

Editor's comments

I have now received two reviews of your Stage 2 submission and I'm happy to say that both are very positive. I completely agree with the reviewers that this is a rigorous and well-written RR, and is already very close to meeting the Stage 2 criteria. Within the reviews you will find some helpful points, mostly concerning the interpretation of the results, consideration of limitations (including limits on causal inference) and general conclusions. Provided you are able to address these comments in a revision and response, I anticipate being able to accept your next submission without further review.

Response:

Thank you and the reviewers very much for your comments. We appreciate the time and effort that you and the reviewers invested in our RR and have done our best to address the comments below.

Review by Daniel Toribio-Flórez

I highly appreciate having been part of this review process (my first RR via PCI RR), and in particular, of this thoughtful and rigorous research project. I learned a lot through its findings and comprehensive review of the literature, but also through the high standards the authors used in terms of transparency, openness, and pre-registration.

I will follow the PCI RR criteria for the review of this Stage 2 manuscript, with the hope that my comments are helpful in improving an already solid piece of research.

Response:

Thank you very much for your supportive words and for taking the time to review our RR.

2A. Whether the data are able to test the authors' proposed hypotheses (or answer the proposed research question) by passing the approved outcome-neutral criteria, such as absence of floor and ceiling effects or success of positive controls or other quality checks.

The control group included in the experiment was successfully distinguished from the experimental groups (brooding and reflection conditions) based on the manipulation checks (i.e., measuring self-reported thinking styles used during the task). A second important difference between the control and experimental conditions was the frequency of early terminations of the survey, higher in the brooding and the reflection conditions (as confirmed in the exploratory analyses). This can signal an effect of irritation, boredom, or disengagement that some participants could have experienced during the brooding and

reflection tasks (as discussed in Stage 1), and is in line with the authors' finding that both the brooming AND reflection (but MORE brooming THAN reflection) induced negative affect and decreased positive affect, relative to the control condition. I appreciate that you discuss this issue as a limitation in the General Discussion, as it could introduce an important confound regarding an additional "irritation/boredom" effect of the experimental conditions. In the end, it is plausible that the predicted increase (or the observed lower decrease) of conspiracy beliefs could partly be due to the irritation/boredom experienced during the task being satisfied by the entertaining value of conspiracy beliefs (van Prooijen et al., 2022), which may have led participants to endorse these beliefs more, relative to the control condition.

A small comment about the sample demographics. It is possible that highly educated people, like the majority of your sample, show higher dispositional levels of reflection/brooding due to their training and educational background. Is there any reference to this? If not, perhaps it should also be mentioned in the Limitation section, as a more equally distributed sample may attenuate the effect of your manipulation.

Response:

Thank you for your detailed consideration of our manipulation checks, and for your comment about the sample demographics. Your example convinced us that sample characteristics and other variables (e.g., cultural factors) might influence the effect in a multitude of ways. We now mention this possibility under "Practical Meaningfulness and Generalizability" (p. 46).

2B. Whether the introduction, rationale, and stated hypotheses (where applicable) are the same as the approved Stage 1 submission. This can be readily assessed by referring to the tracked-changes manuscript supplied by the authors.

The introduction, rationale, and tested hypotheses were exactly the same as the ones approved in the Stage 1 submission.

2C. Whether the authors adhered precisely to the registered study procedures.

Based on their report and their research materials, the authors adhered to the registered study procedures, analysis plan, and their sequential approach to data collection.

2D. Where applicable, whether any unregistered exploratory analyses are justified, methodologically sound, and informative.

Most exploratory analyses reported by the authors were registered in Stage 1 and are relevant insofar as they offer insight regarding:

- a) the second, exploratory experimental condition (i.e., reflection condition), which had the potential to inform the mixed results of the prior Pilot Studies 1-3,
- b) dependent measures related to theoretically relevant mechanisms of the effect under study (i.e., negative and positive affect),
- c) the role of conceptually relevant dispositional moderators (i.e., participants' tendency to brood and their baseline conspiracy beliefs), and
- d) robustness checks to rule out potential random effects of the experimental stimuli (e.g., worry topic of each participant).

The authors further included dropout analyses, unregistered, yet important to clarify the difference in the early terminations between the control and the experimental conditions.

I assume that the open and transparent report of every exploratory analysis will eventually clash with the word count limitations of some journals. Thus, if necessary, I would make an even shorter mention of the exploratory results in the main paper, and share the full Exploratory Analyses section in the Supplement.

Response:

Thank you for this suggestion, which we will keep in mind in case it becomes necessary to reduce the word count.

2E. Whether the authors' conclusions are justified given the evidence.

I think you did a very good job in summarizing your results and, consistently with how you did throughout the rest of the paper, in acknowledging when evidence or your experimental design was limited. I just have very few minor comments:

p. 42 - *“Building on a series of correlational and experimental pilot studies, this Registered Report disentangled the causal effects of two subtypes of rumination on conspiracy beliefs: brooding and reflection.”*

Although it is true that your results quantitatively distinguished the effect of brooding from the effect of reflection (i.e., a smaller decrease of conspiracy beliefs, and a bigger increase of negative affect due to brooding vs. reflection), there are still some question marks about what underlies this distinction (e.g., level of irritation/boredom, task duration) that would prevent me from claiming that this RR clearly “disentangled the causal effects” of brooding and reflection. Yes, we observe some differences between brooding and reflection, but we do not know exactly why. Thus, I would focus this first paragraph more on the main effect of

interest –i.e., the effect of brooding, as you do in the 2nd paragraph of the General Discussion–, and only introduce reflection as an exploratory comparison, as you originally proposed in Stage 1.

Response:

We agree with this comment and have changed the paragraph accordingly.

P. 44 “...participants aware that a conspiracy is not such an **unplausible** explanation after all.” Typo, it should be “implausible”.

Response:

Thanks for spotting this, we corrected it.

I really like the section regarding opening a discussion about SESOIs in the subfield of research on conspiracy theories. I totally agree with you that is critical to think about the size of the effects we study, and also about how these effect sizes are related to the temporal features of the sociopsychological phenomenon under study (using your example, the frequency in which people brood over worrying societal issues may determine whether the small effect is cumulative over time, and therefore, its ultimate practical implications). In the case of conspiracy beliefs, they are a phenomenon that unpacks over time, in a process of internalization that goes from their mere entertainment to their integration within a broader system of attitudes and the individual’s social identity (for references on this, see Franks et al., 2017; Sutton & Douglas, 2022). And this is unlikely to be captured by experiments that offer single snapshots, as you describe. Thus, I think that the discussion about SESOIs could be accompanied by a discussion about which experimental designs enable us to predict and capture the temporal characteristics of the effect of interest (e.g., longitudinal designs). This reminded me of your PSPB paper on the longitudinal effects of existential motives on conspiracy beliefs, and how different intervals between waves led to different results. To me, this is another paradigmatic example justifying the importance of this type of conversation, as it showed how some effects might only have short-term (or long-term) consequences, and therefore, might only be observed in longitudinal designs with shorter (longer) intervals between waves.

Response:

Thank you for this thoughtful comment. We agree that this section could profit from a discussion about longitudinal research and the role of temporal processes. We added a paragraph that describes this idea: “So, our findings should ideally be complemented with

longitudinal studies. In these, brooding and conspiracy beliefs could be measured repeatedly and with multiple time-lags to better understand the temporal characteristics of the effect. It is, for example, conceivable that brooding only has a fleeting effect on conspiracy beliefs. It is, however, also conceivable that the effects of brooding on conspiracy beliefs accumulate over time.”

I wish you the best of luck with the publication of this RR!

Thank you very much for your support!

Review by Matt Williams

I've enjoyed following this study through the RR stages, and I think this is an excellent Stage 2 RR. I believe all the criteria for acceptance at Stage 2 are either met or can be met with very minor revisions. I've added specific notes in relation to each criterion below.

Response:

Thank you very much for your kind words and for taking the time to review our RR.

2A. Whether the data are able to test the authors' proposed hypotheses (or answer the proposed research question) by passing the approved outcome-neutral criteria, such as absence of floor and ceiling effects or success of positive controls or other quality checks.

They were; the inferential criteria relating to manipulation checks were met.

2B. Whether the introduction, rationale and stated hypotheses (where applicable) are the same as the approved Stage 1 submission. This can be readily assessed by referring to the [tracked-changes manuscript supplied by the authors](#).

They are nearly identical. There are a couple of minor tracked changes in the introduction on page 15, but they simply provide a bit more elaboration about how equivalence testing works. I think this is fine.

2C. Whether the authors adhered precisely to the registered study procedures.

They did. The closest thing to a change from the original plan I could identify was that there were a couple of unforeseen technical errors that resulted in the need to exclude 3 participants (as noted in the Recruitments). While the Stage 1 RR naturally doesn't specify how they

would deal with this unanticipated issue, the way the authors chose to deal with it seems appropriate.

2D. Where applicable, whether any unregistered exploratory analyses are justified, methodologically sound, and informative.

I agree that they were. One minor note: The exploratory analyses say, “For these analyses, we used the largest sample we had available (i.e., all participants that passed the inclusion criteria and completed the study until October 15, 2023).” Does this mean that the exclusion criteria specified in the Recruitment of Participants subsection were not applied for these exploratory analyses? Or just that the sample from the second/final look was used?

Response:

For these participants, the same exclusion criteria specified in the recruitment of participants section were applied. This sample was larger than the sample from the second look, since more participants than planned completed the study (N = 2,007). To stay as closely to the registered analyses as possible, we included the precise registered sample size for the confirmatory analyses at look 2 (N = 1,638). Thank you for pointing out that this was unclear. We added a reference to the Look 2 sample description where this point is described in greater detail.

2E. Whether the authors’ conclusions are justified given the evidence.

I believe they were. I just have a handful of minor notes:

1. Re. “A worry-thinking-style (which is similar to brooding) has been proposed as a causal factor involved in the development and maintenance of paranoid delusions (Foster et al., 2010; Freeman et al., 2015; Freeman et al., 2012). **Based on our findings**, it appears likely that brooding is a causal factor that conspiracy beliefs and paranoid delusions share”. I think it would be clearer to phrase this as something like “In conjunction with our findings, this suggests...” That makes it clearer this conclusion comes partly from the citations in the previous sentence, and avoids inadvertently implying that the present findings (in isolation) justify the conclusion.

Response:

We agree with this comment and changed the sentence to “In conjunction with our findings,...”

2. Re. “Rumination in general, and brooding in particular, represent a risk factor for many psychological disorders (Aldao et al., 2010), and could explain why conspiracy believers tend to be more vulnerable to a variety of mental health problems (Barron et al., 2018; Chen et al., 2020; Coninck et al., 2021; Furnham & Grover, 2021; Leibovitz et al., 2021).” This is an interesting idea, but naturally speculative – e.g., it doesn’t necessarily follow from brooding being a risk factor for mental health problems that brooding necessarily *causes* mental health problems, and even if it does it’s probably only a partial explanation for the relationship between conspiracism and mental health problems (since there are presumably many other third variables that affect both). The word “could” signals this idea is just a *possibility* rather than a claim warranted by the findings presented, but I’d wonder about being a bit explicit about the fact that this is a speculative hypothesis that would need to be tested in future studies.

Response:

Thank you for this comment. We agree that it should be emphasized more that this is a speculative idea. We added a sentence that clarifies this.

3. “Exploratory analyses showed that reflection may also have increased conspiracy beliefs.” I mulled over this one a bit, given that conspiracy beliefs *decreased* from T1 to T2 in the reflection condition, just less so than the (surprisingly large!) T2-T1 difference in the control condition. As best I can tell, I think this inference is warranted *if* we assume that the control condition cannot have itself decreased conspiracy beliefs (such that the apparent decrease is just a measurement artefact or similar). But perhaps a little more elaboration of the justification for the claim would be useful.

Response:

We agree that this claim is not necessarily justified. Throughout the manuscript, we aimed to avoid the term “increase”, and use “smaller decrease” instead, avoiding at least some interpretational pitfalls. We changed the sentence to: “Exploratory analyses showed that reflection also resulted in a smaller decrease in conspiracy beliefs compared to the control group.”

4. “The decrease in conspiracy beliefs from T1 to T2 might also be attributed to the way they were measured at both time points. During T1, participants were asked to choose the societal issue that concerned them the most from a list of six topics. Being confronted with numerous social issues might have in itself contributed to higher scores on the conspiracy belief

measure. Perhaps, the plurality of social problems has been interpreted as evidence for a conspiracy or being confronted with multiple worry topics resulted in spontaneous brooding.” That makes sense, but if exposure to the social issues affected conspiracy beliefs at T1, wouldn't it continue to exert an effect a few minutes later at T2? Or would this effect be very transient?

Response:

There were at least 7 days between T1 and T2. We think it rather unlikely that the way in which the topics were presented at T1 would exert a noticeable effect on conspiracy beliefs at T2.

5. “The finding that brooding increased conspiracy beliefs implies that interventions aimed at reducing conspiracy beliefs could focus on brooding as a potential cause and facilitator.”

True, but does this jibe with the observation that the estimated effect of brooding on conspiracy beliefs was too small for us to be confident it's practically meaningful? The effect of something like psychoeducation or CBT on brooding might itself not be very large, and then the effect of brooding in turn on conspiracy beliefs appears to be quite small... So do we have strong reason to suspect that psychoeducation, CBT etc. would yield practically meaningful changes in conspiracy beliefs?

Response:

Thank you for this comment. We agree that it would be premature to assume that such interventions would lead to a meaningful change, and added a sentence that clarifies this.

6. In the Limitations and Directions... section: “Lastly, it is important to consider the possibility of an effect in the reversed causal direction”. This is absolutely a possibility, but I wonder if it could lead inattentive readers into thinking this is a limitation in the specific sense of being an alternative explanation of the effects found in this study? (It isn't, of course, given the experimental design). This is definitely an optional suggestion, but the author might prefer to reframe this slightly to head off such an interpretation.

Response:

We changed the section to: “Lastly, the preregistered experiment focused on the effect of brooding on conspiracy beliefs. Future research should also consider the possibility of an effect in the reversed causal direction: Conspiracy beliefs might also lead to increased levels of brooding.”

7. It was noticeable that there was a lot less dropout in the control condition (n = 703) than in the brooding condition (n = 546) or the reflection condition (n = 499). I believe the exclusion of participants with incomplete responses implicitly assumes the data is missing completely at random (MCAR), and the pattern of dropout suggests the data is not in reality MCAR. There is consequently at least some possibility of bias here (e.g., imagine, say, if people in the brooding condition who would have displayed lower changes in conspiracist beliefs from T1 to T2 were also more likely to drop out). I don't think this necessarily merits any substantial changes, but perhaps the dropout issue merits some brief discussion under limitations?

Response:

Thank you for this comment, this is an important point that should be addressed in the limitations. We included a section on p. 47: "The fact that the brooding and reflection conditions were longer and more demanding than the empty control group could explain why early termination of the study at T2 was more frequent in the brooding and reflection conditions than in the control group. Potentially, this selective dropout could introduce some bias (e.g., if people in the brooding condition who would have displayed lower changes in conspiracy beliefs from T1 to T2 were also more likely to drop out). By including an active control group, it would be possible to test the robustness of the effect observed in the present study. "