

Poison Parasite Counter: Turning Duplicitous Mass Communications into Self-Negating
Memory Retrieval Cues

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Abstract

Disinformation in politics, advertising, and mass communications has proliferated in recent years, as has research for countering its deleterious effects. Few counter-argumentation strategies have proven effective at undermining a deceptive rival's message over time. This paper introduces the Poison Parasite Counter (PPC), a cognitive science-based strategy for durably countering deceptive rival communications. The PPC involves inserting a strong (poisonous) counter-message, just once, into a close replica of a rival's communication. In parasitic fashion, the rival's communication then "hosts" the counter-message, which is recalled upon each re-exposure to the rival communication. The strategy harnesses associative memory to turn the rival's communication into a retrieval cue for its own self-negating counter-message. Seven randomized experiments ($N = 3,678$) show that the PPC lastingly undermines a duplicitous rival's communication by influencing judgments of communicator honesty and favorability, as well as real political donations.

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In recent years disinformation in politics, advertising, and mass communications has proliferated (Pennycook & Rand, 2019; Lazer et al., 2018; Vosoughi et al., 2018). This paper introduces and tests a new cognitive science-based strategy for increasing the durability of persuasive counterarguments that aim to correct deceptive rival communications. The Poison Parasite Counter (PPC) leverages associative memory to increase the accessibility and salience of counterarguments by embedding a counter-message in a close replica of a rival's communication. In doing so, the PPC effectively turns the rival's communication into a retrieval cue for the counter-message, which is then activated and evaluated upon each re-exposure to the rival communication. Seven online experiments show that the PPC more enduringly undercuts a rival's communication than traditionally-presented counterarguments, and that this effect is driven by associative memory processes. This work contributes to behavioral policy research by applying novel behavioral insights to pressing political and social issues (Benartzi et al., 2017).

Commonly used strategies for combating disinformation (e.g., disclosures, forewarnings, fact checks) have generally yielded mixed results (Wahlheim et al., 2020; Schwartz et al., 2016). One notable exception entails presenting strong counterarguments after exposure to a rival message (Petrova & Cialdini, 2011). Even sound counterarguments, though, become less salient and accessible over time, thereby decreasing their persuasiveness and efficacy (Koriat et al., 2000). Consequently, traditional counter-argumentation is most—or only—effective when it is encountered immediately after every rival message. This ensures that the countervailing message is accessible and salient each time the rival message is re-encountered. In practice, however, this can be difficult to achieve. Even if a communicator is able to quickly craft a refutational message, unequal access to mass communication channels makes it difficult—if not impossible—for disadvantaged communicators to ensure equal exposure to counter-messages (Koerth-Baker, 2018; OpenSecrets, 2018). This asymmetry is particularly consequential as research has shown that increasing exposure to an argument increases viewers' perceptions of its veracity (Fazio & Sherry, 2020; Unkelbach et al., 2019).

This paper introduces the PPC as one strategy for increasing the efficacy of counterarguments against deceptive communications. The PPC involves two components—the “parasite” and the “poison”—each corresponding with distinct psychological processes. The “parasitic” component of the PPC relies on associative memory. Specifically, it leverages Tulving's (1983) encoding specificity principle, which suggests that memory recall is facilitated when conditions present when a memory is first encoded are also present at the time of retrieval (Petrova & Cialdini, 2011; Roediger et al., 2017). By this process, associating a counter-message with the imagery of a rival's existing communication effectively embeds the counter-message into the rival's communication. When employed, the perceptual similarity between the PPC-embedded counter-message and the rival's communication turns the latter into a retrieval cue for the countervailing message upon each re-exposure to the rival communication. This strategy can mitigate the natural memory decay that decreases both the accessibility and salience of previously encountered counterarguments over time (Wixted, 2004). By deliberately turning a

rival communication into a “host” for a countervailing message, the PPC also mitigates the persuasive effects of repeated exposure to the rival communication.

Once counterarguments are made accessible and salient upon re-exposure to a rival communication they can be used for online evaluation. The counterarguments must be sufficiently “poisonous” to effectively neutralize the rival message upon evaluation. Tautologically, the PPC cannot be effective unless the counter-message is, by itself, effective. A particularly effective form of counter-argumentation is one that reveals the dishonesty of the rival communicator. There appears to be an evolved human sensitivity and aversion to dishonesty such that, once deception is recognized, targets tend to resist both the communicator and information (Cosmides & Tooby, 1992; Fehr & Gächter, 2002; Farrelly et al., 2005).

We hypothesize that, together, the parasitic and poisonous components of the PPC will counter a rival’s deceptive communications, even when the rival benefits from asymmetric exposure to target audiences. Seven randomized experiments test this in the realm of political and commercial advertising, two areas where both disinformation and asymmetric reach in communication channels are common and consequential (Lowery, 2014; Gerber, 1998; Gerber, 2004). We show that the PPC more effectively undercuts a rival’s communication than traditionally-presented counterarguments at a single point in time (Studies 1-3); these effects persist across time and in the face of large frequency-of-exposure asymmetries (Study 4); the PPC can affect a consequential behavior (political donations) in a real-world setting (Study 5); the PPC can be effectively implemented with either static or video ads (Study 6); and the PPC effect is driven by associative memory processes (Study 7).

Sample sizes for all studies were determined prior to data collection based on pilot studies that yielded medium effects ($d = 0.70$, $d = 0.49$). Accordingly, for each study reported here (and in the SOM), we targeted a minimum of 70 participants per condition. With 80% power and a standard alpha level of 0.05, this yields a minimum detectable effect of $d = 0.48$ for each pairwise comparison. All materials and data are available on Open Science Framework (osf.io/aps8h).

Study 1: The Poison Parasite Counter Effect

Study 1 tested whether embedding strong counter-messages into a replica of a deceptive rival political ad subsequently undermines the rival communication relative to presenting the same counter-messages in a traditional, visually independent fashion.

Method

Participants. Participants were recruited through Amazon’s Mechanical Turk (MTurk) to complete a 15-minute online survey for which they were paid \$1.00 each. Only MTurk workers located in the United States, who had an MTurk approval rating of at least 95%, who had not participated in previous similar studies, who consented to participate, and who passed an initial

attention check were eligible to complete the survey. All studies reported here employed these standard qualifications (see SOM). A total of 297 participants (mean age = 38 years, $SD = 11.9$; 50% female) completed the study.

Procedure. All workers who consented to participate and passed the attention check were randomly assigned by the survey platform to one of two experimental conditions: a Traditional Response condition or the Poison Parasite Counter condition. Participants were not aware of their condition assignment.

In the approximately 15-minute long survey, participants saw a total of 10 political ads for five fictional candidates—one “pro” and one “response” ad for each candidate. For one of these candidates, Walter McKinley, we developed two response ads corresponding with each experimental condition. The first utilized the PPC by overlaying counter-messages highlighting the duplicitous nature of the rival message on an exact visual replica of the rival ad (see Fig. 1B). The Traditional Response ad presented the same counter-messages as the PPC ad, but with a different visual aesthetic that provided no associative links to the rival’s original ad (see Fig. 1C). The other fictional ads were used as filler to distract participants from the focus of the study and interfere with memory processes. For the same purpose, the ads were interspersed with four excerpts from current, non-partisan news articles, and filler questions were asked after every ad or article excerpt. Each ad or excerpt was shown on a separate page, and page timers ensured that each participant had to wait at least five seconds to advance from one page to the next. All participants saw the rival Walter McKinley ad on the second screen, and either the PPC or Traditional Response ad on the eighth. This paradigm forms the basis for each study reported here.

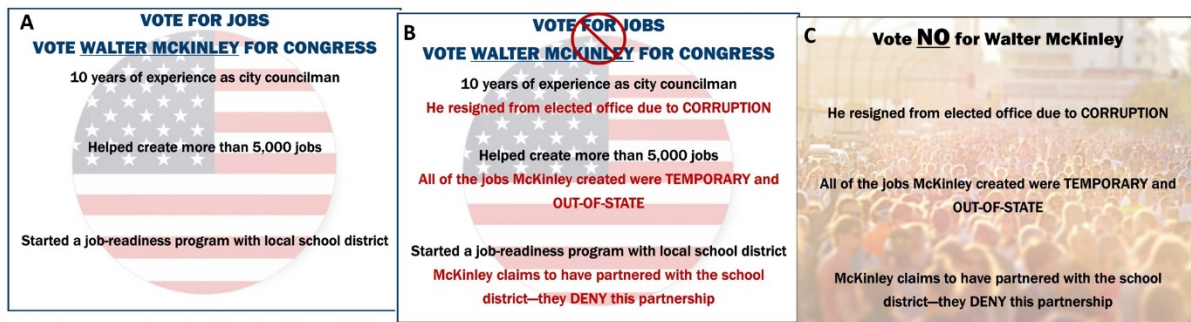


Fig. 1. Walter McKinley ads used in Studies 1 and 2. (A) Rival ad; (B) PPC ad; (C) Traditional Response ad

At the end of the survey, participants were told that they would be shown one of the candidate ads from the first section, chosen arbitrarily. All participants were again shown the rival McKinley ad and were subsequently asked:

1. If Walter McKinley was running in your state, how likely is it that you would vote for him?
2. How honest do you think Walter McKinley is?

Both outcomes were ranked on a five-point scale, from extremely unlikely to extremely likely, and extremely dishonest to extremely honest, respectively.

In addition, immediately after viewing the PPC or Traditional Response ad, participants were shown four counterclaims and asked to identify which one was *not* mentioned on the ad that they had just viewed. Testing immediate recall after viewing the PPC or Traditional Response ad allowed us to determine whether participants were paying equal attention in both conditions.

Analysis and Results

We hypothesized that by directly challenging the claims in the rival ad and creating mnemonic links between the response ad and the rival ad, the PPC would result in recurring, cue-based recall of the counter-messages whenever the rival's ad was re-encountered, making the counterargument resistant to normal memory degrading processes. This would, in turn, lead participants to view McKinley as more dishonest and reduce their willingness to vote for him compared to a traditionally presented response ad.

In a standard linear model, we regressed each primary outcome on an indicator for treatment assignment, controlling for participant gender, age, party affiliation (Democrat, Republican, Independent, or Other), and an indicator for college education. To facilitate comparability across studies and outcomes, each outcome measure is standardized.

As predicted, exposure to the PPC ad subsequently reduced participants' reported likelihood of voting for McKinley relative to participants who had seen the Traditional Response ad by 0.61 SD, $t(296) = 5.52$, $p < .001$, 95% confidence interval (CI) = [0.39, 0.83] (see Fig. 2, which reports unstandardized means for ease of interpretability). In a similar pattern, participants who saw the PPC ad rated McKinley as 0.70 SD, $t(296) = 6.40$, $p < .001$, 95% CI = [0.49, 0.92], less honest than participants in the Traditional Response condition.

When asked immediately after viewing the PPC or Traditional Response ad to identify which of four counterclaims was not included in the PPC or Traditional Response ad, 81% of participants in the PPC condition answered correctly, as did 77% of participants in the Traditional Response condition ($\chi^2(1) = 0.56$, $p = .45$).

We also tested whether perceptions of McKinley's honesty mediated the effect of the PPC on likelihood of voting for McKinley. Based on 5,000 bootstrap samples, perceived honesty mediated the indirect effect of assignment to the PPC condition on voting preference, $\beta = -0.50$, $SE = 0.08$, 95% CI = [-0.66, -0.35].

Discussion

Study 1 demonstrated that the PPC more effectively undermines a rival communication than traditionally-presented counterarguments.

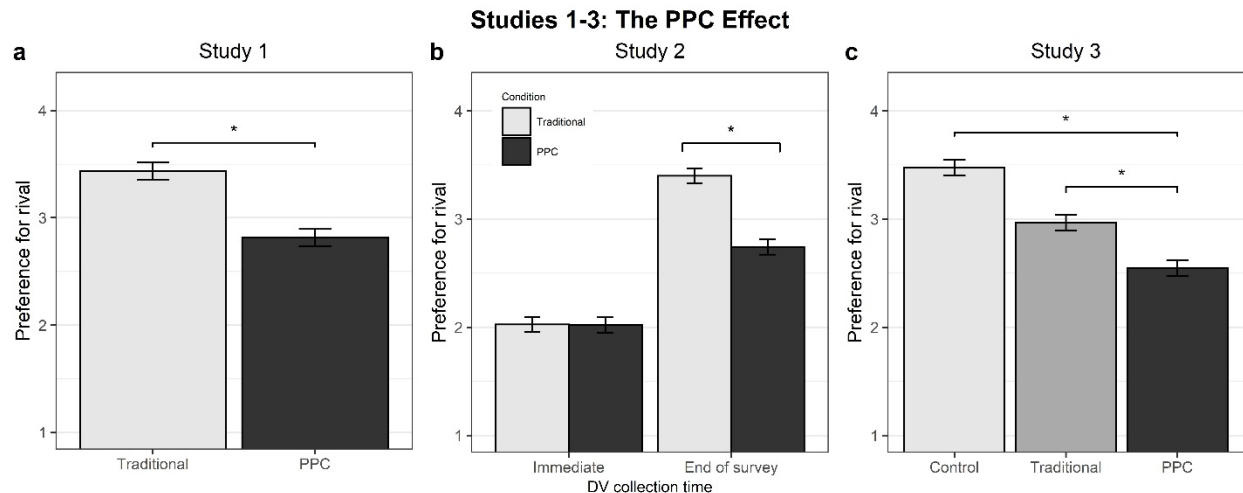


Fig. 2. Results from (a) Study 1; (b) Study 2; and (c) Study 3. Outcomes reflect regression-adjusted unstandardized means, measured on 1-5 scale where 5 represents “extremely likely to vote.” Error bars reflect ± 1 standard error * reflects differences significant at $p < .01$.

Study 2: The PPC Retrieval Cue Mechanism

The PPC and Traditional Response ads in Study 1 had identical content and were from the same source, which ensures that any difference between conditions was not the result of source sleeper effects (Kumkale & Albarracín, 2004). Yet, it is possible that the effects were driven by differential ad quality. If the PPC ad was simply a superior ad, we would expect it to dominate the Traditional Response ad immediately after exposure. If instead the superiority of the PPC is due to the memory retrieval cue mechanism, effects should emerge only after participants are re-exposed to the rival communication. Study 2 tested this directly.

Method

Participants. Participants were 713 MTurk workers (mean age = 36 years, $SD = 10.9$; 52% female) who were recruited to complete a 15-minute online survey for which they were each paid \$1.20. Standard participant qualifications were applied (see SOM).

Procedure. The content and outcomes for this study were identical to those used in Study 1 (Fig. 1), with Walter McKinley as the focal candidate. In a pre-registered 2 x 2 factorial design, all participants were randomly assigned to either the PPC or Traditional Response condition, as well

as to either an Immediate Outcome or End-of-survey Outcome condition. Participants were not aware of their condition assignments.

The study procedures followed those of Study 1, with the exception of the timing of the outcome questions. In the Immediate Outcome condition, participants answered the two dependent variable questions immediately after seeing the PPC or Traditional Response ad. In the End-of-survey Outcome condition, participants answered the two dependent variable questions at the end of the 15-minute long survey, after being re-exposed to the rival McKinley ad. In both conditions, the dependent variable questions were the same as in Study 1.

In order to keep the survey the same length for participants in all experimental conditions, those assigned to the End-of-survey Outcome condition were also asked two questions—one recall, and one filler—immediately after viewing the PPC or Traditional Response ad. The recall question asked participants to identify which of four possible counterarguments was *not* mentioned on the PPC or Traditional Response ad that they had just viewed.

Analysis and Results

All analysis procedures followed those described in Study 1, and are pre-registered on OSF. If the PPC and Traditional Response ads are of similar quality, participants' reactions to McKinley should be the same across both conditions when assessed immediately after viewing the counter ad. As expected, when measured immediately after viewing the response ad, participants who had seen the PPC ad were as likely to vote for McKinley as participants who had seen the Traditional Response ad, $F(1,348) = 0.00, p = .95$. There was also no difference in perceptions of McKinley's honesty immediately after viewing the PPC or Traditional Response ad, $F(1,348) = 1.28, p = 0.26$. Additionally, immediate recall did not differ significantly across conditions: when participants in the End-of-survey Outcome condition were asked to identify the counterclaims they had just seen immediately after viewing the PPC or Traditional Response ad, 71% of participants in the PPC condition and 72% of participants in the Traditional Response condition were able to correctly do so, $\chi^2(1) = 0.02, p = 0.89$.

When participants were asked the outcome questions at the end of the survey—after interference-producing filler and decoy materials—the results parallel those of Study 1 (see Fig. 2). As would be expected given evidence of quick decay of persuasive effects and the memory interference effects of interpolated materials, overall favorability of McKinley was higher among participants in both conditions at the end of the survey compared to immediately after exposure to the treatment ad. Yet, as hypothesized, the PPC mitigated this decay: upon re-exposure to the rival's communication, participants in the PPC condition who responded to the outcome measures at the end of the survey were significantly less likely to vote for McKinley (0.63 SD, $t(355) = 6.64, p < .001, 95\% \text{ CI} = [0.45, 0.82]$), and rated him as significantly less honest (0.41 SD, $t(355) = 4.23, p < .001, 95\% \text{ CI} = [0.22, 0.61]$), than those who saw the Traditional Response ad.

Discussion

At the time of exposure, the PPC and Traditional Response ads spurred equal recall and produced similarly strong counter-responses to the rival ad, making it implausible that the PPC ad was merely a superior ad or that the qualities of the PPC inherently facilitate a more fluid comparison with the rival material.

Study 3: The PPC Versus No Counter-message Control

Study 3 added a control group and tested the effect of the PPC ad against a more externally valid Traditional Response ad, which offered the same counterarguments as the PPC ad, but presented in a more realistic form.

Method

Participants. Participants were recruited through MTurk to complete a 10-minute online survey for which they were paid \$.60 each. Standard participant qualifications were applied (see SOM). A total of 602 participants (mean age = 40 years, $SD = 12.4$; 58% female) completed the study.

Procedure. All workers who consented to participate and passed the attention check were randomly assigned to one of three conditions: Control, Traditional Response, or PPC. Participants were not aware of their condition assignment.

In Studies 1 and 2, the counter-messages presented in the Traditional Response ad were identical to the messages presented in the PPC ad (see Fig. 1). In reality, response ads often encompass cohesive narratives rather than individual and fragmented counterclaims. Accordingly, Study 3 tested the effect of the PPC against a more externally valid Traditional Response ad, as shown in Fig. 3. While the Traditional Response ad offered the same counterarguments as the PPC ad, it was presented in a more realistic form. In addition, Study 3 included a pure control group, in which participants saw an ad for an entirely different fictional candidate, in order to compare the effect sizes of the PPC and Traditional Response ads.

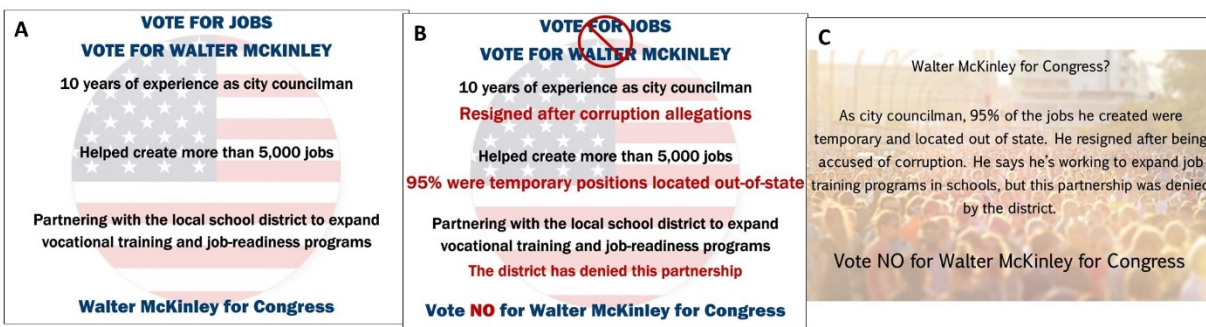


Fig. 3. Walter McKinley ads used in Studies 3, 4, and 7, as well as Supplement Studies I, II, and III. (A) Rival ad; (B) PPD ad; (C) Traditional Response ad.

Following the same procedure as Study 1, all participants saw the rival McKinley ad, and either the PPC, Traditional Response, or Control ad, depending on condition assignment. These ads were interspersed with eight other ads for fictional political candidates and filler questions designed to distract participants from the focus of the study and interfere with memory processes. At the end of the survey, all participants were shown the rival McKinley ad and were subsequently asked the same dependent variable questions as in Studies 1 and 2.

Analysis and Results

This study was pre-registered on OSF, and analysis procedures followed those described in Study 1. As shown in Fig. 2, exposure to the PPC ad significantly reduced participants' subsequent likelihood of voting for McKinley relative to the Control ad (0.85 SD, $t(601) = 8.98$, $p < .001$, 95% CI = [0.66, 1.03]), and relative to the Traditional Response ad (0.38 SD, $t(601) = 4.10$, $p < .001$, 95% CI = [0.20, 0.57]). In a similar pattern, participants who saw the PPC ad also rated McKinley as significantly less honest than participants in both the Control condition (0.68 SD, $t(601) = 7.04$, $p < .001$, 95% CI = [0.49, 0.87]), and in the Traditional Response condition (0.30 SD, $t(601) = 3.11$, $p = .002$, 95% CI = [0.11, 0.48]). As in Study 1, honesty mediated indirect effect of assignment to the PPC condition on voting preference, $\beta = -0.40$, SE = 0.06, 95% CI = [-0.53, -0.28], based on an analysis of 5,000 bootstrap samples.

Relative to the Control condition, the Traditional Response ad also reduced participants' likelihood of voting for McKinley (0.46 SD, $t(601) = 4.95$, $p < .001$, 95% CI = [0.28, 0.65]), and perceptions of his honesty (0.38 SD, $t(601) = 3.98$, $p < .001$, 95% CI = [0.19, 0.57]), although these effects are about half the size of those produced by the PPC ad.

Discussion

The first three studies demonstrated that the PPC slows the decay of a counter-message's persuasive effects at a single point in time, relative to presenting the same counter-message in a traditional fashion. Supplemental Studies I and II replicate these results with variations in the frequency of exposure to both the rival ad and response ad.

Study 4: PPC Durability Over Time

Research indicates that the persuasive effects of a message decay over time and in the presence of memory interference (Gerber et al., 2011). Study 4 thus examined the durability of the PPC effect over a 17-day period.

Method

Participants. An initial sample of 557 participants (mean age = 37 years, $SD = 11.7$; 67% female) was recruited via Amazon's MTurk to complete a series of five surveys. Standard participant qualifications were applied (see SOM). Participants were compensated \$1.10 for the each of the first and second surveys; \$0.70 each for the third and fourth surveys; and \$1.00 for

the fifth survey. Additionally, all participants who completed the first four surveys received a \$.75 bonus as an incentive to return for the fifth and final wave.

Of the 557 participants who completed the first wave of the study, 330 completed all five waves (mean age = 39 years, $SD = 12.6$; 69% female). Attrition was balanced evenly across experimental condition ($\chi^2(2) = 0.80, p = 0.67$). Younger participants, participants whose party affiliation was Independent, and non-college educated participants were all more likely to attrit. A joint significance test shows that we cannot reject the null hypothesis that attrition was balanced across conditions and all covariates ($\chi^2(8) = 23.05, p = 0.003$). All analyses thus control for party affiliation, college education, age, and participant gender.

Procedure. All workers who consented to participate and passed the attention check were randomly assigned to one of three conditions: Control, Traditional Response, or PPC. Participants were not aware of their condition assignment. Participants were told in wave 1 (day 1) that the study entailed five separate surveys. Each subsequent wave was open for 24 hours to all participants who had completed the preceding survey. Reminder emails were sent to all eligible workers when each follow-up survey opened.

The study was run over a period of 17 days, with waves conducted on days 1, 3, 6, 9, and 16. Each wave followed the same procedures as Study 3, with one exception: to ensure that we did not unintentionally provide associative links between the McKinley ad and the PPC or Traditional Response ads, participants viewed the rival McKinley ad during the first wave on day 1, and the PPC, Traditional Response, or Control ads during the second wave which was administered on day three. In all other waves, participants were only shown the rival McKinley ad. In each wave, the McKinley content was interspersed with other fictional ads, news article excerpts, and filler questions designed to produce memory interference. As in Studies 1-3, page timers were used to ensure that participants spent a minimum amount of time on each article and ad.

At the end of every wave, participants were asked the two dependent variable questions about two “arbitrarily” selected candidates—one was always Walter McKinley, while the second subject differed in each wave. By the end of the five-wave study, all participants had seen the rival McKinley ad nine times, and the PPC, Traditional Response, or Control ad once.

Analysis and Results

This study was pre-registered on OSF, and analysis procedures followed those described in Study 1. The results from the second wave, the only wave in which participants saw either the PPC, Traditional Response, or Control ads, parallel those of Study 3: the PPC had a large and significant effect on the likelihood of voting for McKinley relative to both the Traditional Response ad (0.74 SD, $t(329) = 6.27, p < .001, 95\% CI = [0.51, 0.98]$) and the Control ad (1.18 SD, $t(329) = 9.91, p < .001, 95\% CI = [0.94, 1.41]$). Similarly, participants who saw the PPC ad rated McKinley as significantly less honesty than participants who saw the Traditional Response

ad (0.75 SD, $t(329) = 6.20$, $p < .001$, 95% CI = [0.51, 0.99]) or the Control ad (1.13 SD, $t(329) = 9.30$, $p < .001$, 95% CI = [0.89, 1.36]).

In waves 3-5, the effect of the PPC remained significantly superior to the Traditional Response ad (see Fig. 4, which reports unstandardized means). By the fifth wave (on day 16), participants who had seen the PPC ad during the second wave (on day 3) were still significantly less likely to vote for McKinley (0.74 SD, $t(329) = 5.83$, $p < .001$, 95% CI = [0.49, 0.98]), and rated him as significantly less honest (0.43 SD, $t(329) = 3.27$, $p = .001$, 95% CI = [0.17, 0.69]) relative to those who had seen the Traditional Response ad (on day 3). The SOM reports full results for both outcomes for each wave.

Discussion

Despite large frequency-of-exposure disparities and time-induced memory interference, the PPC continued to undercut the rival ad throughout the two-week period of Study 4. In contrast, the initial effectiveness of the Traditional Response ad waned relative to the Control condition, in keeping with the characteristic decay of political ad effectiveness over time (Gerber et al., 2011; Kalla & Broockman, 2018): in waves 3-5, there was no significant difference on either outcome between participants in the Control condition and in the Traditional Response condition (see SOM). These findings were replicated in Supplemental Study III.

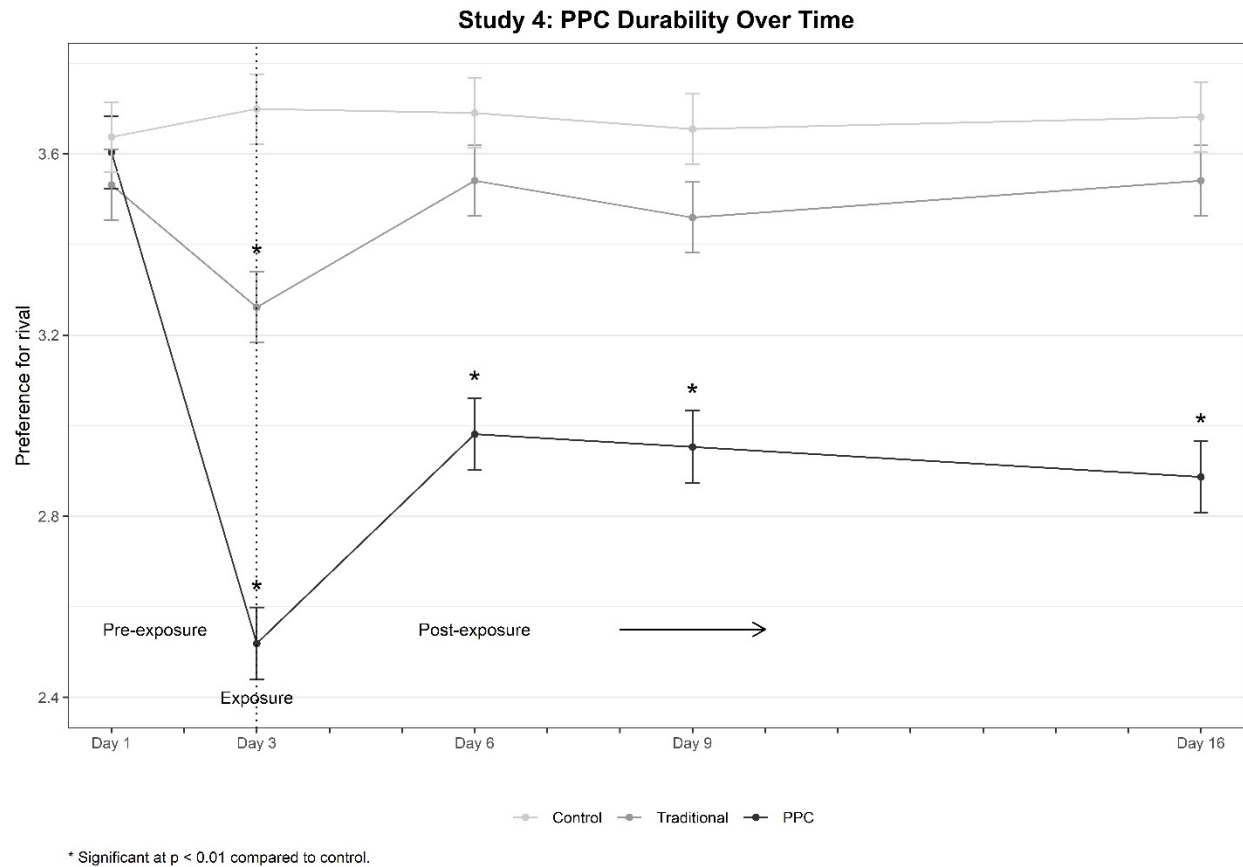


Fig. 4. Preference for rival each day in study 4. All participants saw the Control, Traditional Response, or PPC ad a single time on day 3. In all other waves (on days 6, 9, and 16), participants saw the rival ad interspersed with decoy ads and filler material. Outcomes reflect regression-adjusted unstandardized means, measured on 1-5 scale where 5 represents “extremely likely to vote.” Error bars reflect ± 1 standard error. $*p < .01$ relative to Control condition.

Study 5: The PPC Effect on Real-World Political Donations

The first four studies provided strong evidence of the efficacy and durability of the PPC in a hypothetical setting—a contest between fictional political candidates. Study 5 aimed to demonstrate that the PPC can also affect a consequential behavior—political donations—in a real campaign using real political ads.

Method

Participants. Participants were 299 Amazon MTurk workers (mean age = 36 years, $SD = 10.7$; 55% female) who received \$1.30 compensation for completing the survey. Standard participant qualifications were applied (see SOM). Because this study used actual campaign ads from the Michigan Democratic primary election, all workers in the state of Michigan were excluded per Institutional Review Board (IRB) requirements so as not to influence any potential voters’

opinions prior to the election. Additionally, since the primary outcome measure asked about voting in a Democratic primary election, all self-identified Republicans were also excluded.

Procedure. A real print ad produced by Gretchen Whitmer’s campaign, the leading 2018 Democratic gubernatorial candidate in Michigan, served as the rival ad for Study 5. The Traditional Response ad was an actual ad produced and circulated during the election by the campaign of Shri Thanedar, one of Whitmer’s main Democratic opponents. Thanedar’s ad provided strong and explicit counter-messages, but no associative links to the rival Whitmer ad. We modified this response ad to create two new versions that used the PPC procedure: a “full” and a “tailored” PPC ad (Fig. 5). In the “full” application, the rival Whitmer ad and the Traditional Response ad were placed side-by-side with a line down the middle and the respective headers: “Typical Gretchen Whitmer ad” and “Here’s what we say in our ad.” In the “tailored” application, the exact counter-messages from Thanedar’s response ad were embedded in the rival Whitmer ad. Both ads were created purely for research purposes; neither was used in the campaign or circulated to prospective voters. We had no a priori hypothesis as to which manifestation of the PPC would be more effective, and thus tested each relative to the real Traditional Response ad.

The study was run prior to the primary election on August 6, 2018. The procedures for this study paralleled those of Study 3. All workers who consented to participate and passed the attention check were randomly assigned to one of four conditions: Control, Traditional Response, Full PPC, or Tailored PPC. Participants were not aware of their condition assignment.

All participants were told that they would see a series of ads for real political candidates currently running for office, as well as excerpts from actual news articles. All participants first saw the rival Whitmer ad and then, depending on their experimental condition, either one of the PPC ads, the Traditional Response ad, or a Control ad for a different candidate in a different election. The ads were interspersed with eight decoy ads, all of which were real campaign ads from other current political races across the United States, as well as news article excerpts and related filler questions. At the end of the roughly 15-minute survey, all participants were asked:

1. If you lived in Michigan, how likely would you be to vote for Gretchen Whitmer in the upcoming Democratic primary election?
2. How honest do you think Gretchen Whitmer is?
3. You have a chance to allocate real resources. We are donating \$0.10 on behalf of every worker who takes our survey. We can either donate this \$0.10 to Gretchen Whitmer’s campaign or to the campaign of Shri Thanedar, her opponent. Who would you like us to donate this \$0.10 to?

In response to question 3, a total of \$21.20 was donated to Whitmer’s campaign, and \$8.70 to Thanedar’s campaign. All donations were made by the authors prior to the primary election.

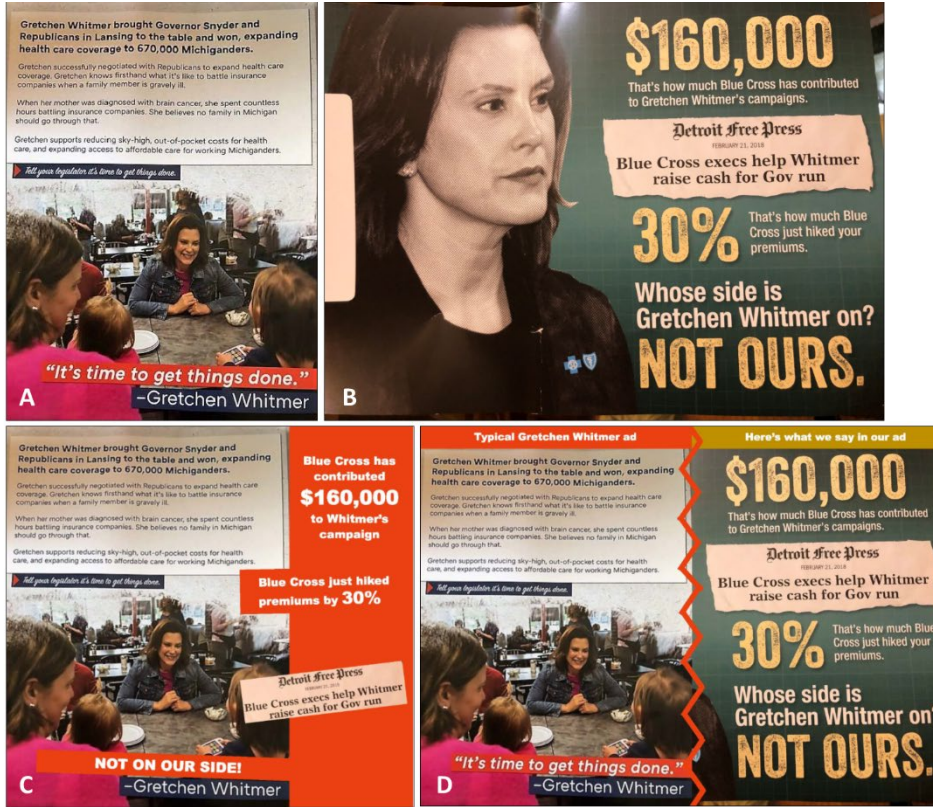


Fig. 5. Gretchen Whitmer ads. (A) Rival ad; (B) Traditional Response ad; (C) Tailored PPC ad; (D) Full PPC ad. Used in Study 5.

Analysis and Results

Consistent with results from the previous studies, participants in both PPC conditions were significantly less likely to express willingness to vote for Whitmer and rated her as significantly less honest than participants in the Traditional Response and Control conditions (see Fig. 6, which reports unstandardized means). Exposure to the Tailored PPC ad reduced participants' subsequent likelihood of voting for Whitmer by 0.40 SD, $t(298) = 2.48, p = .01$, 95% CI = [0.08, 0.71], and 0.50 SD, $t(298) = 3.15, p = .002$, 95% CI = [0.19, 0.82], relative to the Traditional Response and Control ads, respectively. Similarly, exposure to the Full PPC ad reduced participants' likelihood of voting by 0.60 SD, $t(298) = 3.78, p < .001$, 95% CI = [0.29, 0.91], and 0.70 SD, $t(298) = 4.48, p < .001$, 95% CI = [0.29, 1.01], compared to the Traditional Response and Control ads, respectively.

Participants in the Tailored PPC condition rated Whitmer as 0.38 SD, $t(298) = 2.38, p = .02$, 95% CI = [0.07, 0.70], less honest than participants in the Traditional Response condition, and 0.43 SD, $t(298) = 2.66, p = .008$, 95% CI = [0.11, 0.75], less honest than those in the Control conditions. Meanwhile, participants in the Full PPC condition rated Whitmer as 0.62 SD, $t(298) = 3.93, p < .001$, 95% CI = [0.31, 0.93], less honest than participants in the Traditional Response condition, and 0.67 SD, $t(298) = 4.23, p < .001$, 95% CI = [0.36, 0.98], less honest than those in the Control conditions. As seen with the McKinley paradigms, perceptions of Whitmer's honesty

significantly mediated the indirect effect of assignment to either the Tailored PPC condition ($\beta = -0.26$, $SE = 0.10$, 95% $CI = [-0.46, -0.06]$) or the Full PPC condition on voting preference ($\beta = -0.40$, $SE = 0.10$, 95% $CI = [-0.59, -0.21]$) based on an analysis of 5,000 bootstrap samples.

There was no significant difference in voting likelihood or perceived honesty between participants who saw the Traditional Response ad and those who saw the Control ad (see Fig. 6 and SOM), demonstrating that the mere presence of counterarguments is not necessarily sufficient to produce meaningful resistance to a rival ad. Additionally, there was no significant difference between the two PPC conditions on either of the outcome measures, although the Full PPC ad produced larger directional results.

After the questions on voting and perceived honesty, participants were told that a \$0.10 donation would be made on their behalf to either Gretchen Whitmer or Shri Thanedar, her opponent, and were asked to direct the donation to their preferred candidate. Fifty-eight percent of participants in the Full PPC condition directed the donation to Whitmer's campaign (instead of Thanedar's) compared to 75% in the Traditional Response condition, $\chi^2(1) = 5.01$, $p = .03$, and 90% in the Control condition, $\chi^2(1) = 17.43$, $p < .001$. The Tailored PPC condition yielded very similar effects: 60% of participants in the Tailored PPC condition directed the donation to Whitmer's campaign, significantly less than in the Traditional Response condition, $\chi^2(1) = 3.69$, $p = .05$, and in the Control condition, $\chi^2(1) = 15.10$, $p < .001$.

Discussion

Study 5 demonstrated that the PPC both reduces the viability of a rival's message, and influences related behavior in the form of financial support for that candidate. The relative equivalency of the Full and Tailored PPC versions indicates there are multiple ways to implement the PPC effectively.

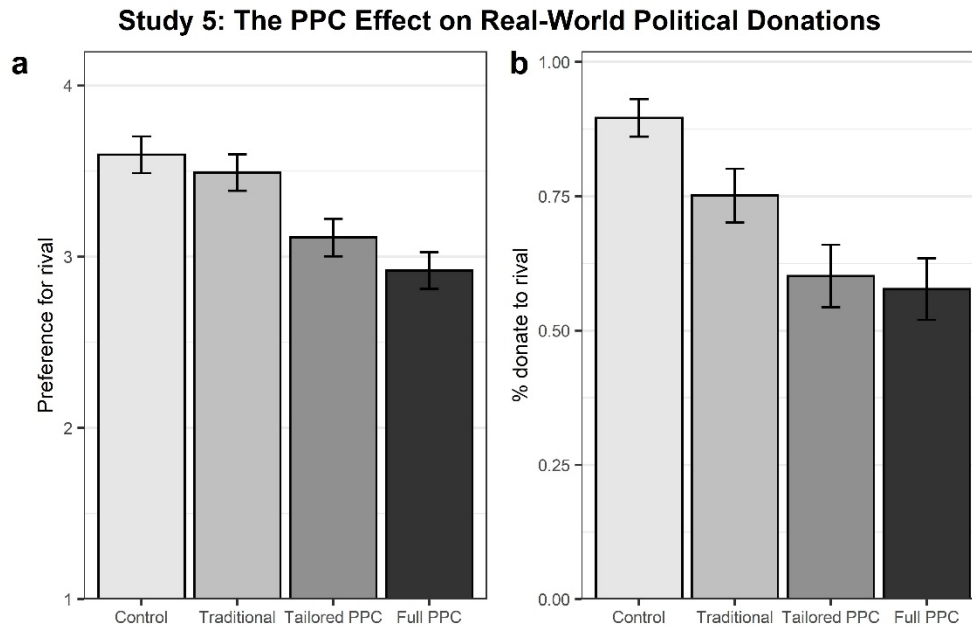


Fig. 6. (a) Preference for rival, and (b) donations to rival in study 5. Outcome for (a) reflects regression-adjusted unstandardized means, measured on 1-5 scale where 5 represents “extremely likely to vote.” Error bars reflect ± 1 standard error.

Study 6: Implementing the PPC using Video Ads

Study 6 examined the PPC in a nonpolitical, commercial context using a new communication modality: video advertising.

Method

Participants. On the Friday before the 2020 Super Bowl, an initial sample of 2,429 participants (mean age = 41 years, $SD = 12.8$; 50% female) was recruited via Amazon’s MTurk for a three-wave study that was run over nine days. Standard participant qualifications were applied (see SOM).

Of the 2,429 participants who completed the first wave of the study (day 1), 2,152 (89%) completed the second wave (day 3), balanced evenly across conditions ($\chi^2(2) = 1.71, p = .43$). Then, anyone who completed the second wave and reported having watched the Super Bowl was invited to complete a third wave exactly one week later (day 9). Of the 2,152 participants who completed the second wave of the study, 1,463 reported watching the Super Bowl between wave 1 and wave 2, and 1,172 (80%) of these participants completed the third wave. As such our final analytic sample is comprised of 1,172 participants who watched the 2020 Super Bowl and completed all three surveys over the nine-day period (mean age = 41 years; $SD = 12.6$; 44% female).

Overall attrition across all three surveys was balanced evenly across conditions ($\chi^2(2) = 0.44, p = 0.80$), as was self-reported Super Bowl viewing ($\chi^2(2) = 1.25, p = 0.54$) among participants who completed wave 2. However, across demographics, women were less likely to report having watched the game, while those with higher incomes were more likely to have watched the game—both gender and income are controlled for in all analyses. Participants were compensated \$1.60 for the first survey; \$0.70 each for the second survey; and \$1.00 for the third survey.

Procedure. During the 2020 Super Bowl, TurboTax—one of the largest online tax preparation companies—ran a 45-second ad highlighting the simplicity and benefits of their software. They released the ad five days before the game, which afforded a unique opportunity to test the PPC knowing that participants who watched the game would be subsequently re-exposed to the rival's communication. Prior to the game, we developed three response ads. The PPC ad overlaid a counter message on the exact TurboTax ad that was to run during the Super Bowl. This message stated: "TurboTax says they work to make filing taxes easy for us. Yet, they've spent \$10 million lobbying lawmakers to prevent free automatic filing. This makes filing harder and more expensive for us, so they can make money." This counterargument is true (see, e.g., OpenSecrets.org, 2020; Huseman, 2017; Elliott & Kiel, 2019), and offers evidence of TurboTax's duplicity. In the PPC ad, this text scrolled twice across the screen during the 45-second video, and then ended with a static screen that displayed this message for an additional three seconds. In the Poison Only ad, the exact same scrolling text was overlaid on a different TurboTax commercial, which was of an equivalent length. And in the Pure Counterargument condition, the same scrolling text was presented with a solid black screen as the background.*

Participants were told in wave 1 (day 1) that the study would entail two waves, and were asked to signal their intention to complete both before proceeding to the survey. The first wave took place during the 24 hours preceding the Super Bowl. In a design that mimicked that of the previous studies, participants were randomly assigned to see the PPC ad, the Poison Only ad, or the Pure Counterargument ad. In a 15-minute survey, the assigned treatment ad was interspersed with the rival TurboTax ad—the one that was to run during the Super Bowl—and eight other real television ads for a variety of services and products that served as filler. In addition, to ensure that the TurboTax response ad did not stand out, we created similar response ads for four of the filler ads. Each of these "decoy" response ads involved scrolling counterarguments against a solid background or against visually distinct ads, but none employed the PPC procedure.

At the end of the survey, participants were re-exposed to the rival TurboTax ad and asked a series of four questions to gauge how favorably they viewed TurboTax:

1. How positively or negatively do you view TurboTax?
2. If you were to use an online tax filing service, how likely would you be to use TurboTax?

* Ads available at: <https://bit.ly/poisonparasite>

3. There are many competing tax preparation companies. Imagine they all offer tax filing for the same price. Would you choose to file your taxes through TurboTax or one of its comparable competitors?
4. If a friend asked you for a recommendation on online tax filing services, which company would you be most likely to recommend?

On the Monday after the Super Bowl—beginning about 12 hours after the game—the initial sample of participants was re-recruited to complete the second wave survey. The rival TurboTax ad was aired during the second quarter of the Super Bowl. This constituted the second exposure to the rival ad for all participants who watched the game. As a manipulation check, at the end of wave 2—after the outcome measures were collected—all participants were asked if they recalled seeing the rival TurboTax ad. Sixty-seven percent recalled seeing the ad (see SOM). We hypothesized that, as in prior controlled experiments with static ads, the PPC would mitigate decay of the counterclaims all participants saw in wave 1 (day 1), thereby neutralizing the persuasive effects of being re-exposed to the rival TurboTax ad during the Super Bowl. As such, wave 2 utilized the same outcome measures as in the first wave, but without explicit re-exposure to the rival ad since the game served as the second re-exposure for those who watched.

Seven days later, all participants who completed wave 2 and reported watching the Super Bowl (i.e., had presumably been exposed to the rival ad a second time) were invited to complete wave 3. In wave 3, participants were exposed for a third time to the rival ad, and again asked about their attitudes toward TurboTax.

Analysis and Results

The analytic universe is limited to those participants who reported watching the Super Bowl ($N = 1,172$) and thus had the opportunity to be re-exposed organically to the rival TurboTax ad during the game. If the PPC is effective, it should undercut the persuasive effects of the rival TurboTax ad upon each subsequent re-exposure—during the Super Bowl, and then again during the third wave. The analysis presented here focuses on the effect of the PPC relative to both the Poison Only ad and the Pure Counterargument ad. In the SOM, we also explore how removing the distraction of a background video (as in the Pure Counterargument ad) may affect recall and influence the efficacy of the ad, but that is not the main emphasis of this study.

The primary outcome of interest is a standardized aggregate “favorability index” comprised of the first two outcome measures. We evaluate the effect of treatment assignment on Turbo Tax favorability using a linear model controlling for participant race, age, party affiliation, gender, and income, as well as indicators for college education, prior Turbo Tax use, and whether self-reported weekly hours of television watched was above the median for the analytic sample.

Exposure to the PPC ad in the first wave (before the Super Bowl) effectively reduced TurboTax favorability during each subsequent wave, with the largest effects seen during the first wave. This aligns with the results of Study 3, which also showed the strongest effects of the PPC

at the time at which participants were initially exposed to the counter messages. In the first wave (day 1), TurboTax favorability among participants who had seen the PPC ad was 0.32 SD, $t(1171) = 4.88, p < .001, 95\% \text{ CI} = [0.19, 0.45]$, lower than favorability among participants who had seen the Poison Only ad, and 0.30 SD, $t(1171) = 4.51, p < .001, 95\% \text{ CI} = [0.17, 0.42]$, lower than favorability among participants who had seen the Pure Counterargument ad.

In the second wave (day 3)—after being re-exposed to the rival TurboTax ad during the Super Bowl—participants in the PPC condition still rated TurboTax as less favorable than participants in the Poison Only condition (0.32 SD, $t(1171) = 4.76, p < .001, 95\% \text{ CI} = [0.18, 0.44]$) and the Pure Counterargument condition (0.21 SD, $t(1171) = 3.17, p = .002, 95\% \text{ CI} = [0.08, 0.34]$). Effect sizes decreased slightly by the third wave (day 9), but remained highly significant: participants who had seen the PPC ad in wave 1 still rated TurboTax less favorably in wave 3 than participants who had seen the Poison Only (0.30 SD, $t(1171) = 4.49, p < .001, 95\% \text{ CI} = [0.17, 0.43]$) or Pure Counterargument ad (0.24 SD, $t(1171) = 3.57, p < .001, 95\% \text{ CI} = [0.11, 0.37]$). Similar patterns can be seen across all four outcome measures independently (see SOM).

Discussion

By demonstrating that the PPC can be effectively implemented via video ads, Study 6 meaningfully extends the applicability and utility of the PPC procedure, especially for communicators who may rely more heavily on TV or online video appeals.

Study 7: A Test of Cue-Based Recall

The previous studies established the effectiveness of the PPC across domains and modalities. Study 7 tested our hypothesized mechanism that the PPC's parasitic component leverages associative memory to overcome natural memory decay.

Method

Participants. Participants were 266 Amazon MTurk workers (mean age = 35 years, $SD = 11.5$; 51% female) who received \$1.80 for completing the survey. Standard participant qualifications were applied (see SOM).

Procedure. Study 7 utilized the same materials as Studies 3 and 4 (Fig. 3), with McKinley serving as the rival candidate. All workers who consented to participate and passed the attention check were randomly assigned to one of three conditions: Control, Traditional Response, PPC. Participants were not aware of their condition assignment.

The study procedures followed those described in Studies 1 and 2, except included two additional outcome questions asked at the end of the survey, upon re-exposure to the rival ad:

1. When you see the claims in McKinley's ad, how clearly do you recall the specifics of any arguments you may have viewed against those claims?

2. Which of the following anti-McKinley claims do you recall seeing, if any? *Participants were asked to choose from a list of eight options. Three of the choices were the exact counter-messages included in both the Traditional Response ad and the PPC ad.*

Analysis and Results

Following the same analysis procedures as in the previous studies, participants assigned to the PPC condition were again significantly less likely to vote for McKinley than participants in the Control condition (0.70 SD, $t(265) = 5.02$, $p < .001$, 95% CI = [0.43, 0.98]) and in the Traditional Response condition (0.43 SD, $t(265) = 3.06$, $p = .002$, 95% CI = [0.16, 0.71]). Similar effects of the PPC can be seen on perceived honesty (see SOM).

On the first recall measure, 27% of participants in the PPC condition reported they recalled seeing specific arguments against McKinley's claims "extremely clearly," versus 15% of participants in the Traditional Response condition ($\chi^2(1) = 3.71$, $p = .05$) and 5% of participants in the Control condition ($\chi^2(1) = 13.25$, $p < .001$). Corroborating these reports, when asked to identify which anti-McKinley messages they saw—from a list of eight possible choices—participants in the PPC condition correctly identified more of the three counter-messages ($M = 1.6$, $SD = 1.0$) than participants in the Traditional Response condition ($M = 1.3$, $SD = 0.97$), $t(265) = 2.73$, $p = .007$, 95% CI = [0.10, 0.61], or Control condition ($M = 0.16$, $SD = 0.40$), $t(265) = 11.32$, $p < .001$, 95% CI = [1.20, 1.70]. Relatedly, 24% of participants in the PPC condition correctly identified *all* three counter-messages, compared to 15% of participants in the Traditional Response condition ($\chi^2(1) = 2.57$, $p = .11$) and 0% of participants in the control condition.

Tellingly, the indirect effect of assignment to the PPC condition on perceived honesty was mediated by participants' recall of the specific counter-messages against McKinley in an analysis of 5,000 bootstrap samples, $\beta = -0.37$, $SE = 0.08$, 95% CI = [-0.54, -0.21]. In turn, as seen in Study 1, honesty mediated the effect of assignment to the PPC condition on participants' likelihood of voting for McKinley, $\beta = -0.37$, $SE = 0.09$, 95% CI = [-0.54, -0.19].

Discussion

Study 7 demonstrated that the PPC spurs recall of its counter-messages upon repeated exposure to a rival's ad, and that this can explain at least some of the effect of the PPC on perceptions of the rival candidate's dishonesty and subsequent voting behavior.

General Discussion

The Poison Parasite Counter is a cognitive science-based strategy for durably countering deceptive rival communications. By using associative memory to parasitically link a counterargument to a deceptive rival's communication, the PPC turns a rival's communication into a memory retrieval cue for its own self-negating counterargument. Associating the counterargument with the rival's communication increases the accessibility and salience of the

counterargument with each re-exposure to the rival communication. Once the counterargument is made accessible and salient, it can influence (and subvert) online evaluation of the rival's communication. Seven studies (and three additional studies in SOM) show that the PPC undercuts the persuasive effects of a rival's communication effectively, enduringly, and more potently than traditional counter-argumentation strategies.

This research makes four contributions. First, it theoretically develops and empirically validates a strategy to counter deceptive communications from better resourced rival communicators. This is particularly important because other corrective strategies for countering disinformation show minimal effects (Dias et al., 2020; Pennycook et al., 2020). This work can inform political psychologists who wrestle with how political information is processed and remembered, especially when communicators have asymmetric access (Taber & Young, 2013; McGraw, 2000). Similarly, it is relevant to marketing and communications scholars who study the dynamics and strategies of participants in unequal information environments (Mohr & Nevin, 1990).

Second, this work brings associative memory insights to the area of behavioral policy (Benartzi et al., 2017; Thaler & Sunstein, 2003). The PPC directly addresses one central challenge for behavioral policy: how to develop communications that bridge the time between when they are initially administered and when they are intended to have influence (Rogers & Frey, 2015; Rogers & Milkman, 2016).

Third, this work contributes to our understanding of multi-stage communication strategies. Recent work has explored the psychology of multi-stage social (Huang et al., 2017; Cooney et al., 2020) and negotiation communications (Bitterly & Schweitzer, 2019; Rogers, et al., 2017). This research suggests that associative memory can play a powerful strategic role in these contexts.

Fourth, PPC contributes to work on delayed persuasion, which examines sleeper (Kumkale & Albarracin, 2004) and inoculation effects (van der Linden & Roozenbeek, 2020). These effects are driven by source forgetting and defense fortification processes, whereas the PPC is driven by associative memory processes.

The studies reported here examined one prevalent form of communication: paid advertisements. Future research should examine the PPC's generalizability to other political communications like earned media, debates, and speeches. It should also explore non-political communications (e.g., marketing, management, and negotiation), as well as two-way turn-taking conversations as opposed to one-way communications. We examined the PPC only in the context of communicators who were previously unfamiliar to participants, and who were deceptive. Future research should explore the PPC's potency when the communicators are more familiar and/or not deceptive.

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