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Altering the past to shape the future: Manipulating information accessibility to influence case-based reasoning☆

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ABSTRACT

One strategy for decision-making involves the process known as case-based reasoning, where individuals retrieve past decisions in similar cases, compare the new and old situation, and adapt previous decisions to the new context. However, remembering past cases is a selective process. Research on retrieval-induced forgetting found that retrieving a subset of information about a certain topic causes forgetting of related information. In two experiments we use retrieval-induced forgetting to activate and deactivate similar features between a new case and past cases. We measured whether this intervention impacted decision-making about a controversial policy and whether the positive and negative outcomes of past cases influenced both information accessibility and decision-making. Study 1 demonstrated socially-shared retrieval-induced forgetting: hearing others talk about non-critical features from the past cases reduced memory accessibility of critical but unmentioned features of the positive past case (i.e., success), but not for negative past case (i.e., failure), compared with a control condition. Study 2 demonstrated that individuals' decisions were consistent with the manipulated memory pattern. Individuals were less supportive of the controversial policy in a new case when they heard non-critical information in the positive past case, whereas individuals were no less supportive when hearing non-critical information in the negative past case, compared with the control condition. We speculate that failure to trigger retrieval-induced forgetting in negative cases might be due to a negativity bias in information processing. We discuss the implication of these results for real-world phenomena involving people using the past to reason about the future.

One strategy for decision-making involves retrieving past decisions in similar circumstances, comparing the new and old situation, and adapting previous decisions to the new context, a process known as case-based reasoning. If the circumstances of the old and new situations are similar enough, then the decision reached in the old case should be informative for the new case under consideration. Case-based reasoning has been widely used to make consequential decisions. Military personnel used it to deliberate about the troop deployment strategy in Vietnam (Khong, 1992), politicians used it to make decisions about the Iraq invasion in 1991 (Voss, Kennet, Wiley, & Schooler, 1992), and negotiators used it to attempt hostage rescue missions in Iran in 1980 (Hemmer, 2000). An extensive body of research explores how case-based reasoning has been deployed to assist with decision-making (Axelrod & Forster, 2017; Kolodner, 1993). In the present research, we focus on the underlying socio-cognitive processes involved when people engage in case-based reasoning. We will test how manipulating information accessibility of previous cases in memory impacts case-based reasoning in a current case. Such an investigation is important for both theoretical and practical reasons. On the theoretical side, we would be providing a socio-cognitive scaffold to the processes involved in case-based reasoning. On the practical side, our findings would be of interest to policymakers who would be in a better position to understand how people make real-world decisions based on prior cases.

Psychologists have long established that the accessibility of information in memory affects judgments (Tversky & Kahneman, 1973). This general principle has been applied to analogical reasoning: The perceived similarity between two cases increases with the number of similar features that the two cases have in common and decreases with the number of dissimilar features the two cases share (Tversky, 1977). Key to evaluating this perceived similarity is the accessibility of

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similarities and dissimilarities that characterizes the comparison between the two cases. For example, "leopard" is perceived to be more similar to "tiger" than vice versa because a tiger's features are more accessible in one's memory (Tversky, 1977). If one could experimentally manipulate this accessibility, one could influence this perceived similarity and, through it, might bias people's decisions.

One well-established strategy to increase and decrease the accessibility of information in memory involves selectively rehearsing previously encoded information. An extensive literature has found that rehearsing previously encoded information results in better remembering of the rehearsed information—a rehearsal effect. However, this retrieval practice can also induce forgetting in unmentioned information that is related to the mentioned information—a retrieval-induced forgetting effect (Anderson, Bjork, & Bjork, 1994). As part of this paradigm, participants first learn category-exemplar pairs (e.g., *fruit-apple, fruit-orange; tree-oak, tree-pine*) and then receive selective retrieval-practice for some pairs by way of a stem completion task (e.g., *fruit-a__*). Analyses of a final recall task show that retrieval-practiced items (Rp + items / Retrieval practice plus: *apple*) are remembered better than *unrelated* and *unpracticed* items (Nrp items / No retrieval practice: *oak, pine*)—a rehearsal effect. Items that were *unpracticed* but *related to* those practiced (Rp– items / Retrieval practice minus: *orange*) are remembered worse than Nrp items—a retrieval-induced forgetting effect (RIF). For a more accessible example, if one tries to recall what one had for dinner last Wednesday evening (Rp+), one could trigger a rehearsal effect for Wednesday's dinner and a retrieval-induced forgetting effect for Thursday's dinner (Rp-). This would lead to better memory for Wednesday's dinner and worse memory for Thursday's dinner compared to a situation where no attempt to remember Wednesday's dinner occurred. The rehearsal effect is thought to occur because of trace strengthening (Karpicke & Roediger, 2007), whereas retrieval-induced forgetting is thought to arise because of inhibitory processes triggered by response competition during the retrieval practice phase (Anderson & Levy, 2009; Kuhl, Dudukovic, Kahn, & Wagner, 2007; but see Mensink & Raaijmakers, 1988, for an alternative account). Retrieval-induced forgetting is a well-established phenomenon that has been found with various stimulus materials, recall tasks, and delay intervals (see Murayama, Miyatsu, Buchli, & Storm, 2014, for a meta-analysis).

Retrieval-induced forgetting (RIF) also occurs in social interactions. A selective retrieval-practice that occurs in a free-flowing conversation was found to produce similar rehearsal and retrieval-induced forgetting effects for both speakers and listeners (Cuc, Koppel, & Hirst, 2007). In this paradigm, participants study information in category-exemplar structures (e.g., stories) and are then exposed to selective retrieval-practice by listening to another person (e.g., face-to-face interaction) selectively recounting the initially studied story. Finally, participants individually recall the initially studied information. A now extensive literature shows that listening to someone else rehearse information results in *socially-shared retrieval-induced forgetting* (SS-RIF; Barber & Mather, 2013; Hirst, Yamashiro, & Coman, 2019; Stone, Barnier, Sutton, & Hirst, 2010). SS-RIF has been reliably observed with reaction time measurements that measure how accessible a memory is (Coman, Manier, & Hirst, 2009; Veling & van Knippenberg, 2004).

A series of studies have shown that experimentally manipulating the accessibility of memories impacts medical decision-making (Coman, Coman, & Hirst, 2013; Vlasceanu & Coman, 2018; Weber, Bockenholt, Hilton, & Wallace, 1993; Monteiro et al., 2020) and analogical problem-solving (Valle, Gómez-Ariza, & Bajo, 2019), the strength with which people hold attitudes about euthanasia (Coman & Hirst, 2012), and the degree of endorsement of stereotyped identity (Dunn & Spellman, 2003). There are, however, several open questions regarding how retrieval-induced forgetting (RIF) could impact judgment and decision-making. For instance, previous research focused on the impact of manipulating mnemonic accessibility of existing information on decision-making (Coman et al., 2013). But reasoning—defined as the computational process of reaching conclusions from operating with facts and/or premises—is different from decision-making, which is seen as an outcome of the reasoning process (see Johnson-Laird & Shafir, 1993, for a discussion of the interaction between these processes). The current investigation focuses on altering the reasoning process and, therefore, goes beyond prior investigations. At the same time, we aim to expand the usefulness of psychological phenomena in understanding policy-relevant domains beyond medical decision-making and stereotyping. One such area involves the influence that experts, pundits, and politicians could exert in persuading the public to support or oppose certain policies.

In addition to investigating the potential influence of information accessibility on case-based reasoning, we also aim to understand whether the valence of case outcomes will modulate the influence of memory on decisions. In other words, by using retrieval-induced forgetting, could one reduce the accessibility of information similarly for cases that have positive and negative outcomes? On the one hand, in the domain of autobiographical memories, existing research shows that a reduction of accessibility can be attained regardless of emotional valence. That is, emotionally positive memories were as likely to be forgotten as emotionally negative memories (Barnier, Hung, & Conway, 2004). On the other hand, loss frames (involving negative consequences) have been found to be "stickier" than gain frames (involving positive consequences) (Iglesias-Parro & Gómez-Ariza, 2006; Ledgerwood & Boydstun, 2014), and therefore, could be harder to suppress in memory. A well-established literature showed that individuals are more sensitive to negative than positive information—a phenomenon known as the negativity bias (Rozin & Royzman, 2001). Based on this literature, it is possible that cases with a negative outcome would be harder to suppress than cases with a positive outcome.

In two studies, we present different policy scenarios based on a real-world policy program aimed at tackling extreme poverty (i.e., Millennium Village Project; Sachs, 2008). Participants are randomly assigned to experimental and control conditions with or without the presence of memory manipulation. They read different cases and undergo repeated-measures of memory assessment. In Experiment 1, we provide participants with two past cases for which the outcomes of the anti-poverty policy implementation differ: one case with positive and one case with negative outcomes. We will explore whether the accessibility of critical information pertaining to the two cases is reduced following a selective retrieval-practice manipulation that involves a social interaction. In Experiment 2, we reason that when people have to make a decision about a new case that is equally similar to the two previous cases, then forgetting critical features that are shared between the past and current case should impact people's decisions about the new case.

1. Experiment 1

In Experiment 1, we test whether selectively rehearsing irrelevant information from past cases induces forgetting of critical information from these cases, and whether the valence of case outcomes influences information accessibility. Specifically, we will test whether listening to a speaker talk about non-critical information in a past case will result in the forgetting of the critical information, relative to a control condition that does not involve listening to a speaker discuss non-critical information.

1.1. Method

We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study.

1.1.1. Participants

Three hundred participants were recruited from Amazon Mechanical Turk (43% female, *Mean age* = 36.82, *SD* = 10.80; 5.1% self-identified as Asian or Asian American, 8.3% Black or African American, 5.1% non-

White Latinx, 78.3% White or European American). The sample size was determined before any data analysis. We were aiming for a final sample of 255 participants (85 per condition) to detect a main effect size of 0.50 for retrieval type with a 0.90 power. We used two pre-established exclusion criteria: (1) not completing the recognition test[1] ($N = 23$ excluded participants) and (2) having at-chance recognition rates ($N = 24$ excluded participants). The final sample was composed of 253 participants (43.08% female, *Mean age* = 37.13, *SD* = 10.57), randomly assigned to three conditions: the *Deactivate success* condition ($N = 75$), the *Deactivate failure* condition ($N = 86$), and the *Control* condition ($N = 92$).

1.1.2. Experimental design and procedure

Participants first read information about an existing poverty intervention program—the Millennium Village Project—and were told that the success of this program is debated among policy makers, with the general consensus being that in some villages the program led to systemic failures, while in other villages it promoted meaningful positive change. This is indeed an accurate depiction of the program (Clemens & Demombynes, 2011; Tollefson, 2015). The purported goal of the study, participants were told, was to use the power of online communities to evaluate the efficiency of the Millennium Village Project intervention.

In the case presentation phase, participants were shown information about the features and outcomes of two villages (Case Siora and Case Polto) targeted by the Millennium Village Project. The order of the case presentation was counterbalanced across participants. The village features were neutral while the outcome items were valenced (i.e., either positive or negative). For *Case Siora*, Kenya (Positive case), the description included two critical features ("a relatively small population" and "closeness to urban markets") and one non-critical feature (that an anti-HIV campaign was implemented in the village). For outcome information, the implementation was positive (i.e., "increased agricultural yields" and "improved water supply"). For *Case Polto*, Senegal (Negative case), the description also included two critical features ("minimal temperature fluctuations" and "richness in mineral resources") and one non-critical feature (that an anti-Malaria campaign was implemented in the village). The outcome of the program implementation was negative (i.e., "erosion of soil structure" and "worsened social divisions"). We pre-tested these items with an independent sample of 60 participants (38.22% female, *Mean age* = 31.62, *SD* = 10.32) to ensure that the different items were equally relevant (with a survey item "how relevant is [item] as a consideration of Millennium Villages Project implementation?" from 1-not relevant at all to 7-extremely relevant) and equally memorable (with a cued recall task) between the two cases (p's > 0.1 for all pair-wise comparisons within-subject).

In the retrieval-practice phase, participants were randomly assigned to one of three conditions: *Deactivate success, Deactivate failure,* and *Control condition*. In the *Deactivate success condition,* they listened to a 3-minute radio interview discussing the non-critical feature from the past success case (Case Siora, Kenya). Participants were instructed to pay attention to the information presented in the radio show because their memory would be tested in a later phase. Therefore, the non-critical feature of the success case constituted Rp+ items (retrieval-practiced items), the remaining unpracticed critical features in the success case were Rp- items (unpracticed items related to practiced items), and all features of the failure case were Nrp items (unpracticed items unrelated to practiced items). In the *Deactivate failure condition,* participants listened to the non-critical feature from the past failure case (Case Polto, Senegal). Therefore, the non-critical feature of the past failure case was Rp+, the remaining unpracticed critical features in the failure case were Rp- items, and all features of the success case were Nrp items. Participants in the *Control condition* completed a 3-minute distractor task that involved answering a questionnaire of internet habits and voting behaviors instead of the retrieval-practice phase.

The final recognition phase involved a yes/no recognition task for which we recorded reaction time. Participants were presented with a name of a village (either Polto or Siora) and were asked to indicate whether the village had a critical feature or not. A statement based on each of the items from the two cases appeared at the center of a computer screen, followed by a recognition probe, and participants were asked to indicate whether the probe accurately depicted the information they studied. The recognition probe consisted of at most three words and was either an accurate or inaccurate piece of information from the two cases. Each participant was presented with 12 statements and probes with regard to Case Siora and 12 statements and probes with regard to Case Polto (for a total of 24 recognition trials) in a randomized order (See OSF for the material: https://osf.io/5wkqj/). Half of the recognition probes were *True* and half were *False*. Consistent with the retrieval-induced forgetting literature (Coman et al., 2009; Veling & van Knippenberg, 2004), the probes involving statements depicting the village features and outcome information always required true answers, while the false probes were comprised of information that never appeared in the case presentations or false information pertaining to filler items that were used in the village descriptions.

1.2. Results

This experiment was designed to test whether we can alter the information accessibility of the past cases using a socially-shared retrieval-induced forgetting paradigm. As a preview of the results, we found a retrieval-induced forgetting effect only for the past success case, but not for the past failure case. This suggests that past failure cases might be more resilient to retrieval-induced forgetting than past success cases, for reasons that we will address in the discussion section.

To test this hypothesis, we first measured the reaction time (RTs) for hits as a proxy for information accessibility of the past cases (see SI Fig. 1 for accuracy results). For each participant, we checked whether there were reaction times that were 3 standard deviations above or below the participant's mean reaction time (0% of the data). We then normalized the reaction times within each participant so that reaction times range from −1 (fastest) to +1 (slowest) (Whelan, 2008).

A mixed ANOVA with Condition (*Deactivate Success* vs. *Deactivate Failure*) as a between-subject factor and Retrieval Type (Rp+, Rp-, and Nrp)[2] as a within-subject factor revealed a significant main effect for Retrieval Type (Rp+, Rp-, Nrp), $F(2, 316) = 14.78$, $p < .001$, Cohen's $f = 0.29$ (see Fig. 2). As expected, no main effect for Condition, $F(1, 157) = 0.93$, $p = .34$, $f < 0.001$, or interaction effect, $F(2, 314) = 1.84$, $p = .16$, $f = 0.07$, was found. Post hoc analyses were conducted separately for the retrieval practice effect (i.e., Rp+ vs. Nrp) and socially-shared retrieval-induced forgetting effect (i.e., Nrp vs. Rp-). We found that participants' reaction times were faster for Rp+ items ($M = -0.22$, $SD = 0.53$, CI = [−0.28, −0.15]) than for Nrp items ($M = -0.08$, $SD = 0.34$, CI = [−0.12, −0.03]), $t = 2.65$, $p = .009$, $d = 0.32$. Reaction times were also faster for Nrp ($M = -0.08$, $SD = 0.34$) items than for Rp- items ($M = 0.07$, $SD = 0.35$, CI = [0.03, 0.11]), $t = 2.98$, $p = .003$, $d = 0.42$. Thus, we found both a practice effect and a retrieval-induced forgetting

[1] The incompletions were due to system compatibility issues with the Inquisit Web program which we used for memory assessment or refusing to download the program (even though we highlighted the need to download the software in order to complete the study in the study description).

[2] The Control condition cannot be entered in this analysis, since it does not involve an Rp+, Rp-, Nrp designation.

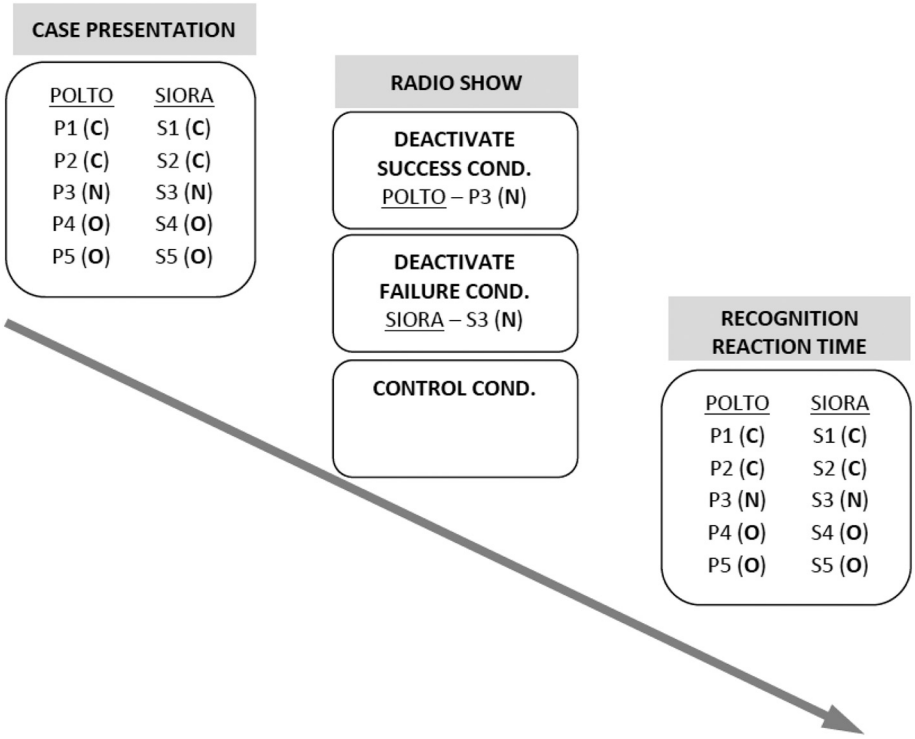

Fig. 1. Study 1 Experimental Procedure.
Note. In the case presentation phase, participants study two cases of villages that are part of a poverty-reduction program, one with a positive outcome (i.e., success) and one with a negative outcome (i.e., failure). In each case, two items are critical village features (C), one item is a non-critical village feature (N), and two items are outcome information (O). Critical village features were equated for memorability and relevance. Next, participants are assigned to one of three conditions in a between-subjects design: *Deactivate success condition* (radio show mentions non-critical village feature from the success case), *Deactivate failure condition* (radio show mentions non-critical village feature from the failure case), or *Control condition* (a distractor task that did not mention the previously studied information). Finally, in the Yes/No recognition task, we record the time it takes for participants to respond to the recognition prompt, for a measure of information accessibility.

effect.[3]

Since we set out to explore differences between the *Deactivate success* and *Deactivate failure* conditions, we tested the level of socially-shared retrieval-induced forgetting within each treatment condition (see Fig. 2). For the *Deactivate success* condition, we found a marginal retrieval practice effect ($t = 1.87$, $p = .09$, $d = 0.28$) and a significant socially-shared retrieval-induced forgetting effect ($t = 3.70$, $p < .001$, $d = 0.71$). For the *Deactivate past failure* condition, while the retrieval practice effect was present ($t = 2.02$, $p = .047$, $d = 0.36$), there was no socially-shared retrieval-induced forgetting effect ($t = 0.32$, $p = .75$, $d = 0.06$), indicating that accessibility of memories related to the past failure case was not reduced.

As a robustness check, we also conducted independent *t*-tests comparing the reaction times for designated items between the treatment conditions and the same items in the *Control* condition. We conducted this analysis to ensure that the results we obtained were due to the retrieval practice manipulation, rather than any features of the information content. Comparing the *Deactivate past success* and the *Control* conditions, the reaction time for Rp- items was significant slower in the *Deactivate past success* condition ($M = 0.11$, $SD = 0.35$) than the reaction time for the same items in the *Control* condition ($M = -0.11$, $SD = 0.56$), $t = 3.13$, $p = .002$, $d = 0.47$. However, there was no significant difference between the reaction times for Rp- items in the *Deactivate past failure* ($M = 0.02$, $SD = 0.36$) and the *Control* condition ($M = -0.03$, $SD = 0.32$), $p = .35$, $d = 0.15$. This solidifies the conclusion that critical features in the negative case were harder to forget than those in the positive case. For both Rp+ and Nrp items, the reaction times were not significantly different between the treatment conditions and the Control condition.

[3] We conducted a sensitivity power analysis with alpha at the conventional 0.05 level with sufficient power (beta > 0.80), our overall sample size ($N = 253$) would be sensitive to detect an effect size of $d_z = 0.177$ for difference in retrieval practice types. Within the *Deactivate success* condition ($N = 75$), it would be sensitive to detect an effect size of $d_z = 0.327$; for the *Deactivate failure* condition ($N = 86$), it would be sensitive to detect an effect size of $d_z = 0.306$.

1.3. Discussion

In summary, our experimental manipulation—listening to others selectively rehearse non-critical information—induced forgetting of critical features in the past success case but did not induce forgetting of critical features in the past failure case. Our results suggest an asymmetry between the likelihood of information forgetting depending on the valence associated with the provided information. Memories of negative information might be more difficult to forget than those of positive information, which is consistent with a negativity bias in risk preferences (Ledgerwood & Boydstun, 2014) and personnel decision-making (Iglesias-Parro & Gómez-Ariza, 2006). Next, we will test whether individuals' decision pattern is consistent with the asymmetrical forgetting we observed in Experiment 1.

2. Experiment 2

Experiment 1 established an asymmetry between the retrieval-induced forgetting of critical items in the negative and positive outcome conditions. In Experiment 2, we built on Experiment 1 to incorporate a case-based reasoning component. During the case presentation phase, a target village that was supposedly considered for future Millennium Village Project implementation was presented in addition to the two past villages described in Experiment 1. For this experiment, we measured decisions instead of memories. The decision to discard the memory task was made because using a recognition task before the decision task would have contaminated the decision-making process. We hypothesized that an experimental manipulation to induce forgetting in the shared features between the past successful case and the current case would result in reduced support for intervention in the current case, relative to a control condition. Given that we found no retrieval-induced forgetting effect for the failure case, we expect no difference between a condition aimed at suppressing similarity with the past failure case and the current case relative to a control condition (see SI Figure 4 for a graphical illustration of the hypothesis).

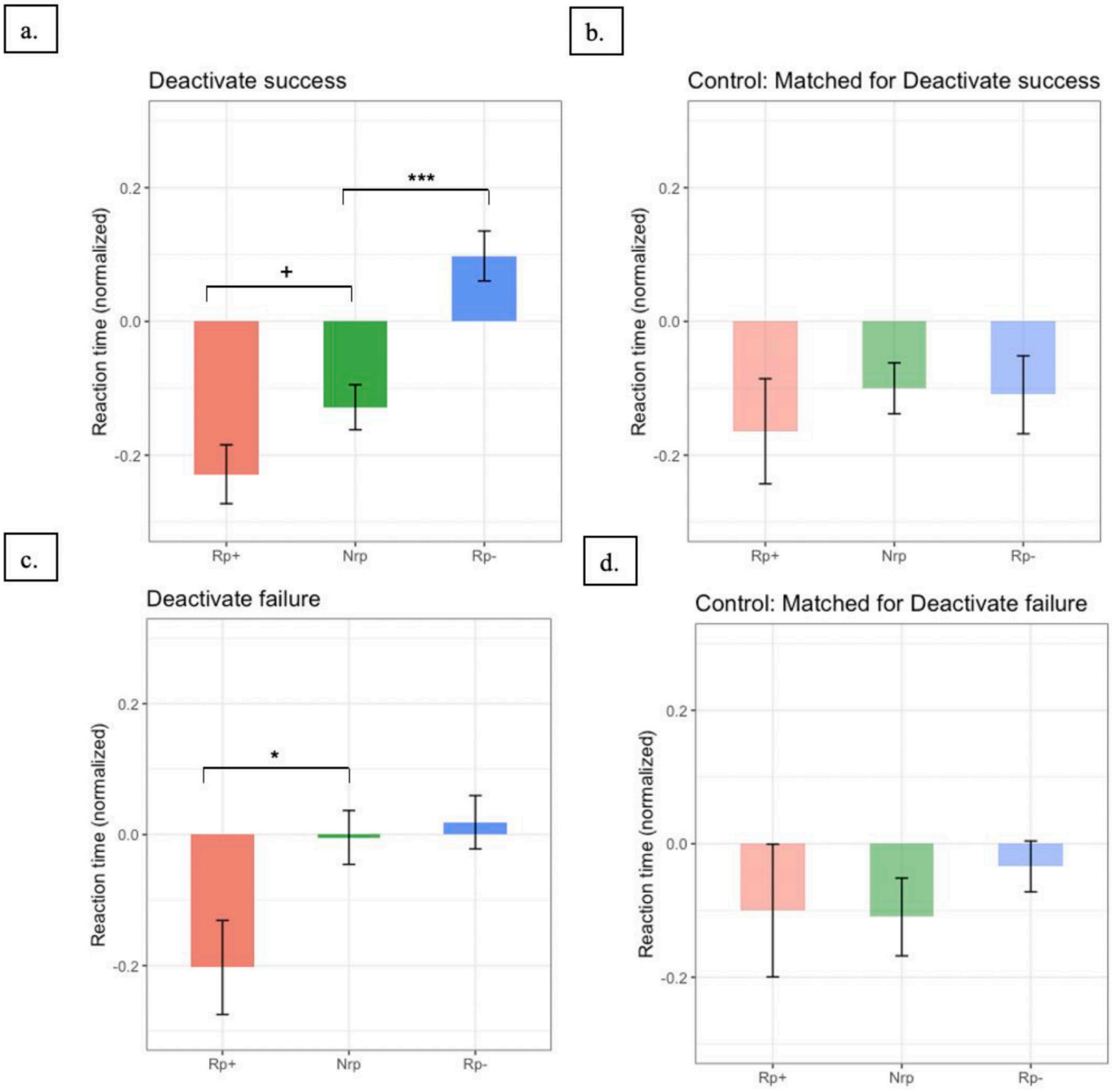

Fig. 2. Reaction Times for the Experimental Conditions (*Deactivating Success* and *Deactivating Failure*) Separately, and for Matched Items in the *Control Condition. Note.* Panels a and c depict the normalized reaction time for Rp+ (retrieval-practiced items), Nrp (unpracticed items unrelated to practiced items), and Rp- (unpracticed items related to practiced items) items in the two experimental conditions (*Deactivating Success and Deactivating Failure*). Retrieval-induced forgetting was observed in the *Deactivate Success condition,* but not in the *Deactivate Failure condition.* Panels b and d depict the normalized reaction time comparing the corresponding items in the *Control* condition matched for the same items from the experimental conditions. There was no significant difference in reaction time between different items in the cases. Error bars depict standard errors. $^{+}p < .1$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

2.1. Method

2.1.1. Participants

Two hundred and ninety-eight participants were recruited over Amazon Mechanical Turk to take part in this experiment (48.48% female, *Mean age* = 35.26, *SD* = 10.05; 4.0% self-identified as Asian or Asian American, 9.7% Black or African American, 5.7% non-White Latinx, 78.9% White or European American). Sample size was determined before any data analysis. We were aiming for a final sample of 300 participants (100 per group) to detect an effect size of 0.45 with 0.90 power. Participants were randomly assigned to three conditions: the *Deactivate success* condition ($N = 99$), the *Deactivate failure* condition ($N = 96$), and the *Control* condition ($N = 103$). No participant was dropped for this experiment (everyone completed the study). The analyses were conducted on the entire sample.

2.1.2. Experimental design and procedure

The experimental design and procedure were similar to those of Experiment 1 in most respects except that after the retrieval practice (3-minute radio interview), a new target village with shared features of the

past villages was introduced and participants were asked to make judgments about whether the Millennium Village Project should be implemented in the new village (see Fig. 3). For the new target case, labeled as Molbe, Tanzania, the critical features were "minimal temperature fluctuations," "richness in mineral resources," "a relatively small population," and "closeness to urban markets." We designed the target case so that it shared two critical features with Case Siora (Success case in Experiment 1) and another two critical features with Case Polto (Failure case in Experiment 1). Thus, theoretically, the target case should be equally similar to both past cases. Indeed, results from a pilot study with a separate sample of MTurk participants ($N = 64$; 48.40% female; *Mean age* = 37.30, $SD = 13.83$) showed that the target village was perceived to be as similar to Case Siora ($M = 4.46$, $SD = 1.27$) as to Case Polto ($M = 4.49$, $SD = 1.21$; $p = .94$).

Similar to Experiment 1, in the case presentation phase, participants read an article introducing the Millennium Village Project and studied the features and outcomes of two villages in which the program was implemented in the past. The order of presentation was counterbalanced. In the retrieval-practice phase, participants were randomly assigned to three conditions: *Deactivate success, Deactivate failure,* and *Control condition*. Participants in the *Deactivate success* condition listened to a 3-minute radio interview in which the non-critical feature from the past successful case was discussed while participants in the *Deactivate failure* condition listened to a discussion about the non-critical feature of the past failure case. The participants in the *Control* condition completed a 3-minute distractor task involving a questionnaire of internet habits and voting behaviors instead of the retrieval-practice phase.

Following the radio interview (*Deactivate success* or *Deactivate failure* conditions) or distractor task (*Control* condition), all participants were presented with the novel target case that was supposedly evaluated for feasibility of future Millennium Village Project implementation. All participants were asked to make judgments about the implementation of the program in the target village. We measured the perceived outcome and support level of the program implementation in the target village. Participants rated the perceived outcome ("How do you foresee the outcome if the Millennium Village Project is implemented in Molbe, Tanzania?" with a 7-point Likert scale where 1 = complete failure and 7 = complete success), their support level of program implementation in the target village ("How supportive are you about the Millennium Village Project implementation in Molbe, Tanzania?" with a 7-point Likert scale where 1 = strongly oppose and 7 = strongly support). Participants were also asked to allocate a proposed percentage of the total U.S. budget among five issues: "Education & arts," "Foreign & crisis relief aid," "Poverty & hunger reduction," "Defense & intelligence," and "Corporate regulations." "Poverty & hunger reduction" and "Foreign & crisis relief aid" were the target of this measurement. Even though the budget allocation was not directly related to the target village, we hypothesized that there might be a downstream effect of the manipulation on participants' allocation decision.

2.2. Results

We designed Experiment 2 to investigate whether information accessibility impacts case-based reasoning. As a preview of the results, we found that the decision-making process was altered when we aimed to trigger retrieval-induced forgetting of the past success case, but not when we aimed to trigger retrieval-induced forgetting of the past failure case.

To test the hypothesis, we conducted a one-way analysis of variance (ANOVA) with Condition (*Deactivate success, Deactivate failure,* and *Control* condition) as a between-subjects factor and perceived outcome, support level of target village policy implementation, and budget contribution as separate dependent variables. There was a significant effect of *Condition* on both perceived outcome ($F_{(1, 296)} = 7.28$, $p = .007$, Cohen's $f = 0.22$) and support level of program implementation in the target village ($F_{(1, 296)} = 4.82$, $p = .03$, $f = 0.19$), but not for general budget contribution on poverty ($F = 0.19$, $p = .66$) (see Fig. 4).[4]

Post hoc tests revealed that participants rated the potential outcome of the program implementation (Millennium Village Project) in the target village significantly more negative when participants listened to the non-critical information in the past success village (i.e., *Deactivate success* condition; $M = 4.60$, $SD = 1.49$, $CI = [4.30, 4.90]$) than when participants listened to the non-critical information in the past failure case (i.e., *Deactivate failure* condition, $M = 5.14$, $SD = 1.17$, $CI = [4.91, 5.37]$, $t = -2.80$, $p = .006$, $d = 0.40$), and also than those in the *Control* condition ($M = 5.11$, $SD = 1.28$, $CI = [4.87, 5.36]$, $t = -2.59$, $p = .010$, $d = 0.37$). There was no statistically significant difference in perceived outcome between the *Deactivate failure* and the *Control* condition, as expected.

A similar pattern was obtained for post hoc tests for participants' support level for the new policy implementation in the target village. Participants who listened to the non-critical information about the past success case (i.e., *Deactivate success* condition) were significantly more likely to oppose the new policy implementation ($M = 4.78$, $SD = 1.46$, $CI = [4.31, 4.89]$) than those who listened to the non-critical information about the past failure village (i.e., the *Deactivate failure* condition; $M = 5.29$, $SD = 1.36$, $CI = [4.87, 5.41]$ $t = -2.53$, $p = .012$, $d = 0.36$), and than those in the *Control* condition ($M = 5.22$, $SD = 1.36$, $CI = [4.85, 5.38]$, $t = -2.20$, $p = .029$, d = 0.31). There was no statistically significant difference in the support level of the new policy implementation between the *Deactivate failure* condition and *the Control* condition.

We did not find any significant difference between conditions on participants' budget allocation to "Poverty & hunger reduction" and "Foreign & crisis relief aid." Since we did significance tests on multiple dependent variables, we used a joint significance test by conducting a multivariate analysis of variance (MANOVA) including all three dependent variables—perceived outcome, support level, and budget allocation for reducing hunger & poverty. A significant difference was found for all proposed dependent variables among the three experimental conditions, $F_{(1, 296)} = 3.65$, $p = .027$, $f = 0.13$.

2.3. Discussion

Consistent with the hypothesis, we found that participants' decision patterns correspond to the memory patterns. When they heard others talk about the non-critical information in a past success case (the *Deactivate Success* condition), participants were significantly less likely to expect success and support the implementation of the Millennium Village Project (MVP) in the new target case in Molbe, Tanzania. However, hearing others talk about the non-critical information in a past failure case (the *Deactivate Failure* condition) had no significant effect compared with the *Control* condition where no selective rehearsal of information took place. This further illustrates that past failure is more resilient to retrieval-induced forgetting and, because of this resilience, is less likely to impact case-based reasoning.

3. General discussion

Across two experiments, the results are consistent with the hypothesis that the reasoning process can be influenced by retrieval-induced forgetting. This influence is modulated by the valence of outcomes associated with the considered alternatives. In Study 1, we found that listening to others talk about the non-critical features from a past positive case induced forgetting in the critical but unmentioned features from the past positive case. Conversely, no such effect was found for the participants who listened to others talk about the non-critical features

[4] We conducted a sensitivity power analysis with alpha at the conventional 0.05 level with sufficient power (beta > 0.80), our overall sample size ($N = 298$, 3 conditions) would be sensitive to detect an effect size of $f = 0.180$ in a one-way ANOVA.

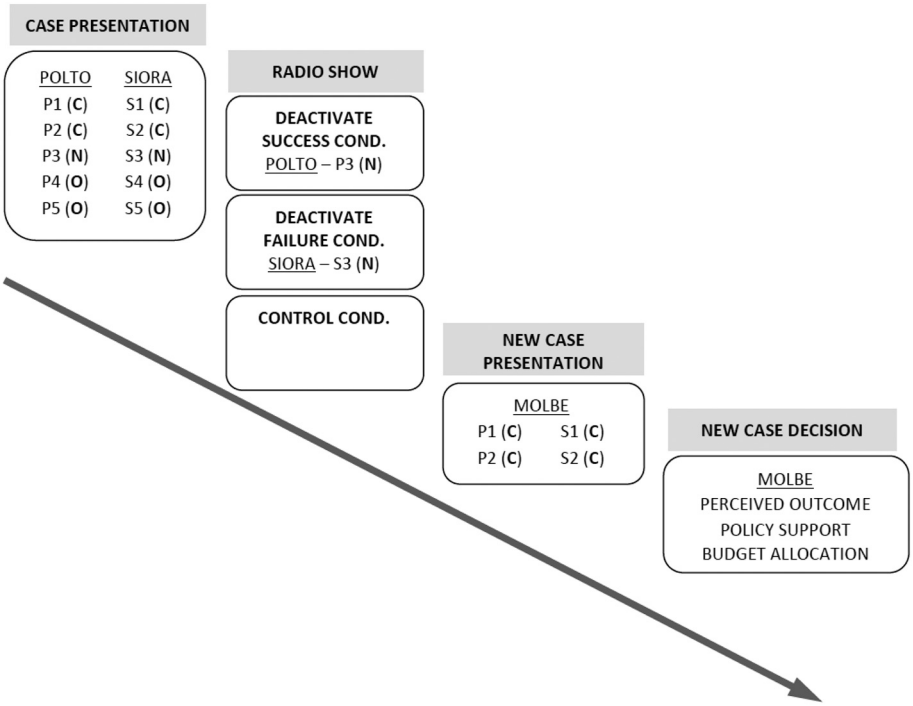

Fig. 3. Study 2 Experimental Procedure.
Note. In the case presentation phase, participants study two cases of villages that are part of a poverty-reduction policy program, one with a positive outcome and one with a negative outcome. In each case, two items are critical village features (C), one item is a non-critical village feature (N), and two items are outcome information (O). Critical village features were equated for memorability and relevance. The order of the case presentation is counterbalanced. Next, participants are assigned to one of three conditions: *Deactivate success condition* (radio show mentions non-critical village feature from the success case), *Deactivate failure condition* (radio show mentions non-critical village feature from the failure case), or *Control condition* (a distractor task). In the new case presentation phase, participants study a new target case for potential policy implementation. The new case shares the critical features from both the past success case and the past failure case. In the new case decision phase, participants predict the potential outcome of the new case, their support level of the policy implementation in the new case, and budget allocation in different policy areas.

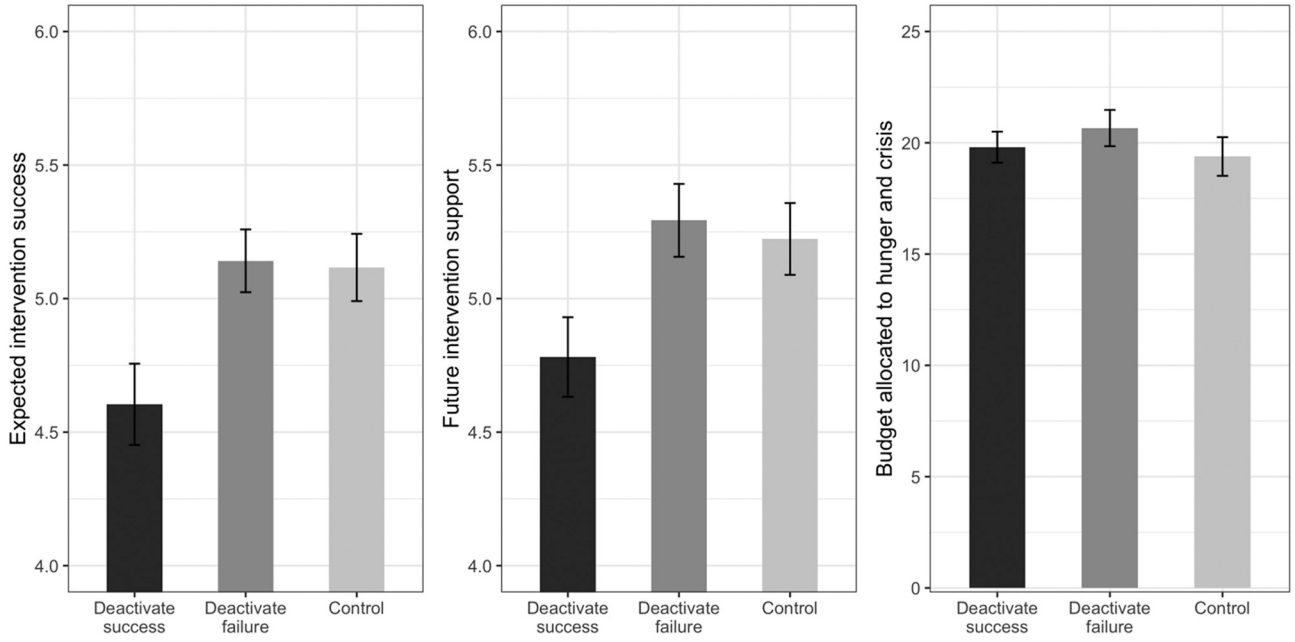

Fig. 4. Participants' Average Ratings for the Dependent Variables in Experiment 2.
Note. When non-critical information in a past success case was mentioned in the *Deactivate success condition*, participants were significantly less likely to expect success and support the intervention aimed to reduce extreme poverty in a new target case, compared with the *Deactivate failure and Control condition*. Error bars depict standard errors.

from the past negative case. This suggests an asymmetrical effect of positive versus negative case outcomes on information accessibility. The consequences of this asymmetrical effect on memory were further found in a decision-making task in Study 2, when participants were asked to predict the intervention outcomes of and indicate their support for a controversial policy program in a new case. After listening to others talk about the non-critical feature of a positive-outcome case that overlapped with the new case, participants were more likely to oppose the policy intervention. However, participants' decisions were not swayed when they listened to the non-critical feature of a negative-outcome case that overlapped with the new case.

To our knowledge, these are the first experiments that connect socially-shared retrieval-induced forgetting to case-based reasoning in a policy context. By investigating socio-cognitive processes through which individuals make decisions supporting or suppressing hunger and poverty reduction interventions, the current research provides a novel perspective on how memory influences decision making in policy-relevant contexts. The findings from the current research have

meaningful theoretical and practical implications. First, we show that retrieval-induced forgetting is attenuated when the information is associated with negative consequences. Second, memory encoding and suppression can be a potential mechanism of a negativity bias in the reasoning context. Third, information accessibility of similar features, rather than the objective similarity, impacts case-based reasoning. Practically, the findings elucidate the social dynamics involved in persuading audiences based on their memories of the past. Discussing irrelevant information aimed at suppressing critical information can effectively influence people's decisions. Below, we elaborate on each of the theoretical and practical implications.

The results we obtained advance our current understanding of how socially-shared retrieval-induced forgetting is attenuated in circumstances that involve emotional contexts (Murayama et al., 2014). On the one hand, past research finds retrieval-induced forgetting for neutral, positive, and negative autobiographical memories (Stone, Barnier, Sutton, & Hirst, 2013; Wessel & Hauer, 2006). On the other hand, several studies find that the degree of forgetting of negative items decreases as the emotional intensity of those items increases (Kuhbandner, Bäuml, & Stiedl, 2009; Storm & Jobe, 2012). Our results extend the boundary conditions of socially-shared retrieval-induced forgetting to contexts in which categories are associated with certain outcomes in a decision task. This points to the intriguing possibility that framing effects could modulate the extent to which memories are susceptible to alteration following retrieval-induced forgetting.

This research helps uncover some of the underlying mechanisms of negativity bias in a reasoning context. Individuals have a general tendency to be more sensitive to negative than positive information (Rozin & Royzman, 2001). We tend to pay more attention to the potential threats in our environment (Rozin & Royzman, 2001), are asymmetrically influenced by losses over gains (Kahneman & Tversky, 1979), and overweigh negative behavior in person perception (Fiske, 1980). A negative or loss frame has a more long-lasting impact than a positive or gain frame on individuals' judgments (Ledgerwood & Boydstun, 2014). As the current research suggests, a potential process underlying the negativity bias could come from the disruption of memory suppression phenomena.

When encountering a new case, people might rely on past similar cases to make decisions (Axelrod & Forster, 2017). Our research suggests that similarity in memory, rather than objective similarity, between past and present cases may be a central mechanism for case-based reasoning. This is consistent with the principles developed in Tversky's (1977) canonical study on similarity. Both past and present cases are construed as a collection of different features, and people's perception of similarity between the past and the present cases involves a feature-matching process that is determined both by feature content and feature salience. It is worth noting that in the present study, the new case shares the same number and quality of features with the two past cases. Indeed, objectively speaking, the present case should be equally similar to either one of the cases under the feature-matching process, and therefore the intervention outcomes in the two past cases should be equally weighted for the current decision. However, we found that individuals' decision pattern corresponded to the memory accessibility pattern, which suggests that the information accessibility of past features affects the feature-matching process (i.e., memory similarity) and subsequently influences judgments and decision making. In sum, memory retrieval of similarities could be a central process in case-based reasoning.

The manipulation of the memory accessibility of critical information was, in these experiments, fundamentally social in nature. Participants listen to another individual—in this case an expert—mentioning previously encoded information. The social dimension of the experimental setting we created points to the relevance of the current findings for the literature on social cognition and persuasion research (Cialdini & Goldstein, 2004; Fiske, 1980; Paluck, Shafir, & Wu, 2017). It is possible, we showed, to impact people's choices in ways that do not involve explicitly refuting or affirming their beliefs. Simply discussing irrelevant information aimed at suppressing critical information meaningfully shapes the decisions that people end up making. This technique, we claim, constitutes an important addition to the literature on persuasion tools aimed at impacting people's attitudes, decisions, and behaviors. The current investigation also points to a set of characteristics one could manipulate with respect to the social source of the information. The perceived trustworthiness, credibility, expertise, and similarity of the source that disseminates information might be important factors that are likely to increase the impact of case-based reasoning on people's decisions.

Finally, our findings also speak to issues around information dissemination in our highly interconnected world. We show that a minimal information manipulation strategy could lead to a changed level of support or opposition for different courses of actions. When people make decisions about societally relevant topics—such as support or opposition for military interventions in foreign countries—they are oftentimes presented with selective information crafted by pundits and politicians. Our results indicate that individuals need to be aware of the potential insidious nature of selective information presentation, which has a direct effect on memory retrieval and subsequent judgments.

Open practices

The experiments in this article are under consideration for Open Material and Open Data badges for transparent practices. Materials and data for the experiments are available at https://bit.ly/3hbv50L.

Data availability

Data will be made available on request.

Acknowledgements

We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study. Our datasets and experimental materials can be found on our OSF page [https://osf.io/5wkqj/]. The study was approved by Princeton University Institutional Review Board. Both SJW and AC contributed to the study design, data collection and analysis, and manuscript preparation. We declare no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jesp.2022.104407.

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