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Review

Effective correction of misinformation

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Abstract

This paper reviews correction effectiveness, highlighting which factors matter, which do not, and where further research is needed. To boost effectiveness, we recommend using detailed corrections and providing an alternative explanation wherever possible. We also recommend providing a reminder of the initial misinformation and repeating the correction. Presenting corrections pre-emptively (i.e., prebunking) or after misinformation exposure is unlikely to greatly impact correction effectiveness. There is also limited risk of repeating misinformation within a correction or that a correction will inadvertently spread misinformation to new audiences. Further research is needed into which correction formats are most effective, whether boosting correction memorability can enhance effectiveness, the effectiveness of discrediting a misinformation source, and whether distrusted correction sources can contribute to corrections backfiring.

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Current Opinion in Psychology 2023, **54:**101712

This review comes from a themed issue on **The Psychology of Misinformation (2024)**

Edited by **Gordon Pennycook** and **Lisa K. Fazio**

For complete overview about the section, refer The Psychology of Misinformation (2024)

Available online 19 October 2023

https://doi.org/10.1016/j.copsyc.2023.101712

Keywords

Misinformation, Correction, Fake news, Debunking.

Misinformation can have negative impacts for both individuals and societies [1,2]. For example, misinformation has contributed to vaccine hesitancy, resistance to public-health measures, and negative political outcomes such as reduced satisfaction with democracy [3–7]. Therefore, it is important to identify and implement effective interventions. Several such interventions, which rely on a variety of underlying strategies, have been identified. For example, interventions such as accuracy prompts and social norms use a nudging approach, interventions involving media-literacy training aim to boost misinformation detection, and warning labels or corrections debunk misinformation (see Ref. [8]). This brief review focuses on this last approach, the effective correction of misinformation.

Effective correction of misinformation

Providing a correction is a natural response to encountering a piece of information one finds to be false. Corrections are broadly applicable as they can vary in specificity and detail depending on how much is known about the misinformation being corrected and its falsity. However, compared to other interventions, corrections have the disadvantage that they are generally designed to be (1) employed retroactively and (2) specific to the particular misinformation they target. The retroactive nature of corrections presents a challenge because if a recipient has already formed a false belief based on the misinformation, undoing this belief requires cognitively challenging processes of memory updating or knowledge revision [1]. Together with the need for specificity, this means that in environments awash with misinformation, a corrective approach will face challenges of scale. Thus, if corrections were the only tool available, countering misinformation would truly be a Sisyphean task. However, the specificity of corrections also enhances intervention salience; that is, correction recipients will typically know exactly which claim is being challenged. Thus, corrections have generally been found to be at least somewhat effective at reducing false beliefs and reliance on misinformation [9,10]. Therefore, corrections are a crucial tool for countering misinformation, particularly misinformation with the potential for harm.

What makes a correction effective

Fortunately, the correction of misinformation has been widely studied, allowing for the identification of several key considerations for designing effective corrections (see Table 1). Firstly, providing an alternative, factual explanation wherever possible increases the effectiveness of corrections (e.g., Ref. [1]). This is a well-established finding, and including an alternative explanation is likely to be particularly important when correcting causal misinformation (e.g., the cause of an accident or health problem). Several recent papers provide insight into why providing alternative explanations enhances correction effectiveness. Susmann and Wegener [11] found that retracting misinformation induces psychological discomfort, and this discomfort is

Table 1

Overview of factors that do, do not, and might impact correction effectiveness.

Factor	Impact on Effectiveness	Relevant Evidence
Provide an alternative explanation	Yes	[11,12]
Provide details	Yes	[9,13–16]
Repeat the correction	Yes	[17,18]
Misinformation reminder	Yes	[19–24]
Trustworthy correction source	Yes	[25–29]
Discredit misinformation source	Likely	[30–33]
Correction format	Possible	[19,28,34–40]
Worldview congruence	Possible	[41–53]
Correction retrieval practice	Unlikely	[35,54]
Misinformation repetition within correction	Unlikely	[16,20,21,24,46,50,52,55,56]
Presentation order	Unlikely	[22,57–61]

associated with continued reliance on misinformation post-correction. This is consistent with the idea that one benefit of providing an alternative explanation is that it allows people to maintain a complete mental model of an event, situation, or causal relation, thereby reducing discomfort associated with an incomplete mental model [1]. Kendeou et al. [12] used a thinking aloud paradigm and found that while reading a correction with an alternative explanation, participants reported increased cognitive conflict and monitoring. However, when subsequently reading the corrected outcome, participants had faster reading times, lower cognitive conflict and monitoring, and made more accurate elaborations, suggesting a correction containing an explanation leads to greater integration of the correction and reduced misinformation reactivation, thereby enhancing knowledge revision.

Although providing an alternative explanation is beneficial, it is not always possible or applicable (e.g., when no factual alternative information is currently available, or in cases of non-causal misinformation). However, providing additional details within a correction is nearly always possible (e.g., details about why the misinformation is false, or why it may be believed or spread), and this is also a well-established strategy for enhancing the effectiveness of misinformation corrections, as confirmed by a recent meta-analysis [9]. Benefits of providing additional details have also been found in the context of corrections related to public health [15] and even when using corrections during crisis communication [14]. Recent research from our own lab has found that providing additional details increases the longevity of correction effects, even when using short-format corrections (i.e., less than 140 characters; [13]).

Table 1

Another recommendation is to repeat misinformation corrections. Repetition can enhance memory for the correction and thereby alleviate belief regression—the tendency for misinformation belief to creep back up over time as the correction fades in memory [18]. Repetition of corrections may be particularly useful if recipients are distracted when they encounter the correction, with recent research finding that when participants are under cognitive load, multiple retractions are needed for corrections to be effective [17]. There is also a growing body of evidence that placing a reminder of the specific piece of misinformation being corrected within or alongside a correction can help to enhance correction effectiveness [20,21,23]. This beneficial effect of reminders may stem from enhanced clarity and salience, allowing recipients to more easily co-activate the correction and the targeted misinformation in memory [1,12].

The previously listed recommendations all relate to features of corrections, but source factors—and particularly the trustworthiness of the correction source—are also important for ensuring correction effectiveness. Several papers have shown that the credibility of correction sources matters, with official organizations and socially connected sources leading to increased correction efficacy [25,28,29]. Recent work has further investigated correction source credibility by disentangling the impacts of expertise and trustworthiness, showing that source trustworthiness is more impactful than expertise, and that corrections from untrusted sources may even be entirely ineffective [26,27].

What not to worry about

Just as important as identifying factors that do impact correction effectiveness is identifying factors that have limited impact so that researchers and practitioners can focus their efforts elsewhere. The timing of corrections and the ordering of correction elements is one such factor. With news headlines, there is some evidence that it is beneficial to present corrective fact-checks (i.e., 'false' tags) after headline exposure rather than before [57]. On social media, fact-focused corrections (but not corrections that expose misleading logic) may also be more effective when presented after misinformation exposure [61]. However, several other recent studies found similar levels of correction effectiveness regardless of whether the correction occurred before (i.e., prebunking) or after misinformation exposure [22,59,60].

Moreover, the specific ordering of correction elements—whether a correction is presented in a 'myth-fact', a 'fact-myth', or a 'truth sandwich' ('fact-myth-fact') format—does not seem to affect efficacy much, with various formats appearing to be equally effective at correcting misinformation [22,58]. Likewise, many

more-peripheral presentation features seem to have no or negligible impact on correction effectiveness. For example, Fazio et al. [35] found that providing visual information indicating the type of misinformation being corrected (e.g., manufactured vs. manipulated) and the number of news organizations endorsing the correction were poorly remembered by participants and provided no benefit.

Thus, cumulatively the evidence suggests that corrections are likely to be similarly effective regardless of presentation order or secondary presentation features, and that pre-emptively presenting corrections (i.e., prebunking) can be an effective alternative to traditional retroactive corrections in situations where future misinformation exposure can be foreseen.

A longstanding concern has been that repeating misinformation within a correction may be counterproductive and lead to a familiarity backfire effect, whereby misinformation repetition ironically increases false beliefs post-correction due to a boost to misinformation familiarity (see Ref. [50], for discussion). However, evidence continues to accumulate against familiarity backfire effects. As aforementioned, reminders of misinformation within a correction help rather than hinder. Multiple studies have also found that corrections that contain both 'myth' and 'fact' are superior to 'fact-only' interventions that aim to correct a misconception by focusing only on the facts [19,22,24]. Even with explicit misinformation repetition under conditions conducive to familiarity effects, recent studies have failed to find evidence for familiarity backfire [13,16]. Some have argued that familiarity backfire may be a particular risk when a correction of novel misinformation is presented without prior misinformation exposure [55]. However, recent studies from our lab have found that even without initial misinformation exposure, corrections are unlikely to backfire [46,56]. Cumulatively, we believe that the evidence shows there is limited risk of familiarity backfire effects and that even the correction of novel misinformation is unlikely to backfire.

What might matter

In addition to the factors mentioned above, there are several factors that may impact correction effectiveness for which there is not yet enough evidence to draw firm conclusions. One emerging research question is whether including a discreditation of a misinformation source within a correction can enhance effectiveness. There is some evidence that reducing trust in a misinformation source can lead to reduced misinformation reliance [33] and recent work conducted within our lab found that discrediting a misinformation source (e.g., highlighting a conflict of interest) can enhance a correction and also reduce misinformation reliance on its own [31]. However, in other studies, telling participants that

misinformation originated from an intentional lie or a website that creates false stories provided no additional benefit over a standard correction [30,32]. These results may suggest that a strong and explicit source discreditation is needed for it to provide additional benefit over and above a standard correction.

Another area that has received considerable attention is correction format and medium. Pasquetto et al. [28] reported that audio corrections were more effective than image or text-based corrections on WhatsApp (possibly because they created more interest), but the observed difference was small. Ecker, Sharkey et al. [16] found that only a format juxtaposing 'myths' and 'facts' was effective at reducing vaccine-related misconceptions, whereas other formats, including a simple 'false tag', a fear appeal, and even a detailed visual correction format (comprehension of which may have required more attention than participants gave it), were ineffective. Challenger et al. [19] found that when correcting COVID-19 misinformation, a 'question-answer' format was more effective than a 'fact-myth' format, but only after a delay, and only marginally so. Several studies have also suggested there are benefits to using a narrative format or adding narrative elements to a correction [52,54,55]. However, when narrative corrections are contrasted with similarly detailed non-narrative corrections, there does not appear to be any benefit of narrative [51,53,56]. Overall, there is mixed evidence regarding which correction formats are most effective, and many studies confound correction format and provision of details. Further research is needed to examine whether some formats and/or elements consistently lead to improved correction efficacy when other factors are controlled for.

A somewhat surprising recent finding is that conducting memory tests after a correction led to enhanced memory of correction details after a 1-week delay but did not impact correction effectiveness [35,54]. This is particularly noteworthy given that correction memory has been found to negatively correlate with post-correction misinformation reliance, and memory failure is a proposed mechanism by which correction efficacy fades over time [18,35]. Future research should further explore the relationship between memory and correction efficacy and examine whether there are methods for boosting correction memory that transfer to reduced misinformation reliance.

Another area of ongoing research relates to the impact of worldview on misinformation corrections. Many recent studies have shown that corrections of political misinformation are effective even if the misinformation is consistent with a participant's worldview and/or comes from a politically aligned source [42–44,47,51]. However, some studies have found that corrections are less

effective if they challenge a strongly held belief or require attitudinal change [45,49,53]. Additionally, a recent paper found that even though corrections were effective overall, some individuals were more prone to increasing misinformation belief in response to a correction, particularly when the correction source was a political outgroup [48]. Work in our own lab has also recently shown that corrections can be ineffective and may even backfire if people are skeptical of the correction source [46]. However, it is important to note that the risk of both familiarity and worldview-driven backfire effects is likely much lower than once thought, and backfire effects are less likely to occur when reliable (multi-item) measures of misinformation belief are used [52]. Therefore, future research should further examine if backfire effects reliably occur when people are sufficiently distrustful or skeptical of a correction source [41,52].

Conclusion

There is considerable evidence about how to enhance correction effectiveness and which factors have little impact. Providing an alternative explanation and/or more details will boost correction efficacy, as will providing a reminder of the initial misinformation and repeating the correction. Whether the correction is presented before (i.e., as a prebunking) or after misinformation exposure is unlikely to greatly impact correction effectiveness. There is also limited risk of repeating misinformation within a correction or that a correction will inadvertently spread misinformation to new audiences. Further research is needed into which correction formats are most effective, and whether the benefits seen for some formats are simply due to providing additional details. The research into boosting memory for corrections has hitherto found relatively little benefit, but given the link between correction memory and effectiveness over time, further research in this area is warranted. Source trust is also a promising area for future research, including further examination of the effectiveness of source discreditation, as well as whether distrust and/or skepticism of a correction source can contribute to corrections backfiring.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

Acknowledgement

UKHE is supported by the Australian Research Council (grant FT190100708).

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