# Does Brooding Meaningfully Increase the Likelihood of Believing in a Conspiracy? Stage 1 Registered Report

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# Abstract

This project aims to investigate the relationship between rumination and conspiracy beliefs. It involves four pilot studies, including one observational and three experimental studies, but the results were inconclusive. We suggest that rumination needs to be further differentiated, with reflection and brooding as two distinct forms of rumination: Whereas for reflection no clear prediction can be made, brooding should contribute to the formation of conspiracy beliefs. This Registered Report will test the hypothesis that specifically brooding increases conspiracy beliefs by conducting a repeated-measures within-person experiment, where participants will be randomly assigned to brooding, reflection, or control conditions. We will use a sequential study design and employ both equivalence and minimum effect tests. This way, we ensure that the results will be informative regardless of the specific outcome while keeping the study resources efficient.

# Does Brooding Meaningfully Increase the Likelihood of Believing in a Conspiracy?

Worrisome events are all over the news: Reports about multiple societal crises, such as the COVID-19 pandemic, war, climate change, and political division, dominate the current information landscape (Gabbatiss, 2019; Grynspan, 2022; United Nations, 2022). When exposed to such distressing information, people may respond in various ways. They may accept or reappraise the situation, avoid the stressor, or engage in dysfunctional rumination. Here, we focus on the consequences of dysfunctional rumination about worrisome societal events. Rumination is a style of thinking that is repetitive, difficult to disengage from, and focused on negative content (Ehring & Watkins, 2008; Nolen-Hoeksema et al., 2008). It consists of repeatedly asking oneself “why” and “what if” types of questions in an unproductive manner (Zetsche et al., 2009). A large body of evidence links rumination to negative affect, depression and other undesirable psychological consequences (Lyubomirsky & Tkach, 2004).

This research program investigates how rumination may affect the formation of conspiracy beliefs. Several theories about the formation of conspiracy beliefs predict that rumination should increase the tendency to believe in conspiracies, e.g., via negative affect or negative attention and interpretation biases. Below, we describe these theories, and outline the rationale for our pilot studies (one observational, three experimental), which investigated the causal link from rumination to conspiracy beliefs. Based on these pilot studies, we outline subsequently that rumination needs to be further differentiated: Whereas reflection is a deliberate and analytic form of rumination, brooding consists of dwelling on negative thoughts and emotions. This Registered Report tests the hypothesis that specifically the brooding subtype of rumination increases conspiracy beliefs.

## Defining Conspiracy Beliefs

A conspiracy is a secret plot by a powerful group that aims to achieve a common goal. Importantly, the conspirators pursue this goal regardless of the consequences for others: Malicious intentions are not required, but the goal is pursued even if this harms others. Thus, conspiracies tend to have harmful consequences for many people (Douglas & Sutton, 2023). A conspiracy belief is the conviction that a conspiracy has taken (or is currently taking) place (Douglas et al., 2019). Some well-known examples include the belief that Bill Gates is using the Coronavirus vaccines as a ploy to gain control over the world population, or that the American government was responsible for the 9/11 terrorist attacks. There are other conspiracy beliefs that many would consider more plausible, such as beliefs about the tobacco industry having concealed evidence (Francey & Chapman, 2000), or the Volkswagen emissions scandal (where the corporation eventually plead guilty to charges of conspiracy, Carey, 2017).

Understanding causes and enabling conditions of conspiracy beliefs is important. It lies in the public interest to disprove false, and uncover true conspiracies, particularly because conspiracy beliefs can have harmful consequences for individuals and societies: they negatively affect psychological well-being (Leibovitz et al., 2021; Liekefett et al., 2021), and decrease institutional trust, societal engagement, as well as compliance with important health behaviors (Bertin et al., 2020; Hornsey et al., 2020; Jolley & Douglas, 2014; Pummerer et al., 2020; van Mulukom et al., 2022). So, arguably, it would be ideal if people only believed in conspiracies that actually took place and not in any that did not take place. For the present purposes, however, we do not differentiate between true and false, or plausible and implausible conspiracy beliefs. We focus entirely on subjective beliefs that fulfill the criteria of a conspiracy belief. That is, we consider conspiracy beliefs as a superordinate category that may entail both warranted and unwarranted beliefs (Nera & Schöpfer, 2022).

## Possible Pathways from Rumination to Conspiracy Beliefs

Several theories on the formation of conspiracy beliefs, as well as on the consequences of rumination, imply that rumination should increase conspiracy beliefs. In this section, we summarize these theories and their predictions. Our goal is not to test these models against each other, or to identify the specific pathways through which rumination impacts conspiracy beliefs. Instead, our goal is to show that multiple theoretical approaches would suggest a causal link from rumination to conspiracy beliefs.

### Rumination, Negative Affect and Conspiracy Beliefs

Current theories about the formation of conspiracy beliefs suggest that they result, at least in part, from the experience of negative affect. In a highly influential review paper, Douglas et al. (2017) argue that conspiracy beliefs emerge when people’s fundamental needs for security, certainty, and belonging are frustrated. Such negative affective states make conspiracy beliefs appear attractive: Conspiracy beliefs offer ostensibly simple answers to complex questions, allow to shift the blame to clearly identified enemies, and provide a positive image of the self and ingroup (Douglas et al., 2017). In a similar vein, the existential threat model of conspiracy theories suggests that existential threat, defined as feelings of anxiety and uncertainty, is at the root of conspiracy beliefs (van Prooijen, 2020). Existential threat prompts a sense-making process in which people aim to identify simple causal relations between and explanations for phenomena. When antagonistic outgroups that can be blamed for social problems are present, this sense-making process leads to conspiracy beliefs (van Prooijen, 2020). So, according to both Douglas et al. (2017) and van Prooijen (2020), experiencing negative affect is conducive to the formation of conspiracy beliefs.

Crucially, it is well-established that rumination in response to distress increases negative affect. Rumination has been described as an “emotional magnifier” that amplifies existing negative affective states (Watkins & Roberts, 2020, p.2). A number of experiments have shown that ruminating about distressing events prolongs negative mood. These studies have typically used a repeated measures design in which a rumination condition was compared to a distraction condition, and negative affect was measured before and after the manipulation. In a comprehensive review of research on the link between rumination and negative affect, Kirkegaard Thomsen (2006) concludes that 15 out of 20 studies that used such a design found the predicted group difference between rumination and distraction, two reported a trend in the expected direction, and three reported null results (which may, in part, be attributable to a failed manipulation). However, these studies did not examine whether effects resulted from an increase in negative affect due to rumination, or a decrease due to distraction (Kirkegaard Thomsen, 2006). As such, one can conclude that rumination increases negative affect compared to distraction, while its effects alone are less well studied experimentally.

Beyond these experimental results, a number of longitudinal studies provide evidence for a link between rumination and negative affect: the tendency to ruminate has consistently been found to predict longer and more severe periods of depression at a later time (Nolen-Hoeksema et al., 1997; Nolen-Hoeksema et al., 1994). Similarly, a recent experience-sampling study found evidence for a reciprocal relation between rumination and negative affect: within-person increases in rumination predicted subsequent within-person increases in negative affect, and vice versa (Blanke et al., 2022). Converging findings have been obtained by researchers using similar designs (Brans et al., 2013; Lennarz et al., 2019; Moberly & Watkins, 2008; Pavani et al., 2017).

Taken together, rumination and negative emotion appear to reinforce each other in a vicious cycle (Lyubomirsky & Tkach, 2004). Given that theories on the formation of conspiracy beliefs state that they are more likely to emerge when people experience negative affect (Douglas et al., 2017; van Prooijen, 2020; van Prooijen & Douglas, 2018), rumination in response to distressing events should increase conspiracy beliefs. A similar line of thought can be found in recent research that suggests that emotion dysregulation, which is a general inability to regulate negative emotions, is correlated with conspiracy beliefs (Molenda et al., 2023; Scandurra et al., 2022). The following mechanism is proposed: Dysfunctional emotion regulation results in negative affect which, in turn, leads people to interpret ambiguous stimuli as threatening and hostile. This bias, in turn, contributes to the adoption of conspiracy beliefs (Molenda et al., 2023). Since rumination is a dysfunctional emotion regulation strategy (Aldao et al., 2010), the same argument can be applied to justify the effect of rumination on conspiracy beliefs.

### Rumination, Negative Cognitive Biases, and Conspiracy Beliefs

Research demonstrates that rumination leads to negatively biased thinking (Lyubomirsky & Tkach, 2004). For example, experiments have shown that dysphoric participants induced to ruminate made more pessimistic attributions about upsetting experiences, made more negative predictions about future events, retrieved more negative memories from their past, and judged negative events as having occurred more frequently that dysphoric individuals that were distracted (Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky et al., 1999). A more recent study using a thinking-aloud paradigm further found that participants with higher trait rumination scores (specifically, trait brooding scores) demonstrated longer periods of negative thoughts in a resting state, and their negative thoughts were linked to a stronger narrowing in conceptual scope over time, as indicated by higher semantic similarity (Raffaelli et al., 2021). This converges with Andrews-Hanna et al. (2022)’s finding that, during a free association task, trait ruminators are more strongly attracted to negative conceptual spaces and more likely to remain there longer.

Conspiracy beliefs are negative explanations of often ambiguous, meaningful events: powerful groups or individuals that act in secret are made responsible for societal problems. Therefore, the negative attention and interpretation biases induced by rumination can be expected to contribute to conspiracy beliefs. In line with this, recent research has shown that conspiracy beliefs are related to a general suspicious processing style, that is, an intuitive tendency to perceive negative intentionality and secrecy in both conspiracy-related and -unrelated events (Frenken & Imhoff, 2022). Further, conspiracy beliefs are associated with several other thinking biases, such as the tendency to attribute agency and intentionality to inanimate objects (Douglas et al., 2016). An anxious attachment style, which entails an exaggerated perception of threat and a negatively biased view of others, has also been found to predict conspiracy beliefs (Green & Douglas, 2018). These findings show that styles of thinking that share properties with rumination contribute to the formation of conspiracy beliefs.

### Analogous Evidence from Research on Persecutory Delusions

Lastly, rumination has been identified as an important precursor of persecutory delusions, defined as false beliefs about a malevolent persecutor who intends to commit harm (Westermann & Lincoln, 2011). Several studies provide evidence for an association between rumination (or closely related forms of repetitive negative thinking, such as worrying) and persecutory delusions (Freeman & Garety, 2014; Freeman et al., 2008; Hepworth et al., 2011; Ludwig et al., 2020; Martinelli et al., 2013; McKie et al., 2017). Importantly, the presence of worry predicts delusional episodes longitudinally (Freeman et al., 2012), and interventions targeting a worry thinking style were effective in reducing persecutory delusions, which provides evidence for a causal relationship (Foster et al., 2010; Freeman et al., 2015). The suggested causal mechanism again refers to a narrowing of attention to negative stimuli, and subsequent threat-related interpretation biases. These biases prevent the consideration of non-threatening information that could potentially disprove the delusion (e.g., Bortolon & Raffard, 2021).

Importantly, we do not equate conspiracy beliefs with persecutory delusions: Persecutory delusions are a form of psychopathology and conspiracy beliefs are not. Nonetheless, similar to persecutory delusions, conspiracy beliefs entail the conviction that harm is going to occur (or already has occurred), and that a threatening agent (persecutor or group of conspirators) will cause (or already has caused) harm (Freeman, 2007)[[1]](#footnote-2). Further, both conspiracy beliefs and persecutory delusions are firmly held, resistant to change, and highly distressing (Douglas et al., 2019; Freeman, 2007). Because of these substantial similarities, it appears worthwhile to investigate whether they may be enabled by analogous conditions and brought about by analogous causes. This kind of analogous reasoning has previously been used to motivate research on the link between narcissism and conspiracy belief (Cichocka et al., 2016).

### Preliminary Predictions for the Current Research

In sum, major theories directly concerned with the formation of conspiracy beliefs, combined with theories on the affective and cognitive consequences of rumination, strongly imply that rumination should increase the likelihood of conspiracy beliefs. Further support for this idea comes from research on persecutory delusions, which share key characteristics with conspiracy beliefs.

# Pilot Studies

 We conducted four pilot studies to test the causal role of rumination (broadly conceived) in conspiracy beliefs. Pilot Study 1 tests the idea that the habitual tendency to ruminate is correlated with conspiracy beliefs. Pilot Studies 2a and 2b aimed to test the causal effect of experimentally induced rumination on conspiracy beliefs using hypothetical scenarios. Pilot Study 3 aimed to test the causal effect of rumination on conspiracy beliefs using real-world issues that were dynamically matched to participants based on which issue caused them the most concern. All Pilot Studies were administered in German language, and sampled participants that currently live in Germany and speak German fluently. The samples and results from all Pilot Studies are described in detail in the Supplement: <https://osf.io/rdpz4/?view_only=91e958b982d64379a2c94e13859151a7>

## Pilot Study 1

Pilot Study 1(218 participants, recruited by the survey company respondi) tested correlations between two rumination measures (the Perseverative Thinking Questionnaire [PTQ], Ehring et al., 2011, and the Rumination Subscale of the Heidelberg Form of Emotion Regulation Strategies [HFERST], Izadpanah et al., 2019) and three conspiracy belief measures (Brotherton et al., 2013; Bruder et al., 2013; Wood, 2017). Both rumination scales measure the broad tendency to engage in repetitive negative thinking. The PTQ focusses on the general characteristics of the thinking process (i.e., whether it is repetitive, unproductive, and/or intrusive), whereas the rumination subscale of the HFERST refers specifically to distressing events and ruminating about the causes of one’s negative emotions.

Pilot Study 1 was preregistered (<https://aspredicted.org/77Y_QYF>). Any deviations from the preregistration are described in the Supplement. Results demonstrated that both rumination measures were significantly correlated with all conspiracy belief measures (see Table 1)[[2]](#footnote-3). This supports the idea that the tendency to ruminate is related to conspiracy beliefs[[3]](#footnote-4).

## Table 1

*Bivariate correlations between conspiracy beliefs and rumination Pilot Study 1*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | *M*  | *SD* | 1 | 2 | 3 | 4 | 5 |
| 1 – Conspiracy Mentality Questionnaire | 4.00 | 1.58 | 1 |  |  |  |  |
| 2 – Generic Conspiracist Belief Scale | 2.99 | 1.58 | .82\*\* | 1 |  |  |  |
| 3 – Flexible Inventory of Conspiracy Suspicions | 3.49 | 1.84 | .79\*\* | .74\*\* | 1 |  |  |
| 4 – Perseverative Thinking Questionnaire | 3.49 | 1.34 | **.26\*\*** | **.27\*\*** | **.19\*\*** | 1 |  |
| 5 – Rumination Subscale | 4.09 | 1.21 | **.22\*\*** | **.17\*** | **.16\*** | .64\*\* | 1 |

*Note*. \**p* < .050, \*\**p* < .010; correlations between rumination and conspiracy beliefs are in bold.

## Pilot Studies 2a and 2b

Pilot Studies 2a (*N* = 401) and 2b (*N* = 249, both recruited by respondi) aimed to test the causal effect of rumination on conspiracy beliefs using hypothetical scenarios, i.e., mock newspaper articles that raised the possibility of a conspiracy. In Pilot Study 2a, two scenarios were used: The first referred to claims about social media corporations wiretapping users’ smartphones in secret for personal gains (social media scenario), the second described a controversial politician dying in a plane crash (plane crash scenario). In Pilot Study 2b, only the social media scenario was used. For each scenario, participants were randomly assigned to a rumination or a control condition. In the rumination condition, participants were asked to repeatedly think about and write down their thoughts and concerns about the events described in the scenario. Conspiracy beliefs and non-conspiratorial explanations about the scenario were measured, and participants indicated the extent to which they ruminated as a manipulation check (see Table 2).

Pilot Studies 2a and 2b were preregistered (Pilot 2a: <https://aspredicted.org/CPG_NW2>, Pilot 2b: <https://aspredicted.org/16G_642>). Any deviations from the preregistration are described in the Supplement. Results revealed that, in the social media scenario of Pilot Study 2a, rumination was successfully induced (*d* = 0.25)[[4]](#footnote-5). As predicted, the rumination condition also scored significantly higher on conspiracy beliefs than the control group (*d* = 0.39). However, in the plane crash scenario of Pilot Study 2a (*d* = 0.16), and in the social media scenario of Pilot Study 2b (*d* = 0.16), we failed to successfully induce rumination. In both cases, we found no evidence that participants in the rumination condition ruminated significantly more or more intensely than those in the control group, which precluded a meaningful test of our hypothesis. We further did not find any statistically significant differences in conspiracy beliefs between the conditions (*d* Pilot Study 2a = 0.13, *d* Pilot Study 2b = -.01).

However, in all scenarios of these pilot experiments, the extent to which participants ruminated during the manipulation (i.e., the manipulation check) was positively correlated with conspiracy beliefs (*r*’s between .34 and .57). This suggests that not only habitual rumination, but also the spontaneous use of rumination in an experimental setting is correlated with conspiracy beliefs. Nevertheless, these results cannot provide evidence for a causal relationship. It may be that unobserved confounding variables that are related to both state rumination and conspiracy beliefs introduced a spurious correlation (Bollen, 1989).

## Table 2

*Descriptive Statistics per Condition Pilot Studies 2a and 2b*

|  |  |  |  |
| --- | --- | --- | --- |
| **Pilot Study 2a** |  |  |  |
| **Scenario 1 (Social Media)** |  |  |  |
|  | Total (*N* = 193),*M (SD)* | Rumination (*n* = 82), *M (SD)* | Control (*n* = 111), *M (SD)* |
| State Rumination | 3.00 (1.34) | 3.19 (1.37) | 2.86 (1.30) |
| Conspiracy Beliefs | 3.60 (1.55) | 3.94 (1.60) | 3.35 (1.47) |
| Non-Conspiratorial Explanations | 4.70 (1.37) | 4.52 (1.52) | 4.84 (1.24) |
| **Scenario 2 (Plane Crash)** |
|  | Total (*N* = 208),*M (SD)* | Rumination (*n* = 78),*M (SD)* | Control (*n* = 130),*M (SD)* |
| State Rumination | 2.62 (1.40) | 2.76 (1.51) | 2.54 (1.33) |
| Conspiracy Beliefs | 3.19 (1.68) | 3.32 (1.79) | 3.10 (1.60) |
| Non-Conspiratorial Explanations | 4.55 (1.55) | 4.35 (1.75) | 4.67 (1.41) |
| **Pilot Study 2b: Scenario 1 (Social Media)** |
|  | Total (*N* = 228),*M (SD)* | Rumination (*n* = 101),*M (SD)* | Control (*n* = 127),*M (SD)* |
| State Rumination | 2.87 (1.65) | 3.02 (1.71) | 2.75 (1.59) |
| Conspiracy Beliefs | 3.45 (1.68) | 3.44 (1.76) | 3.46 (1.63) |
| Non-Conspiratorial Explanations | 4.85 (1.38) | 4.96 (1.45) | 4.75 (1.31) |

*Note.* All items were answered on a 7-point Likert scale.

## Pilot Study 3

Overall, the results of Pilot Studies 2a and 2b highlighted the necessity to reconceptualize the experiment, especially since we failed to reliably induce rumination. First, our manipulation was considerably shorter than those typically used in clinical research. Second, the hypothetical scenarios may not have been considered real and/or worrisome by all participants. This may have resulted in a failure to induce rumination, or in effects that, assuming a monotonic dose-response relationship, were too small to be detected with adequate power. For these reasons, we designed a new rumination manipulation that was a) considerably longer and b) focused on real-world issues that caused actual worries to our participants. Participants were randomly assigned to rumination and control conditions, and were dynamically matched with the societal topic (out of a list of six topics, e.g., growing gap between rich and poor) that caused them the most concern. The list of the six topics was based on a pre-test: We selected topics that were worrisome to our participant pool and allowed for the interpretation of a conspiracy (see Supplement for details).

Results from Pilot Study 3 (*N* = 297, recruited from Prolific) revealed that this strategy was successful: The new rumination condition scored consistently and significantly higher than the control group on an entire range of manipulation checks (e.g., estimated and subjective length of time spent ruminating, intensity of rumination, thoughts growing more and more negative, perceived increases in frustration and negative mood). However, conspiracy beliefs were not affected in the theoretically expected direction (*d* = -0.05). An equivalence test revealed that an effect larger than *d* = 0.20 could be rejected (*p* = .034, see Figure 1). Assuming *d* = 0.20 as the smallest effect size of interest, we can conclude that rumination did not meaningfully increase conspiracy beliefs. Nevertheless, conspiracy beliefs were again significantly correlated with a variety of manipulation checks (e.g., intensity of rumination, thoughts growing more and more negative, negative mood and frustration, *r* ranging from .22 to .37; although conspiracy beliefs were not significantly correlated with estimated and subjective length of time spent ruminating). It must be considered that these correlations may be due to the influence of third variables that are related to both the predictor and the outcome but not included in the current model.

## Figure 1

*Equivalence Bounds for Key Hypothesis Test*

*Note***.** On the x-axis, unstandardized mean differences are depicted. The dashed vertical lines indicate the equivalence interval. The bold horizontal line indicates the 90% CI.

## *Insights from Pilot Studies*

Overall, our Pilot Studies produced an inconclusive pattern of results. Out of two experiments that successfully induced rumination, only one showed the predicted effect on conspiracy beliefs (Pilot Study 2a, social media scenario). Pilot Study 3 provided evidence against the hypothesis that rumination increases conspiracy beliefs: Although rumination was successfully induced, conspiracy beliefs did not meaningfully increase (assuming *d* = 0.20 as the smallest effect size of interest). Our Pilot Studies provide several valuable insights for our Registered Report. First, Pilot Study 3 demonstrated that using real-world issues that are dynamically matched to participants is an effective procedure for inducing rumination. Second, they provide reason to suspect that rumination broadly conceived does not reliably impact conspiracy beliefs. A more fine-grained understanding of rumination may be necessary (see below). Lastly, our Pilot Studies are limited in that they only examined between-person effects. Yet the predicted effect explicitly takes place at the within-person level: If a person ruminates, that same person is thought to be more likely to believe in a conspiracy subsequently. Since between-person data are limited with regard to the evaluation of within-person hypotheses (Curran & Bauer, 2011), we plan to include within-person measures of change in the Registered Report.

## Two Subtypes of Rumination: Brooding and Reflection

Although initially thought of as a unitary construct (e.g., Lyubomirsky & Nolen-Hoeksema, 1995), advances in research on rumination suggest the existence of at least two subtypes: reflection and brooding (Treynor et al., 2003). Reflection is defined as a purposeful style of thinking aimed at cognitive problem solving, and brooding as a passive, unproductive dwelling on negative information (Armey et al., 2009; Treynor et al., 2003). More recent definitions state that reflection is purposeful, self-distanced, and solution-focused, whereas brooding is self-immersed, problem-focused, and passive (Satyshur et al., 2018).

For the present purposes, we define reflection as a deliberate, analytic, and controlled form of thinking that aims to achieve an epistemic goal, such as a better understanding of the problem at hand. It entails a critical evaluation of one’s beliefs and conclusions and, potentially, updating one’s belief of what is true and why. Engaging in reflection requires cognitive resources. Reflection is self-distanced in the sense that the focus of attention is on the matter at hand, and not on the self and one’s emotions. Brooding, in contrast, consists of unproductive dwelling on one’s worries and distressing emotions. The attention is focused on negative self-relevant information without pursuing any clear epistemic goal (Armey et al., 2009; Junkins & Haeffel, 2017). It can be difficult to disengage from brooding: The process can be thought of as a downward-spiral that pulls you deeper and deeper into negative circles of thoughts (Moberly & Watkins, 2008). For a comparison of reflection and brooding, see Table 3.

Table 3*Comparison of Brooding and Reflection*

|  |  |  |
| --- | --- | --- |
|  | **Brooding** | **Reflection** |
| Focus of attention | Self-focused; one’s negative emotions and worries | Self-distanced; the concrete matter at hand |
| Processing style | Bias toward negative information; no critical evaluation of one’s conclusions; uncontrolled; downward-spiral toward more negative thoughts | Ideally neutral, unbiased; critical evaluation of one’s conclusions; deliberate; clear epistemic goal (e.g., understanding, problem-solving…) |
| Cognitive resources | Requires fewer resources to engage in, but difficult to disengage from | Requires more resources to engage in, but easier to disengage from |
| Consequences | Negative affect, negative attention and interpretation biases  | Context-dependent |

We argue that, depending on contextual factors, reflection may increase, decrease, or not affect conspiracy beliefs. For brooding, however, a clear prediction can be theoretically derived: it should increase the likelihood of adopting conspiracy beliefs. Our experimental manipulations so far induced rumination in the broader sense, and allowed for a mix of brooding and reflection: Although participants were instructed to write down their worries, and imagine their worry topic to get even worse, they were also asked about causes and consequences of their worry topic in a rather neutral and analytical way. Depending on the context, the reflective aspects of this manipulation may have counteracted the effect of brooding on conspiracy beliefs. This may have contributed to the inconclusive results. We summarize evidence pertaining to the distinct consequences of brooding and reflection below.

### Distinct Consequences of Brooding and Reflection

Studies show that brooding and reflection are differentially related to negative affect, as well as negative attention and interpretation biases. Brooding is consistently and positively related to depression and negative affect, even among participants currently not suffering from a psychiatric disease (e.g., Armey et al., 2009; Burwell & Shirk, 2007; Joormann et al., 2006; Watkins, 2009). With regard to reflection, however, it does not seem possible to make as clear a prediction as for brooding. While some studies find no correlation between reflection and depression, others observe that reflection constitutes a protective factor. Yet others observe that reflection, similar to brooding, is positively associated with depression (for a summary, see Allard & Yaroslavsky, 2019). Some have argued that reflection has detrimental consequences only when it is combined with brooding (Junkins & Haeffel, 2017). One reason for this pattern of results may be that the consequences of reflection are highly context dependent: Reflection entails engaging with information about the issue at hand and relating it to one’s background knowledge and relevant existing beliefs. As such, reflection combined with different types of background knowledge and pre-existing beliefs would produce different outcomes.

Further, brooding is consistently related to negative attention and interpretation biases, whereas reflection is not. For instance, brooding, but not reflection, is correlated with difficulties to disengage from sad faces, and quick disengagement from happy faces (Allard & Yaroslavsky, 2019; Joormann et al., 2006; Owens & Gibb, 2017). Brooding, but not reflection, is related to impaired executive functions (i.e., slowed refreshing). This suggests that brooders (but not reflectors) attribute greater relevance and allocate more cognitive resources to negative emotional stimuli (Bernblum & Mor, 2010). Further, Lo et al. (2008) observed that brooding was positively, and reflection even negatively associated with a negative cognitive style, defined as making more negative attributions in the Attributional Style Questionnaire (a self-report measure that assesses attributions of internality, stability and globality regarding hypothetical events).

These findings suggest that specifically brooding can be expected to increase negative affect and lead to a negatively biased processing of information. Since these are the processes that are relevant for the formation of conspiracy beliefs (see above), we predict that brooding should increase conspiracy beliefs. For reflection, we do not make a clear prediction. Some evidence suggests that reflective forms of thinking (e.g., deliberation) may even counteract conspiracy beliefs directly (Pennycook et al., 2015; Rizeq et al., 2021; Swami et al., 2014), yet this effect may also depend on contextual variables, such as the plausibility of a conspiracy in the respective domain, or the extent to which one is already invested in the idea of a conspiracy (van Prooijen et al., 2020, see Supplement for details on this idea).

# Registered Report

This Registered Report will conduct a comprehensive test of the hypothesis that brooding about distressing societal issues increases conspiracy beliefs. We also explore how reflection impacts conspiracy beliefs. We will experimentally manipulate both brooding and reflection by adapting the experimental procedure from Pilot Study 3: Participants will again be dynamically matched with a societal topic that causes them concern. In the brooding condition, participants will focus on their worries and negative emotions related to this issue. In the reflection condition, participants will be instructed to think about potential explanations for their worry topic in an analytical way. Further, we will focus on within-person changes: We will include a baseline assessment (T1) 5-10 days prior to the experiment (T2) where participants’ conspiracy beliefs about their worry topic will be measured. At T2, participants will be randomly assigned to three conditions (brooding, reflection, control), go through their respective manipulations, and again indicate their conspiracy beliefs about their worry topic. We predict that participants in the brooding condition experience a greater increase (or smaller decrease) in conspiracy beliefs from T1 to T2 than participants in the control group.

By incorporating equivalence and minimum effect tests, we ensure that results are informative and interpretable regardless of whether the hypothesized effect exists or not (Lakens, 2017). Further, we increase the efficiency of our sampling procedure by using a sequential design (Lakens et al., 2021). The last stage of the sequential design will have 90% power to detect our smallest effect of interest.

## Method

Drafts of the questionnaires for T1 and T2 can be found in the Supplement (English translations) on OSF: <https://osf.io/rdpz4/?view_only=91e958b982d64379a2c94e13859151a7>. All materials presented to participants will be in German.

### Time Point 1 (T1)

**Identification of Worry Topic.** To begin, participants will be presented with six societal issues and asked to rank them according to which worries them most: (a) Growing gap between rich and poor, (b) Growing division in society, (c) Mass surveillance in the internet, (d) Censorship and restriction of freedom of expression, (e) Political influence of large corporations, and (f) Exploitation by global capitalism. Based on a pre-test (see Pilot Study 3 in the Supplement), we selected topics that were worrisome to participants and, at the same time, allowed for the interpretation of a conspiracy. It may be that some topics lend themselves more easily to the interpretation of a conspiracy than others, which could introduce some bias in between-person comparisons. However, due to randomization, the distribution of selected topics in the conditions should be similar between conditions. All in all, we believe that, for the present purposes, it is more important that all participants receive a topic that actually causes them concern, than to keep the actual topic constant across conditions. Nevertheless, we will conduct robustness checks to investigate whether effects are similar for different topics, and estimate mixed models that include a random effect for societal topic (exploratory analyses).

**Conspiracy Beliefs.** Participants will indicate the extent to which they believe that their worry topic could be explained by a conspiracy. They will answer three items on a 7-point scale, each of which entail all defining characteristics of a conspiracy: X exists because powerful actors secretly advance their own interests, even if they harm others in this process; X is caused by influential groups that keep their actions covert and are concerned only with their own advantage; X can be traced back to the fact that certain key players ruthlessly pursue their own goals in secret (X will be replaced by the topic participants chose as most worrisome at T1).

**Depression and Suicidality Screening.** Participants who do not pass a depression and suicidality screening will not be able to complete T2. This is because we do not want to expose vulnerable participants to the brooding manipulation. Participants will answer the Patient-Health-Questionnaire-9 (PHQ-9), and a four-item suicide screening tool (Horowitz et al., 2012). Participants who score 10 or higher on the PHQ-9 (Levis et al., 2019), or answer yes to any of the suicide screening items, will be filtered out .

**Exploratory Measures.** Some measures will be included for exploratory purposes, namely participants’ trait tendency to brood and reflect (self-developed items), the Conspiracy Mentality Questionnaire (Bruder et al., 2013), the Generic Conspiracist Belief Scale-5 (Kay & Slovic, 2023), and some demographic items (age, gender, level of education, subjective social class, political orientation).

### Time Point 2 (T2)

**Overall Procedure.** First, participants will be randomly assigned to brooding, reflection or control conditions. Then, participants in the brooding and reflection conditions will be reminded of the topic they selected at T1 as most worrisome, and proceed to their respective manipulations. Participants in the control condition will proceed directly to the dependent variable. We deliberately chose a control group that proceeds directly to the dependent variable (baseline control group) over a distraction control group because only the baseline control group allows for the conclusion that it was actually brooding that affected conspiracy beliefs. In a distraction control group, it would be impossible to disentangle whether brooding increased, or whether the alternative task given in the distraction control group actually decreased conspiracy beliefs. Nevertheless, this creates a minor limitation: the participants in the brooding and reflection conditions will spend extra time answering open-ended, repetitive questions – a task that most participants presumably will not enjoy. As such, the possibility remains that this feature of the manipulation may increase frustration, which could, in theory, affect conspiracy beliefs. Yet we believe that the advantages of this design (isolating the causal effect of brooding) outweigh this disadvantage.

After the manipulations, participants will answer the dependent variable again (see T1), manipulation checks about the extent to which they brooded, reflected or thought about an unrelated topic during the manipulation (see below), as well the German version of the SPANE (Rahm et al., 2017), which is a short measure of positive and negative affect.

**Brooding Manipulation.** In the brooding condition, participants will be instructed to repeatedly think about the concerns that their worry topic causes them, and how this makes them feel. They will answer a series of questions that build onto each other, and simulate a downward spiral of worries and negative thoughts. To begin, all participants will answer seven questions. Subsequently, all participants will answer one cycle of repetitions. Then, the repetition questions will be repeated one after the other until five minutes have passed. As soon as five minutes have passed, the “continue” button will bring participants to the dependent variable instead of to the next question. Participants will receive the following instructions: You indicated that X worries you the most. The following is for you to reflect on your concerns about this topic (X will be replaced by the topic participants chose as most worrisome at T1):

1. What concerns do you have about X? Please take a moment to think about this before writing down your concerns.
2. Which of these concerns makes you feel particularly bad?
3. Why does this concern make you feel so bad?
4. How do you feel as you think about this concern? Please describe these feelings in as much detail as possible.
5. Which of these feelings do you find most uncomfortable?
6. Why is this feeling the most uncomfortable for you?
7. What would happen to you if you felt such feelings very intensely for a long time?

Repetitions (until 5 minutes have passed; at least one cycle of repetitions):

1. What other concern about X makes you feel particularly bad?
2. (questions 3-7 as above)

**Reflection Manipulation.** The goal of the reflection manipulation is for participants to analytically think about the topic and try to achieve an epistemic goal, namely evaluating potential explanations for their worry topic. An important aspect of reflection is that one critically evaluates one’s beliefs and interpretations. For this reason, participants will generate potential explanations of their worry topic, evaluate the plausibility of these explanations, and think about alternatives. As in the brooding condition, participants will answer seven questions and go through at least one cycle of repetitions. If five minutes have not passed by then, the repetition questions will be presented one by one until five minutes are over. They will receive the following instructions: You indicated that X worries you the most. In the following, you should think about this topic.

1. What could be possible explanation for X? Please take a moment to think about this before writing down the possible explanations.
2. Which of these explanations do you think is the most plausible?
3. What speaks for or against this explanation actually being true?
4. What is a particularly compelling argument **for** this explanation being true?
5. What is a particularly compelling argument **against** this explanation being true?
6. Now that you have thought about this, please make a final judgement: How plausible do you think it is that this explanation is actually true?
7. What could influence your judgement in one direction or the other?

Repetitions (until 5 minutes have passed, at least one cycle of repetitions):

1. What could be another explanation for X that you think is plausible?
2. (questions 3-7 as above)

**Manipulation Checks.** To ensure that our manipulations achieved what was intended, all participants will indicate the extent to which they (a) brooded about their worries and emotions in relation to their worry topic, (b) reflected on potential explanations for their worry topic, and (c) did not think about their worry topic in a particular way *in the five minutes before they answered the dependent variable (DV).* As such, for participants in the brooding condition, the manipulation checks (MCs) will indicate the extent to which they brooded, reflected or thought about something else during the brooding manipulation; in the reflection condition, the MCs will capture participants’ style of thinking during the reflection manipulation; and in the control condition, the MCs will refer to whatever participants did in the 5 minutes before they answered the DV, thus capturing participants’ ‘thinking as usual’. So, in all conditions, the MCs capture participants’ style of thinking in the five minutes before they answered the DV.

Participants will read: *When answering the following questions, think about the 5 minutes before you answered the previous page of the questionnaire.* In addition, a timeline will graphically display the 5 minutes participants should refer to (see Supplement for details).

All items will be introduced with “During these five minutes…”. Brooding will be measured with three items: I was constantly thinking depressing thoughts about X, I have been ruminating about unpleasant thoughts and feelings that X triggers in me, and I have thought a lot about how bad my worries about X make me feel. Reflection will be measured with three items: I thought analytically about possible explanations for X, I have tried to arrive at the most correct estimate of possible explanations for X, I systematically questioned different explanations for X. ‘Thinking as usual’ will be measured with three items: I did not spend any thought on X, I did not think about X, I have not thought specifically about X”.

## Analysis Plan

In order to ensure that our final study is informative regardless of whether the hypothesized effect actually exists, we will complement conventional null-hypothesis significance tests with equivalence and minimum effect tests for both the main hypothesis and the manipulation checks (Lakens, 2022; Lakens et al., 2018).

Equivalence tests determine whether effects large enough to be of interest can be rejected. Since it is never possible to demonstrate that an effect is *exactly* zero, performing an equivalence test requires the specification of a range of values that are considered equivalent to zero, that is, a smallest effect size of interest (SESOI): the smallest effect that would still be considered theoretically interesting (Lakens et al., 2018). If the lower and upper limits of the confidence interval of the effect size fall completely within the equivalence range, one would consider the effect equivalent to zero.

Minimum effect tests determine whether effects smaller than the SESOI can be rejected, that is, whether an effect is not just statistically significant, but also practically meaningful. If the confidence interval of the effect size would fall completely beyond the SESOI, one would consider the effect practically meaningful (Lakens, 2017, 2022). All t-tests that will be conducted will be Welch’s t-tests.

### Justification of Smallest Effect Size of Interest

We begin with defining the SESOI of our main hypothesis test: the effect of brooding on conspiracy beliefs. Subsequently, we outline our rationale for the SESOI of our manipulation checks. To our knowledge, the question of what constitutes a meaningful effect has not yet been addressed in the conspiracy beliefs literature. For this reason, we considered several potential justifications for our SESOI (see Table 4), which are described in detail in the Supplement. This leaves us with five plausible SESOIS that range from *d* = 0.15 to *d* ~ .30, with a median of *d* = 0.20. Based on this median, we suggest *d* = 0.20 as our SESOI for the effect of brooding on conspiracy beliefs. Since we test a directional hypothesis, we will conduct one-sided equivalence and minimum effect tests. This means that we will consider our effect practically meaningful if the lower limit of the 90% confidence interval of the effect size falls beyond *d* = 0.20, and practically negligible if the upper limit falls below *d* = 0.20.

We argue that the SESOI for our manipulation check (i.e., the SESOI that determines whether the manipulation produced a meaningful effect on brooding) should be larger than that of the main hypothesis test: Presumably, a change of a certain magnitude in brooding would lead to a respectively smaller change in conspiracy beliefs. Thus, a larger change in brooding would be required to observe an effect of *d* = 0.20 on conspiracy beliefs. We are unaware of any recommendations for how the SESOI of a manipulation check should relate to the SESOI of the main effect of interest. Most likely, the manipulation check should show a stronger effect. We propose that the SESOI for the manipulation check should be at least 50% larger, which results in *d* = 0.30. So, we would consider the effect of the manipulation check practically meaningful if the lower limit of its 90% confidence interval falls beyond *d* = 0.30, and practically negligible if the upper limit falls below *d* = 0.30.

## Table 4

*Set of Plausible Approaches to Setting the SESOI*

|  |  |
| --- | --- |
| Approach  | Effect size *d* |
| Small standardized effect (Cohen, 1992) | 0.20 |
| Small effect based on empirically derived effect size distributions (Lovakov & Agadullina, 2021) | 0.15  |
| Small telescope approach: what the original study had 33% power to detect (Simonsohn, 2015), in this case: Pilot Study 2a | 0.18 |
| Meta-analysis of related research (Biddlestone et al., 2022) | 0.26 |
| Raw mean difference of within-person changes of .50  | ~ 0.30 |

### Manipulation Checks

The following pattern of results would be ideal for our manipulation checks (see also Figure 2): (a) the brooding condition should score meaningfully higher on the brooding MC than both reflection and control conditions, (b) the reflection condition should score meaningfully higher on the reflection MC than both brooding and control conditions, (c) the control group should score meaningfully higher on the ‘thinking as usual’ MC than both brooding and reflection conditions, (d) reflection and control conditions should not differ on the brooding MC, (e) brooding and control conditions should not differ on the reflection MC, (f) brooding and reflection conditions should not differ on the ‘thinking as usual’ MC, (g) within the brooding condition, brooding scores should be higher than reflection and ‘thinking as usual’ scores, (h) within the reflection condition, reflection scores should be higher than brooding and ‘thinking as usual’ scores, and (i) within the control condition, ‘thinking as usual’ scores should be higher than brooding and reflection scores.

However, testing each of these hypotheses (which would, ideally, all be supported at the same time) at the usual alpha level would result in a very conservative test of the overall pattern. Further, not all aspects of this pattern are equally important for the analyses we intend to conduct. For this reason, we do not make the entire pattern of results a condition for accepting (or rejecting) our manipulation as effective. Instead, we focus on the most relevant criteria (see also the stopping rules specified in the sampling plan). That is, we will consider the brooding manipulation effective if (1) the brooding condition scores meaningfully higher on the brooding MC than the control group, that is, the lower limit of the 90% CI falls above *d* = 0.30, AND (2) the control group scores meaningfully higher on the ‘thinking as usual’ MC than the brooding condition, that is, the lower limit of the 90% CI falls above *d* = 0.30 (see also MC 1 and MC 2 in Figure 2). We will nonetheless evaluate the full pattern and discuss how deviations from the optimum might limit the interpretation of the findings.

Should this manipulation check fail, we will nonetheless explore the data and report results for the main hypothesis test. However, we will not draw any confirmatory conclusions about our hypothesis, since it will not be possible to conclude whether it was actually brooding that increased (or failed to increase) conspiracy beliefs (see also Fiedler et al., 2021).

## Figure 2

***Ideal Pattern of Manipulation Check Results***

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*Note.*On the y-axis, mean scores on the brooding, reflection and ‘thinking as usual’ manipulation checks are depicted. MC1 and MC2 are the key tests on which the testability of our main hypothesis depends.

### Main Hypothesis Test

To test our main hypothesis, we will compute difference scores by subtracting T1 conspiracy belief scores from T2 conspiracy belief scores. We will then evaluate whether the brooding condition reported a greater increase (or smaller decrease) in conspiracy beliefs from T1 to T2 than the control group. A one-sided minimum effect test will determine whether the effect of the brooding manipulation is practically meaningful (i.e., whether the lower limit of the 90% confidence interval of *d*  falls beyond *d* = 0.20), which would confirm our hypothesis. If not, a one-sided equivalence test will determine whether the effect of brooding is practically negligible (i.e., the upper limit of the 90% confidence interval of *d*  falls below *d* = 0.20, equivalence test), which would disconfirm our hypothesis. If neither the equivalence nor the minimum effect test yields a conclusive result (i.e., the 90% CI of *d* overlaps with *d* = 0.20), a conventional one-sided Welch’s t-test will determine whether we can at least reject zero. In this case, we would conclude that most likely there is an effect, but it is unclear whether it is practically meaningful.

### Exploratory Analyses

Several exploratory analyses will be conducted, e.g., concerning negative affect and the role of potential moderators (e.g., it may be that effects of brooding on conspiracy beliefs are stronger for those participants with a high tendency to brood or with high levels of conspiracy mentality at T1), and whether the within-person change in the reflection condition differs from the within-person change in the control group. We will also conduct a variety of robustness checks: e.g., mixed models that include a random effect for which worry topic participants chose, ANCOVA testing for mean differences in T2 conspiracy beliefs using T1 scores as a covariate, bias-corrected effect size estimates instead of Cohen’s d (such as Hedge’s g and Glass’ delta), and Bayes factors that quantify the relative evidence for the null and alternative hypothesis.

## Sampling Plan

We aim to achieve 90% power to detect our smallest SESOI (*d* = 0.20) with alpha = .05 in a one-sided Welch’s t-test. In order to design our study as efficiently as possible, we will use a sequential design. This means that data will be analyzed repeatedly during data collection and data collection may be stopped, either because sufficient evidence for a meaningful effect has been obtained (the minimum effect test is significant), or because sufficient evidence for the absence of a meaningful effect has been obtained (the equivalence test is significant). Due to the possibility of stopping data collection early, sequential designs lead to a lower average expected sample size than fixed designs, and can thus be considered more efficient (Lakens et al., 2021). In contrast to optional stopping, which is a questionable research practice, the average type I and type II error rates are controlled across looks.

### Sequential Design

Using the rpact package (Wassmer & Pahlke, 2022) we have designed a sequential study with 90% power for *d* = 0.20 in a one-sided test, an alpha level of 5%, and two equally spaced looks (the first look after approximately 50% of data have been collected). The Type I error rate is kept at 5% across both looks using a Pocock-like alpha spending function, and the Type II error rate is kept at 10% using a Pocock-like beta spending function.

An a priori power analysis shows that at most 546 participants per condition are needed (total *N* = 1638). The first look will be after approximately 820 participants have been collected.

Using the Pocock like alpha spending function, we can calculate the alpha levels at each look that will lead to a rejection of the respective null hypotheses of equivalence, minimum effect and conventional t-test. At the first look (50% of data), the alpha level is.031. At the last look (100% of data), the alpha level is 0.30.

When there are deviations from the pre-planned number or timing of looks, the alpha spending function allows to recalculate the alpha levels based on the exact amount of information that has been observed. So, it is not strictly necessary to analyze the data *exactly* after 50% have been collected (Lakens et al., 2021).

### Power for Equivalence and Minimum Effect Test

We have planned the design to be able to detect the SESOI of *d* = 0.20 with 90% power in a one-sided Welch’s t-test. We conducted additional sensitivity analyses for the power of the equivalence and minimum effect tests. The power of both of these tests depends on the true effect size, and how close it is to the SESOI: If the true effect size happened to be identical to the SESOI, neither the null hypothesis of the equivalence test (i.e., an effect as large or larger than *d* = 0.20) nor that of the minimum effect test (i.e., an effect below *d* = 0.20) could be correctly rejected: every significant result would be a type I error. The closer the true effect is to *d* = 0.20, the more participants are needed for a high-powered equivalence and minimum effect test.

Assuming a true effect of zero, the one-sided equivalence test at the final stage of the sequential design would have 99% power (with *n* = 1092 [for two conditions] and alpha = 5%). Assuming a true effect of *d* = 0.1, the equivalence test would have 75% power. Assuming a true effect of *d* = 0.35, the minimum effect test at the final stage would have 97% power (with *n* = 1092 and alpha = 5%). Assuming a true effect size of *d* = 0.30, the minimum effect test would have 76% power.

### Stopping Rules

We will terminate data collection if any of the following conditions are met (see also Table 5): (a) the brooding manipulation was ineffective, that is, the equivalence test for the brooding MC is significant (the upper limit of the 90% CI falls below *d* = 0.30), OR the equivalence test for the ‘thinking as usual’ items is significant (the upper limit of the 90% CI falls below *d* = 0.30); (b) the presence of a meaningful effect of brooding on conspiracy beliefs can be rejected (significant equivalence test: the upper limit of the 90% CI falls below *d* = 0.20); (c) the manipulation was effective AND the effect of brooding on conspiracy beliefs is practically meaningful (significant minimum effect test: the lower limit of the 90% CI falls above *d* = 0.20).

### Recruitment of Participants

Participants will be recruited from the non-commercial SoSci Panel (Leiner, 2016). This panel provides two major advantages compared to other providers: First, its participants have signed up for the panel because they are genuinely interested in participating in surveys, which should increase data quality and compliance (Leiner, 2016). Second, the panel provides a large pool of German-speaking participants: In August 2019, more than 80,000 active panelists were registered in the SoSci Panel, the majority of which is resident in Germany (SoSci Panel, 2023). This clearly outnumbers the pool of German-speaking participants on Prolific.

In the first step, approximately 1,000 participants will be recruited for T1. These participants will be invited to T2 5-10 days later. Those who did not pass the depression or suicidality screening, or did not complete T1 until the end, will be filtered out in the beginning of T2. We hope that, from this first round of invitations, about 820 participants (i.e., about 50% of the full sample) will complete T2 and pass the exclusion criteria. If this is not the case, more participants will be recruited, until about 820 can be included in T2. If no conclusive result is obtained after this first stage, another batch of 800 participants will be recruited for T1, and will be invited to T2 5-10 days later. If this is not sufficient to achieve the full sample (*N* = 1,638), more participants will be added successively until the full sample size is achieved.

Participants will be excluded from data analysis if they (a) cancel their participation and request their responses to be deleted, (b) do not provide complete data on all necessary measurements (i.e., the manipulations, dependent variable and manipulation checks), or (c) if they indicate at the end of the survey that they did not participate seriously. Participants (including those who were filtered out in the depression and suicidality screening) will be able to participate in a raffle of 5 vouchers worth 100 €.

**Table 5**

*Design Table*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question | Hypothesis | Sampling plan | Analysis Plan | Rationale for deciding the sensitivity of the test for confirming or disconfirming the hypothesis | Interpretation given to different outcomes | Theory that could be shown wrong by the outcomes |
| Was the brooding manipulation effective? | (1) Participants in the brooding condition show significantly greater mean scores on the brooding MCs than participants in the control group. This effect is practically meaningful, i.e., the lower limits of the 90% CI of *d* falls above *d* = 0.30.(2) The control condition scores significantly higher on the ‘thinking as usual’ items that the brooding condition, and this effect is practically meaningful (the lower limits of the 90% CI of *d* falls above *d* = 0.30).  | See below | (1) A one-sided t-test will determine whether the brooding condition scores significantly higher on the brooding items than the control group. If yes, a one-sided minimum effect test will determine whether effect sizes below *d* = 0.30 can be rejected. (2) The same procedure as in (1).  | We set the SESOI for the effect of brooding on conspiracy beliefs at *d* = 0.20 (see below). We argue that a change of some magnitude in brooding would lead to a respectively smaller change in conspiracy beliefs. For this reason, the SESOI of the manipulation check tests should be larger than that of the main hypothesis. We suggest it should be at least 50% larger, i.e., *d* = 0.30.  | For the manipulation to be considered effective, both hypotheses need to be supported. That is, (1) and (2) need to be practically meaningful. In all other cases, the manipulation will be considered ineffective. | - |
| Does brooding meaningfully increase conspiracy beliefs? (within-person) | Participants in the brooding condition show a significantly greater increase (or smaller decrease) in conspiracy beliefs about their worry topic from T1 to T2 than participants in the control condition, and this effect is practically meaningful, i.e., the lower limits of the 90% CI of *d* falls above *d* = 0.20. | This test served as the basis for the design of the sampling plan. The final stage of the sequential analysis will have 90% power to detect *d* = 0.20 with α = .05.  | We will conduct a one-sided t-test to determine whether participants in the brooding condition showed a significantly greater increase (or smaller decrease) in conspiracy beliefs than those in the control condition. A subsequent equivalence and minimum effect test will determine whether this effect is also practically meaningful (i.e., values below *d* = 0.20 can be rejected, Case 1), too small to be of interest (i.e., values as large or larger than *d* = 0.20 can be rejected, Case 2), or inconclusive with regard to practical meaningfulness (Case 3, the 90% CI of *d* overlaps with *d* = 0.20). If the t-test is insignificant, an equivalence test will determine whether the effect can be considered practically equivalent to zero (Case 4) or whether the possibility of a meaningful effect cannot be rejected (Case 5). | We considered several plausible approaches to setting the SESOI (e.g., small telescope approach, average effect sizes of related variables, Cohen’s guidelines) and took the median, resulting in *d* = 0.20.  | If the manipulation was not effective, the hypothesis cannot be tested.Assuming that brooding was effectively induced: Case 1: Brooding has a statistically significant and practically meaningful effect on conspiracy beliefs **(**hypothesis confirmed). Case 2: Brooding has a statistically significant, but practically negligible effect (hypothesis disconfirmed). Case 3: Brooding has a statistically significant effect, but it is unclear if it is practically meaningful (inconclusive). Case 4: The effect of brooding is neither statistically significant nor practically meaningful (hypothesis disconfirmed). Case 5: The effect of brooding is not significant, but the possibility of a practically meaningful effect cannot be rejected (hypothesis disconfirmed). | A failure to confirm this hypothesis would either question theories about the formation of conspiracy beliefs, or theories about the consequences of brooding rumination. At this point, it would be unclear which specific element of these theories is wrong. It could be that the formation of conspiracy beliefs is not facilitated by negative affect or negative attention and interpretation biases, or that brooding does not induce negative affect or negative attention and interpretation biases in a non-clinical sample (or both).A failure to confirm this hypothesis could also indicate that an experiment is not the appropriate procedure to test this hypothesis, perhaps because experimentally induced brooding differs from naturally occurring brooding. However, future research would be needed to test this possibility.  |

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1. Please note that not all conspiracy beliefs contain an anticipation of harm. Some are conspiratorial interpretations of ongoing or past events (e.g., 9/11 conspiracy beliefs). [↑](#footnote-ref-2)
2. These correlations remain significant using Holm (1979) or Hommel (1988) correction for multiple testing. Using a Bonferroni correction, the two smallest correlations fail to reach significance. However, it can be argued that no correction for multiple testing is necessary: To confirm our expectation, all correlations between rumination and conspiracy beliefs need to be significant, not only one of them. [↑](#footnote-ref-3)
3. Note that, given our sample size, the achieved power for some of these correlations (assuming that they reflect the true correlation) was not that high (e.g., we would have had a power of 66% for a correlation of .16 with alpha = 0.05). Future research attempting to replicate these correlations should ideally use larger samples. [↑](#footnote-ref-4)
4. Note that the p-value for this one-sided test was close to .05 (specifically, .048), and can thus only provide tentative evidence of a successful manipulation (Benjamin et al. (2018). [↑](#footnote-ref-5)