Article

Making Pledges More Powerful: Effects on Pro-Environmental Beliefs and Conservation Behavior

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Abstract: We developed pledges that capitalized on several self-related properties (e.g., freedom of choice, actual-ought self-discrepancies, foot-in-door technique) and manipulated two experimental factors: pledge beneficiary and pledge audience. In two studies, participants received a recycling pledge based on a random assignment in a 2 (Beneficiaries: Nature vs. Self) × 2 (Audience: Ingroup vs. Outgroup) design. Afterwards, we assessed their pro-environmental beliefs and provided them with a behavioral opportunity to support conservation (i.e., recycling debriefing forms in Study 1, writing letters to congresspeople regarding an environmental policy in Study 2). In both studies, an interaction between beneficiaries and audience was observed, showing that a recycling pledge framed as benefitting nature and sponsored by a social ingroup led to more progressive environmental beliefs. In Study 2, individuals in the same condition (i.e., the nature-ingroup pledge) wrote more persuasive letters (longer and more sophisticated letters) supporting pro-environmental legislation. Implications for constructing effective pledges and for leveraging the self to promote pro-environmental action are discussed.

Keywords: environmental pledges; social influence; self-concept; climate change

1. Introduction

The adverse impact of human activity on the planet is undeniable. Anthropogenic climate change is causing warming temperatures, rising sea levels, reductions in fresh drinking water, shrinking crop yields, and losses in biodiversity [1–3], and the impact of global warming will be catastrophic during the next century unless greenhouse gas emissions are significantly reduced [4]. Furthermore, ambient air pollution kills millions of people each year and harms millions more by producing birth defects, respiratory diseases, and neurodevelopmental and cognitive functioning deficits [5]. In addition to the impact of industrialization, individual behaviors harm the environment. Residential waste can lead to the toxic contamination of fragile ecosystems; however, improving people's beliefs about the benefits of recycling increases the waste recovery of harmful household materials [6,7].

Because psychology studies human motivation and behavior, psychologists must play a key role in developing strategies to foster pro-environmental action [8–10]. In the current work, we focused on conservation pledges that leveraged several important properties of the self that underlie core psychological motivations [11–14].

1.1. The Psychology of Pledges

A pledge is a personal commitment to abide by a rule or to live up to a particular standard of behavior [15,16]. Although pledges are common (e.g., abstain from alcohol, support public radio), there has not been much experimental research conducted to understand their properties. Yet, there are many psychological reasons why pledges (e.g., "I will recycle more in the coming year") might be effective. First, pledging increases self-awareness, which makes people reflect on their actions and whether they comport

with their values [17,18], encouraging normative behavior. Second, a pledge establishes an explicit goal, which will encourage people to reduce the discrepancy between their current behavior and that goal [11,19–21]. Indeed, many self-regulation theories posit that people experience negative emotions when their current actions are discrepant from their goals, and these negative feelings motivate them to pursue their goals to reduce this discomfort [22–25]. Third, once a goal is established, people are more likely to develop if-then implementation intentions to support goal-completing actions [26,27], and encouraging the formation of pro-environmental implementation intentions improves conservation behavior [28]. Finally, making pledges public should increase compliance to serve social affiliation motivations [29]. In other words, if people make pledges to a person or to a social group whose approval matters, people should be more motivated to fulfill the commitment.

Although many pledge programs have been successful, including encouraging people to eat healthy food [30], to wear seat belts [31], and to increase blood donations [32], not all are successful or long-lasting. For instance, Boyce and Geller [15] combined pledging with external incentives to promote pedestrian safety. Even though their pledge program worked in the short term, once the incentives were removed, people no longer maintained safe behavior. In academic contexts, sometimes anti-cheating pledges have been effective [33] and sometimes they have not [34].

This pattern of mixed success has been observed in conservation contexts as well. For example, DeLeon and Fuqua [35] tried to improve community recycling by using pledges, yet they were ineffective. However, their "pledge" consisted of simply listing people's names in a newsletter under the heading "concerned about the future of our environment". The current work was conducted in a more controlled setting and used a more elaborate recycling pledge crafted to leverage self-motivations. Further mixed evidence for the potential of pledges derives from research on general commitment-based conservation approaches, examining pledges and other strategies that ask people to commit to a behavior change over a period of time. A meta-analysis of 19 studies [36] found that, although commitment-based interventions led to more pro-environmental behavior, effect sizes were small-to-moderate. Although pledges may be somewhat effective in instigating change, there appears to be room to improve their efficacy.

1.2. Making Pledges More Powerful

Because of these mixed findings, we sought to identify factors that would make pledges more efficacious. In the current work, we focused on pledges to improve recycling. Our pledges were designed to maximize one's sense of choice in signing a pledge to avoid reactance effects [37,38]. Thus, the pledge used in the current work emphasized its voluntary nature, was signed in a private setting, and participants were repeatedly told that they were under no obligation to sign it. Similarly, our pledges incorporated self-discrepancy theory, especially with respect to people's obligations. When people experience a discrepancy between their actual and ought selves, they experience feelings of agitation that, in turn, increase commitment to meeting those obligations [21,39]. Accordingly, we framed recycling as an important obligation to strengthen commitment to recycling. Finally, we leveraged consistency principles [40–42] by having participants read several paragraphs of information and, after each one, initialing that they understood the paragraph. By providing these initials throughout the pledge document, participants were more likely to sign the pledge at the end of the page because of self-perception and foot-in-door processes [41,43].

All of our pledges incorporated the principles of choice, self-discrepancy, and self-perception to increase their impact. In addition, we considered and manipulated two additional pledge properties. First, we considered the role of pledge audience. Every pledge is made to someone, so does its audience matter? We reasoned that a pledge to an ingroup audience (i.e., a group to which the self is a member) should be more powerful than the same pledge made to an outgroup audience. People experience greater similarity, closeness, and responsibility for the welfare of ingroup, compared to outgroup, members [44–46].

Compared to outgroup members, people desire validation from ingroup members [47], engage in more prosocial actions for ingroup members [48], and seek ingroup members' approval [29]. Thus, a pledge audience composed of ingroup members, compared to outgroup members, should make a pledge more effective.

The second factor that we manipulated was pledge beneficiary. That is, people can take an environmental pledge to benefit selfish needs (e.g., support one's lifestyle) or to benefit nature (e.g., support plants and animals). We hypothesized that having people take a pledge to benefit nature could trigger greater pro-conservation responses because such an expression would associate the self more strongly with nature, which predicts stronger pro-environmental actions [49,50]. Thus, we anticipated that people whose pledges focused on the benefits for plants and animals would show more pro-environmentalism than those whose pledges discussed the benefits for oneself and one's lifestyle. Although taking a pledge for selfish reasons might produce some degree of compliance, we reasoned that taking a pledge to benefit nature should strengthen self-nature associations, leading to subsequent actions consistent with supporting nature in particular.

1.3. The Current Work

We experimentally manipulated pledge audience (ingroup vs. outgroup) and pledge beneficiary (nature vs. self) in a between-subjects factorial design to study how these factors might affect pledge effectiveness, as revealed by shifts in pro-environmental attitudes and behavior. We did not include a control group, both to maximize resources for a study involving individually run participants and because of the inherent difficulty in identifying a truly neutral condition. For example, if we did not specify any pledge audience, participants would have assumed that their pledge had some audience (e.g., experimenters), introducing idiosyncratic variability. In the current work, we acknowledge that the effects of pledge conditions speak to relative differences between the factors investigated. We predicted the strongest pro-conservation outcomes for pledges involving ingroup audiences and nature beneficiaries, and it was an open question about whether we would observe main effects or an interaction involving the two independent variables. For example, it might be that any effect of pledge audience on pro-environmental outcomes might only be revealed for pledges involving nature as a beneficiary, producing an interaction.

We explored multiple outcomes to assess pledge effectiveness. First, in both studies, we examined how pledges would alter people's pro-environmental beliefs. If pledges for ingroup audiences associated with nature beneficiaries are especially powerful, we would expect to see the strongest progressive environmental beliefs in that experimental condition. Second, we assessed more direct behavioral outcomes in two ways. In Study 1, we measured whether participants recycled their debriefing form after leaving the laboratory. In Study 2, we asked participants to consider writing letters to congressional representatives regarding pro-environmental legislation to gauge how pledges may lead to another form of pro-environmental behavior [51]. We examined participant letters for evidence of stronger pro-environmental advocacy (e.g., number of words written in support of pro-environmental legislation) and using indices of argument quality derived from Coh-Metrix [52].

2. Study 1: Materials and Methods

Study 1 examined how recycling pledges that varied in pledge audience and pledge beneficiary affected post-pledge environmental beliefs [53] and recycling behavior (i.e., whether participants recycled their debriefing form or threw it away).

2.1. Participants and Design

An a priori sample size analysis conducted via G*Power [54], assuming 80% desired power and a small-to-medium effect size (f = 0.20) based on the average effect size in social psychology [55], specified a minimum sample size of 199. A slightly larger sample was recruited in order to account for possible missing data, resulting in a final sample of

209 Miami University undergraduate students, who participated for research course credit (163 female, 46 male; Mage = 18.49, SDage = 0.71). Based on self-report (participants could select multiple categories), there were 176 White, 14 Black or African-American, 3 Bi-racial, 1 Native American, 11 Asian, 7 Latino, and 4 group-unidentified participants. Students arrived at the laboratory in small groups, and they were immediately taken to separate rooms where they completed the rest of the study individually (and left individually at the end of the study as well). Participants were randomly assigned to conditions in a 2 Pledge Beneficiary (Nature vs. Self) × 2 Pledge Audience (Ingroup vs. Outgroup) between-subjects factorial design.

2.2. Procedure

Pledge. Participants read a pledge asking them to commit to recycling significantly more materials during the school year (see Appendix A). These one-page pledges were between 563–567 words in length and presented information in three sections, requesting that participants sign their initials after each section confirming that they read the section and understood it. This initialing process encouraged participants to read each section closely and to trigger foot-in-door and self-perception processes [40,43]. Each pledge, regardless of condition, began with an opening narrative explaining that people ought to recycle more than they currently do to enhance actual-ought self-discrepancies [21,23]. Next, each pledge provided an explanation of the benefits of recycling, and this portion of the pledge provided the experimental manipulation of pledge beneficiaries which was based on Schultz's [50] environmental concern scale. Participants in the self-beneficiary condition read, "Recycling produces concrete benefits for me, my lifestyle, my health, and my future". In contrast, participants in the nature beneficiary condition read, "Recycling produces concrete benefits for plants, marine life, birds, and animals". Afterwards, the pledge manipulated its audience by explicitly communicating who would see their pledges. In the ingroup audience condition, participants read that the pledges were sought by a student group at Miami University (their own university) and that all signed pledges would be displayed at the Miami University campus student center for 2 months. In the outgroup audience condition, they were told that the pledges were sought by a student group at Kennesaw State University and that all signed pledges would be displayed in its student center for 2 months. We did this because we wanted to use an outgroup state university unknown to our participants and for which they held no strong attitudes. In pilot testing involving 26 students from the same Midwestern state university (none of whom participated in the main study), we asked them to rate Kennesaw State University (KSU) in terms of their liking on a 9-point scale (1 = strong negative feelings, 5 = mixed or neutral feelings, and 9 = strong positive feelings), their knowledge of KSU on a 9-point scale (1 = no knowledge, 5 = some knowledge, 9 = a lot of knowledge), the number of people they knew at KSU, and to identify the state where KSU is located (open-ended response). They reported neutral attitudes toward KSU ($M = 4.85$, $SD = 1.22$; not different from the midpoint, $t(25) = 0.642$, $p = 0.527$), little knowledge of KSU ($M = 2.08$, $SD = 1.13$; significantly below the midpoint, $t(25) = 13.206$, $p < 0.001$), and did not know anyone at KSU ($M = 0.00$; $SD = 0.00$). Fourteen of them attempted to identify the state where KSU is located, and only 1 student correctly identified Georgia (all other responses were listed by only one participant, except for California and Kentucky, which each were listed by two students).

Pro-environmental beliefs. After completing the pledges, we assessed participants' pro-environmental beliefs using New Ecological Paradigm (NEP) scale [53]. The NEP captures dominant beliefs (e.g., "humans were meant to rule over the rest of nature") and more progressive beliefs (e.g., "The earth is like a spaceship with very limited room and resources"), where each item was endorsed on a scale ranging from 1 (strongly disagree) to 5 (strongly agree). Reliability analyses involving the two subscales showed less-than-desirable reliability for dominant belief ($M = 2.79$, $SD = 0.55$, $\alpha = 0.65$) and contemporary belief ($M = 3.78$, $SD = 0.49$, $\alpha = 0.68$) subscales. We originally planned to examine the

NEP as a single measure (computing an overall mean score, reverse scoring the dominant items, to produce one index of relatively progressive environmental beliefs; [53]). As noted, neither subscale exhibited acceptable reliability, and a reliability analysis including all 15 items showed similar unacceptable reliability ($\alpha = 0.65$), which led us to adopt the factor score approach in the current study. Analyses combining all 15 items into a single measure did not produce significant results in Study 1, which is not surprising because this measure was unreliable (some have expressed concerns about the NEP and its use [56]). This is the only occasion in several studies conducted in our lab where the NEP has shown poor reliability, and it is unclear why the entire scale was unreliable in Study 1. Indeed, we used the NEP again in Study 2, where we observed acceptable reliability for the entire 15-item measure ($\alpha = 0.79$). Thus, in this study, we conducted a principal components analysis with varimax rotation on the entire NEP scale, and the scree plot revealed a one-component solution ($\lambda_1 = 3.74$, with the next four eigenvalues of 1.48, 1.32, 1.14, and 1.08). This component revealed that two dominant items (humans have the right to modify the natural environment to suit their needs; humans were meant to rule over the rest of nature) and two contemporary items (plants and animals have as much right as humans to exist; despite our special abilities humans are still subject to the laws of nature) loaded together, with dominant and contemporary items loading in opposite directions. We used this factor score as the index of relatively more progressive environmental beliefs (i.e., seeing human behavior as having an often detrimental impact on the environment and believing that people should not try to master or manipulate nature) following the pledge.

Debriefing (actual recycling behavior). At the end of the study, participants provided demographic information and were asked to voluntarily provide their email to answer potential follow-up questions (78% of participants complied). Finally, participants were given a debriefing form on blue paper. The form explained that the study was investigating how people respond to pledge requests and how they affect behavior. The participants were then thanked and told that they were free to go. Outside of the laboratory were two clearly labeled bins: trash and recycling (similar bins were paired throughout the entire psychology building). Unbeknownst to the participants, each debriefing form had an identification code, allowing the experimenters to determine whether a particular participant recycled or threw away the debriefing form. Experimenters examined trash and recycling bins throughout the psychology building each night to find debriefing forms disposed of in other parts of the building. In addition, participants who provided their email address to the experimenters were emailed that evening asking them to report what they did with the debriefing forms, and 50% of them responded to the email. Based on debriefing forms found in the psychology building or participants' responses to the email inquiry, we determined that 40 participants recycled their debriefing form, 7 threw it away, and 71 reported still having it that evening.

3. Study 1: Results

3.1. Pledging

Of the 209 participants in the study, 177 signed the pledge (85%). Log-linear analyses revealed that the likelihood of signing the pledge did not vary as a function of the experimental condition, $|Z|s < 1.37$, $ps > 0.172$. Thus, the majority of the participants signed the pledge, and the likelihood of signing did not vary across the conditions.

3.2. Environmental Beliefs

To assess the effect of pledges on environmental beliefs, a 2 (Pledge Beneficiary: Self vs. Nature) $\times$ 2 (Pledge Audience: Ingroup vs. Outgroup) analysis of variance (ANOVA) was conducted on the post-pledge environmental beliefs factor score. An interaction between pledge beneficiary and audience type was found, $F(1,205) = 6.61$, $p = 0.011$, $\eta_p^2 = 0.03$. As Figure 1 shows, participants who read a pledge framed to benefit nature and with an ingroup audience showed the most progressive post-pledge environmental beliefs ($M = 0.39$, $SD = 0.81$; 95% CI 0.13, 0.66). The other three conditions did not reliably differ from each other based on 95% CIs.
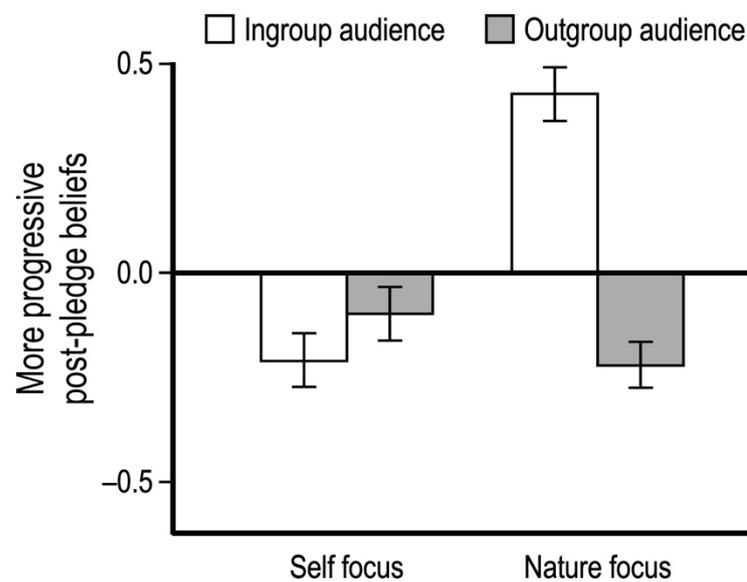
Figure 1. Interaction between pledge focus and audience type on post-pledge progressive environmental beliefs factor score (error bars are standard errors) for participants in Study 1.

3.3. Recycling

Next, we explored whether pledge type affected participants' recycling their debriefing forms. Unfortunately, we could only determine the outcome for 118 debriefing forms (56% of the sample). Because kept debriefing forms reflected an unknown final outcome (at some point, they would be recycled or thrown away, but that outcome was not yet knowable), we computed a recycling-versus-trash score, coding recycled forms as +1 and thrown away forms as −1. A pledge beneficiary by audience type ANOVA found no significant effects, with the interaction not achieving statistical significance, $F(1,114) = 2.16$, $p = 0.145$. Descriptively, the greatest recycling was observed in the nature-ingroup condition ($M = 0.40$, with none of these participants throwing away their debriefing forms) and the other conditions showing descriptively less recycling (range 0.16 to 0.33), but these differences were not statistically significant.

4. Study 1: Discussion

Study 1 focused on the self as a vehicle to improve conservation efforts. Specifically, we developed recycling pledges to enhance personal choice to avoid reactance [37,38], to highlight recycling obligations to trigger actual-ought self-discrepancies [21,23], and to enhance self-perception and foot-in-door effects [40,41]. Additionally, we experimentally manipulated two factors to examine the effects of pledge audience (ingroup vs. outgroup) and pledge beneficiary (nature vs. self). We found that those who signed recycling pledges emphasizing benefits for nature to an ingroup audience showed the most progressive environmental beliefs, revealed by an interaction between pledge audience and pledge beneficiary. Although we observed a similar descriptive pattern for in-the-moment recycling of debriefing forms rather than throwing them away, the interaction did not achieve statistical significance.

5. Study 2: Materials and Methods

Although Study 1 provided good evidence that specific forms of pledge framing (e.g., focusing on benefits for nature and an ingroup audience) promoted greater pro-environmental outcomes, some caveats apply. First, although we observed an interaction between pledge beneficiaries and audience on post-manipulation conservation beliefs, the same effect was not significant for recycling behavior (though descriptively consistent with predictions). Part of the difficulty in fully testing the prediction was that the final disposition of many debriefing forms was unknown. Unlike past work [57] that explicitly

asked participants to discard materials in either a recycling or waste bin immediately outside of the laboratory, we merely provided participants with these two bins outside of the lab without any overt prompting to discard the paper, which resulted in many missing observations. Thus, in Study 2, we used an activity that induced participants to engage in measurable behavior before leaving the lab: writing a letter to their congressional representative regarding pro-environment legislation. We then used Coh-Metrix linguistic analysis software to analyze the length, simplicity, and cohesion of the letters to measure the effort and quality of participant's arguments.

Coh-Metrix (www.cohmetrix.com; accessed 31 August 2021) is a free online discourse technology that provides computational linguistic analyses of text. It calculates computational linguistic variables [58], ranging from simple statistics (e.g., word count) to principal component scores capturing characteristics of text and discourse (e.g., syntactic simplicity). Coh-Metrix has been used in many contexts ranging from assessments of learning environments [59] to dialogues about breast cancer information [60], and in social psychology it has been employed to understand topics such as how narrative construction influences social inferences [61] and the effects of cognitive load on political conservatism [62]. In the current work, Coh-Metrix was used to analyze letters written to congressional representatives on four metrics: message length, syntactic simplicity, referential cohesion, and deep cohesion. Message length was simply the number of words written, and longer letters reflected greater effort expended on message advocacy. Syntactic simplicity measured the degree to which a text used simple sentence structures, such as fewer compound sentences [58], a characteristic of weaker arguments. Cohesion reflected the extent to which a text was structured in ways that repeated concepts and logically structured arguments, and two different indices of cohesion were studied. First, referential cohesion captures the extent to which semantically similar concepts were repeated across a text [58], which is a characteristic of stronger arguments. Deep cohesion measured the degree to which a text uses logical connectives between propositions such as "however", "consequently", and "because" [58], and greater use of these devices reflected stronger arguments. Past work in social psychology examined simplicity [62] but not measures of cohesion. Because we developed a priori predictions for these four Coh-Metrix measures in Study 2, we presented them all in the current work for completeness.

5.1. Participants and Design

An a priori sample size analysis conducted in G*Power, assuming a desired power of 80% and a small-to-medium effect size ($f = 0.27$) based on a meta-analysis of commitment strategies [36], specified a minimum sample of 110 participants. A sample of 129 Miami University undergraduate students participated for research credit in their courses to account for possible missing data. Two participants were excluded due to missing data (not completing the NEP or the letter writing task), resulting in a final sample of 127 participants (63 female, 62 male, 2 unreported; $M_{age} = 19.16$, $SD_{age} = 1.71$). Based on self-report, there were 98 White, 8 Black or African-American, 1 Native American, 7 Asian, 12 Latino, and 12 group-unidentified participants (participants could select multiple categories or none at all).

5.2. Procedure

Pledge. Participants first read the same pledge used in Study 1, asking them to recycle more in the coming year. Once again, there were two beneficiary conditions (self or nature) and two audience conditions (ingroup or outgroup), presented in the same 2 x 2 between-subjects factorial design.

Pro-environmental beliefs. After completing the pledges, participants' pro-environmental beliefs were assessed with the NEP scale [53]. As recommended by Dunlap and colleagues [53], the seven dominant items were reverse-coded, and a mean score of these items along with the eight progressive items was computed ($M = 3.55$, $SD = 0.53$, $\alpha = 0.79$), with greater scores reflecting more progressive pro-environmental beliefs.

Letter writing. Finally, participants' behavior was assessed by inviting them to write a letter to a congressional representative involving the environment. They were presented with four bills unrelated to recycling that had been introduced in the United States Congress, each listed with a brief one-sentence description: protecting endangered species, protecting coastal ecosystems from oil spills, establishing bonds to fund projects to mitigate climate change, and increasing regulation of wastes associated with energy production. Participants were asked to select one of these bills to learn more information about it, and once they did, they received several paragraphs of additional information about the bill. After reading these details, participants were asked to "write a letter urging your congressperson to either support or oppose this piece of legislation". Participants could write as much or as little as they wanted either to support or to oppose the bill.

6. Study 2: Results

6.1. Pledging

Nearly all participants (121 of 127, 95%) signed the pledge. Logistic regressions showed that the likelihood of pledge signing did not vary as a function of condition, $|Z|$s < 1.21, ps > 0.228.

6.2. Environmental Beliefs

To assess the effect of pledges on environmental beliefs, a 2 (Pledge Beneficiary: Self vs. Nature) $\times$ 2 (Pledge Audience: Ingroup vs. Outgroup) ANOVA was conducted on the NEP pro-environmental beliefs score. A significant interaction between pledge beneficiary and audience type was observed, $F(1,123) = 5.92$, $p = 0.016$, $\eta_p^2 = 0.05$. As Figure 2 shows, participants who read a pledge framed to benefit nature for an ingroup audience showed the most progressive environmental beliefs ($M = 3.80$, $SD = 0.39$; 95% CI 3.61, 4.00). The other three conditions did not differ from each other based on 95% CIs.
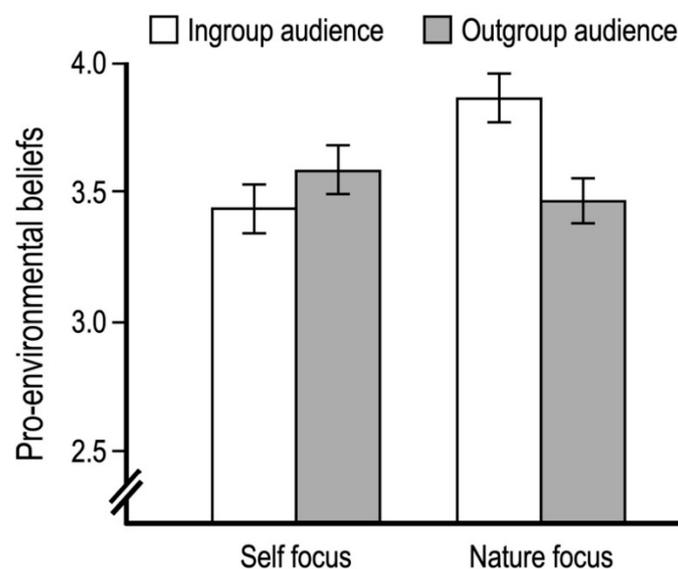

Figure 2. Interaction between pledge focus and audience type on pro-environmental beliefs (error bars are standard errors) in Study 2.

6.3. Letter Writing

Next, we explored how pledges affected participants' letters to their congressional representatives. To calculate a straightforward measure of pro-environmental effort, the number of words written by each participant in support of the selected policy was analyzed. In cases where participants wrote against the policy, the number of words was multiplied by -1 to reflect opposition to the bill. Most participants wrote something to their congressional representative about the bill (102 participants, or 80% of the sample). Those who wrote

nothing either supporting or opposing the selected bill were scored as 0 (i.e., no effort expended in either direction). Thus, larger scores reflected more effort expended in support of the environment (*M* = 55.91, *SD* = 62.41). These writing effort scores were analyzed in a beneficiary by audience type ANOVA, and a significant interaction was observed, $F(1,123)$ = 4.32, p = 0.040, η_p^2 = 0.03. As Figure 3 shows, participants who read a pledge framed to benefit nature for an ingroup audience showed the greatest pro-environmental writing effort (*M* = 79.43, *SD* = 68.97; 95% CI 56.36, 102.49). The other three conditions were not significantly different based on 95% CIs.
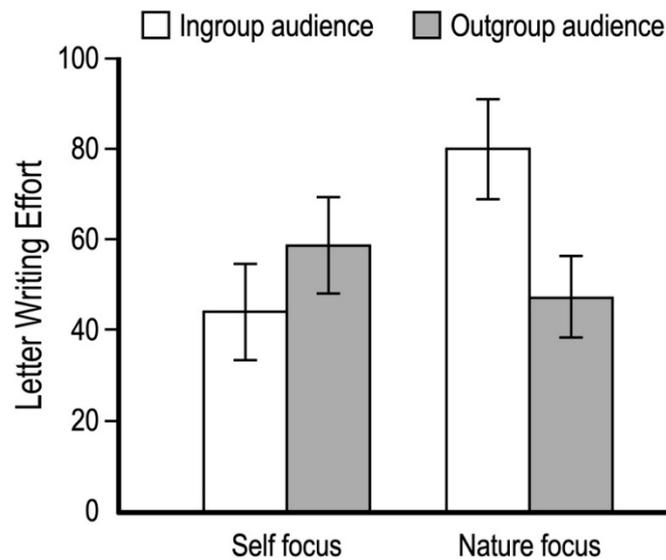

Figure 3. Interaction between pledge focus and pledge audience on pro-environmental legislation letter writing effort (error bars are standard errors) in Study 2.

We then examined Coh-Metrix indices of writing complexity (syntactic simplicity) and cohesion (referential and deep cohesion). (Because Coh-Metrix cannot calculate simplicity and cohesion measures for participants who failed to write letters, only participants who wrote letters were included in the analyses involving simplicity and cohesion.) First, a beneficiary by audience type ANOVA was conducted on syntactic simplicity, and a significant interaction was found, $F(1,98)$ = 5.34, p = 0.023, η_p^2 = 0.05. As seen in Figure 4, participants who read a pledge framed to benefit nature, and with an ingroup audience, wrote letters that were significantly less syntactically simple, reflecting stronger writing (*M* = −0.99, *SD* = 0.92; 95% CI −1.48, −0.51). Additionally, participants supplied with pledges framed to benefit nature, but for an outgroup audience, wrote significantly more syntactically simple letters (*M* = 0.20, *SD* = 0.24; 95% CI −0.44, 0.46). The other two conditions did not vary other based on 95% CIs.

Next, a beneficiary by audience type ANOVA was conducted on referential cohesion, and a significant main effect of pledge audience was observed, $F(1,98)$ = 4.30, p = 0.041, η_p^2 = 0.04. Specifically, participants who read a pledge with an ingroup audience (*M* = 0.29, *SD* = 1.31; 95% CI −0.11, 0.69) wrote letters that were significantly more referentially cohesive than those who read a pledge with an outgroup audience (*M* = −0.29, *SD* = 1.52; 95% CI −0.68, 0.10). The interaction, however, was not significant, $F(1,98)$ = 1.79, p = 0.184, η_p^2 = 0.02. Finally, a beneficiary by audience type ANOVA was conducted on the measure of deep cohesion, but no significant effects were observed (Fs < 1.15, ps > 0.286).
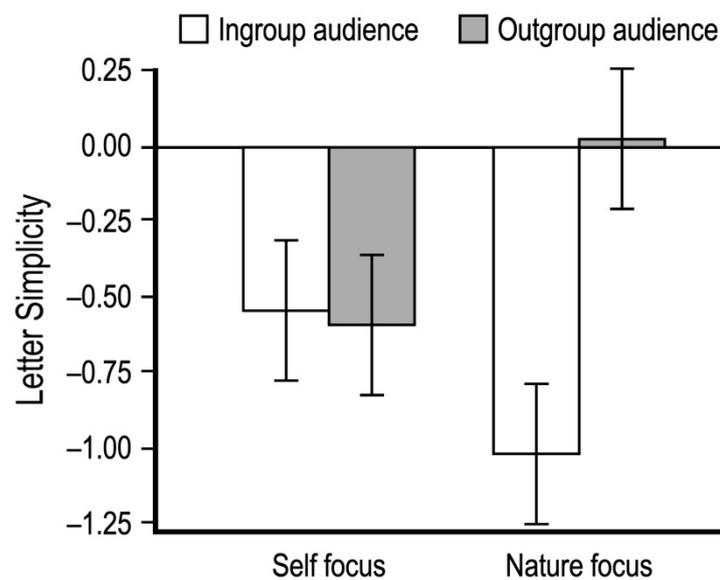
Figure 4. Interaction between pledge focus and pledge audience on letter writing syntactic simplicity (error bars are standard errors), with more negative values indicating greater letter sophistication (i.e., less simplicity) in Study 2.

7. Study 2: Discussion

The current work explored whether variations in conservation pledges might produce stronger effects on pro-environmental beliefs and behaviors. Participants were given a recycling pledge framed as benefiting nature or self-interested concerns, and the pledge was made for either an ingroup or outgroup audience. Afterwards, participants reported their pro-environmental beliefs and had an opportunity to write to a congressional representative supporting or opposing environmental legislation. As with Study 1, we observed an interaction between the pledge beneficiary and audience, showing that a recycling pledge benefiting nature made for an ingroup audience produced the strongest pro-environmental beliefs. Moreover, we found a parallel effect in participants' letters, observing that they wrote longer supportive and more sophisticated (less simplistic) letters for pro-environmental legislation for a pledge framed as benefiting nature with an ingroup audience. It is noteworthy that these effects were observed on behavior (i.e., advocacy for pro-environmental legislation) in domains unrelated to recycling, suggesting that conservation pledges can have effects on pro-environmental actions in different contexts.

8. General Discussion

As noted previously, using pledging to induce compliance has produced mixed results in past research, with some studies showing that pledges were effective [30], others observing effectiveness only under some conditions [15], and others finding them ineffective [35]. We responded to these mixed findings by constructing pledges to maximize personal choice [37,38], actual-ought self-discrepancies [21,23], and self-perception through foot-in-door techniques [40,41]. Further, we explored how variations in pledge beneficiaries and audiences would affect pro-environmental outcomes, anticipating that associating a pledge with benefits for nature would strengthen self-nature associations [63] and that making a pledge to an ingroup audience would increase compliance [29,45,48].

We observed an interaction between pledge beneficiary and audience rather than main effects, suggesting that their combination is particularly important. One reason why this combination might be especially effective is that it increases self-nature associations while heightening ingroup-supportive motivations. This combination addresses all the components of the norm-activation model [64,65], which theorizes that norms for pro-environmental behavior must be activated through four steps: (1) becoming aware that nature needs help, (2) becoming aware of the consequences of one's environmentally

relevant actions, (3) feeling personal responsible for helping nature, and (4) feeling capable of performing pro-environmental behavior. First, strengthening self-nature associations should foster a personal norm of environmentalism. Second, the pledge makes people aware of the need for environmental action by describing issues caused by trash and waste. Third, reading about how their own behavior directly benefits nature increases awareness about the consequences of their personal environmental actions, and having a sense of responsibility toward an ingroup should increase people's accountability for their actions. Finally, the pledge makes it clear that recycling is an impactful behavior that everyone can take part in, thus satisfying the fourth step of norm activation (i.e., feeling capable of performing the necessary action).

To our knowledge, the current work is unique in that it systematically examined which features of pledges are more effective. In both studies, we found that the type of pledge affected conservation beliefs, with people showing more progressive environmental beliefs for pledges to benefit nature that were made to a social ingroup. In Study 1, we attempted to document behavioral effects by observing whether participants recycled or threw away their debriefing form at the end of the study. Although a similar descriptive pattern of data was observed for recycling (i.e., 40% of participants in the nature-ingroup condition recycled their debriefing forms with none of them thrown away), the interaction was not significant. That being said, by only knowing the outcome of 56% of the debriefing forms, the ability to observe a significant effect was limited. This led us to adopt a different behavioral measure in Study 2. In that study, we observed significant interactions, revealing the strongest pro-conservation outcomes (e.g., more progressive environmental beliefs, longer and less simplistic letters written) for those who were given pledges sponsored by an ingroup framed to benefit nature. On the other hand, we did not observe the same interactive pattern on measures of writing cohesion, although those in the ingroup condition did write letters with greater referential cohesion. As noted previously, writing simplicity has been examined previously in the social psychology literature [62] whereas measures of cohesion, to our knowledge, have not. When examining the literature on learning from texts, factors such as amount of background knowledge [52] and the extent to which one actively processes text information [66] can influence whether greater text coherence is more, or at times, less effective. Thus, we derived predictions regarding letter length, simplicity, and cohesion a priori, and accordingly, we presented all of these findings for completeness. Future work may identify ways that cohesion may shed light on these processes.

The current work examines both pro-environmental beliefs as well as actual behavior (e.g., recycling and letters written to congressional representatives). The latter is important to assess because self-reports of beliefs can be influenced by social desirability and sometimes behavioral intentions do not predict actual behavior [67–71]. This can particularly be an issue in the realm of conservation, where self-reported pro-environmental behavior or behavioral intentions measures do not always predict sustainable actions in the real world [72]. In response to the challenges of attitude-behavior consistency, the current work uses two ecologically valid measures of actual pro-environmental behavior: recycling and letter writing. Study 2 is particularly noteworthy in this regard because it provides a new methodology for assessing behavior: asking participants to write letters to congressional representatives about pro-environmental legislation. Letter writing also has the benefit of being a form of pro-environmental behavior with the potential to have a significant environmental impact by changing policy. A recent debate in the environmental psychology literature [73–75] highlights the importance of investigating forms of pro-environmental behavior that have the potential for strong, beneficial impacts on the natural environment, rather than weaker behaviors that have little impact on environmental issues. Altogether, we believe this letter-writing approach has promise for future work not only in conservation research but in other policy-driven domains.

Interestingly, Study 2 found that a pledge about recycling behavior had a significant effect on a different form of pro-environmental behavior (letter writing). There are a couple of reasons

why pledges targeting less effortful behaviors such as recycling could also increase more effortful behaviors such as political action. First, our nature-ingroup pledges led participants to have a more progressive environmental worldview as indicated by the NEP [53], and these worldviews predicted a large range of pro-environmental behaviors [53,76]. Thus, pledges that change people's environmental beliefs may be especially effective at increasing pro-environmental behaviors that are not the specific focus of the pledge. Additionally, pledges can have positive spillover effects [74,77], which occur when an increase in a targeted behavior (recycling) subsequently leads to an increase in a related behavior (political action). Although we were not able to test this spillover hypothesis because Study 2 did not assess recycling, our pledges could produce positive spillover because they were designed to increase commitment to actions that benefit nature. This could lead to a foot-in-the-door effect [41] in which an initial commitment to recycling induced participants to enact other pro-environmental actions (i.e., advocating for green legislation). In support of this possibility, past longitudinal research found that greater recycling predicts other effortful behaviors such as using green transport over time [78]. Future research should more directly explore the potential for positive spillover resulting from recycling pledges because they would demonstrate that pledges can have powerful effects on a wide range of high-impact conservation behaviors, even those actions not contained in the pledge itself.

In addition, our work may have implications for interventions and for policy makers. For example, our pledges could be adapted for many applications (e.g., reducing electricity consumption, increasing mass transit use), and they offer an easy, cost-effective intervention. With respect to public policy, pledges could be used in domains where pro-environmental compliance has proven difficult. For example, the percentage of people who carpool in the United States decreased from 20% in 1980 to 9% in 2017 [79], contributing to the carbon footprint through increased gasoline consumption and building more roads. Framing a pledge to carpool as benefiting nature and made to an ingroup audience might help people engage in more pro-environmental behavior that often seems difficult to change.

Although the current research highlights several ways to increase pledge effectiveness, limitations should be acknowledged. First, because the current research was cross-sectional, we could not test the long-term effectiveness of the pledges, and this is an area where consistency-based interventions have been relatively more effective [36]. Thus, the observed differences may persist or even grow with the passage of time to the extent that they engage motivational forces tied to the self [12,14], though it will take additional work to explore this possibility. Second, Study 1 had a large amount of missing recycling data, and Study 2 had a somewhat smaller sample size (particularly for the analyses using Coh-Metrix measures). Future research should reproduce these findings with larger samples with more statistical power, though admittedly, running participants individually in studies like these has practical challenges. In addition, although our pledges incorporated psychological factors such as freedom of choice, self-discrepancy, foot-in-the-door technique, and self-perception, these elements were not manipulated in the current study, and future research should investigate whether these elements are essential for pledge effectiveness. Some readers might also wonder if the pledge beneficiary manipulation actually led people to focus on the self- and nature-orientated benefits of recycling because a manipulation check was not included. We assumed that this manipulation would be effective because the wording for the beneficiary manipulation was taken from Schultz's environmental concern scale [50], which is a well-validated measure of nature- versus self-orientated motivations for pro-environmental behavior. Future work, however, should directly test if the pledges led people to hold more nature-centered or self-centered environmental concerns. Also, most participants (85% in Study 1 and 95% in Study 2) signed the pledges, but some participants did not. Because the likelihood of signing pledges did not vary by condition and because the number who did not sign was very small, all participants were included in the analyses (their inclusion would only make observing the significant findings reported in this paper more difficult). Nonetheless, the consequences of pledges could be smaller because of those who did not sign the pledge, and future research should account for this possibility.

Finally, additional work is needed to test these pledges in real-world settings to more thoroughly gauge their effectiveness. Although our pledges showed small-to-medium effect sizes (η_p^2 = 0.03–0.05; based on Cohen's [80] recommendations) similar to those reported in Lokhorst et al. [36], it is difficult to compare these effect sizes because our study compared multiple pledge types to each other in the lab, whereas the studies included in the meta-analysis compared commitment-based interventions (including strategies other than pledges) to groups receiving no manipulations at all. In order to allow for more direct comparisons with past work, future research should explore our pledges in contexts beyond the lab. For example, students in college dormitories could be random assigned to receive different pledges (or no pledge) and their recycling and electricity use could be measured over time to assess whether nature-ingroup pledges increase pro-environmental behavior and for how long.

In sum, the current work highlights the value of harnessing the self for pro-environmental action. Indeed, some work has established the value of the self for conservation, ranging from environmental self-identification [81,82] to self-nature representations [49,50]. Part of the challenge in improving human stewardship of the planet is the difficulty in sustaining motivation for conservation action [8,10,83,84]. The environmental threats that humanity faces in the decades ahead are daunting, but leveraging the self may be one of the most promising ways to address these challenges.

Appendix A

Recently, a group approached our lab that is interested in having undergraduates consider a recycling pledge. Below is the pledge they asked students to consider. Before reading it, however, please be aware that you are free to choose whether to take part in the pledge or not. The pledge is completely voluntary, and you have already received credit for participating in this study regardless of whether or not you take part in any aspect of the pledge. Once again, you are under no obligation at all to complete the pledge. If you have any questions about this point, please ask the experimenter now.

<div align="center">Recycling Pledge</div>

Below is a recycling pledge. We asked that you read each paragraph, and if you understand each paragraph, we ask that you initial each paragraph to indicate they have read it in its entirety and understood it.

Recycling is an important behavior that everyone can take part in. For example, Americans use over 80 billion aluminum soda cans each year, and the energy saved from recycling just one aluminum can saves enough energy to run a television set for three hours. Paper products are yet another area where recycling matters. For example, the average

American uses seven trees each year for paper products (everything from newspaper to wood to toilet paper), and approximately 1 billion trees of paper are throw away each year in the United States. Further, if we just recycled one-tenth of our newspapers, we would save about 25 million trees each year. Finally, everyday products like motor oil are easily recycled (oil only gets dirty, it does not wear out), yet one quart of improperly disposed of motor oil can contaminate up to 2 million gallons of drinking water. Each person in the United States produces 4.4 pounds of solid waste each day (almost 1 ton each year), most of which can be recycled! Facts like these indicate that people ought to perform more recycling than they currently do because it is important.

My initials in the blank at the right indicate that I understand the above paragraph _____

One reason why recycling is important is that it has important benefits for the biosphere. Specifically, recycling produces concrete benefits for plants, marine life, birds, and animals [for me, my lifestyle, my health, and my future].

My initials in the blank at the right indicate that I understand the above paragraph _____

This recycling pledge is being solicited by a student group at Miami [Kennesaw State] University. Once the pledge collection phase is complete, all signed pledges will be displayed at the Miami [Kennesaw State] University Student Center for two months.

My initials in the blank at the right indicate that I understand the above paragraph _____

Now, after reading all of the above, we ask that you consider pledging to significantly increase the extent to which you recycle in the coming school year. If you agree to this pledge, you will be stating that you are committed to recycling more aluminum cans, plastic bottles, paper products, and other recyclable materials in the current school year. If you agree to take this pledge, please sign below. If you do not agree to take this pledge, do not sign below. Once again, signing this pledge is not a condition of your receiving research participation credit in your course.

By signing below, I hereby take the pledge to recycle more materials in the current school year.

_____ _____

Printed name Signature.

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