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Voluntary Forgetting of (Presumably) Untrustworthy News: The Case of List-Method Directed Forgetting

Magdalena Abel | Karl-Heinz T. Bäuml

Department of Experimental Psychology, Regensburg University, Germany

Correspondence: Magdalena Abel (magdalena.abel@ur.de)

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ABSTRACT

Research on list-method directed forgetting (LMDF) shows that previously encountered material can be voluntarily forgotten. Here, we examined LMDF of news contents. Experiment 1 found that a first set of news headlines from a supposedly untrustworthy source could be voluntarily forgotten, which benefited memory for a second set of news headlines from a supposedly trustworthy source. Experiment 2 used fictitious news reports as study materials and also found intact voluntary forgetting for Set 1 as well as a benefit for Set 2. Moreover, Experiment 2 clarified that the results were not affected by whether the news source for Set 1 was characterized as trustworthy or untrustworthy. News contents can be voluntarily forgotten, but whether this curtails the spread of untrustworthy information may depend on an individual's goals and motivation. Future work is needed to better understand how voluntary forgetting operates in applied settings.

1 | Introduction

News and media reports are our primary source for learning about important public events and political developments (Abel and Berntsen 2021). Some news reports that we encounter in daily life may, however, not be factually accurate, but contain false or misleading information. By now, a great deal of research examines how misinformation may affect our memories and our beliefs, as well as how such misinformation may be countered and corrected (e.g., Ecker et al. 2022; Kemp et al. 2024; Pennycook et al. 2021). When it turns out that we encoded information from an untrustworthy source, wouldn't it be useful to be able to forget this information in a targeted fashion? Indeed, there is evidence that humans can, up to some extent, engage in such voluntary forgetting (Anderson and Hanslmayr 2014; Nørby 2015). One task that is used to study voluntary forgetting in the lab is the list-method directed forgetting (LMDF) task (Bjork 1970, 1972). The goal of the present study was to examine if voluntary forgetting in the form of LMDF could possibly reduce the accessibility of (presumably) untrustworthy information in memory.

In the LMDF task, participants study two sets of information, usually two lists of unrelated words. After encoding the first set, participants receive either a remember or a forget cue. With a remember cue, participants are asked to try to keep on remembering the first set for a later test, and to try to additionally memorize a second set of information. With a forget cue, participants are instead asked to try to forget the first set, for example pretending that it was presented just for practice or by accident (e.g., Abel and Bäuml 2013; Barnier et al. 2007). Participants in this condition are asked to try to memorize the second set of information instead, pretending that only this second set will be tested later. Regardless of these instructions, memory for both sets is, however, tested. The typical finding is that forget relative to remember cues prompt reduced recall of the first set of information, an expression of motivated forgetting. These costs of LMDF can additionally be accompanied by enhanced recall of the second set of information, the so-called benefits of LMDF (for reviews, see Bäuml et al. 2020; MacLeod 1998; Sahakyan et al. 2013).

One-mechanism accounts attribute both costs and benefits to the same cognitive mechanism. The inhibition account (Geiselman et al. 1983), for example, attributes Set-1 forgetting to a cognitive control process, which reduces between-list interference by inhibiting access to Set 1. Another account, the context change account (Sahakyan and Kelley 2002), suggests that forget cues prompt participants to actively switch their mental contexts, and that Set-1 forgetting is caused by the mismatch between context at test and during Set-1 encoding. Both accounts attribute Set-2 enhancement to decreased proactive interference from Set 1 (either as a consequence of inhibition or context change). In contrast, two-mechanism accounts may attribute Set-2 enhancement to an entirely different mechanism, usually to improved encoding. One suggestion is that forget cues may encourage participants to switch to better encoding strategies when studying the second set (Sahakyan and Delaney 2003); another proposal is that forget cues may reset attention, thus improving encoding of Set 2 (Pastötter and Bäuml 2010). The assumption of an additional mechanism for List-2 enhancement is also consistent with prior findings that List-2 enhancement and List-1 forgetting can be dissociated and do not always arise in unison (Benjamin 2006; Pastötter and Bäuml 2010; Sahakyan and Delaney 2005; Zellner and Bäuml 2006).

Why might one expect LMDF to affect memory for news items? Although most studies in the literature examined LMDF with unrelated lists of words as study materials, there are also a couple of studies which used more complex materials. For example, LMDF has been shown to affect autobiographical memories (Barnier et al. 2007), memories for product attributes (Shapiro et al. 2006), and memories for statements describing actions, attitudes, or other people's behavior (Sahakyan and Foster 2009; Scully and Hupbach 2020; Waldum and Sahakyan 2012; for further work on selective LMDF, see also Aguirre et al. 2017; Delaney et al. 2009). Based on these studies, we assumed that LMDF might also be intact when people are instructed to try to forget a set of previously studied news items from a (presumably) untrustworthy source.

This expectation is also supported by a recent study, which reported intact voluntary forgetting of news headlines in the form of item-method directed forgetting (Abel and Bäuml 2023; for a comparison of item- and LMDF, see MacLeod 1999). In item-method directed forgetting, remember and forget cues are not presented after the encoding of a full set of information is complete, but instead directly after every single piece of information was presented. The ensuing forgetting effects are typically attributed to different cognitive mechanisms and are assumed to operate directly at encoding. One proposal is that continued rehearsal of to-be-remembered information and stopped rehearsal of to-be-forgotten information causes later differences in remembering (e.g., Basden et al. 1993; Basden and Basden 1996; Bjork 1972; Woodward and Bjork 1971). Despite these differences, the fact that item-method directed forgetting has been shown to affect memory for real-world news headlines may support the expectation that LMDF could extend to these materials as well.

In two experiments, we examined if LMDF can be observed for news items from an untrustworthy source, and if instructions to forget can also enhance recall of subsequently encoded information from a trustworthy source. Participants were asked to memorize news headlines (Experiment 1) or information from a news report (Experiment 2). Moreover, in Experiment 1, remember instructions were paired with the prompt that the news source was trustworthy, whereas forget instructions were paired with the prompt that the source was untrustworthy. In Experiment 2, source trustworthiness was varied independently of cue, thus also addressing if LMDF of news content is affected by the supposed trustworthiness of the source.

2 | Experiment 1

2.1 | Method

2.1.1 | Participants

An a priori sensitivity analysis for within-between interactions in 2×2 mixed ANOVAs was run in G*Power 3.1 (Faul et al. 2007). It suggested that overall samples of 80 participants would enable us to observe small- to medium-sized interaction effects of $f = 0.16$ with a power of 0.80 ($alpha = 0.05$; correlation among repeated measures set to 0.5). We thus recruited 80 participants for Experiment 1. Mean age was 24.1 years (range 18–35 years). All subjects were fluent in German. Fifty four participants were female, 26 male. Participants were recruited via social media posts and received course credit or online gift vouchers for participating.

2.1.2 | Material

Materials as well as data for all experiments are available on the Open Science Framework (https://osf.io/m58a6/). Study materials for Experiment 1 consisted of 20 news headlines collected from the websites of major German news outlets (e.g., sueddeutsche.de, faz.net, zeit.de, spiegel.de). The headlines contained facts unlikely to change during data collection (e.g., "Great Barrier Reef loses more than half of its coral," "US approves first Ebola drug")[1]. Materials were split into two collections of 10 headlines each. Across participants, the two collections were equally often used as the to-be-studied sets 1 and 2. Participants who received a remember cue after Set 1 were instructed that the headlines they had just seen came from a trustworthy source (and should be remembered). In contrast, participants who received a forget cue after Set 1 were instructed that the headlines came from an untrustworthy source (and should be forgotten). At the end of the experiment, participants were of course carefully debriefed and informed that all news headlines were taken from trustworthy sources.

To increase the similarity of our experiments to the consumption of news headlines in daily life, we paired each headline with a thematically fitting photograph, which has been shown to increase perceived knowledge and truth (e.g., Cardwell et al. 2017; Newman et al. 2015). For example, the headline "Great Barrier Reef loses more than half of its coral" was accompanied by a picture of a reef from above; the headline

"US approves first Ebola drug" was shown next to a picture of somebody receiving a shot. Pictures were collected on unsplash.com or pixabay.com.

2.1.3 | Design

The experiment had a two-factorial design. The factor set (Set 1, Set 2) was varied within participants. Each participant studied two sets of news headlines. The factor cue (remember cue, forget cue) was varied between participants. Half of the participants received a remember cue after studying the first and before studying the second set of headlines. The other half received a forget cue between sets instead. The main dependent variable of interest was recall performance for the two sets of headlines, and we report these results in the main text. Additionally, we also examined source memory for each remembered headline; for completeness, these results are reported in Appendix A.

2.1.4 | Procedure

All experiments reported in this manuscript were conducted during the Covid19 pandemic, while severe contact restrictions were in place. As a consequence, the experiments were not conducted in the lab, but via the video conference software Zoom. After signing up for the study, participants received an individual invitation link. When they joined the Zoom meeting, they were greeted by an experimenter who gave them basic information about the study and their rights as participants. All participants provided verbal consent to participate. The experimenter kept their camera and microphone activated to facilitate communication, and participants were asked to do the same. Of course, to protect participants' privacy, no video or audio recordings were made; this was also emphasized to participants. Stimulus presentation was implemented via screensharing.

To start off, participants provided some basic demographic information about themselves. Next, they were asked to memorize news headlines for a later test. They were instructed that the headlines were taken from a specific German newspaper (with the fictitious newspaper names "Berliner Tagesanzeiger" and "Hamburger Neue Presse" being counterbalanced across Sets 1 and 2). Participants were asked to imagine opening up the newspaper and browsing through the reported headlines. Headlines were then shown in random order. Each headline was presented for 10 s, right next to a thematically fitting photograph.

After the first list of news headlines had been presented in this manner, participants received one of two cues. When receiving a remember cue for the first list, participants received the information that the newspaper the headlines had been taken from was indeed a trustworthy source. Then, they were asked to try to keep on remembering the headlines, as they would be relevant for a later test. Next, participants were asked to additionally memorize a second set of headlines from another trustworthy newspaper (e.g., if the first set of headlines had been presented as coming from the "Berliner Tagesanzeiger," the second set was presented as coming from the "Hamburger Neue Presse"). Participants were asked to memorize the second set of headlines in addition to the first set and were informed that memory for both sets would be tested later.

In contrast, when participants received a forget cue after studying the first set of news headlines, they were instructed that the newspaper the headlines had been taken from was in fact an untrustworthy source. They were then asked to try to forget the untrustworthy headlines, pretending that the headlines would not be relevant for a later test. Instead, participants were asked to memorize a second set of headlines that were taken from a trustworthy newspaper (e.g., "Hamburger Neue Presse"). Participants were instructed that memory would later only be tested for this second set of trustworthy headlines.

The second set of headlines was then presented in parallel to the first set of headlines (i.e., in random sequence, at a rate of 10 s per headline, and accompanied by thematically fitting photographs). When Set-2 presentation was complete, all participants counted backwards from a three-digit number in steps of 2 for 2 min, and then moved on to the final memory test.

At test, participants were asked to list all news headlines from the study phase that they could still remember. They were asked to list the headlines in any sequence, as they came to mind, with no regard for which of the two newspapers the headlines had belonged to. Importantly, participants who had received a forget cue for the first set of headlines were debriefed before the final test; i.e., they were informed that the forgetting instructions they had received were in fact invalid and that we would like to ask them to try to recall the information as best as they could. Participants were specifically asked to please list ALL headlines that they could still remember (i.e., also headlines from the first set, which they had previously been instructed to forget). Participants were given a maximum of 5 min to recall as many headlines as possible; their verbatim responses were recorded by the experimenter. Subsequently, source memory was tested as well (see Appendix A). The experimenter read each verbatim response back to the participants and asked them to indicate whether the headline belonged to the first or second set of headlines. At the end of the experiment, all participants were carefully debriefed, thanked, and compensated for their participation.

2.1.5 | Data Coding and Analysis of the Free Recall Responses

Two independent coders evaluated the accuracy of participants' verbatim responses on the free recall test. Accurately recalled news headlines from the study phase were scored with 1 point, whereas descriptions that were not 100% correct but still contained the main content of the headlines were scored with 0.5 points (e.g., "Great Barrier Reef loses large parts of its coral" instead of the full headline "Great Barrier Reef loses more than half of its coral"). The independent coders were in agreement for 84.8% of all responses; disagreements were resolved through discussion. For each subject, the total score was then calculated separately for headlines from Sets 1 and 2 and was transformed into percentage correct. For example, a total score of 3.5 for Set 1 would be transformed to 35% correct (based on the 10 headlines presented in each set)[2].

2.2 | Results

Mean recall of news headlines from both sets is shown in Figure 1. A 2×2 ANOVA showed no significant main effects of set, $F(1,78)=2.77$, $MSE=0.02$, $p=0.100$, $\eta^2=0.03$, and cue, $F(1,78)=0.002$, $MSE=0.04$, $p=0.968$, $\eta^2<0.001$, but a significant interaction between the two factors, $F(1,78)=15.24$, $MSE=0.02$, $p<0.001$, $\eta^2=0.16$. This suggests that the influence of remember versus forget cues was different for the two sets of headlines. To follow up, we ran separate *t*-tests for Set-1 and Set-2 recall (independent samples, two-tailed). Indeed, relative to participants who received remember cues, participants who received instructions to forget showed not only reduced recall of the first set of (presumably untrustworthy) headlines (31.8% vs. 41.3%), $t(78)=2.55$, $p=0.013$, $d=0.57$, 95% CI [0.12, 1.02], but also enhanced recall of the second (presumably trustworthy) set of headlines (45.1% vs. 35.9%), $t(78)=-2.26$, $p=0.027$, $d=-0.51$, 95% CI [−0.95, −0.06].

2.3 | Discussion

Applying news headlines as study materials, Experiment 1 showed intact effects of LMDF: Instructions to forget decreased memory for an initially studied set of headlines, but increased memory for a subsequently studied set of headlines. These costs and benefits of directed forgetting are often reported in the LMDF literature (Bjork 1989; MacLeod 1998), though they do not always arise simultaneously (e.g., Benjamin 2006; Pastötter and Bäuml 2010; Sahakyan and Delaney 2005; Zellner and Bäuml 2006). In sum, Experiment 1 shows that it is possible to engage in voluntary forgetting of headlines from a (presumably) untrustworthy source, which may also come with an advantage for remembering subsequently encoded headlines from a trustworthy source.

Study materials in Experiment 1 consisted of completely unrelated news headlines, i.e., each headline dealt with a different

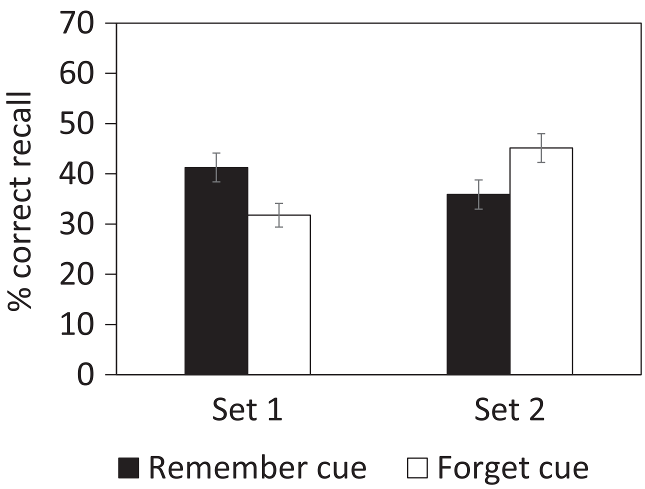

FIGURE 1 | Results of Experiment 1. Mean correct recall of news headlines from sets 1 and 2, shown as a function of cue (remember cue, forget cue). Error bars represent ±1 standard error of the mean.

topic. An open question is if voluntary forgetting of information from a (presumably) untrustworthy source also works when to-be-forgotten pieces of information concern the same overarching topic and when subsequently encoded information is also connected to this topic. For example, a brief news article might cover a number of facts about a specific political candidate who is running for office. Can somewhat related information (within and between sets) be voluntarily forgotten?

A prior study demonstrated directed forgetting for a list of behaviors attributed to another person (Scully and Hupbach 2020). Although LMDF can be eliminated when related information is presented across sets, this is usually only the case when the information is highly related, for example when all Set-1 items are chosen to have strong associations to Set-2 items (Sahakyan and Goodmon 2007). When associations are weaker or only single items across sets are associated, LMDF has been reported to be intact (see also Conway et al. 2000). Based on theoretical accounts that stress the importance of between-list interference for the elicitation of LMDF (Bjork 1970; Pastötter and Bäuml 2010), we expected LMDF to remain intact as long as text materials provided facts that were not highly related. Experiment 2 was conducted to address this possibility. Moreover, Experiment 2 also varied the characterization of Set 1 as trustworthy or untrustworthy, to additionally address if voluntary forgetting of Set 1 may be modulated by the (supposed) trustworthiness of the information.

3 | Experiment 2

3.1 | Method

3.1.1 | Participants

One hundred and ninety two new participants were recruited for Experiment 2, with 48 participants per condition. This sample size allows observing between-subjects effects of $f=0.21$, within-subject effects of $f=0.10$, and within-between interactions of $f=0.12$ with a power of 0.80 ($alpha=0.05$; correlation among repeated measures set to 0.5). Mean age was 23.0 years (range 18–34 years). All subjects were fluent in German. One hundred and twenty participants were female, 72 male.

3.1.2 | Material

Two texts were created as study materials and are available on the Open Science Framework (https://osf.io/m58a6/). Both texts provided information on the same fictitious political candidate (”Peter Meyer”), who was introduced as re-running for a Bundestag mandate in the upcoming federal election. Each text was accompanied by an individual headline (e.g., “Short profile—Who is the federal political candidate Peter Meyer?”) and a photograph of a person wearing a suit (two similar photographs of the same person wearing a suit were found on unsplash.com). Texts were formatted so as to look similar to reports in actual German newspapers.

The main body of each text comprised 100 words and was made up of 10 pieces of information about the political candidate. The specific contents were different, but the structure was the same for both texts: two facts per text covered the candidate's engagement for his constituency (e.g., his patronage for the new cancer ward at a local clinic); three facts covered liberal to left-spectrum political positions (e.g., that he supports higher taxation of top earners); three facts covered conservative to right-spectrum positions (e.g., that he calls for expansion of the police force to strengthen internal security); and two facts covered aspects of his private life (e.g., that he got divorced last year). All participants read both texts; across participants, both texts served equally often as Set 1 versus 2.

3.1.3 | Design

The experiment had a three-factorial design. The first two factors were identical to Experiment 1: Set (Set 1, Set 2) was varied within-participants; cue (remember cue, forget cue) was varied between-participants. The third factor, trustworthiness of Set 1, was new and was manipulated between-participants. For half the participants in each cue condition, the news source of Set 1 was characterized as trustworthy, whereas it was characterized as untrustworthy for the other half. Trustworthiness of Set 2 was held constant, and the corresponding news source was always characterized as trustworthy.

3.1.4 | Procedure

The procedure was identical to Experiment 1, except for the following changes: At the beginning of the experiment, participants were now asked to study a brief newspaper article (instead of separate headlines). During study, each text (plus the accompanying headline and photograph) was presented for 2 min, and participants were asked to memorize the information for a later test.

After study of the first text, participants were either informed that the newspaper the text had been taken from was a trustworthy source, or they were informed that it was an untrustworthy source. Then, they were either asked to try to keep remembering the text for a later test, or they were asked to try to forget it, pretending that it would not be tested later. The rest of the procedure was identical to Experiment 1. Just like Experiment 1, Experiment 2 was conducted online by means of individual Zoom sessions.

3.1.5 | Data Coding

Participants' responses on the free-recall test were again coded for accuracy by independent coders. Interrater agreement was at 89.1%.

3.2 | Results

Mean recall of facts from both texts is shown in Figure 2; panel (a) shows recall when the source of text/Set 1 was characterized as trustworthy, panel (b) shows recall when it was characterized as untrustworthy. A 2×2×2 ANOVA showed a significant main effect of set, $F(1,188)=40.96$, $MSE=0.02$, $p<0.001$, $\eta^2=0.18$, as well as a significant two-way interaction between set and cue, $F(1,188)=34.40$, $MSE=0.02$, $p<0.001$, $\eta^2=0.16$. This suggests that the influence of remember versus forget cues was different for the two sets of texts. The ANOVA did not reveal any other significant effects (all $Fs \leq 1.32$, $ps \geq 0.253$, $\eta^2 \leq 0.01$).

For Set 1, participants who had received instructions to forget showed reduced recall relative to participants who had received instructions to remember; characterizing the news source of Set 1 as trustworthy or untrustworthy did however not affect recall. Consistently, a 2×2 ANOVA showed a significant main effect of cue, $F(1,188)=16.82$, $MSE=0.03$, $p<0.001$, $\eta^2=0.08$, but no significant main effect of Set-1 trustworthiness, $F(1,188)=0.34$, $MSE=0.03$, $p=0.563$, $\eta^2=0.002$, and no significant two-way interaction between cue and trustworthiness, $F(1,188)=0.14$, $MSE=0.03$, $p=0.710$, $\eta^2=0.001$.

For Set 2, participants who had received instructions to forget Set 1 showed enhanced recall relative to participants who had received instructions to remember Set 1; characterizing the news source of Set 1 as trustworthy or untrustworthy did not affect Set-2 recall. A 2×2 ANOVA showed a significant main effect of cue, $F(1,188)=8.09$, $MSE=0.03$, $p=0.005$, $\eta^2=0.04$, but no significant main effect of Set-1 trustworthiness, $F(1,188)=0.004$, $MSE=0.03$, $p=0.948$, $\eta^2<0.001$, and no significant two-way interaction between cue and trustworthiness, $F(1,188)=2.25$, $MSE=0.03$, $p=0.136$, $\eta^2=0.01$.

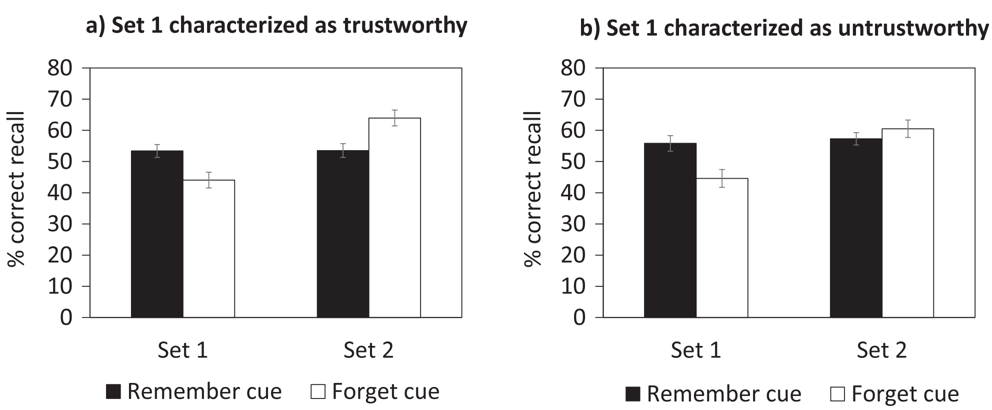

FIGURE 2 | Results of Experiment 2. Mean correct recall of facts from sets/texts 1 and 2, shown as a function of cue (remember cue, forget cue). Panel (a) shows results for when the news source for set/text 1 was characterized as trustworthy, panel (b) shows results for when it was characterized as untrustworthy. Error bars represent ±1 standard error of the mean.

3.3 | Discussion

Applying texts as study materials that contained loosely related facts on the same political candidate, Experiment 2 confirmed that information from a news source can be intentionally forgotten, which may also come with a benefit for a subsequently studied text. Importantly, Experiment 2 also suggested that this pattern was not affected by whether to-be-forgotten or to-be-remembered text was described as coming from a trustworthy or an untrustworthy source. In fact, the trustworthiness of Set 1 had no significant effect on recall of either Set 1 or Set 2 (see also Abel and Bäuml 2023, for similar findings on item-method directed forgetting).

A recent study (Pasttter and Haciahmet 2022) reported no significant forgetting when prose passages were used in a three-list version of LMDF. The relatively long prose passages were not connected, however, and dealt with entirely different topics (providing information on Dorothea Dix, an advocate for the mentally ill; on a house, designed by famous architect Frank Lloyd Wright; and on Georgia O'Keeffe, a modernist painter). Theoretical accounts stress the importance of between-list interference for the elicitation of voluntary forgetting in LMDF (Bjork 1970; Pastötter and Bäuml 2010). When texts cover entirely different topics, interference may be too low to elicit LMDF. The present Experiment 2, however, suggests that LMDF can be intact if text materials deal with the same overarching topic (e.g., a specific politician) and present a series of loosely related facts with little hierarchical organization (see also Scully and Hupbach 2020).

4 | General Discussion

In two experiments, we examined if it was possible for voluntary forgetting in the form of LMDF to render encoded, but untrustworthy information less accessible in memory. Both experiments found intact directed forgetting of information from an untrustworthy source, which was accompanied by a significant benefit for subsequently studied information from a trustworthy source. This pattern was present for unrelated news headlines in Experiment 1 and also for loosely related information from a newspaper report in Experiment 2. Moreover, Experiment 2 clarified that trustworthiness prompts had no independent effect, and that forgetting of Set 1 and benefits for Set 2 were present regardless of whether the source of Set 1 was characterized as trustworthy or untrustworthy.

A recent study by Abel and Bäuml (2023) found intact item-method directed forgetting of news headlines, which, similar to the present results, was unaffected by the supposed trustworthiness of the headlines. Item-method directed forgetting is usually attributed to selective rehearsal of to-be-remembered contents at encoding (Basden et al. 1993; Basden and Basden 1996; Bjork 1972; Woodward and Bjork 1971). In contrast, LMDF is attributed to reduced accessibility at retrieval; either as a consequence of an inhibitory control mechanism (Geiselman et al. 1983) or as a consequence of mental context change (Sahakyan and Kelley 2002). Therefore, together, the studies may suggest that directed forgetting can rather generally affect memory for information from news reports, irrespective of whether the forgetting operates at encoding or retrieval. An interesting question for future research may concern the consequences of voluntary forgetting. To what degree are subsequent judgments, choices, and behavior affected by shifted access to information in memory? Indeed, working with the relatively large forgetting effects in the item-method directed forgetting task, Abel and Bäuml (2023) additionally examined perceived truth. They found a small effect of forget cues, such that headlines cued to be forgotten were later judged as slightly less true than completely new headlines. Although forgetting effects tend to be smaller in the LMDF task, future work could follow the same approach and examine the consequences of forgetting. For example, an open question is whether directed forgetting of news contents may influence an individual's subsequent tendency to spread the information and share it with others.

The experiments so far suggest that directed forgetting can affect memory for both trustworthy and untrustworthy information, and as such, directed forgetting may not always help to curtail the spread of untrustworthy information. In daily life, motivation to try to remember or forget trustworthy or untrustworthy information may be highly variable across individuals, and it may additionally depend on the specific contents or the surrounding situation. For example, if planning on voting in upcoming federal elections, learning that information about a particular political candidate came from an untrustworthy source might still be enough reason to try to forget it and to focus on trustworthy information instead, so as to be able to cast one's vote based on correct information. In other cases, people may however be more motivated to forget information that runs counter to their belief that a particular candidate would be best suited for office, even when the source of the information is trustworthy. Future work is clearly needed on this front, to better understand the relationship between (individual) motivation and voluntary forgetting in real-world contexts.

Some aspects of the present study should be explicitly mentioned as limitations. For example, output order was not controlled at test, and participants were simply asked to recall any information that they still remembered, which might be closest to attempts to recall information in daily life. Nevertheless, as a consequence, participants in the remember condition may more frequently have started recall with information from Set 1, whereas participants in the forget condition may more frequently have started recall with information from Set 2. Although biasing effects of output order may typically be small (Delaney et al. 2020) and unlikely to provide an explanation for the observed effects in LMDF (Geiselman et al. 1983), it may still be desirable to control output order in future studies. Another issue is that trustworthiness was manipulated in this study by explicitly characterizing fictitious newspaper sources as trustworthy or untrustworthy. This manipulation did not have any major effect on memory, but it cannot be excluded that participants may simply have disregarded the provided prompts, especially because the news sources were fictitious and unknown to them.

Further aspects of the present experiments were focused on making them as comparable to real-world situations as possible. For example, we used real news headlines accompanied by photographs in Experiment 1, and formatted texts such that they visually resembled real news reports in Experiment 2.

Nevertheless, there are still aspects of the experimental set-up that are removed from real-world applications. One aspect to consider here is that we only used factually correct news headlines in Experiment 1, and made-up information about a fictitious political candidate in Experiment 2. Although these choices were made for good reasons, they may nevertheless pose a limitation, inasmuch as we cannot address if the same results would be obtained with actual fake news items and incorrect information about a real political candidate.

Another aspect concerns encoding. Both experiments applied intentional encoding, which is the standard in LMDF experiments. In daily life, news items may however often be encoded in a more incidental manner, without a specific intention to try to memorize and later remember the contents. For sets of unrelated words, prior work has shown intact LMDF with incidental encoding (Abel and Bäuml 2019; Geiselman et al. 1983; Sahakyan and Delaney 2005, 2010; White and Marks 2004). These studies exclusively relied on orienting tasks with deep processing in the form of pleasantness ratings, however. Whether this finding generalizes to different orienting tasks as well as to more complex materials has never been examined. It should be a priority for future work to fill this empirical gap.

In sum, the present study suggests that information from an initial news source can be voluntarily forgotten, which can benefit memory for subsequently encoded information from another news source. Future work is needed to address if these effects on memory for news contents may also influence an individual's subsequent judgments and actions, and to what degree they may vary with an individual's goals and motivations.

Author Contributions

Magdalena Abel: conceptualization, methodology, formal analysis, writing – review and editing, writing – original draft. **Karl-Heinz T. Bäuml:** conceptualization, methodology, writing – review and editing.

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Ethics Statement

The experiments were carried out in accordance with the provisions of the World Medical Association's Declaration of Helsinki.

Consent

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data and materials for all experiments are available on the Open Science Framework (https://osf.io/m58a6/).

Endnotes

[1] Prior work has shown that exposure to fake news alone can increase participants' actual belief in the information (Pennycook et al. 2018). Out of ethical concerns, we refrained from exposing our participants to real fake news headlines from untrustworthy sources in the present experiments.

[2] This strategy for analyzing the recall data was used in both experiments reported in this study. We also looked into two alternative ways of data coding to ensure that including partially correct responses did not distort the results. With strict coding, all partially correct responses were scored as 0s; with liberal coding, they were scored as 1s. Yet, the main results were not affected by the type of coding in any of the experiments. Because including partially correct responses most closely resembles participants' responses, we decided to use this approach.

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Appendix A

See Appendix A

Analysis of Source Memory Performance

Although not routinely examined, source memory for correctly recalled items can also be addressed in LMDF. In both Experiments, participants were asked to decide for each recalled item whether it belonged to the first or second set of previously studied information. Prior studies suggest that forget cues can also reduce correct source attributions for Set 1, whereas improved source attributions for Set 2 were not found in all studies (e.g., Bjork and Bjork 2003; Geiselman et al. 1983; Hanczakowski et al. 2012; Sahakyan and Delaney 2005; White and Marks 2004).

Experiment 1

Mean correct source attributions for recalled headlines from both sets is shown in panel (a) of Figure A1. A 2×2 ANOVA showed a significant main effect of set, $F(1,75)=32.79$, $MSE=0.03$, $p<0.001$, $\eta^2=0.30$, reflecting better source memory for the second than for the first set of headlines (96.0% vs. 78.8% correct). There was neither a significant main effect of cue, $F(1,75)=0.11$, $MSE=0.05$, $p=0.744$, $\eta^2=0.001$, nor a significant interaction between the two factors, $F(1,75)=3.85$, $MSE=0.03$, $p=0.054$, $\eta^2=0.05$. Source memory did not differ significantly between participants who had received remember or forget cues; neither for Set 1 (82.8% vs. 75.3%), $t(76)=1.31$, $p=0.193$, $d=0.30$, 95% CI [−0.15, 0.74], nor for Set 2 (93.7% vs. 98.3%), $t(43.93)=-1.46$, $p=0.152$, $d=-0.33$, 95% CI [−0.78, 0.11].

Experiment 2

Mean correct source attributions for recalled facts from both texts is shown in panel (b) of Figure A1. A 2×2×2 ANOVA with the factors of set, cue, and Set-1 trustworthiness was performed. It showed a significant main effect of set, $F(1,187)=13.07$, $MSE=0.02$, $p<0.001$, $\eta^2=0.07$, reflecting slightly better source memory for the second than for the first studied text (93.5% vs. 88.4% correct). There was also a significant main effect of cue, $F(1,187)=9.47$, $MSE=0.02$, $p=0.002$, $\eta^2=0.05$, but no significant interaction between cue and set, $F(1,187)=2.83$, $MSE=0.02$, $p=0.094$, $\eta^2=0.02$. Source memory was higher when participants had received remember rather than forget cues; in single comparisons (independent samples *t*-tests, two-tailed), this difference was, however, only significant for the first studied text (91.9% vs. 84.7%), $t(162.05)=2.92$, $p=0.004$, $d=0.42$, 95% CI [0.14, 0.71], not for the second studied text (94.7% vs. 92.3%), $t(170.89)=1.47$, $p=0.145$, $d=0.21$, 95% CI [−0.07, 0.50]. The ANOVA showed no significant main or interaction effects involving the factor Set-1 trustworthiness (all $Fs(1,187)\leq 1.45$, $ps\geq 0.230$, $\eta^2\leq 0.01$; for further work on the interplay between trustworthiness and source memory, see for example Bell et al. 2021; Nadarevic and Erdfelder 2019; Niedzialkowska and Nieznanski 2021).

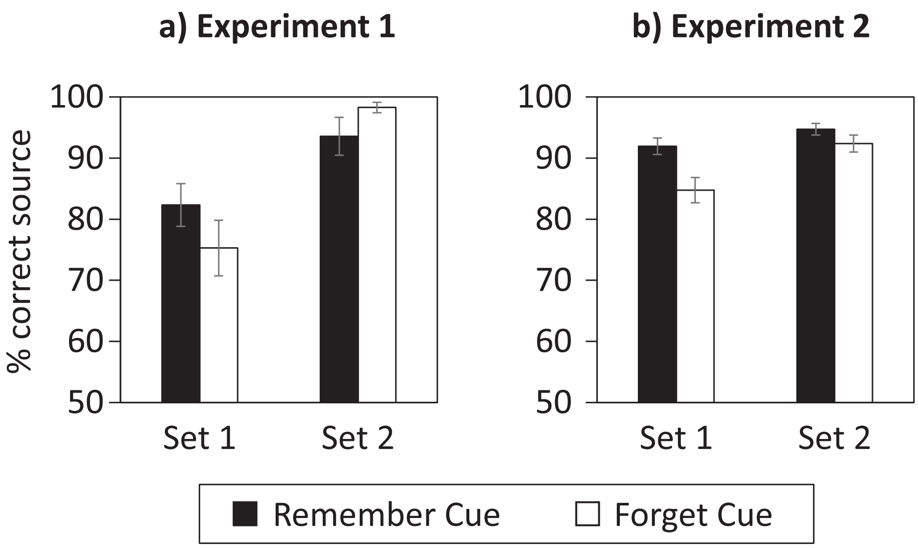

FIGURE A1 | Mean correct source attributions for information from sets 1 and 2, shown as a function of cue (remember cue, forget cue). Error bars represent ±1 standard error of the mean.