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Verification of Past Beliefs Influences Current Beliefs

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Abstract:

Background: It is important to understand the factors that influence belief formation and belief change.

Objective: We test the hypothesis that following belief change about contentious topics, verifying a past belief will influence current beliefs.

Methods: In Experiment 1, participants reported initial beliefs about television violence in a prescreening, then read a belief-inconsistent text in the experiment. Participants either verified or did not verify their initial beliefs before reporting current beliefs. In Experiment 2, participants were randomly assigned to verify their initial belief (about gun control effectiveness), a false belief that was the opposite of their initial belief or did not verify a belief.

Results: Participants changed their beliefs after reading a belief-inconsistent text. If participants first verified the beliefs they held several weeks prior to the experiment, they reported their post-reading beliefs as closer to those initial beliefs. In Experiment 2, although 80% of participants in the false belief condition verified that belief as accurate, it did not influence their post-reading beliefs.

Conclusion: Results show that beliefs were moderated when participants verified their initial beliefs. Results are consistent with the belief fluency hypothesis, which contends that salient information is used in constructing our current beliefs.

Keywords: Beliefs, Belief change, Belief verification, Belief fluency, Metacognition, Contentious topic.

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1. INTRODUCTION

To understand belief formation, maintenance, and change, it is important to examine the range of factors that influence these processes. In the current research, we examine how the ordinary occurrence of verifying a previously held belief affects individuals' current beliefs. Understanding the influence of previously held beliefs on current beliefs is important for a couple of reasons. First, if a belief is updated based on new information, it may not be desirable to alter that current belief merely because a person previously held a different belief. Also, if verifying previously held beliefs influences current beliefs, this implies that awareness of these past beliefs is either limited or not accessible until they are made salient. We address the influence of past beliefs on current beliefs to determine if beliefs are spontaneously constructed from salient information at the time of generation or updated over time as new information is assimilated. We investigated belief change on the contentious issues of whether viewing television violence leads to actual

violence and whether gun control is effective in reducing gun violence in the United States.

1.1. Belief Change

We define a belief as a statement about the truth value of a proposition [1]. Colloquially speaking, beliefs are statements about what is true of the world. Our hypothesis that verifying previously held beliefs influences current beliefs is theoretically informed by past research suggesting that attitudes [2, 3] and beliefs are constructed from salient information at the time they are generated. We refer to this hypothesis as the *belief fluency hypothesis*. Information that is highly accessible due to a particular context is referred to as *salient* and may include prior knowledge, evidence, arguments, values, and emotions connected to those beliefs [4]. In the present context, initial beliefs are conceptualized as an information source that is made salient upon verification and, therefore, highly accessible at the time of belief construction. Conversely, belief change may result more from a deliberate consideration of new information compared to previous beliefs. Sharot *et al*. [5], suggest that belief change involves weighing the utility of a new belief against a previous belief in light of new information. These hypotheses about belief change differ in the extent to which previous beliefs are accessible to a person at the time new information is considered. The claim that belief-relevant information is weighed against initial beliefs suggests an awareness of one's previous beliefs. However, we contend that most people have poor awareness of past beliefs. Wolfe and Williams [6] found poor awareness of belief change, as evidenced by inaccurate recollections of their initial beliefs after they had changed. Similar findings have been shown with attitude change [7, 8] and emotion [9-11].

Our question about the verification of initial beliefs is also germane to the larger literature that focuses on the factors that induce belief change. Many studies indicate that belief change occurs in response to reading information that is inconsistent with current beliefs [1, 5, 12]. In some studies, people show greater belief change after reading a belief-inconsistent text compared to a belief-consistent text [13-16]. In others, additional factors are manipulated to induce belief change. For example, belief change is greater when the information presented is causally coherent [17, 18], easier to comprehend [19], or accompanied by mechanistic explanations for a phenomenon [20]. In the education literature, research on refutation texts suggests that belief change or misconception correction is greater if incorrect beliefs are addressed, and refuted and the correct explanation is elaborated upon [21-23].

Studies that have examined the role of emotion in belief change show that moderators need not present relevant evidence or be directly associated with the topic per se. Hayes *et al*. [24], found less belief change regarding evolution when participants were first able to derogate the author than when they were not, indicating that derogation decreased emotional threat. Thacker *et al*.

[25], found that people reduced misconceptions about GMOs more if they read a refutation text followed by a positive persuasive *versus* a negative message. Heddy *et al*. [26], found attitude change following the presentation of relevant information related to genetically modified foods, and that this effect was mediated by their emotional reactions. Moreover, research on probability and decision-making suggests these judgments can be influenced by nondiagnostic information [27, 28].

1.2. Current Research

In the current research, we test the hypothesis that information about a person's past beliefs influences their current beliefs. Consistent with the belief fluency hypothesis, we predict making one's past belief on a topic salient at the time of belief generation will influence current beliefs. If the past belief is different than the current belief, a reminder of this belief should elicit change towards the initial belief. Past beliefs may also be persuasive as an information source under the assumption that one's own experience is relevant in belief formation [29]. In contrast, if belief change involves a careful consideration of new information in light of past beliefs [5], then verifying a past belief should not provide novel information and should not influence current beliefs. We are unaware of any research that examines whether past beliefs influence the formation of beliefs. On a theoretical level, the influence of past beliefs on current beliefs is important to understand. It is conceivable that information concerning past beliefs does not influence current beliefs at all because new information is deemed more important than past beliefs. It also may be the case that past beliefs are analogous to seductive details in the learning literature [30] in that they relate to the general topic but provide little diagnostic information regarding the believability of the phenomenon.

In the verification conditions of these experiments participants first verify their initial beliefs on the topic before reporting their current beliefs. In the control conditions of these experiments, belief change is assessed without first verifying participants' initial beliefs. In the control conditions, participants also recollect initial beliefs. Inaccurate recollection of participants' initial beliefs represents a necessary, but not sufficient, condition for verification to influence their current beliefs. If previous beliefs are accurately recalled as different from current beliefs, then verifying those beliefs should not influence current beliefs since it would not be adding novel information into a person's memory representation of their beliefs. However, if current beliefs change following verification of their initial beliefs, then poor memory for these beliefs can be inferred.

In the current research, participants began by reporting their initial beliefs on a contentious topic. Two to 11 weeks later, participants engaged in an experimental session in which they read a one-sided text about a contentious topic. The text was either belief-consistent or inconsistent and was designed to induce belief change. Before reporting their post-reading beliefs, participants

either verified or did not verify their responses to the initial belief survey. This verification procedure made the initial belief salient (or not) as the subject reported their post-reading beliefs. We predicted that reading a belief-inconsistent text would result in belief change, but that belief verification would moderate post-reading beliefs such that they would be closer to participants' initial beliefs than those who did not verify their initial beliefs. We also examined awareness of belief change for participants who did not verify initial beliefs. We predicted poor awareness of belief change would be reflected by the degree of bias in participants' recollections of their initial beliefs. Specifically, less awareness should lead participants to report their past beliefs as closer to their post-reading beliefs than is the case.

2. EXPERIMENT 1

2.1. Method

Participants who completed an online prescreening session and reported that they either believed or disbelieved that watching violent television caused violence were invited to participate in the experiment. In the experiment, participants began by reading a text that was inconsistent with their beliefs. Participants either verified their initial beliefs or not and then reported their current beliefs. Those who did not verify their initial beliefs recollected those initial beliefs, with the order of belief reporting and recollection counterbalanced across participants. Participants completed a prior knowledge test to assess their knowledge of television violence research. Prior knowledge is an important factor in comprehension [31], but uncertainty remains about whether it moderates belief change [6]. It is possible that people with greater domain knowledge will have beliefs that are more integrated with this knowledge and will, therefore, be less susceptible to belief change influences. We collected Need For Cognition [32] to assess whether variation in the desire to meaningfully engage with information moderates belief change. Finally, we collected the Positive and Negative Affect Scale (PANAS [33]) after the reading task to assess whether affective reactions to the texts mediated any of the observed effects. Analyses of the individual difference variables in this study are considered exploratory.

The experiment was a 2 x 3 x 2 mixed factorial. Text position (Pro *vs*. Con) and verification conditions (verify *vs*. no verify with initial belief recollection first *vs*. no verify with post-reading belief first) were between-participant variables. Initial *versus* post-reading beliefs were a within-participants variable. Materials, data, and ancillary analyses for Experiment 1 are located at: https://osf.io/sbmwf/?view_only=cb5edbda1a174de59b55b dc1420e8c89. These studies and analysis plans were not preregistered.

2.1.1. Participants

One hundred fifty-one participants from a large Midwestern United States university participated for partial course credit in Introductory Psychology. Two to 11 weeks prior to the experimental session, participants completed an online prescreening where they responded to the question, "To what extent do you believe that viewing television violence causes people to commit real violence?" They responded on a 9-point scale: 1 = "completely disbelieve", 5 = "unsure whether I believe this", and 9 = "completely believe". Participants qualified by responding either 1-3 (disbelievers) or 7-9 (believers). Seventy-five participants were believers and 76 were disbelievers. The full subject pool from which participants were drawn had a mean age of 18.6 and was 63.7% female. The racial makeup was 50% Caucasian, 5% African American, 2% Asian American, 4% Hispanic, and 39% other/did not respond.

2.1.2. Materials

The prescreening questionnaire consists of questions on a 9-point scale (described above) that asks about participants' beliefs regarding TV violence influences, gun control, homosexuality, global warming, cell phone use while driving, spanking, abstinence-only sex education, the death penalty, social media and relationships, and women in combat. For the TV violence topic, questions also addressed the reasons why participants hold their beliefs [1], as well as their concerns about, the importance of, and self-rated knowledge about the topic.

A 20-question multiple choice test was used to assess participants' prior knowledge of the topic. The specific terminology and experiments that are discussed in the pretest are not part of the content of the Pro and Con texts. The Pro and Con texts present one-sided evidence and arguments suggesting that viewing television violence does (Pro) or does not (Con) result in actual violence. The Pro text is 1,783 words with a Flesch-Kincaid grade level score of 13.1. The Con text is 1,892 words with a Flesch-Kincaid grade level score of 11.0. Both texts clearly state their proposition in the first paragraph and follow a similar structure. They discuss longitudinal studies, experimental studies, and studies of aggression before and after a town got access to television. The Pro text makes the causal claim that viewing violent television causes actual violence. The Con text contends that the research on the topic is flawed and/or cherry-picked and that the preponderance of the evidence does not indicate the existence of a causal link between viewing and committing violence.

2.1.3. Procedure

Participants responded to the prescreening questions during an online survey at the beginning of the semester. Believers and disbelievers were invited by email to participate in the experiment, which was conducted two to 11 weeks after the prescreening. The experiment was administered on a computer using Superlab software. Up to four participants were seated in rooms with individual cubicles. The study was described for informed consent purposes and was obtained within the experiment program. Next, participants completed the prior knowledge test and read the Pro or Con text. Participants were instructed to read for comprehension because they

would be responding to questions afterwards. Each subject read a belief-inconsistent text at their own pace, with believers reading the Con text and disbelievers reading the Pro text.

After reading, participants were given five minutes to complete the Positive and Negative Affect Scale (PANAS [33],) and the Need for Cognition scale [32] before moving on to the next task. A cover story was used to conceal the true nature of the belief verification manipulation. The experimenter informed participants of the ostensible need to match their data with their responses on the prescreening and that the experimenter would read each response. Participants were asked to verify their responses to eight questions from the prescreen, with a "yes" or "no". 50 participants, who were in the *belief verification* condition verified their responses to the TV violence question and seven other questions about their demographics and beliefs on other topics. The remaining two-thirds of the participants verified their responses to only the non-TV violence questions. Participants then reported their post-reading beliefs about TV violence, social media influences, homosexuality as a choice, and spanking effectiveness. The questions and scale were identical to those used in the prescreening. The participants who did not verify their TV violence beliefs were counterbalanced, such that 46 reported their post-reading beliefs followed by a recollection of their initial beliefs, whereas the remaining 55 completed them in the reverse order. For belief recollection, participants were instructed to think back to the beginning of the semester prescreening test. They were told to select the number that was "the same as your answer at the beginning of the semester." Participants verified their initial beliefs about the control topics in all conditions, therefore, we do not analyze current beliefs or recollections for the control topics. Finally, participants completed a memory test that is unrelated to the current questions and will not be discussed further.

2.2. Result

Results address the hypothesis that verifying initial beliefs will moderate belief change in response to a belief-inconsistent text. For all analyses, believers' responses on the 9-point scale were reversed to align the direction of belief change among believers and disbelievers. For both of these groups, belief change in the direction of the text position resulted in higher (more moderate) values compared to their extreme initial beliefs. We also analyzed recollection of initial beliefs, as well as the relationship between belief change, prior knowledge, current mood, and need for cognition.

2.2.1. Initial Belief Verification

To test whether the order manipulation of recollection and belief reporting influenced beliefs, we conducted a mixed-effects ANOVA. Initial *vs.* post-reading beliefs was a within-participants variable, and belief reporting order (belief first *vs.* recollection first) was a between-participants variable. There was a main effect of belief

rating, $F(1, 98) = 149.28$, $p < .001$, $\eta_p^2 = .60$, indicating participants significantly changed beliefs after reading. There was no main effect of belief reporting order, $F(1, 98) = 1.73$, *ns*, nor did it interact with belief rating, $F(1, 98) = 0.05$, *ns*. Because there were no order effects, these two conditions were collapsed in subsequent analyses.

The influence of the belief verification task was tested with a mixed-effects ANOVA with belief rating (initial *vs.* post-reading beliefs) as a within-participants variable and belief verification as a between-participants variable (see Fig. **1**). Levene's test revealed no significant difference in variance across conditions, *p-values* > .35. There was a main effect of belief rating, $F(1, 144) = 133.46$, $p < .001$, $\eta_p^2 = .48$, indicating belief change in the direction of the text position. There was also a main effect of belief verification, $F(1, 144) = 6.02$, $p = .02$, $\eta_p^2 = .04$, and a belief rating x belief verification interaction, $F(1, 144) = 5.18$, $p = .02$, $\eta_p^2 = .04$. The simple effect of belief rating among those who did not verify TV violence beliefs revealed that post-reading beliefs, $M = 5.00$, *95%* CI [4.61, 5.39], were more moderate than initial beliefs, $M = 2.44$, *95%* CI [2.28, 2.60], $F(1, 144) = 151.73$, $p < .001$. For the belief verification condition, post-reading beliefs, $M = 4.11$, *95%* CI [3.54, 4.68], were also more moderate than initial beliefs, $M = 2.39$, *95%* CI [2.16, 2.62], $F(1, 144) = 31.42$, $p < .001$. Simple effects between verification conditions revealed no significant difference for initial beliefs, $F(1, 144) = 0.12$, $p = .73$; however, there was a significant difference between verification conditions for post-reading beliefs, $F(1, 144) = 6.50$, $p = .01$.

2.2.2. Initial Belief Recollection

Recollection accuracy among participants who recalled their initial beliefs was assessed with a mixed-effects ANOVA. Initial beliefs *vs.* recollection of initial beliefs were a within-participants variable and belief reporting order (post-reading beliefs first *vs.* recollection first) was between-participants variable. There was a main effect of recollection in which initial beliefs were more extreme, $M = 2.45$, *95%* CI [2.29, 2.60], than their recollection of those beliefs, $M = 4.15$, *95%* CI [3.79, 4.50], $F(1, 92) = 74.87$, $p < 0.001$. There was no interaction between initial beliefs *vs.* recollections and recollection order, $F(1, 92) = 2.09$, $p = 0.15$.

2.2.3. Individual Difference Variables

The prior knowledge test was scored as a number of questions correct out of 20. The questions regarding how much participants cared about the issue and how important the issue was were highly correlated, $r(147) = .86$, $p < .001$, and were averaged into a single variable. The PANAS subscales were calculated to yield positive and negative affect scores, and the Need for Cognition questionnaire yielded a single overall score. Belief change was calculated as the difference between post-reading and initial belief. In correlational analyses, none of these variables emerged as significant predictors of belief change (*p-values* >.24).
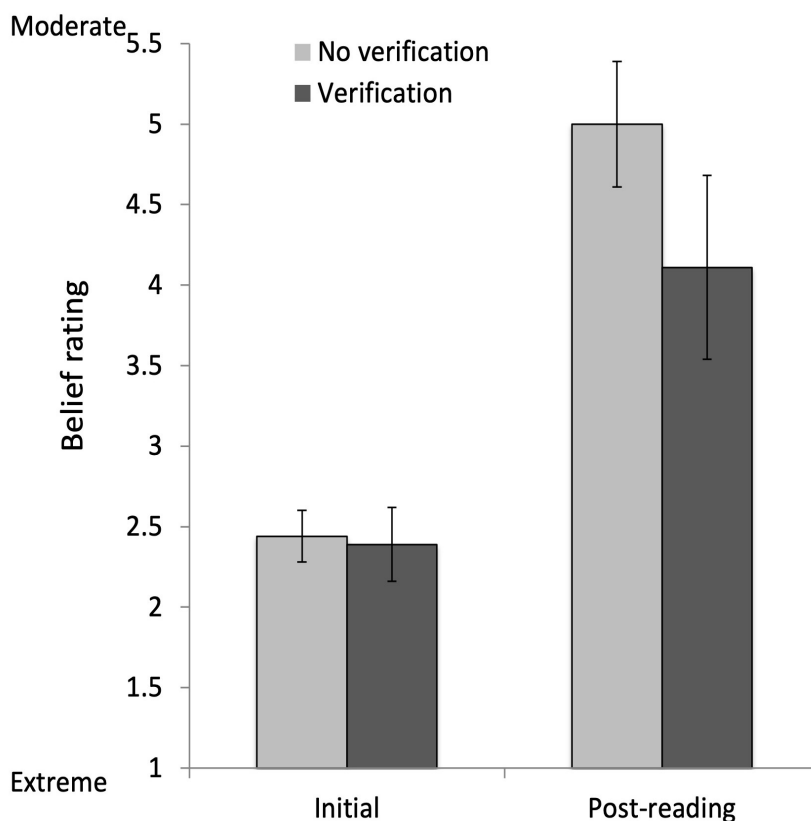
Fig. (1). Belief ratings as a function of initial belief verification condition and time of belief rating.
Note. Error bars are 95% confidence intervals.

2.3. Discussion

After reading a belief-inconsistent text, participants changed their beliefs about the effects of TV violence on actual violence. Participants who verified their initial beliefs reported their post-reading beliefs as closer to their initial beliefs than those who did not. The inaccurate recollection of initial beliefs suggests these beliefs are not utilized in the process of belief generation unless they are first verified or are otherwise made salient.

Experiment 2 extends this work in a couple of ways. First, we included a group of participants who read a belief-consistent text to establish that belief change is induced by reading belief-inconsistent facts and arguments rather than another mechanism, such as regression to the mean. Second, we added a condition to examine whether verifying inaccurate information about past beliefs affects participants' post-reading beliefs differently than verifying accurate information.

3. EXPERIMENT 2

3.1. Method

In Experiment 2, we extended the finding that verifying initial beliefs influences post-reading beliefs by using a different but politically relevant topic: gun control effectiveness. Second, we extended the paradigm of Experiment 1 by adding a false verification condition

regarding participants' initial beliefs. This addition was inspired by classical work related to the anchoring bias [34]. In Experiment 2, participants were randomly assigned to either verify their initial belief or verify a belief that was the opposite of what they had actually reported. The purpose of this manipulation was twofold. First, verification of a false belief instead of an actual belief is a novel way to assess awareness of previous beliefs. If participants actually verify a false belief as their own, it suggests that memory for previous beliefs is inaccurate. Second, we were interested in whether verifying a false belief would influence post-reading beliefs as evidence related to the anchoring bias might predict (for a review, see [35]). We hypothesized that verifying an accurate initial belief would lead participants to moderate their post-reading beliefs. We further hypothesized that participants who verified a false belief located at the opposite end of the scale from their initial belief would report beliefs that were closer to this false belief. This pattern of results would suggest that beliefs are constructed from information that is salient at the time of belief construction. The only individual difference variables included were positive and negative affect, as measured by the PANAS [33]. We specifically assessed whether affect was influenced by the belief consistency of the text, and whether affect mediated the relationship between text-belief consistency and belief change.

3.1.1. Participants – Method

Three hundred twenty-four participants completed the experiment for partial course credit in Introductory Psychology at a large Midwestern United States university. Four participants did not provide complete data and were excluded from our analysis. Participants were invited to the experiment based on their initial beliefs about gun control effectiveness using the same pre-screening procedure as in Experiment 1. Participants reported their agreement with the statement, "To what extent do you believe that increased gun control will reduce gun violence in the United States? Gun control is defined as strengthening laws or policies that regulate the manufacture, sale, transfer, possession, modification, or use of firearms by civilians." One hundred ninety-one participants were believers and 129 were disbelievers. Participants reported a mean age of 18.8, 53% female, 19% male, 1% other gender, and 27% did not respond. The racial makeup was 60% Caucasian, 2% African American, 3% Asian American, 4% Hispanic, 1% Native American, 3% multi-racial, 15% other, and 12% did not respond.

3.1.2. Materials

A Pro and a Con text each present one-sided evidence and arguments regarding gun control. The Pro text is 2,252 words and 23 paragraphs, with a Flesch-Kincaid grade level score of 14.1. The Con text is 2,223 words and 21 paragraphs with a Flesch-Kincaid grade level score of 15.2. Both texts state the main proposition (gun control is or is not effective) in the title and introductory paragraphs. Both texts discuss gun control in other countries, the correlation between guns and crime, high-capacity magazine clips, and suicide, along with a small number of unique topics. Both texts present accurate information and arguments that were obtained from internet sources. Materials, data, and ancillary analyses for Experiment 2 are located at: https://osf.io/z5unx/?view_only=0953129b0b614424b18aa27412b701d3

3.1.3. Design

The experiment was a 2 X 2 X 3 X 2 mixed factorial design. The first three variables were between-participant variables. Participants in each belief status group (believers *vs.* disbelievers) were randomly assigned to read one text (Pro or Con) and to one of three verification conditions (true *vs.* false *vs.* none). In the "true" condition, participants verified their actual initial gun control belief. In the "false" condition, they verified a gun control belief that was the opposite of their initial belief. In the control condition (none), participants verified all other information (described below) except for gun control beliefs. As with Experiment 1, subject beliefs (initial *vs.* post-reading) were a within-participants variable.

3.1.4. Procedure

Participants reported their initial beliefs on an online prescreening questionnaire in the first two weeks of the semester. Beliefs were reported on gun control and six control topics using the nine-point scale described in Experiment 1. The control topics concerned genetically modified food safety, spanking effectiveness, homosexuality as a choice, government health care effectiveness, immigrants and terrorism, and the dangers of cell phones. For gun control, participants also reported the importance, relevance, and emotions related to the topic. Believers and disbelievers were invited *via* email to participate in the experiment two to 11 weeks after the prescreening.

The experiment was administered using Qualtrics software. Participants sat at individual cubicles in a room with up to five other participants during each experiment session. Before their arrival, the experimenter entered the prescreen responses and demographic information for each subject using a blind coding system. The study was described for informed consent purposes and was obtained within the experiment program. Participants read the Pro or Con text at their own pace. Participants were instructed to read carefully, after which they would respond to questions about the text. The text was presented on a single screen that participants scrolled through. After indicating they were finished, they were instructed to reflect on the content of the text for one minute. Participants then completed the PANAS [33].

As in Experiment 1, participants were told that the ostensible purpose of the verification task was to match their data with the earlier prescreen session. With the exception of gun control, all demographic and belief information was accurate. Participants verified their birthdate, student ID number, and responses to five or six of the belief items, depending on their condition. Participants in the control condition verified all their beliefs except for gun control. Each verification question appeared individually with the response scale below each item. Below the scale, it stated, "One of the questions asked about the extent to which you believe that . . ." On the next line it stated, "You selected [response]". To ensure participants spent sufficient time reflecting on the questions, the verification option appeared four to six seconds after the response. The verification question "Is this correct?" was followed by "Yes" or "No" response options. The gun control belief was always presented as the second of the six beliefs to be verified. In the false condition, participants were told they had selected a response that was nearly the opposite of their actual response. Specifically, believers were told they had reported strong disagreement with the statement that gun control is effective ("2"), whereas disbelievers were told that they had reported strong agreement with the statement ("8").

After the verification task, participants reported their post-reading beliefs about the topics, including gun control. The question wording and the scales were identical to the prescreening questions and gun control was the second topic presented. Next, participants were instructed to "please write an argumentative essay in which you describe and explain your beliefs about the effectiveness of gun control." They were told they could include information and/or opinions that were in the text

they read or from elsewhere. Participants were instructed to write between 240 and 270 words. The word count appeared on the screen, and participants were allowed to proceed when their word count was within this range and they indicated they were finished. Finally, participants responded to a question designed to probe for suspicion regarding the purpose of the experiment. Participants took between 25 and 50 minutes to complete the study.

3.1.5. Essay Ratings

Six hundred fifty-two ancillary participants were recruited from the Prolific research participant platform (https://www.prolific.co/) to rate the characteristics of the argumentative essays. Participants were recruited from the "standard sample". Each subject rated five essays on each of seven different questions. The first two questions are of primary interest in the present study. Participants rated their level of agreement with the statement "The arguments in the essay claim that increased gun control will reduce gun violence" using the same nine-point scale as the belief rating question ("Completely agree", "Neutral", and "Completely disagree"). Participants also rated their agreement with the statement, "The author of this essay believes that increased gun control will reduce gun violence." The other questions addressed the extent to which the arguments were clear, appealed to emotion, included facts, personal experiences, and considered both sides of the issue. These questions were part of a different study, and the results are not reported here.

3.2. Results

As with Experiment 1, belief ratings for believers on gun control were reverse scored so that belief change towards the belief inconsistent text position was represented on a common scale. For the control topics, there was a significant shift towards more moderate beliefs for each topic (see Table 1). Results address belief change as a function of the belief verification condition for both the belief ratings and the ratings of the argumentative essays.

3.2.1. Belief Consistency and Verification Influences on Belief Change

Analyses of initial *vs.* post-reading beliefs, belief status (believers *vs.* disbelievers), and text position (Pro *vs.* Con)

indicated that it was reasonable to collapse across belief status and text position to create a contrast between participants who read a belief-consistent *versus* inconsistent text (see https://osf.io/z5unx/?view_only= 0953129b0b614424b18aa27412b701d3). The influence of belief verification on participants' post-reading beliefs was evaluated with a mixed-effects ANOVA with belief rating (initial *vs.* post-reading beliefs) as a within-participants variable and belief consistency (consistent *vs.* inconsistent) and belief verification (true *vs.* false *vs.* none) as between-participants variables (see Fig. 2). The within-participants effect of belief rating indicated that post-reading beliefs, $M = 3.11$, 95% CI (2.90, 3.31) were more moderate than initial beliefs, $M = 2.16$, 95% CI (2.07, 2.25), $F(1, 314) = 91.89$, $p < .001$, $\eta_p^2 = .23$. Participants who read a belief-inconsistent text, $M = 3.22$, 95% CI (3.04, 3.39), reported more moderate beliefs than participants who read a belief-consistent text, $M = 2.05$, 95% CI (1.87, 2.22), $F(1, 314) = 85.90$, $p < .001$, $\eta_p^2 = .22$. There was a belief rating by consistency interaction, $F(1, 314) = 128.92$, $p < .001$, $\eta_p^2 = .29$, indicating greater belief change after reading of a belief-inconsistent than a belief-consistent text. The main effect of belief verification condition was not significant, $F(2, 314) = 2.69$, $p = .07$, $\eta_p^2 = .02$, but there was a significant belief verification by belief rating interaction, $F(2, 314) = 3.30$, $p = .038$, $\eta_p^2 = .02$. The three-way interaction was not significant, $F(2, 314) = 1.62$, $p = .20$. Planned comparisons for post-reading beliefs between verification conditions were conducted within participants who read belief-consistent and inconsistent texts respectively. Participants who read belief-consistent texts did not differ between verification conditions (*p-values* > .20). Among participants who read a belief-inconsistent text, post-reading beliefs did not differ between false belief verification and none, $F(1, 314) = 0.07$, $p = .95$. However, beliefs were significantly more moderate for the false belief verification condition, $M = 4.56$, 95% CI (4.05, 5.07), than for the true verification condition, $M = 3.66$, 95% CI (3.18, 4.15), $F(1, 314) = 6.28$, $p = .013$, and were significantly more moderate for the no belief verification condition, $M = 4.54$, 95% CI (4.05, 5.02), than the true verification condition, $F(1, 314) = 6.31$, $p = .013$.

Table 1. Initial and post-reading belief data for gun control effectiveness and control topics.

-		Initial		Post-reading		-		
-	N	*M*	*95% CI*	*M*	*95% CI*	*F*	*p*	η_p^2
Gun control (belief consistent)	158	2.13	[2.00, 2.27]	1.96	[1.76, 2.16]	2.85	.09	.02
Gun control (belief inconsistent)	162	2.19	[2.07, 2.32]	4.24	[3.89, 4.60]	146.0	< .001	.48
GMOs	156	2.17	[2.04, 2.29]	2.52	[2.30, 2.74]	12.0	< .001	.07
Spanking	214	1.94	[1.83, 2.06]	2.25	[2.06, 2.43]	16.7	< .001	.07
Homosexuality	233	1.50	[1.40, 1.60]	2.02	[1.76, 2.27]	17.7	< .001	.07
Immigration	231	1.81	[1.70, 1.92]	2.09	[1.90, 2.28]	12.2	< .001	.05
Health care	198	2.03	[1.91, 2.15]	2.51	[2.30, 2.72]	19.8	< .001	.09

Note: Because only believers and disbelievers on gun control were invited to participate, we calculated initial and post-reading beliefs for control topics using the same procedure. For each topic, participants choosing either 1-3 or 7-9 in the prescreening were used in these calculations. As a result, N's are different for each topic.
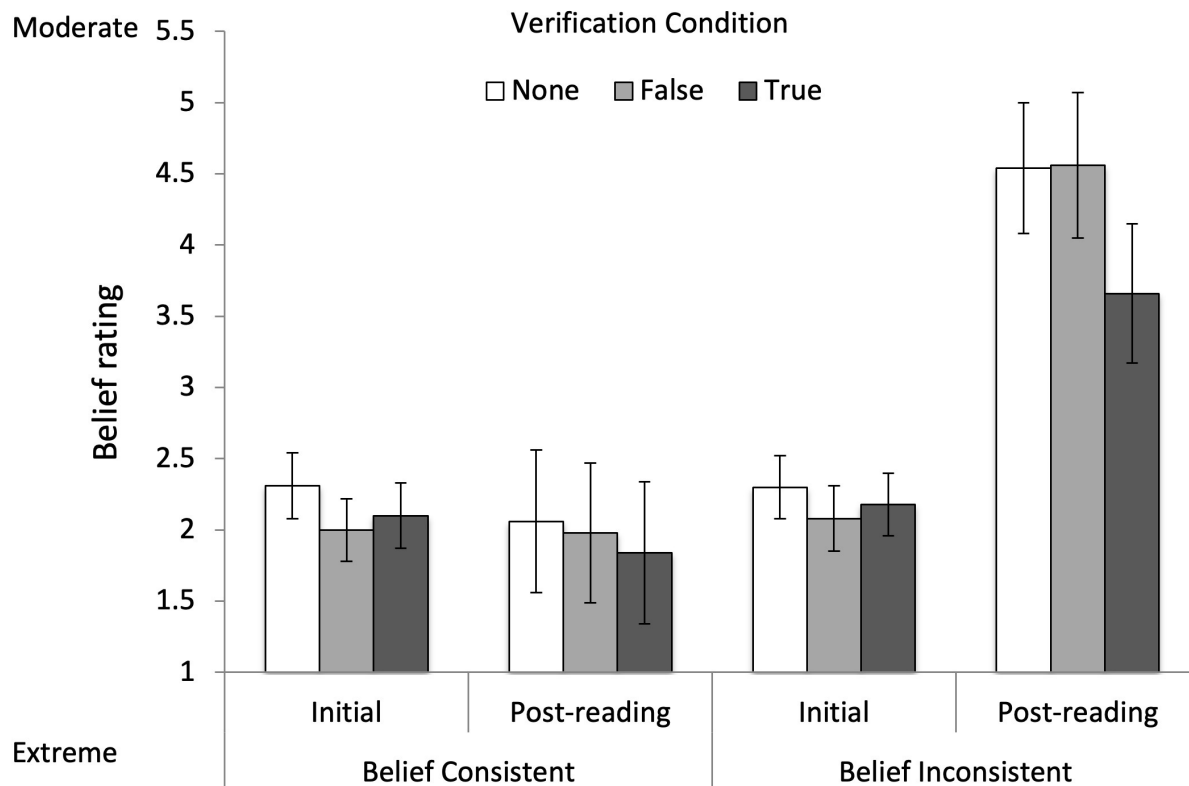
Fig. (2). Belief ratings as a function of initial belief verification condition, belief consistency of text read, and time of belief rating. *Note*. Error bars are 95% confidence intervals.

3.2.2. Belief Verification

To examine whether participants perceived the verification task as credible, we examined participants' acceptance and rejection rates for all topics. Since feedback for the control topics was accurate, participants should have verified its correctness. The percent of participants who verified the feedback as accurate were as follows: GMOs = 89.8%, spanking = 88.4%, homosexuality = 89.3%, immigration = 86.0%, and health care = 89.8%. For gun control, true responses were verified 91.7% of the time, whereas false responses were verified 80.2% of the time. Although relatively few participants rejected the false belief feedback (19.8%), relative to the true feedback condition (8.3%), the same mixed-effects ANOVA was run, including only participants who confirmed the accuracy of the gun control beliefs that they had initially reported. The logic behind this analysis is that acceptance of a belief, whether true or false, may affect the likelihood that participants would be influenced by the verification manipulation. The results of this analysis, reported in the online materials, revealed a pattern of results and corresponding significance levels that match the analysis reported above. Thus, evidence suggests that our manipulation was largely effective and that rejection of the initial beliefs did not significantly impact participants' post-reading beliefs.

3.2.3. Belief Verification Influences on Essay Content

Participants' beliefs regarding gun control were also represented in their essays and are a converging measure of beliefs. Ancillary (Prolific) participants' ratings of the argument claims and the author's beliefs regarding gun control were highly correlated ($r = .79$, $p < .001$), and therefore combined into a single measure of subject beliefs. As in previous analyses, believers were reverse-scored on the belief rating measure. We analyzed essay ratings as a function of belief status and text read to determine that it was reasonable to collapse across these conditions and analyze essays as a function of belief consistency (see: https://osf.io/z5unx/?view_only=0953129b0b614424b18aa27412b701d3). To analyze essay ratings as a function of belief consistency and verification condition, we conducted a mixed-effects model that included subject essays as a random effect and belief consistency and feedback condition as fixed effects. The results of this analysis show a main effect in which participants who read a belief-inconsistent text, $M = 4.51$, 95% CI (4.24, 4.78), wrote essays with more moderate beliefs than participants who read a belief-consistent text, $M = 2.61$, 95% CI (2.34, 2.88). No other main or interactive effects were significant (*p-values* > .27), indicating that the belief verification task did not influence the content of participants' essays (see Table **2** and Fig. **3**).

Table 2. Model parameter estimates (standard errors) for subject beliefs as revealed in essays.

Parameters	Level 1	Level 2 Main Effects	Level 2 Interactions
Fixed effects	-	-	-
Belief consistency	-	1.90 (0.20)***	-
Belief verification 1 (True - False)	-	-0.03 (0.24)	-
Belief verification 2 (None - False)	-	0.01 (0.24)	-
Interaction (Consistent x Verification 1)	-	-	0.52 (0.48)
Interaction (Consistent x Verification 2)	-	-	-0.17 (0.48)
Random effect	-	-	-
Intercept	3.58 (0.11)***	3.56 (0.10)***	3.56 (0.10)***
Model summary	-	-	-
Log likelihood	-6556.61	-6516.55	-6515.19
R^2 marginal	-	.14	.15
R^2 conditional	.58	.58	.58
Number parameters	1	4	6
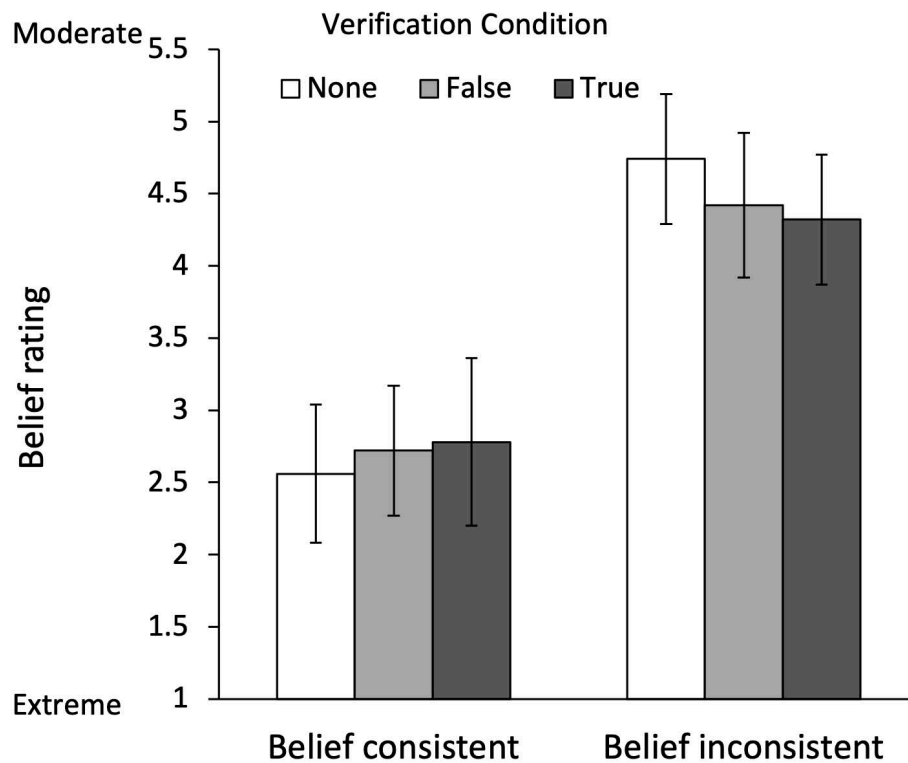
Fig. (3). Belief ratings of argumentative essays as a function of belief consistency and verification condition. *Note.* Error bars are 95% confidence intervals.

3.2.4. Affect Analysis

Analysis of the PANAS [32] revealed no significant differences in positive and negative affect between belief-consistent and inconsistent participants, *p-values* > 0.16. As in Experiment 1, belief change was calculated for belief-inconsistent participants, and the correlations between effect and belief change were examined. Positive affect was correlated with belief change, $r(162) = 0.26$, $p < 0.001$, whereas negative was not significantly correlated with belief change, $r(162) = -0.01$, $p = 0.95$.

3.3. Discussion

Beliefs about the contentious topic of gun control changed as a consequence of participants reading a one-sided argumentative text. As in Experiment 1, participants

who verified their initial gun control belief reported their post-reading gun control beliefs as more moderate than those who did not verify their beliefs. A noteworthy finding was that 80% of participants in the false belief condition verified an initial belief that was the opposite of what they had reported. However, verifying a false belief did not affect post-reading beliefs. The theoretical implications of this finding are further discussed in the General Discussion.

Beliefs were also examined through the content of argumentative essays. As predicted, essay content reflected belief change among those who read a belief inconsistent but not a belief-consistent text. Specifically, beliefs shifted toward the position of the text participants had just read. Interestingly, when participants verified their initial beliefs, the beliefs expressed in their argumentative essay did not shift. One possible explanation for the discrepancy between belief ratings and essay content is that the effects of the belief verification may be subtle or transient in nature. Another possible explanation is that participants not only based the content of their argumentative essay on their beliefs but also on their task model [36] and their argument schema [37].

4. GENERAL DISCUSSION

In two experiments, participants who read information that was inconsistent with initial beliefs about TV violence or gun control shifted their beliefs toward the position of the text. If participants verified their initial beliefs prior to reporting their post-reading beliefs, then they reported their post-reading beliefs as closer to those initial beliefs than those who did not verify their initial beliefs. This pattern of results suggests that initial beliefs serve as an information source in constructing post-reading beliefs. These results advance our understanding of the construction of beliefs and belief change in several ways. First, the evidence that reading a belief-inconsistent text elicits belief change in the direction of the text position converges with past research where beliefs change in response to one-sided persuasive texts [6, 13-16]. Second, evidence that initial beliefs can influence post-reading beliefs extends the literature on factors that can influence beliefs beyond causal coherence [17, 18], mechanistic explanations [20], and refutation texts [23].

Third, the finding that verifying past beliefs can influence current beliefs provides evidence indicating that past beliefs are not accessible after beliefs have changed. If participants were conscious of past beliefs when constructing their current beliefs, then reminders should not have changed their current beliefs. Additionally, if participants did not verify their past beliefs, they were not able to accurately recollect those beliefs. Consistent with the findings of Wolfe and Williams [6], recollections of past beliefs were closer to current beliefs, indicating poor awareness of belief change. Finally, the fact that the false verification condition in Experiment 2 led 80% of participants to verify opposing beliefs to what they had actually reported as correct further indicates poor memory for past beliefs. These findings of poor awareness of belief

change appear to contradict a process in which old beliefs are compared against new information and a deliberate decision about change is made [5]. Essentially, poor awareness of change contradicts the idea that any deliberate decision to change beliefs is actually made.

The practical implication of these experiments is that they establish the moderating effects of verification on people's understanding of their current state. This finding is potentially germane to any field that relies on individuals to self-report current and past events, beliefs, or health. For example, doctors, physical therapists, and psychiatrists commonly verify the details of past symptomology or diagnoses while assessing a patient. This process of verifying past details, in turn, may subtly influence their perception of their current state and, consequently, the treatment recommended by their health practitioner. By repeatedly asking victims or suspects to verify details of past events, law enforcement or legal experts may not only risk influencing people's memory of the crime [38] but also their current understanding of it.

4.1. Theoretical Interpretation: Belief Fluency

The results of these experiments are consistent with a belief fluency hypothesis that beliefs are generated in context based on salient information at the time of generation rather than from static mental representations from long-term memory. This hypothesis postulates that belief change is not explicitly monitored as people consume new information about a topic. While new information is processed and incorporated into a belief network [4, 39, 40], reporting one's current beliefs directly involves evaluating information that is most salient at the time of judgment. Fluency is determined by the ease of activation or retrieval from long-term memory, which is determined by the recency and depth of learning for a given set of knowledge or beliefs [41, 42]. The process proposed in the belief fluency hypothesis draws heavily from research in other domains, such as attitudes, which emphasize the role of information salience and context [3, 43]. Much of the research on metacognition and metamemory similarly contends that judgments and predictions of learning are constructed from information that is salient at the time of judgment [44-46]. Thus, the belief fluency hypothesis may reflect a form of cognitive processing that has already been corroborated by evidence from domains outside of belief change.

Two results from Experiment 2 indicate that there are limits to the scope of the belief fluency hypothesis. First, although 80% of participants verified beliefs that were the opposite of their initial beliefs, their post-reading beliefs were not influenced by this verification. Second, belief change on gun control was observed in the argumentative essays the participants wrote. However, the belief verification manipulation did not influence the beliefs they expressed in their essays. Neither of these findings was predicted. The findings suggest that in the context of this laboratory experiment, participants were experiencing peripheral changes to their beliefs rather than a change to the central tenets of their beliefs. In cataloging responses

to anomalous data, Chinn and Brewer [47] argued that new information or arguments can be added to a belief network without a fundamental restructuring of core beliefs and values connected to them. Hayes *et al*. [25], presented participants with questions to differentiate between peripheral and central change after reading a belief-inconsistent text on evolution and found only peripheral change. In order for central belief change to take place, a restructuring of a person's network of knowledge, experiences, and affective responses needs to occur.

A further question is that if the change is peripheral and not central, why do four out of five people affirmatively verify the false belief? It could be that the verification is temporarily held in abeyance, which is another strategy documented by Chinn & Brewer [47]. Abeyance is when information can be believed, but interpretation of it is deferred until later. The false belief information may trigger some form of disequilibrium or negative affect [24] that will not be resolved by changing the central aspects of their belief network about gun control. The plausibility of the false belief may also be comparatively lower than the true belief information [48]. In future research, a confidence or plausibility rating that accompanies the false belief verification could indicate whether all types of verification are seen as equally likely.

CONCLUSIONS AND LIMITATIONS

In the current research, people's beliefs changed after verifying a previously held belief. This finding suggests that beliefs are not generated from careful consideration of relevant evidence, but rather that they are constructed in context from information that is readily available at that moment. Some of the limitations of the current findings represent directions for future research. First, it is important to acknowledge that verification of initial beliefs represents only one aspect of beliefs that can be made salient at the time of belief generation. Avenues for future research include studying how beliefs are influenced by the beliefs of others, emotionally laden but irrelevant evidence, or information from low trustworthiness sources. Second, the samples in the current research were U.S. university undergraduates and online prolific panel participants. The generalization of these findings to other populations is unknown. It is conceivable that a disparity between initial and current beliefs may influence some individuals or populations differently. Future belief change research would benefit from the inclusion of more diverse cultural populations. The generalizability to other topics is also unknown. We hypothesize that these results will generalize to other contentious societal issues but are less likely to generalize to more personal issues such as religious beliefs. Finally, the interpretation that the belief change in these experiments was most likely peripheral and not central was based on our post hoc interpretation of the results. It will be important for future research to examine these issues in more detail.

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