

Experiencing misinformation: The effect of pre-exposure warnings and debunking on psychic beliefs

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Abstract

Misinformation can have a detrimental impact on our beliefs, and it is therefore necessary to understand the cognitive mechanism by which false information is integrated or can be changed. In two experiments, we worked with fake psychic demonstrations, because observers easily adopt the experience as reflecting a “true” psychic event. We manipulated the availability of alternative explanations by providing a general warning that the performer is a magician with no psychic abilities (Experiment 1) or disclosing afterwards how the fake demonstration had been staged (Experiment 2). In Experiment 1, witnessing the psychic demonstration significantly increased participants’ psychic beliefs, even though they had been warned. However, providing the alternative explanation about the deceptive method mitigated this effect. In Experiment 2, the realisation of deception significantly reduced participants’ psychic beliefs directly after the performance and remained reduced 1 week later.

Keywords

Misinformation; debunking; deception; belief; magic; paranormal belief

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Introduction

Our increased use of social media channels has facilitated the strategic spread of false information, which can lead to suboptimal personal and societal decisions. Unlimited access to social media platforms and online videos means that we no longer simply read or hear about misinformation; we have the immediate visual experience of it. When the conveyed messages convince us, we might blindly trust the news conveyed by a self-serving politician or faked evidence that goes against scientific advice about vaccines (e.g., magnetic arm after Covid-19 vaccine). When false information is well presented and persuasive, we have no a priori reason to assume that this information is not true. Our default mental model seems to be wired so that we accept information, unless clear evidence speaks to the contrary (Schwarz, 1994). Indeed, Gilbert (1991) suggested that comprehension of information itself relies on temporarily believing in this information. Such processing biases do not mean that we naively believe everything, but the deliberate suspension of belief requires a high amount of cognitive effort (Lewandowsky et al., 2012). The latter

authors proposed that in most situations, the deck is stacked in favour of accepting misinformation, rather than rejecting it.

The impact of debunking on false beliefs

To counter the negative impact of fake information, we need to understand the cognitive mechanisms by which such information becomes adapted as well as corrected (Lazer et al., 2018; Lewandowsky et al., 2017). The

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psychological literature highlights a range of mechanisms. Confirmation biases, for instance, render us favourable to seek out and process information that is consistent with our existing beliefs and attitudes (see Butera et al., 2018; Nickerson, 1998, for overviews). Likewise, cognitive dissonance, which occurs when our beliefs or attitudes conflict with our behaviours, often results in the rejection of information that is inconsistent with our worldview (Festinger, 1962). Thus, when we integrate new information while avoiding cognitive dissonance, we tend to adopt information that is in line with our personal worldview, which renders us highly resilient to accept contradictory information (see also Lewandowsky et al., 2012). The latter authors could indeed show that Republicans were more likely than Democrats to continue to believe in the false and retracted information that Barack Obama was born in Kenya or in the presence of Weapons of Mass Destructions in Iraq. On the other hand, Democrats were less accurate than Republicans to foresee the economic consequences of higher oil prices (Schwartz et al., 2011).

Cognitive biases of this kind are helpful in explaining why we accept both true and false information. We must additionally consider that this acceptance prevails after the original information was retracted (Wilkes & Leatherbarrow, 1988). Moreover, retractions, or debunking, do not eliminate our false beliefs despite fully processing the correcting information (Chan et al., 2017)—worse, correcting information that simply encourages people to consider alternative information inadvertently strengthening the fake information's impact on people's false beliefs (Schwarz et al., 2007). According to a recent meta-analysis (Chan et al., 2017), effective debunking of false information necessitates people to access sufficient alternative information that offers a new explanation (Johnson & Seifert, 1994; Wilkes & Leatherbarrow, 1988), ideally of causal nature (Ecker et al., 2010). Alternative, causal explanations can then fill the gap that was left void by simply retracting the original information (Ecker et al., 2010). Most previous studies presented fictional narratives that report "true" or "false" information which are both not true, because they are fictional. Importantly, questioning such narratives is effortful (Gilbert, 1991) as are factual ones (Braddock and Dillard, 2016, for a recent meta-analysis), favouring the adaptation of false information.

The impact of pre-warning on false beliefs

Previous studies have highlighted the continued influence of misinformation, even after its retraction/debunking (for review, see Lewandowsky et al., 2012), to better understand the mechanisms that underlie the continued influence of misinformation, empirical studies have investigated the impact that different types of warnings that are presented before encoding the false information have.

Ecker and colleagues (2010) exposed participants to a classic continued influence paradigm in which a text presented information that was later revoked (e.g., a minibus accident whose victims were initially said to be elderly people) (see also Lewandowsky et al., 2012). Before reading the scenario, one group of participants was given a general warning (sometimes reported "facts" are not double-checked before they are released) and another group was given a specific warning which explained the "continued influence effect" in detail. None of the pre-warnings succeeded in suppressing the continued influence of the misinformation. However, the specific warning was significantly better at reducing this continued influence than the general warning. In the general warning, only participants who remembered the retraction were sensitive to the warning. Both the source monitoring and the dual-process accounts of misinformation retrieval (Chambers & Zaragoza, 2001; Echterhoff et al., 2005; McCabe & Smith, 2002) suggest that exposure to multiple pieces of information (i.e., the misinformation and the retracted information) can result in people confusing the true source of the information. Thus, participants could misremember that some parts of a correction were included in the original scenario and vice versa. A warning, and particularly a specific warning, allows participants to tag the misinformation as suspect during the encoding stage, which can prevent them from confusing the source of the information. This hypothesis would explain why warnings seem to be more effective when they are administered before the misinformation is encoded rather than after (Chambers & Zaragoza, 2001; Ecker et al., 2010). According to Lewandowsky et al. (2012), pre-warning may also induce a more sceptical mind-set, which could lead participants to activate a more analytical cognitive process that questions the origin of the information and thus allows them to better discriminate true and false message. In this vein, Fein and colleagues (1997) showed that raising the suspicion about the motives of a source (i.e., prosecutor) helped participants to disregard inadmissible evidence presented by this source.

In this study, we wanted to go beyond narratives, to test how people integrate and correct false information they just had witnessed in front of their eyes. The rise of social media and other online platforms has changed the way in which we access and process information, and novel technologies, such as deepfakes, have made it increasingly difficult for us to distinguish between real and fake media (Mika, 2019). Deepfakes are hyper-realistic videos that apply artificial intelligence algorithms to depict a person doing or saying something that never happened. These deepfake videos are often shared through social media channels, and they can easily reach millions of people within a short amount of time. Although the content of such videos is often benign, they have also been used more strategically to manipulate people's political views and

attitudes (Mika, 2019). Stage magicians are performance artists who make us experience the impossible (Kuhn, 2019). They use deception and fake information to make us truly experience things that are by default not true. Magicians' performances can perpetuate beliefs in psychic powers (Marks, 2000) or the existence of pseudo-psychological principles (Lan et al., 2018). Indeed, such magic performances often result in spectators truly believing in what they just saw (Lesaffre et al., 2018, 2021; Mohr et al., 2019; Mohr & Kuhn, 2020). Back in 1944, Marcuse and Bitterman (1944) already used a classroom demonstration in which a magician used magic tricks to demonstrate fake paranormal abilities. After the demonstration, participants were asked "On the basis of the evidence presented, how many of you are now convinced of the reality of psychical phenomena?" (p. 241); 70% to 80% answered affirmatively. Recent studies confirmed that firsthand experiences of supposedly paranormal demonstrations were widely accepted as true and that such performances can enhance performance-related beliefs (Lan et al., 2018; Lesaffre et al., 2021), even more so in case of pre-existing paranormal beliefs (Lesaffre et al., 2021). Stage magic therefore provides us with a valuable tool to investigate the impact that misinformation has on people's beliefs.

In sum, humans are strongly biased to adopt false information, whether in narratives or firsthand experiences. For narratives at least, we know that counter-information is largely discarded, unless alternative, causal explanations can replace the void of the original false information. Here, we investigated how different types of counter-information mitigate the impact of false information on people's beliefs. In two independent studies, participants saw a supposedly psychic demonstration that involved a medium communicating with a deceased person. In Experiment 1, we manipulated the nature of the information participants received prior to being exposed to the supposedly psychic demonstration. Participants either received no warning, a general warning, or a specific warning. Participants in the specific warning condition received a warning that contained plausible alternative explanations. In Experiment 2, we fully debunked participants after the demonstration (i.e., explaining how the demonstration was done). In both studies, we asked participants to rate whether they believed the performance was of psychic, trickery, or religious nature. We also measured their beliefs in paranormal phenomena (i.e., psychic beliefs) before and directly after the demonstration (Lesaffre et al., 2018, 2021; Mohr et al., 2019; Mohr & Kuhn, 2020). In Experiment 2, we repeated this measurement again, 1 week later.

Experiment 1: effect of warning on acceptance of false information

We tested three groups of participants who were provided with different types of warnings prior the supposedly

psychic demonstration. One group of participants was told that the performer was a magician with no psychic abilities, who instead uses trickery (general warning). In the past, such general warnings had limited measurable effects on how people interpret such demonstrations (Lan et al., 2018; Lesaffre et al., 2018, 2021; Mohr et al., 2015, 2019; Mohr & Kuhn, 2020). Another group was explained how the demonstration was done (specific warning). The final group received no further information about the demonstration (no warning). We used two dependent measures that focused on two different mechanisms by which the misinformation can affect people's beliefs. The explanations ratings—extent to which participants attributed the phenomenon to psychic, trickery, or religious powers—indicate participants' acceptance of the false information within the given narrative. Our second dependent measure assessed participants' attitudes towards psychic phenomena in general (i.e., psychic belief measures), and this attitudinal measure provides insights into the impact that the experience itself has on people's general attitudes towards psychic phenomena. We predicted that only the specific warning group has a lower likelihood to explain the demonstration in psychic terms. We also predicted that the specific warning group would yield a less pronounced increase in performance-related beliefs (i.e., psychic beliefs) than both the general and no warning group.

Methods and materials

Participants. The experiment was performed during the Open Day for six-form students at Goldsmiths, University of London. The event was intended for potential future students visiting the campus. Students were given the opportunity to attend an introduction lecture to the psychology undergraduate course (see Table 1 for demographics). The experiment was run in two separate sessions, on separate days. All potential future students were offered the possibility to partake. The experiment was approved by the psychology department's ethics committee. All measures are reported.

Psychic beliefs based on Hartman (1999). This 26-item self-report paranormal belief questionnaire (PBS) (Toback, 2004) consists of seven subscales measuring Traditional Religious Belief, Psi, Witchcraft, Superstition, Spiritualism, Extraordinary Life Forms, and Precognition. Item examples include "Some psychics can accurately predict the future" and "It is possible to communicate with the dead." Items are formulated such that participants are asked to answer along a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Accounting for reverse coded items, the scores are summed so that higher scores reflect greater beliefs. Although normative values for this seven-factor solution can be found in Toback (2004), not all psychometric studies agree on the factor structure of

Table 1. Age (in years), gender composition (female/total), and psychic belief subscale (PBS) scores before the demonstration, as a function of warning group for Experiment 1 and Experiment 2, separately.

Experiment	Warning	Age	Female/total	PBS
Experiment 1	Specific	17.3 (4.29)	65/77	3.56 (1.09)
	General	16.8 (0.488)	67/77	3.57 (0.94)
	No	16.8 (0.411)	63/71	3.29 (0.95)
Experiment 2	No	20.2 (3.83)	55/65	N/A
	Alternative	21.1 (5.78)	51/60	N/A

In Experiment 2, PBS scores were not collected before the demonstration and are thus not reported here.

this scale (Hartman, 1999). Of interest to our experiment, Hartman (1999) proposed a four-factor solution with items falling into psychic beliefs, traditional magical beliefs, superstitious beliefs, and beliefs in witchcraft. The psychic beliefs factor contains many items targeting experiences reminiscent of our demonstration (e.g., belief in mind reading, communicating with dead people, psychic powers exist, psychics can predict the future). Based on our previous observations, we would expect that participants' beliefs would be affected by the content of the demonstration (Lesaffre et al., 2021; Mohr et al., 2019), that is, increase in paranormal beliefs could be predicted for the psychic belief subscale scores but not the subscale scores.

Supposedly psychic demonstration. The demonstration was performed by a semi-professional magician and closely resembled performances used before (Lesaffre et al., 2021; Mohr et al., 2019). The experimenter introduced the performer to the class, after which the performer provided some background information about the nature of his psychic abilities. He also explained that he does not perform these demonstrations for money but that he is very keen to have his gift scientifically evaluated. The performance was divided in two parts. In the first part, five different volunteers were chosen at random. The experimenter then handed them a dice which contained a different colour on each side, and they were asked to choose a colour and turn the dice so that the chosen colour was at the top. Participants were then asked to think of a colour that described their personality. Participants were told that the dice allowed the performer to verify their selection. They were not told that the gimmicked device allowed the performer to know the chosen colour. Once the participant chose the colour, the performer pretended to read the person's spiritual energy (and mind), and by doing so, he correctly discovered the chosen colour on four of the five trials. We included one deliberate failure to enhance realism and therefore strengthen the illusion. The performer embellished his performance by using Barnum statements, which are statements that while appearing specific are generally true for most people (Snyder & Shcnkel, 1976).

The second part of the performance was intended to demonstrate the possibility of communicating with a deceased person. To do so, we staged the selection of a

random volunteer, who was a female confederate. The performer asked the confederate to think about one of her deceased family members, to get in touch with them. The performer then claimed to feel the presence of a person and started to "reveal" details about this person. For example, in one of the demonstrations, we staged the presence of the confederate's father, who had died 10 years ago. The performer reported more and more correct details about her father and his life. These details were almost spot on (i.e., he guessed that his name was Zack, but it was actually Jack). The confederate became increasingly emotional. The magician finished his demonstration by telling the young woman that her father loves her, that he was very proud of her, and that he will always look after her.

Overall procedure. Participants attended a 30-min lecture about studying psychology at the university, which took place in a large lecture theatre. The students were then invited to take part in an experiment that explored their thoughts and feelings towards a psychic demonstration. We distributed booklets among those who were willing to participate. Volunteers were randomly allocated to one of the three warning groups (no, general, specific). After signing the consent form, all participants completed the Revised Paranormal Belief (RPB) scale (Toback, 2004). After completing the questionnaire, the experimenter gave them the following verbal information: "As you will be aware, the Anomalistic Psychology Unit at Goldsmiths has a keen interest in investigating psychic abilities. Over the years, we have carried out numerous experiments to test whether the claims made by psychics hold up under closer scrutiny. While most of the individuals tested so far generally fail these tests, we were very fortunate in that we did find one person who passed most of the preliminarily tests (8/10). His name is Cyril, and while not perfect, his performance was significantly better than chance ($p = .0032$). Cyril has told us that he has been developing a presentation of his psychic abilities and has asked us if he could present it to you and get your opinions and reactions. I thought that this would be very interesting, and so, I agreed to let him do it."

All participants were then instructed to turn their booklet to the next page. This next page contained two different types of instructions. Participants in the no warning group were simply instructed to wait for further instructions.

Participants in the general warning group were informed that “Some magicians can perform exactly what psychics claim to be doing using ordinary stage trickery. In fact, Cyril is not a real psychic but a professional magician. You are about to see his illusion skills, rather than genuine psychic ability.” Subsequent to having read this information, they were asked to summarise in their own words what they have just read (see also Lesaffre et al., 2018). In the specific warning group, participants were informed that “Some magicians can perform exactly what psychics claim to be doing using confederates, people who are in on the trick. In fact, Cyril is not a real Psychic but a professional magician and will be using confederates, cold reading (general statements that fit for everyone) and gimmicked electronic devices (e.g., Bluetooth dice). What you are about to see is a demonstration of Cyril’s conjuring skills and use of confederates.” In this condition, participants were given the actual solution to the tricks and as such were presented with concrete alternative explanations.

Once everybody had completed the task, the experimenter introduced the performer to the class and the supposedly psychic demonstration began (see later section for full description).

After the supposedly psychic demonstration, participants were asked to remain silent and complete the remaining questions in the booklet. The first question asked them to describe in their own words how they would explain what they have just seen. In line with previous studies (Benassi et al., 1980; Lesaffre et al., 2018; Mohr et al., 2015), we asked participants to rate on a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) whether the performance was accomplished through (1) paranormal, psychic, or supernatural powers (psychic explanation), (2) ordinary magic trickery (trickery explanation), or (3) a religious miracle (religious explanation) (Figure 1).

After completing these event explanation ratings, participants were asked to complete the RPB Questionnaire for the second time, after which they were fully debriefed. The performer explained in his own words that he used magic tricks to stage the supposedly psychic demonstration. The confederate told the rest of the class that she had played along with the act. Although we did not reveal the details of each of the tricks to all participants, we did inform them about the general principles. As an interesting side note, most of our participants were genuinely surprised and shocked when discovering that the demonstration had been staged (Figure 1).

Results and discussion

Participants. The data were analysed using SPSS v27. We compared age, psychic belief subscale scores, and gender compositions between warning groups (Table 1). Separate univariate analyses of variance (ANOVAs) with warning

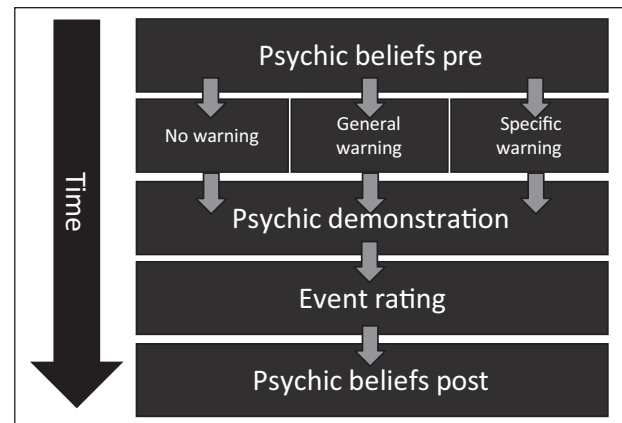


Figure 1. Diagram of the general experimental procedure for Experiment 1.

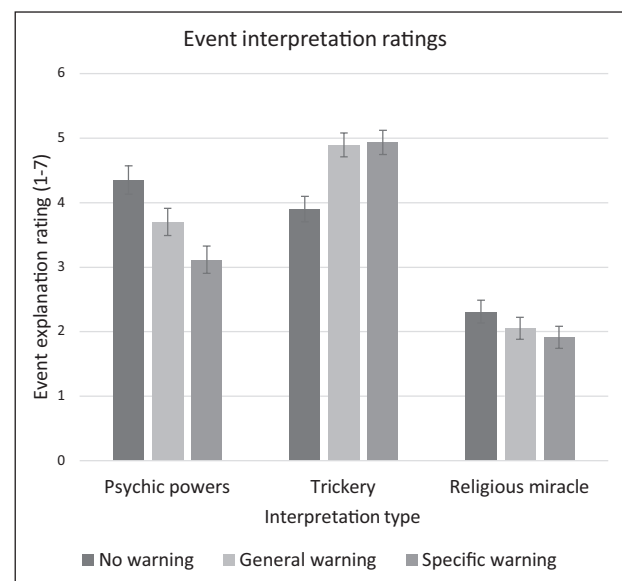


Figure 2. Mean event explanation ratings for the warning groups, separately. Error bars denote 1 standard error of the mean.

group (general, specific, no) as between-subject factor found no significant main effect on age, $F(2, 222)=0.97$, $p=.38$, $\eta_p^2=.009$, and psychic belief subscale scores (before the demonstration), $F(2, 222)=1.83$, $p=.16$, $\eta=.016$. The gender composition was comparable between groups, $\chi^2(2, N=226)=0.97$, $p=.61$ (Table 1).

Impact of explanation warning on event ratings. The first analysis assessed event ratings between groups (see Figure 2). We ran separate one-way ANOVAs with warning group (no, general, specific) as between-subject factor on the explanation ratings for the three different explanation types. For the psychic powers ratings, there was a significant main effect, $F(2, 222)=8.31$, $p<.001$, $\eta_p^2=.07$. Tukey’s post hoc tests

showed that the specific warning group had lower psychic explanation ratings than the no warning group ($p < .0005$, 95% confidence interval [CI]=[0.52, 1.9]) (Figure 2). None of the other group differences were significant (no vs general, $p = .12$, 95% CI=[-1.2, 0.12]; general vs specific, $p = .08$, 95% CI=[-1.37, 0.06]). We were somewhat surprised by the non-significant difference between the general and specific warning group. However, it is clear from the means that the psychic explanation ratings for the specific warning group were numerically higher, and the differences approached significance. The general warning did have some impact, though not as much as the specific warning.

The one-way ANOVA on trickery explanation ratings was also significant, $F(2, 222) = 9.29$, $p < .001$, $\eta_p^2 = .077$. Tukey's post hoc tests showed lower trickery explanation ratings in the no warning group when compared, respectively, with the specific warning group ($p < .0005$, 95% CI=[0.40, 1.67]) and general warning group ($p = .001$, 95% CI=[0.36, 1.63]) (Figure 2). The trickery explanation ratings were comparable in the general and specific warning groups ($p = .99$, 95% CI=[-0.58, 0.66]).

The one-way ANOVA on religious explanation ratings was not significant, $F(2, 222) = 1.35$, $p = .36$, $\eta_p^2 = .012$.

Impact of prior paranormal beliefs on event explanation ratings. Our next analysis examined the impact of participants' prior psychic beliefs on event explanation ratings in general and as a function of warning groups. Accordingly, we performed three separate regression analyses, one for each of the event explanation ratings with psychic belief subscale ratings and warning groups as predictor variables. For warning groups, we dummy coded the warning groups by using the no warning group as the comparison group (general=2, specific=1). The model for the psychic explanation ratings was significant, $F(2, 222) = 36.0$, $p < .001$; both the psychic belief scores ($\beta = .42$, $t = 7.18$, $p < .001$) and the type of warning ($\beta = .31$, $t = 5.18$, $p < .001$) were significant predictors. The beta value for the psychic belief scores was positive, indicating that higher psychic beliefs predicted higher psychic explanation ratings independently of the warning. The warning factor was a significant predictor, showing that participants' psychic explanation ratings were affected by the warning.

The regression model for trickery explanation ratings was also significant, $F(2, 222) = 12.0$, $p < .001$, whereby both psychic belief scores ($\beta = -.20$, $t = 3.07$, $p = .002$) and warning groups ($\beta = -.27$, $t = 4.13$, $p < .001$) were significant predictors. The beta value for psychic belief scores was negative indicating that higher beliefs predicted lower trickery explanation ratings. The warning factor was a significant predictor, showing that participants' trickery explanations were affected by the warning.

The regression model for religious explanation ratings was again significant, $F(2, 222) = 6.12$, $p = .003$, whereby

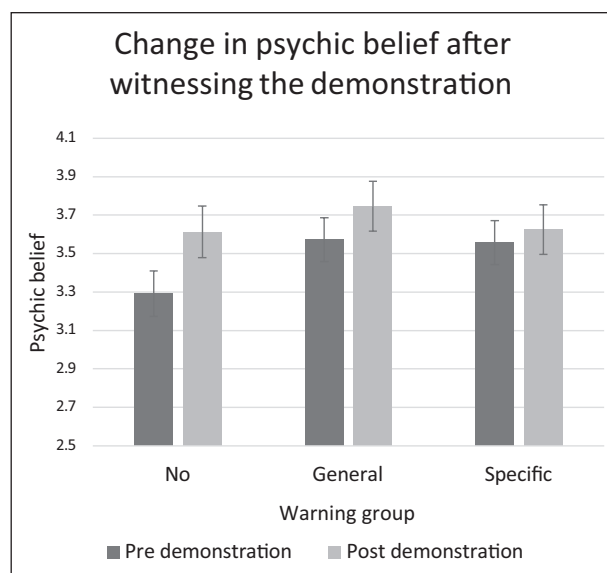


Figure 3. Mean psychic belief scores as a function of warning group and time (pre- and post-demonstration). Error bars denote standard errors of the means.

both psychic belief subscale scores ($\beta = .20$, $t = 3.08$, $p = .002$) and warning groups ($\beta = .13$, $t = 1.97$, $p = .05$) were significant predictors. The beta value for psychic belief scores was positive indicating that higher beliefs predicted higher religious explanation ratings. The warning factor was a significant predictor, showing that participants' religious miracle explanation ratings were affected by the warning.

Impact of warning on belief change. The next analysis examined the impact that the warning had on participants' changes in psychic belief. Figure 3 shows the psychic belief scores pre and post the demonstration as a function of warning group. We performed an ANOVA with warning group (no, general, specific) and time (pre, post) on psychic belief scores. We found no significant main effect of warning group, $F(2, 222) < 1$, but a significant main effect of time, $F(1, 222) = 22.6$, $p < .001$, $\eta_p^2 = .092$ (post > pre) (Figure 3). Moreover, there was a significant warning group by time interaction, $F(2, 222) = 3.45$, $p = .034$, $\eta_p^2 = .030$. We looked at the simple effects to examine the impact that the demonstration had for each group. We used Bonferroni-corrected t tests to do so. In the specific warning group, there was no significant difference in psychic belief scores pre and post demonstration, $t(76) = 1.08$, $p = .84$ (95% CI=[-0.19, 0.06]). However, there were higher psychic belief scores in the post- than pre-demonstration measure in the no warning group, $t(70) = 4.51$, $p < .001$ (95% CI=[0.18, 0.46]), and the difference was marginally significant in the general warning group, $t(76) = 2.42$, $p = .054$ (95% CI=[0.03, 0.31]).¹

Relationship between event explanation ratings and belief change. The final analysis examined whether the belief change we observed in the previous analysis was affected by participants' interpretation of the psychic event. Belief change was measured by subtracting the pre- from the post-demonstration psychic belief subscale scores. For warning groups, we dummy coded the warning groups by using the no warning group as the comparison group (general=2, specific=1). We ran a regression model with the three different event explanation ratings (psychic, trickery, religious) and warning group (no, general, specific) as predictor variables and the difference score as dependent variable. The overall model was significant, $F(4, 220)=12.3$, $p<.001$. Psychic explanation ratings significantly predicted belief change, $\beta=.39$, $t=5.50$, $p<.001$. The positive beta indicates that higher psychic explanation scores predicted a stronger belief increase. The other variables were not significant—trick explanation: $\beta=-.034$, $t<1$; religious explanation: $\beta=.009$, $t<1$; and warning group: $\beta=.061$, $t<1$. These results demonstrate that the belief change was primarily driven by participants' psychic event explanation.

Our results showed that simply telling participants that they were seeing a magician who uses tricks and deception had a relatively limited impact on whether they believed that the performance had been achieved through psychic powers. These results dovetail previous findings that have used a similar design (Lesaffre et al., 2018, 2021; Mohr et al., 2019; Mohr & Kuhn, 2020). However, telling people exactly how the tricks were done beforehand (i.e., providing them with an alternative explanation) significantly reduced the extent to which they believed that the demonstration had been created by psychic powers. These results highlight the importance of including plausible alternative explanations when trying to debunk fake demonstrations (Ecker et al., 2010). When explaining the phenomena in terms of trickery, both general warnings and warnings with alternative were equally effective in reducing the trickery event ratings. In this instance, both the general warning and the warning with alternatives may have provided plausible alternative explanations that affected participants' explanations in terms of trickery. These results suggest that the nature of the warning can have a rather specific impact on how an individual interprets the event. Our regression analysis showed that people's explanation of the events was driven both by the event warning and by their prior psychic beliefs. In other words, individuals with higher psychic beliefs were more likely to interpret the event as having been achieved through psychic powers, which is likely to have resulted from confirmation bias.

We additionally observed that witnessing the psychic demonstration significantly increased participants' psychic beliefs, even when they were given a general warning about the nature of the performer (Lan et al., 2018; Lesaffre et al., 2021). When we told them how the effect

of the demonstration was achieved, we observed no significant increase in psychic beliefs. Our regression analysis showed that this belief change was largely driven by the extent to which participants believed the performance had been accomplished through psychic powers. After the experiment, we fully debriefed our participants, which included that the performer explained that he used deception in the form of gimmicked devices, cold reading, and confederates. Although only anecdotal, we observed that most participants were flabbergasted by the fact that they had been tricked. It seems that the sudden realisation of having been deceived elicited strong emotional reactions, even though about a third of participants had received the written pre-demonstration warnings. These are, however, less effective than one would hope. Being finally shown how the effect has been achieved, participants might have suddenly realised their own susceptibility to process wrong information. We, thus, consider that knowing right away how an effect has been achieved "corrects" people's belief biases. Accordingly, in Experiment 2, we investigated the impact of post-event debunking on participants' psychic beliefs.

Experiment 2—effect of debunking on psychic beliefs

We used the same demonstration described in Experiment 1 but measured participants' psychic beliefs after the demonstration and after debunking the demonstration and again 1 week later. We investigated whether debunking reduces participants' psychic beliefs in the short term as well as 1 week later. We also included a specific warning condition to replicate the findings reported in Experiment 1.

Method

Participants. The experiment was performed as part of an introductory psychology course at Goldsmiths, University of London. The experiment was run in one session. In all, 125 students (M age=20.7, $SD=4.95$, 85% females) participated in the experiment. They knew beforehand that the experiment would be about magic and deception. We obtained follow-up data from 78 (61%) students. See Table 1 for demographic information.

Procedure. The procedure was identical to that used in Experiment 1 with a few exceptions.² First, we only used two warning conditions (no warning, specific warning) (Figure 4). Second, participants completed the RPB scale for the first time after having given their event ratings, a second time after having been debunked, and a third time 1 week after having seen the psychic demonstration. Third, instead of using booklets, we implemented all sections in Qualtrics, and students used their electronic devices (tablets and laptops) to respond.

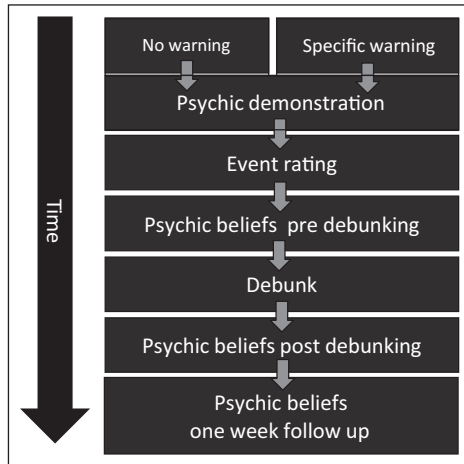


Figure 4. Diagram of the general experimental procedure for Experiment 2.

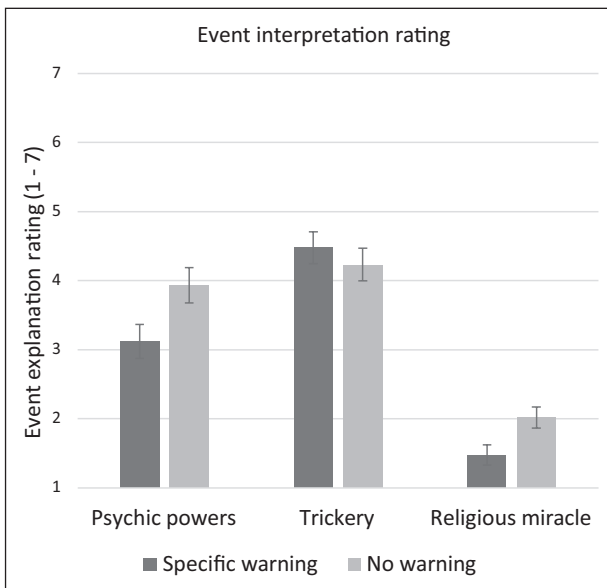


Figure 5. Mean event explanation ratings as a function of group and explanation type. Error bars denote 1 standard error of the mean.

Results and discussion

Participants. We compared age and gender compositions between groups (Table 1). A t test found no significant main effect of group on age, $t(123)=1.13, p=.26$. A chi-square comparison on gender composition between groups was not significant, $\chi^2(1, N=125)=0.004, p=.96$, though there were more female participants overall.

Impact of pre-exposure warning on event ratings. Our first analysis investigated whether our pre-exposure warning had an impact on participants' event ratings. Figure 5 shows the mean explanation ratings for the two groups. We

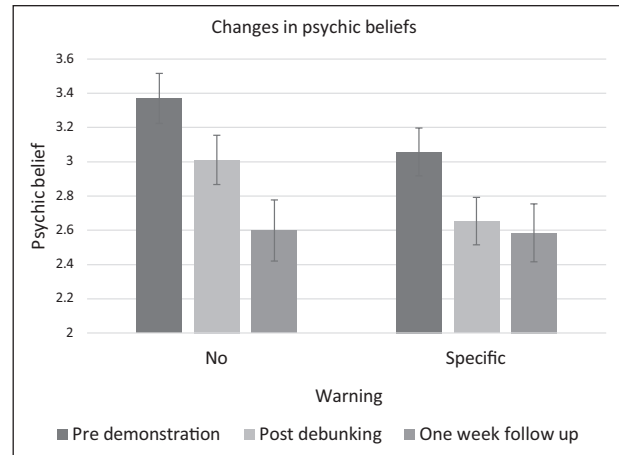


Figure 6. Changes in psychic beliefs as a function of time and group. Error bars represent standard errors.

ran t tests to examine the impact of the warning on the different explanation ratings. The warned participants attributed the demonstration significantly less to psychic powers, $t(123)=2.29, p=.024$ (95% CI=[0.11, 1.51]) than the participants in the no warning group. These results replicate our findings in Experiment 1. We found no significant differences for the trickery explanation ratings, $t(123)=0.74, p=.46$ (95% CI=[-0.89, 0.41]). However, the warned participants were significantly less likely to attribute the demonstration to religious miracles than the participants in the no warning group, $t(123)=2.54, p=.012$ (95% CI=[0.12, 0.96]).

Impact of debunking on belief. We tested whether debunking the psychic demonstration reduces people's psychic beliefs and whether the warning had any impact on this change in belief. Figure 6 shows psychic beliefs pre demonstration and post debunking as a function of group. An ANOVA with warning group (no, specific) and time (pre, post) found no significant main effect of warning, $F(1, 123)=2.91, p=.09, \eta_p^2=.02$, but a significant main effect of time, $F(1, 123)=84.4, p<.001, \eta_p^2=.40$, which illustrates a significant decrease in psychic beliefs after the debunking. Moreover, there was no significant warning by time interaction, $F(1, 123)<1$, which suggests that the belief change was independent of the warning.

Next, we looked at the long-term effects of debunking on psychic beliefs. As we only had data from 78 participants (specific warning: $n=34$, psychic belief score, $M=2.60, SE=0.18$; no warning: $n=33$, psychic belief score, $M=2.85, SE=0.20$), we ran a separate analysis to compare the difference in psychic beliefs after the debunking and the 1-week follow-up on these participants only. An ANOVA with warning group (specific vs. no) and time (demonstration vs follow-up) on psychic belief scores found no significant main effect of group, $F(1, 76)=1.03, p=.31, \eta_p^2=.01$; time, $F(1, 76)<1$; or group by time interaction, $F(1, 76)<1$. This

drop in psychic belief was persistent, being still evident 1 week after the demonstration.

General discussion

As humans, we are strongly biased to integrate fake information, whether provided in the form of narratives (Gilbert, 1991) or through firsthand experiences (Lan et al., 2018; Lesaffre et al., 2021). For narratives at least, we also know that pre-warning and debunking are largely ineffective in correcting such fake information, unless they are specific enough to generate suspicion during the encoding stage and to provide alternative explanations that can logically replace fake information (Ecker et al., 2010; Johnson & Seifert, 1994; Wilkes & Leatherbarrow, 1988). We investigated the impact of pre-warning and debunking when experiencing fake information right in front of your eyes, namely a medium taking contact with a dead person. In Experiment 1, we manipulated the amount of counter-information from none (naïve) to hinting at alternative explanations (warning with or without alternative) before seeing the demonstration. In Experiment 2, we provided explicit counter-information after the demonstration by explaining how the performance was done. In both studies, we asked participants to rate how they thought the demonstration had been achieved (psychic, trickery, religious explanations). We also assessed their self-reported psychic beliefs repeatedly around the demonstration (Lesaffre et al., 2018, 2021; Mohr et al., 2019; Mohr & Kuhn, 2020). We assessed these beliefs a third time in Experiment 2, 1 week later.

In Experiment 1, we found that general warnings that simply informed participants that the demonstration was fake had no significant impact on how participants interpreted the event. Moreover, our results showed that the psychic demonstration increased psychic beliefs, even when people were explicitly told that the performance was not real, though this effect was not sufficiently strong to be statistically significant. It was only once we provided specific and alternative explanations that the misinformation effect was fully mitigated.

Previous research has shown that effective warning requires messages that are detailed and specific enough to lead participants to consider the false information as suspect (Jerit, 2008), so that recipients can effectively work out which aspect of the information is wrong and therefore consider an alternative convincing explanation model (Johnson & Seifert, 1994; Wilkes & Leatherbarrow, 1988). However, in most of these studies, the warning is followed by an explicit debunking which occurred after the presentation of the misinformation. Our results demonstrate that similarly, a priori warnings also have to be well argued to mitigate the influence of a subsequent misinformation in the absence of a posterior debunking (Lan et al., 2018; Lesaffre et al., 2018, 2021; Mohr et al., 2015).

In the general warning group, most of the participants interpret the psychic demonstration both as a trick and a psychic demonstration. In other words, they seemed to activate in parallel two independent mental models of the demonstration. It is probable that participants cannot abandon any of these two models without being in a cognitive dissonance. On one hand, the “magic trick” model is sufficiently detailed to explain all the demonstrations, but it is probably hard to abandon it because it has been proposed as the main model by the experimenter. On the other hand, it may be hard to abandon the “psychic” model because most of the demonstration confirm it as most of its effects cannot be explained by the “magic trick” general model. Thus, participants in the general warning group could consider both models as equiprobably adequate to interpret the event. This hypothesis could also explain why psychic beliefs increased in the general warning group. After the demonstration, all the events which cannot be explained with the general “magic trick” model could feed the “psychic model” which in turn increase, by Bayesian inference, the probability of having a “psychic experience” and the associated psychic beliefs.

The fact that a psychic demonstration that has been labelled as a magic trick enhances people’s psychic beliefs is surprising, but it coincides with previous research on fiction. People extract information from sources that are explicitly identified as fictional (Chan et al., 2017). The problem with most fictional information is that some information about the world is of course correct. For example, watching movies correctly informs viewers about certain cultural practices and traditions. Most of our understanding about the Thanksgiving tradition is based on watching American films, and some of this knowledge is indeed correct (e.g., Americans typically eat a turkey). The same is true for a magic performance. The art of magic is based on deception and misinformation, but the misinformation is sporadically sprinkled into the narrative. Both magicians and film directors are not obliged to stick to facts; as the misinformation is not explicitly marked, observers may struggle to distinguish between fact and fiction. Indeed, Marsh et al. (2003) have shown that people relied on misinformation acquired from clearly fictitious stories when responding to subsequent quiz questions, even when the misinformation contradicted common knowledge. Misinformation effects that occur through fiction appear to be rather stable and difficult to eliminate. Moreover, Marsh and Fazio (2006) have shown that prior warnings were ineffective in reducing the acquisition from fictional text. Eslick et al. (2011) had people read stories that contained misinformation that contradicted well-known facts. One group of participants was explicitly told that even when participants were explicitly informed about the erroneous information and told that “authors of fiction often take liberties with certain facts or ideas in order to make the story flow better or be more entertaining.” And yet, even when

the errors were explicitly highlighted, some of the information was incorporated into their knowledge. Our results dovetail these previous findings and illustrate that unless people are given clear and plausible alternative explanations, fictional information in the form of a magic trick can significantly alter people's beliefs.

Our current results also demonstrate that participants' prior beliefs in psychic phenomena significantly predict the extent to which they accept the demonstration to have been accomplished through psychic powers—in other words, they accept the misinformation to be true. We are more likely to accept information to be true if it is consistent with things we already believe in (Wyer, 1975). Indeed, whenever we are presented with a new piece of information, we assess the evidence in the context of our personal world view (Lewandowsky et al., 2012). Information that is consistent with this world view is readily accepted and highly resilient to change. Our results also show that people's changes in belief were driven by the extent to which they interpreted the anomalous event as being a genuine psychic demonstration, independent of their initial beliefs and the warning, which further illustrates the way misinformation can directly alter people's beliefs.

In Experiment 2, we tried to use a more explicit form of debunking. After the demonstration, the experimenter and the performer explicitly informed participants that the demonstration was fake and explained some of the methods that were being used to deceive and misinform (e.g., they were explicitly told that we used a confederate). This form of debunking is extremely effective, and it elicited a lot of gasps and laughter among our participants. Moreover, their realisation of having been deceived also significantly reduced their psychic beliefs. Participants' psychic beliefs were significantly lower after the debunking than before the debunking, and this reduction was independent of whether participants had been warned or not. Our results suggest that this form of debunking can effectively make people more sceptical. The realisation of how easily they can be deceived in a specific context seems to generalise to beliefs in related phenomena. Most surprisingly, this reduction in psychic belief remained even 1 week after the event, suggesting that it is longer lasting.

When a very convincing “psychic” demonstration is then debunked, it could lead participants to discredit other “paranormal” beliefs that are based on less or equally convincing demonstrations or clues. As our “psychic” demonstration is probably one of the fairest and credible paranormal events most of the participants have experienced, its debunking could turn off the credibility of most of their past paranormal experiences and thus decrease their general beliefs in the paranormal.

Conclusion

We show that exposing people to misinformation in the form of a magic trick can significantly alter people's

beliefs in the associated phenomena and that simply labelling information as false has very limited impact. Effective warnings need to be well argued to mitigate the influence of a subsequent misinformation. Fully debunking the misinformation significantly reduced people's beliefs in the associated phenomena, and this effect lasted for at least 1 week. Debunking such magic tricks might therefore provide us with a valuable tool to foster a more critical mindset more generally.

Author contributions

G.K., C.T., and C.M. conceived and designed the studies; J.O., K.S., and G.K. collected the data; G.K., C.M., and C.T. analysed and interpreted the data; and G.K., C.M., J.O., and C.T. wrote the manuscript.

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Notes

1. While we were only interested in the psychic belief dimension, the Hartman (1999) four-factor model has three additional belief dimensions, which relate to traditional magical beliefs, superstitious beliefs, and beliefs in witchcraft. We ran some additional exploratory analysis to see whether our demonstration would affect these other belief dimensions. For participants in the specific and general warning conditions, there was no significant increase in any of these belief dimensions (all $ps > .12$). However, in the no warning group, there was a significant increase in superstitious beliefs, $t(70) = 2.97$, $p = .004$, 95% confidence interval (CI) = [0.05, 0.24], but not in traditional magical beliefs, $t(70) < 1$, or beliefs in witchcraft, $t(70) = 0.28$, 95% CI = [-0.07, 1.01].
2. After completing the first Revised Paranormal Belief (RPB) scale, participants carried out several short cognitive tests (random number generation task, jumping to conclusion task, cognitive thinking style task). These data will be reported in a separate paper.

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