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

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One sentence summary
A cognitive science-based procedure turns a rival’s communication into an embedded retrieval cue for a poisonous counter-message, thereby undercutting the rival’s persuasive success.

Abstract (142 words)
Democracy requires the free and full exchange of ideas. However, asymmetrical reach in mass communications due to disparities in communicators’ resources or power can lead to imbalances in who is heard, regardless of the validity of their ideas. The Poison Parasite Counter (PPC) involves inserting a strong (poisonous) counter-message, just once, into a replica of a rival’s communication. In parasitic fashion, the rival’s communication then “hosts” the poisonous counter-message, which is recalled upon each new exposure to the rival communication. This strategy harnesses associative memory to turn the rival’s communication into a retrieval cue for a poisonous counter-message embedded within the rival’s communication. In seven randomized tests (N = 3,678), we show that the PPC procedure lastingly undermines a rival’s communication by influencing opinions of the rival communicator, as well as behavior in the form of real political donations to actual candidates.

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In any well-functioning democracy, the free and full exchange of ideas is viewed as essential to the discovery of truth and, consequently, to a properly informed citizenry (1-4). However, powerful, wealthy, or unduly influential sources are often able to use their positions and assets to obtain unequal access to mass communications such as through paid advertising. As a result, the messages of less powerful and less prominent sources can become overwhelmed and functionally suppressed—for example, in a political election campaign (5, 6)—diminishing their influence for reasons unrelated to their validity or veracity. This process, in itself, inhibits the development of a well-informed citizenry; but an even greater threat emerges when advantaged communicators—those who are more powerful and more visible—spread deceptive or untruthful information that ultimately influences public opinion.

We propose a cognitive science-based strategy to counter this problem of asymmetric reach in mass communications. Even absent asymmetries, the persuasive effects of mass communications, such as print, television, radio, or online advertising, tend to decay rapidly as the messages become less salient in memory over time (7, 8), especially in political campaigns (9). The rare evidence of persistence is believed to result from deeper information processing of a communication’s message (10, 11). In memory science literature, retrieval cues are particularly noteworthy for their efficacy in facilitating recall and for the range of contexts in which they are effective (12). We present a new strategy, the Poison Parasite Counter (PPC), that leverages Tulving’s “encoding specificity” mechanism to turn an advantaged rival’s communication into a memory retrieval cue for a countervailing message, thereby strengthening persistence of persuasive effects even in the presence of asymmetrical reach. The encoding specificity principle suggests that memory recall is facilitated when information and conditions present when a memory is first encoded are also present at the time of retrieval (13, 14). By this process, associating a disadvantaged communicator’s counter-message with a close replica of a rival’s existing communication effectively embeds the counter-message into the rival’s communication. Thereafter, the advantaged rival’s existing communication functions as a retrieval cue for the countervailing messages, which are then recalled upon each subsequent exposure to the rival’s communication.

In seven randomized studies, we test this possibility in the realm of product advertising and political candidate advertising, two areas where asymmetric reach in mass communications is common and consequential (15-17). If the persuasive effects of mass communications are small and decay rapidly, as current evidence suggests, advantaged communicators are able to ensure that their message is heard more consistently than less powerful voices. Thus, devising a method to lastingly undercut an advantaged communicator’s message is a critical step toward redressing imbalanced information environments. Moreover, the current lack of evidence of enduring persuasive communication effects in the field, particularly for political communications, does not preclude the possibility that novel communication strategies like the PPC could yield more sustained persuasive success. Using both static and video ads, we show that the PPC procedure can be executed by inserting strong (poisonous) counter-messages, just
once, into a close replica of a rival’s communication, causing the counter-messages to then live (parasitically) in that communication. Specifically, we focus on the capability of the PPC to reduce asymmetric reach in its most troubling form—when the claims of the advantaged communicator are untruthful. There is an evolved human sensitivity and aversion to deceptive presentations (18, 19), as well as a robust reaction against them (20-22). As such, offering evidence of a rival’s duplicity and bringing it to mind each time the rival’s communications are encountered produces an especially toxic kind of “poison” against the rival’s message. Meanwhile, the PPC’s parasitic component is the perceptual similarity between the advantaged rival’s communication and the counter-response. This parasitic element results in recurring, cue-induced recall of the poisonous counter-messages whenever the rival’s communication is later encountered, making the counter-messages resistant to normal memory degrading processes (23). We hypothesized that the combination of poisonous and parasitic elements would neutralize the persuasive effects of repeated exposure to a rival’s communication compared to presenting the same counter-messages in a traditional, visually independent form.

For our first four studies, we created a set of 10 fictional political ads, including one “pro” and one “response” ad for each of five different candidates. For one of these candidates, Walter McKinley, we developed two response ads. The first utilized the PPC procedure by overlaying counter-messages highlighting the duplicitous nature of the original ad on an exact visual replica of the rival’s original ad (see Figure 1). 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.

The first three randomized studies establish the efficacy of the PPC procedure at a single point in time. All were conducted on Amazon’s Mechanical Turk (MTurk). In Study 1 (N = 297) participants completed a 15-minute survey during which they were shown the original pro-McKinley ad (the “rival ad”), and then were randomly assigned to see one of two treatment ads: the PPC ad or the Traditional Response ad. The McKinley ads were interspersed with eight “decoy” ads for other fictional political candidates, and filler material designed to both draw attention away from McKinley and to interfere with memory retrieval processes. About 10 minutes after viewing the PPC or Traditional Response ad, participants were shown the rival McKinley ad a second time, and asked to rate his honesty and how likely they would be to vote for him if he were running in a primary election in their state. Participants who had previously seen the PPC ad were significantly less likely to vote for McKinley relative to participants who had seen the Traditional Response ad (0.61 SD, SE = 0.11, p < .001; see Figure 1, which reports unstandardized means). In a similar pattern, participants who saw the PPC ad rated McKinley as significantly less honest (0.70 SD, SE = 0.11, p < .001) than participants in the Traditional Response condition.

The PPC and Traditional Response ads in Study 1 had identical content (see Figure 1) and were from the same source, which ensures that any difference between conditions was not the result of source sleeper effects (24). Yet, it is possible that the effects were instead driven by
differential ad quality—if the PPC ad was a superior ad, we would expect to see both an immediate and a lasting effect on participants’ perceptions of McKinley. Study 2 tests this directly using the same materials as Study 1 in a pre-registered factorial design ($N = 712$). Participants were first randomized to see the PPC or Traditional Response ad, and subsequently randomized to answer the dependent variable questions either immediately after viewing the treatment ad, or at the end of the survey. When measured immediately after viewing the PPC ad or Traditional Response ad, participants’ likelihood of voting for McKinley was equivalent across conditions ($F(1,348) = 0.00, p = 0.95$), as was perceived honesty ($F(1,348) = 1.28, p = 0.26$). Additionally, immediate recall was also equivalent across conditions: when asked immediately after viewing the PPC or Traditional Response ad to identify the counterclaims they had just seen, 72% of participants in both the PPC condition and the Traditional Response condition were able to correctly do so ($\chi^2(1) = 0.02, p = 0.89$). Thus, at the time of exposure, the two ads spurred equal recall and produced equally 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 procedure inherently facilitate a more fluid comparison with the rival material.

Meanwhile, when participants were asked to rate McKinley’s honesty and their likelihood of voting after being re-exposed to the rival McKinley ad at the end of the survey—after interference-producing filler and decoy materials—we find results that parallel those of Study 1. 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 we hypothesized, the PPC procedure 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, $SE = 0.10, p < .001$) and rated him as significantly less honest (0.41 SD, $SE = 0.10, p < .001$) than those who saw the Traditional Response ad.

In order to establish the efficacy of the PPC procedure, Studies 1 and 2 utilized PPC and Traditional Response ads that offered identically parallel content (see Figure 1); only the visual aesthetic differed between the two ads. In reality, response ads traditionally encompass cohesive narratives, rather than individual and fragmented counterclaims. As such, Study 3 tested the effect of the PPC procedure against a more externally valid Traditional Response ad, which offered the same counterarguments as the PPC ad, but presented in a more realistic narrative form. Study 3 also added a control group, in which participants saw an ad for an entirely different fictional candidate, in order to compare the effects of the PPC and Traditional Response ads relative to no counter-message at all.

In a pre-registered study with 602 MTurk workers, exposure to the PPC ad significantly reduced participants’ subsequent likelihood of voting for McKinley relative to the Control ad ($0.85 SD, SE = 0.10, p < .001$), and relative to the Traditional Response ad ($0.38 SD, SE = 0.09, p < .001$). 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, SE = 0.10, p < .001), as well as in the Traditional Response condition (0.30 SD, SE = 0.10, p < .001). Although the Traditional Response ad also reduced participants’ likelihood of voting for McKinley and their perceptions of his honesty compared to the control (see supplement), it did so to a lesser extent than the PPC ad. This suggests that, as seen in Study 2, the PPC procedure slows the decay of persuasive effects. In supplement studies I and II, we replicated these results with variations in the frequency of exposure to both the rival McKinley ad and the Traditional Response ad.

Study 4, also pre-registered, extends these findings by testing whether the effect of the PPC procedure is durable over time and in the presence of more significant memory interference. With a sample of 330 MTurk workers, we conducted five survey waves over a span of 16 days using the same materials as in study 3. Demographics as measured on the first day and attrition across days are both balanced across conditions. To ensure that we did not unintentionally provide associative links between the McKinley ad and the PPC or Traditional Response ads, participants viewed the McKinley ad during the first wave on day one, and the PPC, Traditional Response, or control ads during the second wave which was administered on day three. On all other waves, participants were only shown the McKinley ad so that by the end of the fifth wave, each had seen the rival McKinley ad nine times.

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. As expected, the PPC procedure had a large and significant effect on likelihood of voting for and perceived honesty of McKinley relative to both the Traditional Response and the control ads. In the waves on all later days, the effect of the PPC procedure remained significantly superior to the Traditional Response ad (see Figure 2, 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, SE = 0.13, p < .001), and rated him as significantly less honest (0.43 SD, SE = 0.13, p = .001) relative to those who had seen the Traditional Response ad. Despite large frequency-of-exposure disparities and time-induced memory interference, the PPC procedure continued to undercut the rival ad throughout the two-week period. 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 (7-9) over time: in waves three (on day 6), four (on day 9), and five (on day 16), there was no significant difference in likelihood of voting or perceived honesty for McKinley between participants who saw during wave two (on day 3) the control ad and those who saw the Traditional Response ad (all p > .10; see supplement). These findings were replicated in supplement study III.

The first four studies provide strong evidence of the efficacy and durability of the PPC procedure in a low-stakes and hypothetical setting—a contest between fictional political candidates. It is possible that the superiority of the PPC procedure in the previous studies was not due to its psychological properties as we hypothesized but, instead, to an artifact within our
procedures or materials—perhaps the PPC procedure is less effective when the focus is a real political candidate and election for which individual opinions may be less malleable. To address this, Study 5 aimed to demonstrate that the PPC procedure can affect a consequential behavior in a real campaign with real political ads. Relying on the same paradigm as Study 1, we replaced the fictional ads with real political communications from an election that was active and ongoing at the time of the study—the 2018 Democratic gubernatorial primary election in Michigan. Critically, we also added a consequential outcome measure that matters to political campaigns—political donations (25).

As the rival ad, we used a real print ad produced by Gretchen Whitmer’s campaign, a 2018 Democratic gubernatorial candidate in Michigan. The Traditional Response ad was an actual ad produced and circulated during the election by the campaign of Shri Thanedar, one of her main Democratic opponents. We modified this response ad to create two new versions that used the PPC procedure: a “full” and a “tailored” PPC ad (26; see Figure 3). We tested the efficacy of these newly created PPC ads against the Traditional Response ad actually used in the campaign with a sample of 299 MTurk workers. The study was conducted prior to the primary election, and excluded all MTurk workers in Michigan, per IRB request, so as not to influence the beliefs or opinions of prospective voters.

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 Figure 3). Meanwhile, 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, 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 stronger directional results. Nevertheless, the relative equivalency of the PPC versions suggests that there are multiple ways to implement the PPC procedure effectively.

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-seven percent of participants in the Full PPC condition and 61% in the Tailored PPC condition directed the donation to Whitmer’s campaign (instead of Thanedar’s), compared to 75% in the Traditional Response condition and 90% in the control condition. The percentage of participants who directed the donation to Whitmer was significantly lower in both PPC conditions than in the Traditional Response condition (both $\chi^2(1) > 3.6, p < .10$) and the control condition (both $\chi^2(1) > 15.1, p < .001$). Thus, not only does the PPC procedure reduce the viability of a rival’s message, it also influences related behavior in the form of financial support for that candidate.
The previous studies relied on static ads because they readily lent themselves to tight experimental controls. Given that video ads comprise a growing share of all digital advertising, showing that the PPC procedure can also be effectively implemented via video would significantly extend its applicability. Study 6 does this by testing the PPC procedure in a real-world setting using video ads for a consumer product. 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 procedure 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.” In the PPC ad, this text scrolled twice across the screen over the course of 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.*

On the Friday before the Super Bowl, we recruited 2,429 participants on MTurk for a three-part study that was run over nine days. The first wave took place during the 24 hours preceding the Super Bowl. In a design that mimicked that of our previous studies (see supplement), we randomly assigned participants to see the PPC ad, the Poison Only ad, or the Pure Counterargument ad. In a 15-minute survey, we interspersed the assigned treatment ad with the rival TurboTax ad—the one that was to run during the Super Bowl—and eight other television ads for a variety of services and products. The rival TurboTax ad was shown first, followed by the assigned treatment ad approximately four minutes later. 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 (see supplement). Then, we re-recruited the same sample of participants on the Monday after the Super Bowl—beginning about 12 hours after the game. We solicited opinions on TurboTax using 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. Finally, we followed-up with the same sample again for a third wave seven days later, offered a third re-exposure to the rival ad, and again re-assessed their attitudes toward TurboTax.

We limit our analysis to only 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 procedure is effective, it should undercut the persuasive effects of the rival TurboTax ad upon each subsequent re-exposure—first during the Super Bowl, and then

* The ads that were created for this study can be found at: https://bit.ly/poisonparasite
during the third wave. Our analysis focuses on the effect of the PPC procedure relative to both the Poison Only ad and the Pure Counterargument ad. In the supplement, 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 here.

We find that 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 procedure at the time at which participants were initially exposed to the counter messages. In the first wave, TurboTax favorability among participants who had seen the PPC ad was significantly lower than favorability among participants who had seen the Poison Only ad (0.32 SD; $SE = 0.07$, $p < .001$), or the Pure Counterargument ad (0.30 SD, $SE = 0.07$, $p < .001$). Effect sizes decreased slightly when collected during the second and third waves, but remained highly significant. Similar patterns can be seen across all four outcome measures independently (see supplement). In a setting in which participants were organically and experimentally exposed repeatedly to a rival communication—the TurboTax Super Bowl ad—the PPC procedure lastingly undercut the rival communication’s persuasive effects. This meaningfully extends the applicability and utility of the PPC procedure, especially for less prominent candidates or organizations whose messages may be relatively infrequently seen and whose communication channels may rely more heavily on either TV or online video advertising.

Together, our first set of studies establishes the potency of the PPC procedure across domains and modalities. We hypothesized that the PPC procedure would be effective against a more frequently encountered rival ad because the parasitic component of the procedure spurs recall of the embedded counter-messages each time the rival ad is subsequently viewed, thereby hindering memory decay. In Study 7 ($N = 266$), we tested this mechanism directly by adding two questions to measure participants’ recall of the counter-messages. Again using the McKinley materials, we followed a similar design as study 1 and added two recall questions at the end of the study after the second exposure to the McKinley rival ad: we asked all participants (a) how well they remembered any specific arguments they may have seen against McKinley on a scale of 1 to 5, and (b) to identify the specific anti-McKinley claims they saw from a list of eight possible choices.

Replicating the effects seen in previous studies, exposure to the PPC advertisement reduced participants’ likelihood of voting for McKinley and reduced perceived honesty. On the first recall measure, 27% of participants in the PPC condition reported that 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 4.6% of participants in the control condition ($\chi^2(1) = 13.25, p < .001$). When asked to identify which anti-McKinley messages they saw—from a list of eight possible choices—24% of participants in the PPC condition correctly identified all three counter-messages, compared to only 15% of participants in the Traditional Response condition ($\chi^2(1) = 2.57, p = .11$) and 0% of participants in the control condition.
The effect of assignment to the PPC condition on perceived honesty was mediated by participants’ recall of the specific counter-messages against McKinley ($z = -4.55, p < .001$). In turn, honesty mediated the effect of assignment to the PPC condition on participants’ likelihood of voting for McKinley ($z = -4.14, p < .001$). In studies 1, 3, and 4, honesty also consistently mediated the effect of condition assignment on our primary outcome measures (see supplement). Taken together, this supports our hypothesis that the PPC procedure spurs accessibility and recall of the counter-messages upon repeated encounters with the advantaged rival’s ad, and that this approach is most potent when the counter-messages offer evidence of a rival’s duplicity.

We showed that the PPC procedure leverages associative memory and cue-based recall to structure one-time communications that lastingly undermine the claims of a more frequently encountered disputable rival. Across the seven studies reported here (and three additional studies in the supplement), the PPC procedure effectively and enduringly undercut the persuasive effects of a rival’s communication by using retrieval cues to activate memory and slow decay of the countervailing messages. While these studies examined one form of communication—paid advertisements—the underlying cognitive mechanisms of the PPC procedure likely apply to earned media and direct forms of communication to constituents as well. These studies also focused on the application of the PPC procedure in the context of asymmetries in frequency of exposure to an unfamiliar rival communication and communicator. Future research should explore how powerful the PPC effect is for advantaged rival communicators who are also more familiar to voters. The PPC procedure’s effectiveness represents an important step towards redressing at least some imbalanced information environments in which legitimate critiques by disadvantaged voices can be drowned out by more advantaged communicators.
Table 1. Description of studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Conditions</th>
<th>Purpose</th>
<th>N</th>
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<tbody>
<tr>
<td>1</td>
<td>PPC; Traditional</td>
<td>To establish basic effect of the PPC procedure relative to a Traditional Response ad at a single point in time.</td>
<td>297</td>
</tr>
<tr>
<td>2</td>
<td>PPC + immediate DV; Traditional + immediate DV; PPC + end DV; Traditional + end DV</td>
<td>To establish the psychological mechanism that the PPC procedure slows the natural decay of persuasive effects of counter-messages.</td>
<td>712</td>
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<tr>
<td>3</td>
<td>PPC; Traditional; Control</td>
<td>To increase external validity by testing the effect of the PPC procedure against a more realistic Traditional Response ad.</td>
<td>602</td>
</tr>
<tr>
<td>4</td>
<td>PPC; Traditional; Control</td>
<td>To establish the durability of the PPC effect over a 16-day period.</td>
<td>330</td>
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<tr>
<td>5</td>
<td>PPC (full); PPC (tailored); Traditional; Control</td>
<td>To demonstrate the PPC effect with real political ads and on a real behavioral measure—political contributions.</td>
<td>299</td>
</tr>
<tr>
<td>6</td>
<td>PPC; Poison Only; Pure Counterargument</td>
<td>To establish the PPC effect with a new modality—video ads—and in the context of real-world re-exposure to the rival communication.</td>
<td>1,172</td>
</tr>
<tr>
<td>7</td>
<td>PPC; Traditional; Control</td>
<td>To demonstrate the mechanism of cue-based recall.</td>
<td>266</td>
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Fig. 1. Study 1 paradigm and results. Participants’ likelihood of voting for the rival candidate (McKinley) in Study 1 on an unstandardized 1-5 scale where 5 represents “extremely likely” and 1 represents “extremely unlikely.” Error bars reflect ±1 standard error. Top horizontal bars show regression-adjusted difference in means. *p<0.01.
Fig. 2. **Study 4 paradigm and results.** All participants saw the rival ad on day 1; the control, traditional, or PPC ad on day 3; and then the rival ad six more times over 13 additional days. Graph represents participants’ likelihood of voting (on an unstandardized scale of 1-5) for the rival candidate (McKinley), measured after each subsequent exposure to the rival ad on days 6, 9, and 16. Error bars reflect ±1 standard error. *p<0.01.

Fig. 3. **Study 5 paradigm and results.** All participants saw the rival ad first, followed by filler material and either the Control, Traditional, Full PPC, or Tailored PPC ad. The tailored PPC ad is shown in the supplement (see Figure S3). Graph represents participants’ likelihood of voting (on an unstandardized scale of 1-5) for the rival candidate (Whitmer) after the second exposure to the rival ad. Error bars reflect ±1 standard error. Vertical bars represent regression-adjusted difference in means. *p<0.01.
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25. All donations that were allocated as part of this study were made to the candidates’ actual 
campaigns prior to the primary election.
26. Neither of the PPC ads was sent by the campaign; they were created solely for the purpose of 
this study.
27. “HIT” stands for “human intelligence task.” Each survey or task completed by a worker on 
MTurk is called a HIT.
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availability: The materials and data for all studies are available on OSF (https://osf.io/aps8h/).

List of supplementary materials:
Materials and Methods
Tables S1 to S25
Figures S1 to S8