Original Research

Science Communication
2025, Vol. 47(6) 800–827

DOI: 10.1177/10755470241311011
journals.sagepub.com/home/scx
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Testing the Durability of Persuasion From Moral Appeals About Renewable Energy

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Abstract

Research shows that opinions rooted in moral justifications may be more stable over time. This suggests that communicators could create more durable persuasion by adding explicit moral claims (i.e., stating that the issue is a matter of right vs. wrong) to persuasive messages. Here, using animated videos about the transition from fossil fuels to renewable energy, we conducted a three-stage longitudinal experiment (N = 4,488) to test whether messages with explicit moral claims have more durable persuasive effects than similar messages without. We replicated this test across two distinct moral dimensions: harm to innocent people and contamination of nature's purity. Our findings show that all message versions had strong immediate persuasive effects relative to a control condition, and much of those effects remained after a 3-week period. However, there were no clear advantages—in immediate effects or in durability—from adding explicit moral claims to the messages.

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Keywords
moral arguments, persuasion, renewable energy, experiment, durability

Introduction

The transition from fossil fuels to renewable energy is critical to mitigating climate change. In addition to technological and economic influences, there are many social, psychological, and political factors that will determine the success of this transition. The public has a large influence on the adoption of new technologies, by way of consumer demand (e.g., for rooftop solar), policy support (e.g., for local ballot measures, federal and state policies), and political elections (e.g., voting for candidates who support the clean energy transition).

Research indicates that *the way in which renewable energy is portrayed or framed* has a large influence on public support for renewable energy policies and individual-level behavioral intentions (Bayulgen & Benegal, 2019; Gustafson et al., 2022; Stokes & Warshaw, 2017). For example, messages emphasizing costs (whether savings or increases) tend to have a greater and more dependable influence on support than messages emphasizing environmental effects or broader economic effects (such as the economy or job creation). However, further research is needed to identify other messaging strategies that can build public support and behavioral intentions in support of the clean energy transition. For example, instead of focusing on external costs and benefits, messaging could use appeal to intrinsic motives.

One such avenue in persuasion research on environmental and sustainability issues is the use of moral appeals—emphasizing the moral or ethical aspects of an issue. This growing body of research is grounded in the fact that many opinions and behaviors in political and social issues have moral roots or rationales. Another growing area of communication research tests the *durability* of message effects. In public communication campaigns, having a wide reach (many people exposed to the message) and a large effect (substantial influence on those who are reached) may still have limited impact if these effects are not durable (Goldberg & Gustafson, 2023). Yet despite this crucial practical importance, communication research rarely investigates the durability of persuasion effects.

Bringing together these areas of research, this study presents a longitudinal experiment that tests the durability of persuasive effects of moral appeals about renewable energy. Specifically, we test whether adding "explicit moral claims" to a persuasive appeal (i.e., specifically stating a moral verdict on the

issue) affects the initial persuasive effect and/or the durability of those effects over a period of about 3 weeks.

Literature Review and Rationale

Moral Appeals in Persuasion

Beyond economic or environmental reasons for supporting the transition from fossil fuels to renewable energy, there are also *moral* reasons. Broadly, moral principles are abstract standards that help define or explain the difference between what is morally "right" or "wrong." One framework for understanding moral values is moral foundations theory (MFT; Graham et al., 2009), which describes six common moral principles that are valued across diverse ideologies, religions, and ethical codes: care (vs. harm), fairness (vs. cheating), loyalty (vs. betrayal), authority (vs. subversion), purity (vs. degradation), and liberty (vs. oppression).

While MFT is not the only way of understanding morality, it can be a helpful tool when analyzing popular positions and arguments on political and social issues. For example, in political discourse on abortion, pro-life advocates often invoke the moral value of care (avoiding harm) while pro-choice advocates often emphasize the moral value of liberty (avoiding coercion). Immigration policy is often contested with arguments focused on fairness and authority being met with counterarguments focused on liberty and care. Similarly, moral arguments are highly relevant to environmental issues. The issue of transitioning from fossil fuels to renewables is an especially vivid example, because fossil fuels harm innocent people via the effects of pollution (care/harm) and they also contaminate the natural purity of our air, water, ecosystems, and climate (purity/degradation).

The use of moral logic in argumentation is referred to as a *moral appeal*—that is, advocating a view by positioning it as upholding moral principles (see Luttrell, 2025). In U.S. politics, moral appeals are a central tool used by political actors across the political spectrum to present their positions more favorably (e.g., Lakoff, 2016). Research also shows that moral appeals can convince individuals to comply with laws (Schwartz & Orleans, 1967), cooperate in social-dilemma situations (Chen et al., 2009; Martichuski & Bell, 1991), and donate blood (Ferrari & Leippe, 1992), although it is worth noting that studies vary in how they conceptualize morality or operationalize moral appeals.

Such messages appeal to a motive that is often held by a large portion of any audience: to act ethically and in alignment with one's moral values. As such, the effectiveness of moral messages may depend on whether the

moral values they appeal to match the moral values held by the audience (Teeny et al., 2021). Experimental evidence supports this, finding that people are more persuaded by pro-environmental moral appeals that align with their respective moral priorities (Feinberg & Willer, 2013; 2019; Kidwell et al., 2013; Wolsko et al., 2016). For example, a prior study found that conservatives are more persuaded by moral arguments that emphasize obedience to authority and protecting the purity of nature (Wolsko et al., 2016), which are moral dimensions that tend to be prioritized more highly by conservatives than by liberals (Graham et al., 2009). However, this finding of a persuasive advantage of matching moral arguments (such as harm and purity) to corresponding political ideologies does not replicate consistently (Arpan et al., 2018; Hahnel et al., 2020). Therefore, we use this opportunity to investigate:

> **Research Question 1 (RQ1):** How do the effects of moral appeals of harm and purity about renewable energy interact with political ideology?

Another recent perspective on moral persuasion is the *moral matching hypothesis* (Luttrell et al., 2019), which posits that moral appeals have the greatest persuasive power when the audience thinks of their own position on the issue as having moral roots. That is, moral appeals are most effective among recipients who are already relatively inclined to see the issue from a moral perspective.

In this study, we consider two ways in which a message can be a "moral appeal." First, a moral appeal could be made with *moral implications*—that is, by presenting information that is relevant to moral values. For example, a message stating that the emissions from fossil fuels are harming innocent people and contaminating the purity of the natural environment would be relevant to the moral foundations of harm and purity, respectively. However, despite the moral implications of this content, these messages do not explicitly state that these things are immoral. Second, a message could include an *explicit moral claim* that specifically states the moral conclusions for the audience, instead of leaving them implied. For instance, a message could describe the effects on human health and nature, and then also could explicitly state that such things are morally wrong.

> **Research Questions 2 (RQ2):** How does adding explicit moral claims to implicit moral appeals affect the initial effect size?

Next, we discuss the importance of durability in persuasion research and, after that, how moral appeals could affect the durability of persuasion.

The Durability of Persuasion Effects

Most persuasion research calculates effects by performing post-treatment measurements within seconds or minutes after individuals are exposed to the persuasive message. Therefore, scholars have relatively little knowledge about how persuasive effects persist over time, and even less knowledge about when and why persuasion durability varies across messages, contexts, and audiences.

Recent work has provided a general benchmark for expectations of durability. Two longitudinal experiments found a general pattern where initial persuasion effects decay in a "hockey stick" shape, such that there is a sharp drop followed by a plateau (Coppock et al., 2018; Gustafson et al., 2022). These two experiments found that about 50% of the immediate persuasive effect remains after about 1 to 2 weeks. Similar levels of durability have been observed with different kinds of messages and with different time lags between measurements (Maertens et al., 2020; Tappin & Hewitt, 2023). However, durability of persuasion may vary across messages, audiences, or contexts. In one study on messaging about the scientific consensus on climate change, for example, researchers found that the percentage of the immediate persuasion effects that persisted 26 days later ranged from 17% to 59%, depending on the audience (Goldberg et al., 2022). One goal of this study is to answer the research question:

> **Research Questions 3 (RQ3):** How durable are the effects of moral appeals about renewable energy?

Interestingly, there are reasons to expect that durability is predictable, not random. Arguments stemming from the Elaboration Likelihood Model (ELM) posit that persuasion effects are more durable when the message is processed deeply and carefully (i.e., through the "central route"). This is because careful consideration and deliberation creates stronger, more stable attitudes that are integrated into an individuals' future judgment and decision making (Bizer et al., 2006; Petty et al., 1995).

This deep processing can be driven by individual traits—such as an individual's "need to evaluate" and their "need for cognition." For example, need to evaluate (NTE) is a trait variable that reflects a person's tendency to form strong opinions and arrive at clear conclusions about others, issues, and the world around them (Jarvis & Petty, 1996). Separately, need for cognition (NFC) describes a person's tendency to analyze carefully, pursue problem-solving, and engage in intellectual challenges (Cacioppo et al., 1996; Cacioppo & Petty, 1982). Applied with the ELM, people higher on NTE and

NFC may engage more deeply with messages and thus any persuasion that occurs may be more durable for them.

Some empirical evidence supports these ideas of trait-based variation in persuasion durability. For example, Chong and Druckman (2010, 2013) found the persuasive effects of political messaging had greater durability among people who scored higher on NTE. Similarly, a longitudinal experiment on the topic of renewable energy (Gustafson et al., 2022) found that the durability of persuasive effects was highest among high NTE individuals, while effects decayed fastest among low NTE individuals. Other longitudinal experiments have found similar patterns with NFC, such that attitude change was more durable for individuals with high NFC compared to low NFC (Haugtvedt & Petty, 1992).

Similarly, the ELM theorizes that deep, careful evaluation of a message is most likely in situations where the individual perceives that the message is highly relevant to them and they have the requisite abilities for careful analysis (Petty & Cacioppo, 1986). Therefore, we expect that individuals who are highly engaged, active, or interested in political and technology issues would be more likely to carefully evaluate a message about renewable energy. Persuasion effects among these individuals with high issue engagement may be more durable because the resulting beliefs and attitudes may have been created via deeper processing. Therefore, we hypothesize the following:

> **Hypothesis 1 (H1):** The durability of the effects of moral appeals is positively related to individuals' trait levels of (a) need to evaluate, (b) need for cognition, and (c) issue engagement.

However, this evidence only allows us to *predict* durability but does not give us tools for *creating* durable effects. The latter is crucial for applied situations, so we must investigate ways to engineer durability via the factors that communicators can control, such as message content. In the next section, we discuss reasons why moral appeals are a promising solution.

Why Explicit Moral Emphasis Might Result in Greater Durability

Research shows that some types of attitudes are more stable and unchanging than others. For example, political attitudes that are rooted in morality—that is based on a moral rationale or ethical justifications—tend to be more resistant to influence (Cole Wright et al., 2008; Luttrell et al., 2016; Skitka &

Morgan, 2009). This may be because people's moral convictions are typically experienced as factual and universally applicable (Skitka et al., 2005), which could make beliefs or attitudes that are rooted in moral convictions seem very certain, objective, and unquestionable. In fact, longitudinal research shows that across many diverse topics, attitudes change less over time when they have moral bases (Luttrell & Togans, 2021). Together, this evidence suggests that beliefs and attitudes rooted in moral rationales may have greater durability.

Importantly, however, this moral salience of attitudes is not necessarily fixed. That is, moral appeals can strengthen the moral basis of an attitude by making moral considerations more salient (Kodapanakkal et al., 2022). This could in turn affect stability or durability of the attitude. Luttrell and colleagues (2016) show that when participants are prompted to moralize attitudes they already hold, those attitudes become more resilient against future counter-arguments. Because the moral basis of an attitude can be influenced by a message and because attitudes with moral bases tend to be more durable, it follows that *a persuasive message designed to explicitly create or strengthen a moral basis for the intended attitude may have effects that are more durable.* Therefore, we advance the current research on moral persuasion by investigating:

> **Research Questions 4 (RQ4):** How does adding explicit moral claims to implicit moral appeals affect the durability of the effects?

The above research question focused on the role of moral appeals in affecting attitude moralization. But attitude moralization also varies across individuals and exists prior to the experiment, so we should also expect to observe a pattern of differential durability such that

> **Hypothesis 2 (H2):** The durability of the effects of moral appeals with explicit moral claims is positively related to the degree of individuals' prior attitude moralization.

Method

This study was a longitudinal experiment designed to test this set of research questions and hypotheses related to the persuasive effects of moral appeals about renewable energy and the durability of those effects. In this study, we independently manipulated the moral appeal type (with and without an explicit moral claim) to test whether the persuasive effects differ depending on the implicit or explicit expression of the moral appeal. We conducted this

test across two different moral domains (harm and purity) and observed the durability of the effects within individuals over a period of about 3 weeks.

All data, materials, and analysis code, along with the study's preregistration, are available on an Open Science Framework project page at https://osf.io/xjk4z/

Design and Procedure

This survey experiment was conducted in the Qualtrics online survey environment. Respondents entered the study, provided informed consent, and then advanced to the beginning of the pre-test. The study followed a longitudinal mixed design where respondents were randomly assigned to one of the five experimental conditions (between-subjects). Prior to presenting the experimental stimuli, we administered the measures of all demographic variables, trait variables (see "Individual difference measures" below), and pre-test measures of all dependent variables (see "Measures of dependent variables" below). Next, participants viewed the stimulus corresponding to their experimental condition, and then responded to post-test measures of all dependent variables, which were identical to the pre-test versions. To measure treatment effect durability, respondents were recontacted and invited into follow-up phases of the study in which they answered the identical post-test dependent measures at two additional time points (Time 2, Time 3). The average duration between Time 1 and Time 2 was about 12 days (ranging from 8 to 19 days). The average duration between Time 2 and Time 3 was about 11 days (ranging from 8 to 15 days).

Conditions and Treatments. The five message conditions were tested using a 2 (moral appeal type: harm vs. purity) x 2 (explicit moral frame: present vs. absent) between-subjects design with an additional control condition. In all conditions, respondents watched a short (approximately 1.5–2.5 minutes) animated video. In the Harm condition, the message focused on the harms of burning fossil fuels, and how getting our energy from renewable sources instead can help avoid these harms. In the Harm + Moral Claim condition, respondents received a message that was the same in every way except it also contained statements explicitly emphasizing that the harms are unethical and wrong (see Figure 1). In the Purity condition, the message stated that burning fossil fuels contaminates the purity of the natural world, and explained how renewable energy can mitigate these problems. In the Purity + Moral Claim condition, the message included the same Purity appeal but added the explicit moralization that this contamination of the natural environment is unethical

Figure 1. Example of Part of the Explicit Moral Claim Manipulation in the Harm + Moral Claim Treatment.

and wrong. After viewing the video, respondents completed all dependent measures. Participants in the control condition viewed an animated video that was created in a similar style but presented basic information about an unrelated science topic: remote robotic surgery.

Pilot Test. All videos were tested in a pilot experiment with the goal of checking whether the treatments satisfied two criteria. First, we assessed whether the explicit moral claim treatments were in fact perceived as having more moral emphasis. This was done to rule out the possibility that potential null findings were the result of ineffective treatments. Second, it was important to assess whether the inclusion of explicit moral claims affects attitude moralization—that is, the moral basis of the attitude—since this is the proposed mechanism of greater durability. In this context, attitude moralization would be the degree to which people see their opinions as being based in morality, or the topic of fossil fuels vs. renewable energy as being a moral or ethical issue.

As described in full detail in the Supplementary Information, the pilot experiment used the same stimuli as the main study and confirmed both of the above criteria. First, using a Likert-type scale, participants rated the treatments with explicit moral claims as having significantly higher moral emphasis than treatments without explicit moral claims (harm $d = 1.11$, $p < .001$;

purity $d = 1.12$, $p < .001$). Second, both treatments with explicit moral claims significantly increased perceptions of the issue as being a moral issue relative to those without explicit moral claims (harm $d = 0.21$, $p < .05$; purity $d = 0.20$, $p < .05$). These perceptions were also measured with Likert-type scales, and are detailed in the Supplementary Information. These results of the pilot experiment provided strong evidence of the quality of the stimuli and manipulations for the main study.

Sample

Power Analysis. To determine sample size, we first set the smallest effect size of interest (Lakens et al., 2018) at $d = 0.15$ to serve as a general benchmark for our power analyses. Next, we examined prior research with similar designs (Goldberg et al., 2022; Gustafson et al., 2022) to estimate likely effect size and observed power. And finally, we aimed for the greatest statistical power within our budget constraints and the parameters outlined here.

We conducted a power analysis in R using the *pwr* package (Champely, 2020) to estimate the number of respondents needed to detect $d = 0.15$ at 80% power and an alpha level of 0.05. The power analysis determined that a sample size of approximately 700 respondents per condition would be needed to achieve this level of statistical power. It is important to note, however, that we expected to have much higher power–and therefore lower sample size needs–because we planned to measure and control for pretreatment measures of the dependent variables. This substantially increases statistical power (Gerber & Green, 2012), and suggests this study is highly likely to have the power to reliably detect effect sizes much smaller than our smallest effect size of interest noted above. We therefore aimed for a minimum sample size of 600 remaining respondents per condition at the final time point.

Recruitment and Exclusion. We recruited participants from Prolific, an online platform of workers who complete tasks such as scientific studies for compensation. Using demographic quotas, we mimicked the U.S. population on political party affiliation, age, and gender. In total, 4,614 respondents participated in the study at Time 1. In the data cleaning stage, four respondents were removed for missing or duplicate participant IDs, 101 respondents were removed for failing an attention check question, and 21 were removed for missing data on the dependent variables. This left a final set of 4,488 valid Time 1 cases for analysis (an average of 898 per condition).

Attrition. We invited all valid Time 1 participants to participate in Time 2 by making the task on Prolific available to only those 4,488 participants. These invitations did not mention any connection to Time 1, so as to minimize bias in attrition. The same procedure was used to invite valid Time 2 participants into Time 3. In total, 3,640 valid responses were recorded for Time 2, and 3,121 for Time 3 (an average of 624 per condition).

In longitudinal experiments, it is essential to determine whether attrition threatens internal validity. We used three approaches to examine this question: descriptive analyses split by condition and whether respondents participated in Time 2 and Time 3, logistic regression analyses predicting whether respondents participated in Time 2 and Time 3, and sensitivity analyses using inverse probability weighting to estimate whether the observed pattern of attrition is likely to affect the key results. Together, all three methods of analysis consistently showed that attrition did not affect the results. These analyses and their results are detailed in the Supplementary Information, along with the demographic characteristics of the sample across all three time points (Table S19).

Measures

Individual Difference Moderators. Prior to the experiment, respondents answered a series of individual difference measures—which are described in full detail in the Supplementary Information. First, we measured *need to evaluate* (NTE), which captures people's propensity for forming strong opinions on issues (Chong & Druckman, 2010; Jarvis & Petty, 1996) using a three-item measure based on the short form developed by Bizer et al. (2004). For example, one item was "Some people say it is important to have firm opinions about lots of things, while other people think it is better to remain neutral on most issues. What about you? Do you think it is better to have firm opinions about lots of things or better to remain neutral on most issues?" with a slider scale ranging from 0 (*Remain neutral*) to 100 (*Have firm opinions*). This construct was measured with three items that were standardized and averaged to form an index ($\alpha = .70$).

Next, we measured *need for cognition* with an abbreviated five-item version (Wood & Swait, 2002; Youn & Kim, 2019) of the original scale by Cacioppo and Petty (1982). This measure represents the extent to which one enjoys engaging in thinking or effortful cognitive activities. For example, one item states "I prefer complex problems over simple problems" and asks respondents how well the statement describes their general tendencies from 1

(*Not at all*) to 7 (*Very much*). NFC was measured with five items that were standardized and averaged to create an index ($\alpha = .90$).

We also created measures of general *issue engagement*. For example, we asked respondents "In general, how closely do you tend to pay attention to current events and topics related to science and technology?" (1 = *I tend to not pay any attention*, 7 = *I tend to pay extremely close attention*). We asked the same question about ". . . related to political issues." These two items were standardized and averaged to create an issue engagement index (Spearman–Brown coefficient = 0.65). Respondents were then given an attention check question before proceeding to the main measures.

Finally, we measured *political ideology* with the item "Which of the following best describes your political ideology?" Response options were "Strong conservative," "Somewhat conservative," "Moderate, middle of the road," "Somewhat liberal," and "Strong liberal." For analysis, these options were coded from 1 (Strong conservative) to 5 (Strong liberal).

Measures of Dependent Variables. The main dependent variable was support for a transition away from fossil fuels toward renewable energy. Before measuring this, we gave participants a short description of what renewable energy is and how it differs from fossil fuels. It read

> To generate the electricity we use, power plants use various types of fuel. Some power plants create energy by burning fossil fuels, such as coal and gas. Other power plants create energy by instead using renewable energy sources such as wind or solar. The following questions ask you to give your opinion about the issue of using fossil fuels for energy.

To measure this main dependent variable (in the pre-test and in the three post-tests), we used four items to construct an index such that higher values represent more positive attitudes and support for renewable energy. The index included questions about general affect toward fossil fuels and renewable energy, policy support, and perceived issue importance of transitioning away from fossil fuels and toward renewable energy sources. For example, the item measuring perceived issue importance was "There are many issues that government officials could focus on addressing. How important do you think it is for them to place a high priority on transitioning away from fossil fuels (coal, gas) to renewable energy sources?" (1 = *Not at all important*; 7 = *Extremely important*). The four items were standardized and averaged to create an index ($\alpha_{pre} = .88$, $\alpha_{t1} = .89$, $\alpha_{t2} = .88$, $\alpha_{t3} = .89$).

To investigate *topical beliefs*, which are beliefs about issue-relevant facts that could be moved by the treatments and could be potential mechanisms for changes in the primary dependent variable (i.e., support for a transition toward renewable energy), we also measured the extent to which respondents believe fossil fuels a) harm people's health, and b) contaminate the natural environment on a scale from 1 (*Not at all*) to 7 (*Very much*). We used one item to measure each of these two beliefs.

Finally, we assessed *attitude moralization*—the moral or ethical basis of people's attitudes— using three items asking participants how much their views about fossil fuels are based on morality or ethics (Skitka & Morgan, 2014). For example, "To what extent is your opinion about fossil fuels determined by your core moral beliefs and ethical principles?" (1 = *Not at all*; 7 = *Extremely*). The three items were standardized and averaged to create an index (α_{pre} = .93, α_{t1} =.95, α_{t2} =.94, α_{t3} =.95).

Analyses

We used ordinary least squares (OLS) regression to estimate the effects of each treatment on the composite dependent variable of renewable energy support at T1 (shortly after exposure to the treatment). We entered indicators for the experimental conditions as predictors with the control condition as the reference group, and also included the pre-test measure of the dependent variable as a covariate. For the conditional (interaction) effects, we used similar regression models—that is, experimental conditions predicting a posttest outcome variable while controlling for pretest levels of that outcome—but for each test we added one of the individual trait variables (NTE, NFC, issue engagement, political ideology) and constructed an interaction term for the interaction between that trait variable and each treatment condition.

To observe the durability of the effects, we follow the method of Gustafson et al. (2022) for estimating the remaining treatment effects at T2 and T3, respectively, by using the new measurements of the post-test dependent variable, while retaining the experimental condition indicators and pre-test variable in the model. This creates, for each treatment, an estimate of its effect re-assessed at each separate time point, while also adjusting for any change that might be simultaneously happening in the control group over time.

In all of the models, all dependent variables, covariates, and moderators were standardized, so the effects reported in the results are expressed in standard deviation units. The full regression models are reported in the Supplementary Information.

Results

Main Effects on Dependent Variables

As shown in Figure 2, all four treatment messages had significant positive effects on support for renewable energy at T1 (the immediate post-test), ranging from $d = 0.19$ to $d = 0.21$ across treatment versions. Similarly, all treatments had significant positive effects on their corresponding beliefs about the human health harms or natural contamination caused by fossil fuels (see Supplementary Information Tables S5 and S6). These findings show all four treatments are effective in their fundamental purpose of shifting beliefs and attitudes about renewable energy and fossil fuels. Next, we turn to our primary research questions and hypotheses.

Informing RQ3, we found strong durability in the effects of the messages with *and* without explicit moral claims on support for renewable energy (Figure 2). The pattern of durability was very similar across conditions. The treatment effects were the highest at T1, and these effects decreased by 50-60% at T2. At T3 (about 3 weeks after exposure to the message), the effects were at a similar level to those at T2, indicating that the pattern of decay of the treatment effects is an initial steep drop followed by a plateau. This pattern mirrors that of findings in prior research (Coppock et al., 2018; Gustafson et al., 2022).

RQ2 asked if adding explicit moral claims would affect the initial effect size and RQ4 asked about the durability of the effects of messages with implicit moral content. The findings showed that the addition of explicit moral claims affected *neither* the immediate effect sizes at T1 *nor* the durability of those effects over the 3-week period. In fact, the results (Figure 2) show striking similarity across all four conditions. Figure 3 combines the two moral frames (purity; harm) that used explicit moral claims (left) and two without (right), respectively, and displays the durability of treatment effects within those two groups of combined conditions.

Similar patterns were observed with the effects on beliefs about fossil fuel harm and fossil fuel contamination. As shown in Tables S5 and S6 in the Supplementary Information, there was no difference between the effects of messages with and without explicit moral claims—neither in their initial persuasive effect on those beliefs about fossil fuels, nor in the durability of those effects.

Counter to our theory-driven expectations, we found—across all outcome variables (beliefs, support) and across both moral appeals (harm, purity)—essentially no effect of adding explicit statements of moral judgments.

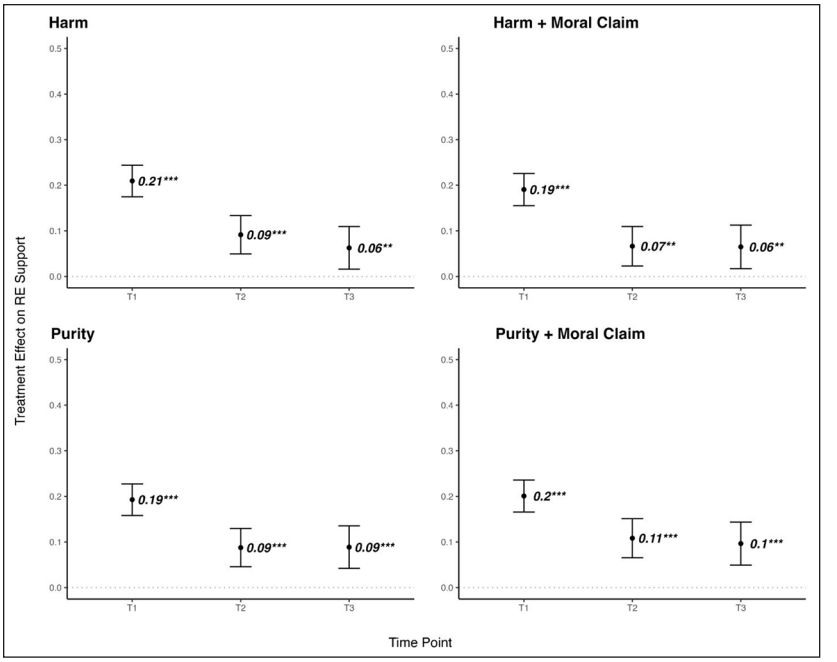

Figure 2. Treatment Effects on Renewable Energy Support Across Conditions.
Note. Chart values are standardized treatment effects compared to the control condition at each time point. T1 = Time 1; T2 = Time 2; T3 = Time 3.
* = $p < .05$; ** = $p < .01$; *** = $p < .001$.

Conditional Effects

First, we tested H1 by examining whether the durability of messages' effects would be positively related to individuals' trait levels of (a) need to evaluate, (b) need for cognition, (c) issue engagement, and (d) political ideology. Overall, our findings did not support this hypothesis. That is, the durability of the effects of all four treatments was not significantly different across levels of these trait variables (see Supplementary Information for detailed results).

We did find that for most outcome variables there were some treatment effects where the initial T1 effect was slightly but significantly different across levels of the trait variables (see Tables S7–S18 in the Supplementary Information). For instance, there were significantly larger initial persuasive effects on all three dependent variables among those with lowest issue engagement compared to those with highest issue engagement. However, as the effects decayed over time, these differences dissipated.

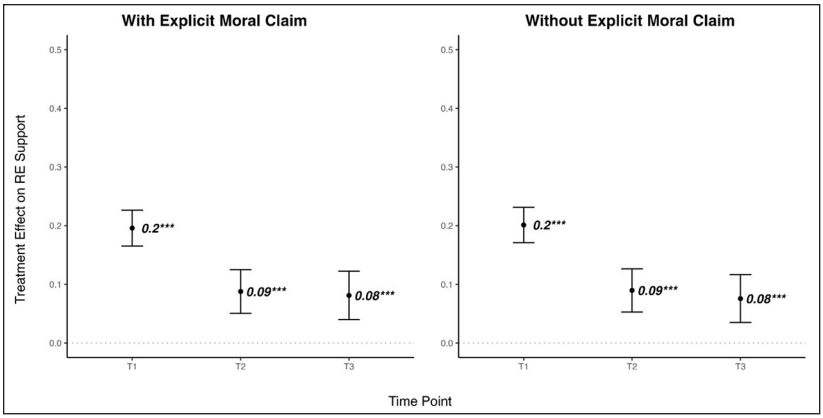

Figure 3. The Durability of the Persuasive Effects of Treatments With and Without Explicit Moral Claims.

Note. Left panel combines two conditions: Purity + Moral and Harm + Moral. Right panel combines two conditions: Purity and Harm. Chart values are standardized treatment effects (Cohen's *d*) compared to the control condition at each time point. T1 = Time 1; T2 = Time 2; T3 = Time 3.

* = $p < .05$; ** = $p < .01$; *** = $p < .001$.

This pattern was also observed among the other moderating trait variables, such that the effects that were initially slightly larger (e.g., low NFC), ended up settling at a level that was similar to those of other groups (e.g., high NFC) at T3. That is, it was common for initial differences in effects between trait subgroups to disappear as all groups' effects reached the same plateau by T3 (see Figures S3 through S14 in the Supplementary Information). Although this pattern does involve different amounts of decay—with initial differences migrating toward the same level over time—this does not provide clear evidence of more durable persuasion in one subgroup compared to another. We summarize our interpretations in the Discussion section.

Next, we tested RQ1 to determine whether the persuasive effects of the two moral frames (harm and purity) differed by political ideology. We tested this both for the implicit and explicit moral claims. For both types, results showed a nonsignificant interaction effect of the Condition × Ideology interaction (with moral claim: $\beta = -.005$, $SE = .018$, $p = .785$; without moral claim: $\beta = -.015$, $SE = .017$, $p = .375$). Therefore, our findings suggest that the effects of framing the transition to renewable energy in terms of purity versus harm does not vary across political ideologies. However, it is notoriously difficult to achieve sufficient power for interaction effects (Gelman,

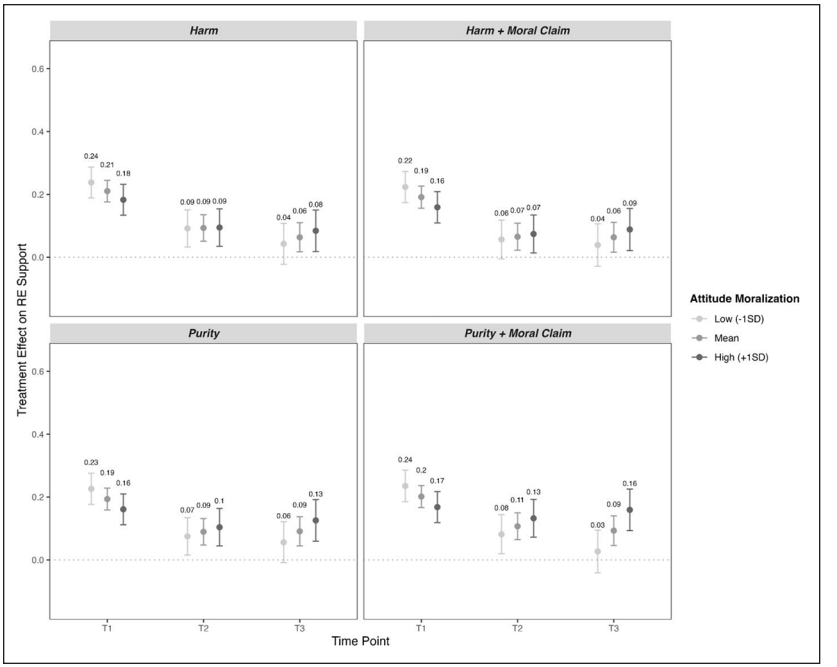

Figure 4. Durability of Moral Appeals Moderated by Attitude Moralization Level.
Note. Chart values are standardized treatment effects compared to the control condition at each time point. T1 = Time 1; T2 = Time 2; T3 = Time 3.

2018; Hainmueller et al., 2019), so it is possible that this result is a false negative. In each of these models, the main effect of ideology is also nonsignificant—likely because the variance explained by political ideology is already captured by the pre-test dependent variable included as a covariate.

Drawing on prior research and theory, H2 posited that the effects of moral appeals (and perhaps especially those with explicit moral frames) will be more durable among people with more moralized attitudes toward the issue. However, we did not find clear support for H2. As visualized in Figure 4,[1] we do see some descriptive indication that a greater portion of the initial treatment effect remained for those with high prior attitude moralization (+1*SD*) than for those with lower levels of attitude moralization (Mean and −1*SD*), especially at T3 in the Purity + Moral Claim condition. This is evidenced by the minimal decay of effect size between T1 and T3 (a change of only 0.01 standard deviations) for those with more moralized initial attitudes, compared to the large decay of effects from T1 to T3 (a change of 0.21 standard

deviations) among people with less initial attitude moralization. However, this evidence should be considered tentative at best, as several aspects of these results prevent us from considering this to be clear support for H2. We explain our interpretation in the Discussion.

Discussion

Durability and Explicit Moral Claims

In this longitudinal experiment, we tested the immediate and over-time effects of two moral appeals on the topic of transitioning from fossil fuels to renewable energy. We tested the durability of persuasive effects over a 3-week period and compared how the effects differed between treatment messages that presented only factual, morally relevant information (e.g., "fossil fuels cause harm . . .") compared to treatment messages that explicitly emphasized moral conclusions (". . . and this is immoral"). This was implemented across two types of moral appeals: harm to human health and contamination of the purity of the natural environment.

Overall, the results showed that—for all variants of moral appeals—there were immediate persuasive effects as well as substantial durability of those effects over time. Informing RQ3, we found that after a 3-week delay, about half of the original effect of the purity treatments and about one third of the original effect of the harm treatments remained. Considering that this experiment involved a 1-time exposure to a brief and basic message, this degree of durability over an approximately 3-week period is substantial.

However, we found that the inclusion of explicit moral claims *did not* affect the initial size or the durability of the effects. A first intuitive explanation for this lack of difference in effects would be that all four treatments were simply perceived as equally moral because they all had content that was relevant (either implicitly or explicitly) to the morality of fossil fuels and renewable energy. However, evidence from the pilot test's manipulation check (Table S1) challenges this explanation because respondents perceived the treatments with explicit moral claims to have had *substantially* more emphasis on morals and ethics than the treatments without explicit moral claims ($d = 1.11$ for the harm treatments and $d = 1.12$ for the purity treatments). This suggests our operationalization of an explicit moral claim successfully created a clear and strong distinction between treatments.

Another potential explanation centers on the intermediate psychological mechanism by which the treatments were intended to affect the dependent variables. For explicit moral claims to produce more durable persuasion via

this mechanism, it is important that they boost the perceived moral basis of the beliefs and attitudes (Luttrell & Togans, 2021). Our pilot test (Table S1) found that the inclusion of explicit moral claims did indeed cause people to view the issue of fossil fuels and renewable energy as being more of a moral issue ($d = 0.21$ for harm, $d = 0.20$ for purity). This gave us confidence that the treatments were influencing this key psychological mechanism as intended. However, in the main study, we found that those same treatments had effects that were much smaller on that same outcome (harm treatments $d = 0.05$, $p = .016$; purity treatments $d = 0.04$; $p = .036$). Therefore, it may be that attitudes in the explicit moral claim conditions did not become sufficiently more morally grounded. This explanation centers on the importance of attitude moralization as the key theoretical mechanism by which moral appeals would be more persuasive or more durable, and it also highlights the difficulty of predictably manipulating attitude moralization.

These findings have important implications for theory and research on moral appeals and the stability or durability of moralized attitudes. There is a relative dearth of research on the long-term dynamics of moralized attitudes and rhetoric (see Luttrell & Togans, 2021). The present research further establishes that moral considerations are not fleeting, ephemeral concerns but could instead be at the center of enduring attitudes. With respect to MFT, despite some recent criticism of purity as a unique contributor to morality (Gray et al., 2023), our findings highlight that both harm and purity concerns can be potent producers of morally driven persuasion. In fact, we found no evidence that one moral foundation was more influential than the other.

In light of this, there are important practical takeaways from observing the lack of benefit from an explicit moral emphasis. Scholars and practitioners often are interested in additional messaging tactics, particularly when they are interesting and new. But we also must remember that simplicity is advantageous too. Here, we find that all treatment versions had similarly strong and durable effects. Communicators should keep in mind that there are limited returns to laboring over crafting the perfect message, especially when limited resources must also be allocated to increasing the reach of that message (Goldberg & Gustafson, 2023). However, communicators may also be able to use moral appeals in service of strategic priorities other than attitude or behavior change. For example, organizations or public figures could use explicit moral appeals to strengthen public perception of their own values or to catalyze a particular narrative in public discourse. In those situations, it is helpful to know that the moral appeal could accomplish those goals while having no negative or polarizing effects on topic-specific opinions and behaviors.

Individual Differences in Durability

Differential Durability by NTE, NFC, Issue Engagement, or Ideology. Our first hypothesis predicted that the durability of the persuasive effects of moral appeals would differ by levels of (a) need to evaluate, (b), need for cognition, and (c) issue engagement. We find no support for this hypothesis, across all four treatment conditions. This is unexpected, in light of prior evidence of differential persuasion durability—even in the same topic over a similar time frame with similar methods and measures (Gustafson et al., 2022).

We do find that the amounts of decay are descriptively different across levels of trait variables, as shown by several examples where the subgroups with slightly larger T1 effects decayed slightly more because they ended up at T3 with the same effect size as the subgroups who started with slightly smaller T1 effects. However, *we do not claim that this is evidence of more durable persuasion in one subgroup compared to another.* One reason we avoid that interpretation is that the differences in durability or decay between groups are too small to make confident inferences. This is an instance where the difference between a significant difference (the T1 difference in effects between levels of trait variables) and a non-significant difference (the T3 difference in those effects) is not itself necessarily significant. A second reason we avoid making that interpretation is that the plateau at T3—the amount of effect remaining for all subgroups across all conditions—might be better explained as a kind of floor for longitudinal persuasive effects. That is, we may be seeing a migration of all effects toward a common plateau, rather than evidence of "greater durability" per se in those effects that were started out relatively smaller at T1.

One possibility here is that the durability of moral messages does not, in fact, depend on individuals' depth of engagement. Perhaps moral messages are not evaluated all that deeply but are instead processed intuitively and thus moral intuition, rather than careful elaboration, is what results in durable change on moral issues. If this is the case, even people who are not motivated to deeply process a message can develop relatively durable attitudes when the message casts an issue in the domain of morality. In a similar vein, despite widespread scholarly interest in rational elaboration as key to developing lasting attitudes, recent evidence highlights that attitudes rooted in higher emotionality are also more stable over time (Rocklage & Luttrell, 2021).

These null effects of classic indicators of message elaboration, though not conclusive, suggest that one of the ELM's central claims—that elaboration enhances persuasion persistence—may be nuanced. On the one hand, as discussed above, durability can be driven by non-elaborative processes such as affective associations. On the other hand, even if elaboration is a robust predictor of persuasion persistence, elaboration is multiply determined. Although

traits like need for cognition and issue involvement are likely to track message engagement, the ELM posits that people may scrutinize a message for many reasons (see Petty & Wegener, 1998). For example, following a failure to replicate the effects of need for cognition on message elaboration (Ebersole et al., 2016), Luttrell et al. (2017) highlighted the importance of situational constraints on trait effects and showed that the original result is reproducible under optimal situational conditions. Therefore, perhaps the moral nature of our messages independently motivated people to elaborate, or the importance of the issue prompted elaboration in general, or the survey context encouraged people to elaborate. In sum, rather than undermine the ELM, our null effects may instead highlight these nuanced and complex aspects of the model that are often oversimplified.

Further, our results show no evidence of an interaction between the moral dimension emphasized by the message (purity or harm) and political ideology. This adds to a growing number of studies (e.g., Arpan et al., 2018; Hahnel et al., 2020) that have failed to replicate the earlier finding that matching moral frames to political ideology enhances persuasion effects (e.g., Wolsko et al., 2016). Although tailoring messages to fit the audience is ubiquitous as strategy and as advice, the evidence for the persuasive benefits of tailoring in environmental topics is quite mixed (Goldberg & Gustafson, 2025). There is a growing body of work that suggests that—with some exceptions—it is most common to observe a pattern of "persuasion in parallel" where persuasive effects are mostly similar across audience groups (Coppock, 2023).

Differential Durability by Prior Attitude Moralization Level. Our second hypothesis was that the persuasive effects of appeals with explicit moral claims would be more durable among people who already viewed the issue through a moral lens (high attitude moralization). Our findings provide mixed support for this hypothesis. Figure 4 shows that specifically for the Purity + Moral Claim treatment there were no clear differences in Time 1 effects between individuals at high (+1*SD*) and low (−1*SD*) levels of attitude moralization, but by Time 3 the amount of remaining effect was significantly different. However, this does not constitute clear support for H2, for a few reasons. First, the Harm + Moral Claim condition did not show a similar pattern as the Purity + Moral Claim condition (Figure 4)—that is, the effects of that treatment were not more durable for those with a high attitude moralization compared to others. Second, a similar pattern was also present in the effects of both treatments *without* the explicit moral claim, suggesting that if there is indeed a true pattern of differential durability, it is *not* likely driven by the theorized resonance between an explicit moral claim and pre-existing attitude

moralization. Third, our hypothesized interaction between condition and prior attitude moralization was also not significant for other outcome variables such as key issue beliefs (i.e., perceived fossil fuel harm and perceived fossil fuel contamination; Tables S17 and S18 in the Supplementary Information). Fourth, the reason effects are more durable at T2 and T3—as a percentage of the T1 effect—for people with high prior attitude moralization may simply be due to the fact that the T1 effect was smaller in this group (Figure 4). If all effects plateau at a floor near zero, the smaller initial effects will appear to proportionally have greater durability simply due to their starting point. Given all of this, our interpretation is that we do not find consistent or compelling evidence to support the idea that the durability of moral appeals will differ by the audience's levels of prior attitude moralization.

Limitations and Future Directions

The findings of this study must be interpreted in light of some caveats. First, it is difficult to precisely test the effect of adding moral emphasis to a persuasive appeal. This is because it is difficult to separate the moral emphasis of a message (e.g., fossil fuels are immoral) from the basic information of the issue itself (fossil fuels have undesirable effects). Even without an explicit statement about the moral and ethical aspects of the issue, just mentioning the undesirable effects of fossil fuels can have some moral undertones that limit the degree of difference between the appeal—and this can potentially explain the lack of difference in effects between implicit and explicit moral appeals. In this study, we chose to maximize internal validity by creating treatments that were equivalent in factual information except for the explicit moral emphasis in the moralized conditions. Although this causes the messages *without* explicit moral claims to still have some small degree of moral implications, it achieves the more important goal of cleanly isolating the effect of explicit moral claims. This approach also mirrors the real world because communicators are already describing the relative advantages of renewable energy—the practical question is whether to add explicit moral claims onto these existing factual arguments.

Our findings are also limited by the stimulus sampling problem. That is, we only test one style of message (short, animated videos) on one topic (renewable energy) across two moral appeals (harm, purity). Our findings and estimates of effects do not necessarily represent the many other messages on this topic that could make moral arguments, or other styles of delivery such as videos with narration or longer-form content. Therefore, readers should exercise caution when generalizing from these findings. In addition,

further research is needed to test the durability of moral appeals across other topics and with many different types of messages.

Conclusion

Overall, we find that all four treatments produced durable persuasive effects, with about 30% to 50% of the treatment effect remaining after a period of about 3 weeks. However, we found no evidence of an added boost in durability from adding explicit moral claims to the message, even though participants clearly recognized the addition of this moral emphasis.

Together, these findings suggest we can expect messages both with and without explicit moral claims to be persuasive and durable, but we should not expect significant gains in persuasion or durability simply by explicitly calling out the moral components of an issue—especially in a topic like this where the issue may already have moral undertones that are implicit or well understood.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This project was supported by the Heising-Simons Foundation, and the University of Cincinnati's Center for Public Engagement with Science.

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Data Availability Statement

The data and analysis code for this study are openly available on the Open Science Framework project page at https://osf.io/xjk4z/

Supplemental Material

Supplemental material for this article is available online at http://journals.sagepub.com/doi/suppl/10.1177/10755470241311011

Note

1. The full statistical results of these conditional analyses are presented in regression tables in Supplementary Information, with Table S16 reporting the interactions with attitude moralization.

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