selected the correct one or not. In cases where the participant failed to select the correct option, they were asked to pay more attention on the subsequent trials. Load was not applied during the final response stage.

Response deadline in Study 1. Another correlate of System 2 deliberation is longer response times (Evans & Stanovich, 2013). To further minimise the possibility of deliberative engagement at the initial response stage, we introduced a strict response deadline during which participants had to provide an initial response. To define the most stringent deadline

possible, we conducted a reading pre-test using 95 participants recruited from Mechanical Turk (38 females, 57 males, *Mean age* = 35.2 years, *SD* = 8.9 years) We instructed them to simply read the material, and click on a button when they finished reading it, and we measured their reaction time. Since the explanations were quite long (*M* = 48.6 sec, *SD* = 40.5 sec) and response times differed among items significantly [*Min* = 31.7 sec, *Max* = 62.9 sec], we decided to apply a different response deadline for each item, but keeping the same deadline for items across conditions (i.e., the deadline for the moon landing conspiracy was the same in each of the 3 experimental conditions). The response deadline for each item is presented in the supplementary materials, and varies between 31 and 62 seconds (they were set to the closest, lower integer to the item's overall average). Note that before calculating all means, we excluded all extreme outliers (i.e., all trials 3 times the standard deviation below or above the mean).

Response deadline in Study 2. As we used different items and a different presentation format than in Study 2, we conducted a new reading time pre-test on 99 participants from Mechanical Turk (34 females, 65 males, *Mean age* = 39.6 years, *SD* = 12.4 years). We only measured the reading time of the actual explanation, i.e., not the time it took them to read the preamble. Since there was no significant between-item variation in RT [*Min* = 12 sec, *Max* = 15.6 sec], we set the response deadline to the closest higher integer to the overall average reading time to give participants some lee way [*M* = 14.3 sec, *SD* = 16.8 sec]. Note that before calculating all means, we excluded all extreme outliers (i.e., all trials 3 times the standard deviation below or above the mean).

One response baseline. In the one response condition, participants simply received the arguments as in Study 1. They were presented with no constraints and could give a response

(akin to the “final response” part of the two response paradigm). After a brief fixation cross period (1 sec) they were redirected to the explanation. In the beginning, participants also received the same number of practice items as in the two response paradigm to assure that it was equivalent across conditions.

Other measures. Participants were also presented with the 7 item version of the Cognitive Reflection Test to measure participants’ general reasoning ability (Frederick, 2005; Thomson & Oppenheimer, 2016). Participants were also presented with a perceptual calibration task in which participants were asked to identify 6 hard-to-identify, blurry images. After which participants were asked how many of the images they think they correctly identified. Last, participants were asked various demographic questions: age, gender, the highest level of education, partisanship, ethnicity; and belief in God. In Study 2, after participants finished the experiment, and before Cognitive Reflection and the reso of the demographic variables were assessed, they were presented with all explanations before and we asked: *“Were you familiar with this explanation prior to this experiment? (Yes/No)”* to assess people’s familiarity with the individual items. Analysis regarding familiarity were preregistered and can be found in the SM (section F).

We report all measures, manipulations, and exclusions in these studies. While all variables and experimental conditions are reported in the Methods section, for clarity, we also reported a list of all measured variables in the SM (section G).

Results

Statistical analysis. We used linear mixed-effect models to analyse the data. As dependent variable, we always used z-scored agreement scores. As fixed effects, we always added explanation type (0.5 - official, -0.5 - refutation or conspiratorial, depending on the analysis), response condition, (0- Intuitive, 1-Baseline) and their interaction. For some models, we also include z-scored conspiracy prior belief, and all 2-way and 3-way interactions. The specific random effect structure is described in each model. We always accepted the model with the most complex random effect structure. If there was a conflict, i.e., two models with the same level of complexity, we selected a model with a smaller AIC value. Note that as preregistered, we wanted to exclude all trials in which participants missed the initial deadline (these trials are NAs), hence, we excluded 2.7% of trials from Study 2 (we only excluded trials from the "intuitive" response condition - no exclusions were applied to the "deiberative" response condition as responding was not under response deadline therefore no missed trials could occur), and none from Study 1. The analysis below includes only the between-subject comparison as the within-subject comparison can be biased by anchoring effects (see, for example, Bago et al, 2021). The results on the within-subject comparison bring us to the same conclusions and can be found in the Supplementary Materials section B. All non-preregistered analyses are labelled as "post hoc". All preregistered analysis that are not presented in the mansucript can be found in the SM (sections E, F)[2].

Sensitivity power analysis. Sensitivity analysis based on alpha level 0.05 and power of 80% suggest that the sample is sufficient to detect a small interaction effect between explanation type and deliberation condition in Study 1 (b = 0.16), and an even smaller effect in Study 2 (b = 0.13). Similarly, the sample is sufficient to detect a small interaction effect

[2] We never included more than one non-randomly assigned predictor (i.e., conspiracy mindset or Cognitive Reflection Test performance)in the models, the rest of the predictors in the models were randomly assigned (explanation type, deliberation condition). Hence, we do not test and report correlations between predictors.

between explanation type, deliberation condition, and conspiracy mindset in both studies (Study 1: b = -0.09, Study 2: b = -0.08). To perform the sensitivity analysis, we used the SimR package in R (Green & MacLeod, 2016), with using the converging random effect structure of the models from the conspiratorial explanations analysis (see the specifications in the statistical analysis).

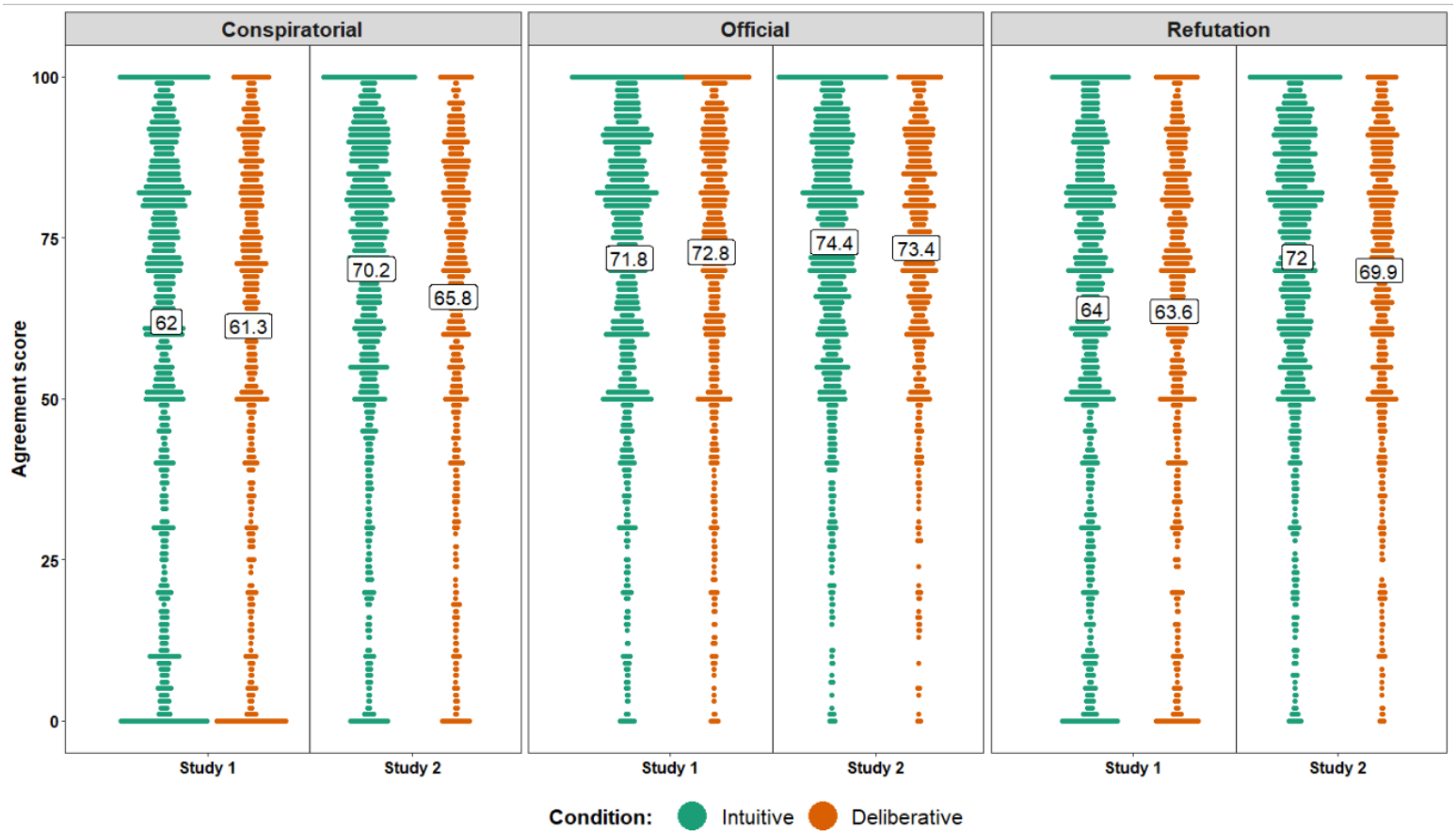


Figure 2. Averages (numbers) and response distributions (each point is one response to a given trial) as a function of deliberation condition and explanation type for both studies separately.

Conspiracy Theories

In Study 1, while not controlling for prior beliefs, we found no effect of deliberation on truth discernment when comparing official versus conspiratorial explanations (interaction between explanation type and response condition), b = 0.06, 95% CI = [-0.06, 0.18], p = .308,

and deliberation also not did it have a main effect on agreement scores, b = 0.004, 95% CI = [-0.08, 0.09], p = .933; there was, however, a main effect of explanation type such that agreement with conspiracy theories was lower than with official explanations, b = 0.37, 95% CI = [0.22, 0.52], p < .001. In Study 2, we introduced a more stringent intuitive response condition, and used conspiracy theories that people are less likely to be familiar with. In Study 2, we found that deliberation significantly increased truth discernment (interaction between explanation type and response condition), b = 0.16, 95% CI = [0.05, 0.26], p = .003, while also having a negative main effect on agreement scores, b = -0.12, 95% CI = [-0.22, -0.02], p = .019; and we once again observed a main effect of explanation type, such that people agreed with conspiratorial explanations less than with official explanations, b = 0.19, 95% CI = [0.12, 0.26], p < .001. Models in both Study 1 and 2 included random intercepts and slopes on explanation type by subject and by item.

When introducing prior belief into the models, in Study 1 we found no significant three-way interaction between prior belief, deliberation condition and explanation type [official vs conspiratorial], b = –0.07, 95% CI = [-0.17, 0.03], p = .191. Interestingly, we found a significant interaction between explanation type and prior beliefs, b = -0.44, 95% CI = [-0.50, -0.37], p < .001, suggesting that people lower on conspiracy mindset show greater truth discernment ability in general. Conspiracy mindset also had a main effect, b = 0.38, 95% CI = [0.33, 0.43], p < .001, suggesting that people low on conspiracy prior belief were less likely to agree with any type of explanation (conspiratorial or not). This model allowed for the variation of explanation type over subjects, and the random intercept of items.

In Study 2, we replicated the interaction between explanation condition and conspiracy prior beliefs, b = -0.19, 95% CI = [-0.25, -0.13], p < .001, and also the main effect

of conspiracy prior belief, b = 0.33, 95% CI = [0.28, 0.39], p < .001, suggesting that people high on conspiracy belief are more likely to agree with all explanations, and that they are less likely to differentiate between conspiratorial and official explanations in terms of overall agreement scores (hence, even intuitively being worst at truth discernment). Most importantly, we found a significant three-way interaction between prior beliefs, explanation type and deliberation condition, b = -0.21, 95% CI = [-0.30, -0.12], p < .001.

In a post-hoc analysis, we tested for non-linear moderating effects of prior beliefs (as the linearity assumption underlying our moderation analyses above may not be valid). For a nonparametric approach, we examined the interaction of explanation type and deliberation condition separately in each quartile of the conspiracy prior belief measure. People on the top (b = 0.38, 95% CI = [0.05, 0.70], p = .026) and the bottom quartiles (b = 0.50, 95% CI = [0.15, 0.84], p = .006) both showed an increase in truth discernment after deliberation, but people in the lower middle (b = 0.10, 95% CI = [-0.05, 0.26], p = .191) or in the upper middle (b = -0.01, 95% CI = [-0.14, 0.11], p = .852) categories did not. This suggests a quadratic relationship between prior beliefs and the effect of deliberation on truth discernment, people on the extremes have improved truth discernment after deliberation but not those in the middle. To test for this possibility, we added the quadratic effect of prior beliefs into the models (along with all interactions except those that would include both linear and quadratic prior belief terms), and found that the quadratic belief term significantly interacted with deliberation condition and explanation type, b = 0.23, 95% CI = [0.11, 0.35], p < .001 (while also leaving the three-way interaction with the linear effect of prior beliefs intact, b = -0.34, 95% CI = [-0.47, -0.22], p < .001) - strongly supporting a non-linear moderating effect of prior conspiratorial beliefs on deliberation. Both models in Study 2 (with and without the quadratic term) allowed for explanation type to vary over the random intercept of subjects

and item contents. For the random effect structure of models in the different quartiles, see the SM. Averages, N, and standard deviations in each quartile are presented in the SM (section H).

Refutation arguments

We next examined truth discernment for official explanations versus refutation arguments, rather than versus conspiratorial arguments. In Study 1, we found no deliberation effect on truth discernment, $b = 0.06$, 95% CI = [-0.06, 0.18], $p = .303$, and deliberation condition also had no main effect, $b = 0.006$, 95% CI = [-0.08, 0.09], $p = .901$, but people agreed less with refutation arguments than with official explanations, $b = 0.30$, 95% CI = [0.13, 0.47], $p = .005$. In Study 2, we found the similar results: deliberation had no significant effect on truth discernment regarding refutation arguments, $b = 0.06$, 95% CI = [-0.03, 0.14], $p = .170$, and deliberation also had no main effect, $b = -0.07$, 95% CI = [-0.18, 0.03], $p = .16$. In general, people agreed to official arguments more than they did to refutation arguments, $b = 0.12$, 95% CI = [0.06, 0.17], $p < .001$.

When we introduced conspiracy mindset to the models, we found consistent results across studies. We found a main effect of conspiracy prior belief (Study 1: $b = 0.37$, 95% CI = [0.32, 0.41], $p < .001$; Study 2: $b = 0.34$, 95% CI = [0.28, 0.39], $p < .001$), and an interaction between explanation condition and conspiracy prior belief (Study 1: $b = -0.39$, 95% CI = [-0.46, -0.33], $p < .001$; Study 2: $b = -0.16$, 95% CI = [-0.20, -0.11], $p < .001$), suggesting that people high on conspiracy prior belief are more likely to agree with all types of explanations, and that they are worse at truth discernment overall. Most importantly, the three-way interaction between conspiracy prior belief, deliberation condition and explanation condition were significant in both studies (Study 1: $b = -0.10$, 95% CI = [-0.21, -0.003], $p =$

.045; Study 2: b = -0.09, 95% CI = [-0.17, -0.005], p = .039). All models in Study 1 included random intercepts and slopes on explanation type by subject and by item. All models in Study 2 included random intercepts of subjects and items, and random slopes of explanation types by subjects.

Looking at potential nonlinear moderation effects, we see a qualitatively similar, albeit weaker, pattern to what we saw for conspiracy explanations. For refutation arguments, people in the top (Study 1: b = 0.15, 95% CI = [-0.35, 0.65], p = .553; Study 2: b = 0.24, 95% CI = [-0.09, 0.57], p = .155) and the bottom (Study 1: b = 0.22, 95% CI = [-0.04, 0.47], p = .100; Study 2: b = 0.28, 95% CI = [-0.04, 0.60], p = .091) quartiles showed the biggest deliberation effect on truth discernment, though the effects were not significant, and generally smaller than what we observed regarding conspiratorial explanations. In the upper middle (Study 1: b = -0.03, 95% CI = [-0.16, 0.09], p = .613; Study 2: b = -0.05, 95% CI = [-0.15, 0.05], p = .378) and lower middle (Study 1: b = -0.01, 95% CI = [-0.19, 0.16], p = .874; Study 2: b = 0.01, 95% CI = [-0.11, 0.12], p = .870) quartiles there was no effect. When we added the quadratic effect of prior beliefs, the three-way interaction was not significant (Study 1: b = 0.07, 95% CI = [-0.04, 0.17], p = .233; Study 2: b = 0.05, 95% CI = [-0.05, 0.15], p = .338). The model including the quadratic effect included the random intercepts of subjects and items, and random slopes of explanation types by subjects. For the random effect structure of models in the different quartiles, see the SM. Averages, N, and standard deviations in each quartile are presented in the SM (section H).

We replicated the pre-registered analysis using our within-subject intuition/deliberation manipulation. While there were some differences (e.g., truth discernment in conspiracy explanations was significant in Study 1, but not in Study 2), one

primary conclusion remained the same: deliberation only had consistently positive effects on truth discernment for people who are at one of the extremes of the conspiracy mindset scale (see details of this analysis in the SM).

All corresponding means and standard deviations can be found in the SM (section H).

Cognitive Reflection Test

Turning to individual differences in deliberation, we find that performance on the cognitive reflection test is positively associated with truth discernment performance through both studies and for both refutation arguments and conspiratorial explanations (Conspiracy beliefs: Study 1: $b = 0.38$, 95% CI = [0.31, 0.44], $p < .001$; Study 2: $b = 0.25$, 95% CI = [0.19, 0.31], $p < .001$; Refutation arguments: Study 1: $b = 0.34$, 95% CI = [0.27, 0.40], $p < .001$; Study 2: $b = 0.17$, 95% CI = [0.12, 0.22], $p < .001$). Furthermore, the deliberation manipulation had a greater effect on truth discernment for higher CRT scorers evaluating conspiratorial explanations in Study 2 but not in Study 1 (Study 1: $b = 0.08$, 95% CI = [-0.03, 0.19], $p = .142$; Study 2: $b = 0.12$, 95% CI = [0.02, 0.21], $p = .017$), and not regarding refutation arguments (Study 1: $b = 0.08$, 95% CI = [-0.03, 0.19], $p = .138$; Study 2: $b = 0.03$, 95% CI = [-0.05, 0.11], $p = .423$). See SM for detailed description of the analysis (section D).

Discussion

In two studies, we tested the idea that increasing deliberation protects against conspiracy theories. Compared to previous studies on the subject, we used a robust methodology that more strongly manipulated intuition versus deliberation by using the two-response methodology in which intuitive thinking is induced by introducing a strict response

deadline and cognitive load. We also included an appropriate control condition (official explanations) and two types of conspiracy arguments (refutation arguments and conspiracy explanations). This allowed us to test predictions from two broad theories regarding the effect of deliberation. The accuracy-driven deliberation account predicted that giving people the opportunity to deliberate (v. rely largely on their intuitions) will increase the extent to which they distinguish between conspiratorial and non-conspiratorial explanations. On the other hand, the deliberation-coherence account predicted that deliberation effect would depend on the prior beliefs of the subject: since people try to evaluate the veracity of new information in the light of their prior beliefs and knowledge, deliberation should increase truth discernment only for people who do not have conspiracy mindset.

Although we found some evidence for the positive effects of deliberation on truth discernment overall, supporting the deliberation-accuracy account, this effect was overall quite small and dependent on participants prior beliefs, supporting the deliberation-coherence account. However, interestingly, deliberation had the weakest effects not for people who were the most conspiratorial in their mindset, but rather for people who did not have strong opinions about conspiracies either way. This is not consistent with *either* account and indicates that the effect of deliberation on conspiracy belief is not as straightforward as previously thought (Swami et al., 2014).

Nonetheless, it is noteworthy that we found evidence that deliberation *can* improve accuracy even for people who most strongly have a conspiratorial mindset (although, again, this was a fairly small effect). This indicates that people who believe in conspiracies may not be as unreachable as is commonly assumed. Naturally, there are several caveats that need to be considered. First and foremost, the “extreme” conspiracy believers in our sample may not

actually be extreme based on real-world benchmarks. They were, after all, willing to engage in a research study on Mechanical Turk - something that people who are deeply committed to conspiracies may not be willing to do. Second, our conspiracy mindset measure consisted of two questions about generic conspiratorial thinking. In cases where an individual is strongly committed to a *particular* conspiracy, merely deliberating may not have the same positive impact on accuracy. Ultimately, the results support the idea that the positive impacts of deliberation are most concentrated among people who are least in need of intervention. Nonetheless, finding any evidence at all that deliberation can improve accuracy among people who have a conspiratorial mindset is noteworthy.

The most important limitation of this study is that, while we manipulate intuitive and deliberative thought, we did not experimentally manipulate prior beliefs; hence, a causal link between prior beliefs and deliberation cannot be established. Second, a potential objection to our results and interpretation is that we did not control for motivations that might affect people's reasoning about conspiracies, such as political partisanship or religious views (and that might, in some way, confound our prior belief measure). However, in our study, we used a variety of conspiracy theories from multiple different contexts so that it is unlikely that there is a systematic or overarching motivation that impacts all of them. Nevertheless, generalization of our results to different conspiracies that are particularly salient in current US politics (Qanon) or to specific religious views (Da Vinci conspiracy) should be done cautiously, as unique motivations might modify how people think about them. Third, we tested conspiracy theories in an artificial "lab" context. It would be interesting to test future studies to look at conspiracy beliefs and reasoning in more naturalistic settings to understand how the broader social context affects how people reason about conspiracy theories.

In practice, this study suggests that making conspiracy theorists and anti-conspiracy theorists deliberate more will make them better at discounting conspiracy theories or refutation arguments. Interestingly, a different problem in the context of the positive effects of deliberation that emerges from this data appears to be among people who are *apathetic* to conspiracies - those who do not have much of an opinion one way or the other and therefore may not benefit from interventions that increase deliberation. This is consistent with recent work showing that, for example, people who are politically disengaged are the least reflective and analytic (Pennycook & Rand, 2019a), or that people who give intermediate responses on a variety of Likert scale attitudes measures are worse at telling truth from falsehood when judging COVID-19 headlines (Arechar et al., 2022). Thus, in addition to the difficulties involved with increasing people's willingness to deliberate, it is important to also understand the underlying motivations that may lead someone to be apathetic about the truth.

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