A Double-Edged Fork:
Motivating and De-Motivating Pro-Environmental Food Behavior

by

Youval Aberman

A thesis submitted in conformity with the requirements for the degree of Master of Arts
Department of Psychology
University of Toronto

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Abstract

Climate change is a consequence of human behavior, but people tend to construe climate change as an unfathomable, abstract phenomenon that is irrelevant to their individual actions. In the present studies, the high-impact, underrepresented behavior of dietary choices was communicated with numerical information that varied in its frame of reference. We present initial evidence that presenting the footprint of human behavior at a global level, compared to at an individual level, demoralizes individual choices and weakens behavioral intentions to change diet. In addition, we find that participants reported reductions in their meat consumption when an implementation intention intervention was combined with our ‘frame of reference’ intervention. Presenting nation-wide consequences of human behavior is a double-edged sword: Framing in a large scale might reveal the relationship between collective actions and environmental issues, but it hinders the belief that individual actions make a difference.
Acknowledgments

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1 INTRODUCTION

We can easily see the relationship between what we eat and our figure; pants that once used to fit can be an excellent, and undesired, reminder for such relationship. On the contrary, when we see the smog that overshadows our cities or a landfill at the horizon, it is far less intuitive to connect a single behavior with such outcomes. Changes in planet Earth are inarguably more complicated than one’s weight fluctuations, but nonetheless, both encompass a symbiosis between observable changes and mental representation of the causes.

1.1 Abstract Environment

The consequences of climate change may be devastating to every inhabitant of the planet. The scientific community has reached a consensus that the unprecedented changes in Earth’s climate are a result of human behavior (Cook et al. 2016). While concern about climate change, which shows some fluctuation, is higher than in the past 30 years (Gallup 2017), per capita estimates of CO₂ emissions have been steadily increasing over time (World Bank 2014). Structural barriers to climate change prevent some parts of humanity from changing behavior, but even individuals who are able to do so rarely adopt behaviors to an extent that results in significant change (Gifford 2011). Encouraging individual action, therefore, is an important endeavor. When it comes to communicating how the behavior of billions of people affects global climate change, it might appear valuable to aggregate those billions and present the shocking enormity of the resources we use. It is not surprising that messages in the media often follow this strategy (Schannel and Gifford 2011).

I suggest, however, that one reason for the low levels of adoption of individual pro-environmental behavior is that people tend to perceive the environment as psychologically distant (Spence et al., 2012). As such, threat associated with the environment is perceived as irrelevant to the here and now (Brügger, Morton and Dessai 2016). The topic of global climate change, for the most part, does not result in a sense of dread that is known to motivate action (Fox-Glassman 2015). Climatic change is a slow, gradual process that happens on a large scale, relies on scientific expertise to document, and reflects distant and uncertain outcomes (Weber 2010, 2016) – properties known to impede concern (Slovic 1986).
Communicating the doomsday scenario of ecological collapse might be well-meaning, but in fact may cause too much dread that cannot be contained. The aptly named term “climate change helplessness” was recently coined by Salomon, Preston, & Tannenbaum (2017), borrowing from classic findings on learned helplessness (Seligman 1975). Like a dog in Seligman’s helplessness studies that cannot change his current situation, it can be difficult for an individual to see how his or her miniscule actions can yield changes on a global scale. In sum, environmental messages often seem to be at odds with human cognition.

1.2 Framing the Environment

While properties of human cognition may make it difficult to process some elements of global climate change messages, there might be a way forward. Recent decades have seen a shift in the models used to describe decision-making (Baron 2004), paving the way to a comprehensive literature suggesting that how messages are framed is intimately tied to the choices, the attitudes, and the meaning that people make from their surrounding.

Environmental psychologists have followed suit by studying how malleable the perception of global climate change is. Much of that literature aims at diminishing disbelief in anthropogenic climate change and/or increasing environmental concern. Indeed, the term “climate change” itself has been subject to framing research. Schuldt, Konrath and Schwarz (2011) noted that although the terms “Global Warming” and “Climate Change” are used interchangeably in media discourse, conservative think tanks tend to use the former term while the opposite is true for liberal think tanks. This pattern was explained by “Global Warming” being suggestive of humanity’s role – an idea with which conservatives tend to disagree (Shuldt, Konrath, and Schwarz 2011). The most notable finding from that work was that the term “Climate Change” reduced the well-established partisan divide. (More findings on message frames that reduce the partisan divide: Feinberg and Wheeler 2013, Shuldt et al., 2015, Weber 2016)

The literature on environmental framing has targeted abstract, psychologically distant descriptions of climate change, with several studies introducing variables intended to “proximate” the environment. For example, predictive flood maps of either nearby or distant geographic locations (Spence and Pidgeon 2010), describing climate change as happening in the near future (Rickard, Yag, & Schuldt 2016), and highlighting non-climate consequences that are personally relevant (McCright et al., 2016), all influence engagement with climate change. (For a
review of climate change perception studies: Weber 2010, Weber 2016). The findings on proximizing the environment, however, are mixed – a recent meta-analysis concluded that the findings are inconsistent (Brugger, Morton, & Dessai 2016). Brugger et al. argued that they could account for such inconsistencies by taking a construal-level perspective (Trope and Liberman 2003). According to Construal Level Theory, different modes of processing take place at different levels of mental abstraction. “Feasibility” concerns – i.e., personal norms and social comparisons – were more relevant in low-level construal while skepticism was associated with high-level messages (Brügger, Morton, & Dessai 2016). Research on construal-level theory suggests low-level construal is associated with heightened efficacy consideration (White, Macdonnell, & Dahl 2011), which I find most relevant to the current investigation.

Multiple models of behavior change include a component referring to one’s belief that an action will result in a certain outcome, e.g., Perceived Control in the Theory of Planned Behavior (TPB, Azjen 1991), Outcome Expectancy in Bandura’s Theory of Self-Efficacy (Bandura 1997), and Resource Appraisal in the Cognitive Theory of Stress (Homburg & Stolberg 2006). There is a rich literature on the downstream effect of outcome efficacy in health behavior (Armitage and Conner 2001) and prosocial behavior (Caprara, Alessandri, & Eisenberg 2011). The Theory of Planned Behavior has guided multiple investigations on pro-environmental attitudes and behavior (Oreg & Katz-Gerro, 2006). Most notable is the development of Stern’s Theory of Environmentally Significant Behavior (Stern 2000), which includes the component of Perceived Ability to Reduce Threat (RA). The role of outcome efficacy was illustrated primarily in correlational designs, such as in water saving behavior (Lam 2006), general pro-environmental actions (Shutte and Bhullar 2017, Study 1), as well as general knowledge about climate change (Ramkissoon & Smith 2014).

Outcome efficacy, to the best of my knowledge, was directly manipulated in two pro-environmental research paradigms. Shutte and Bhullar (2017, Study 2) explicitly mentioned Bandura’s conceptualization of efficacy (by explaining what self-efficacy is, as well as how it can be encouraged with effort) and showed that it increased intentions to foster “green” consumer habits. Salomon, Preston, & Tannenbaum (2017) framed a message about individual mitigation being “easy and effective” (in contrast to “hard and ineffective”), and observed that the “easy and effective” frame increased intentions to adopt environmental action. Furthermore,
a week after participants read that their energy consumption makes “no meaningful impact” on the environment, they reported consuming more energy than usual.

While highlighting efficacy’s role in pro-environmental considerations, these manipulations suffer from a significant limitation: Telling people whether their actions make a difference (hence directly manipulating efficacy) does not allow them to naturally construe efficacy from environmental information. Similar to Salomon et al. (2017), I believe that outcome efficacy might be crucial to avoiding Climate Change Helplessness, but that efficacy can be conveyed more subtly by the way we present numerical information.

1.3 A million-to-one chance

The reasoning behind presenting numerical environmental data at the individual level – as opposed to more macro-levels – is inspired by prior work on risk perception. Slovic and colleagues have identified the non-linear relationship between the magnitudes of atrocities and compassion, such that the suffering of millions is met with modest increases in emotional intensity (Slovic et al., 2007, Slovic 2010). Furthermore, people show less compassion as reference groups become larger (Small and Lowenstein 2003), suggesting that aggregates do not invoke emotional responses in the same way that individuals do. The collapse of compassion has also been explained as a self-regulatory effort to avoid the overwhelming feeling of compassion for multiple victims (Cameron and Payne 2011), which seems analogous to the reasoning behind Climate Change Helplessness.

In the context of environmental numerical messages, Hart (2013) observed that presenting polar bears at risk via numerical descriptors (“12,000 out of 18,000”), compared to verbal descriptors (“most” polar bears), led to greater concern and behavioral intentions to donate. This effect was moderated by numerical predisposition, such that the numeric message was effective only among the less numerate. Graham and Abrahamse (2017) provide the only examination (to my knowledge) of how directly manipulating numerical presentation interacts with pro-environmental intentions. Communicating the yearly savings of adhering to a sustainable diet, they compared an individual frame (“if as an individual [you do X]… this will save 561 KG CO₂e a year, which is the equivalent of driving your car for 7837 kilometers”) to a national frame (“if as a nation [we all do X]… this will save 1.77 million KG CO₂e in a year, which is the equivalent of all of us driving an average car for 7837 kilometers”). This framing variable was
designed to interact with pre-existing values of self-enhancement or self-transcendence (Schwartz 1992). The authors found that attitude change was dependent on a “fit” between values and message framing, such that those who endorsed biospheric or altruistic goals (self-transcendence) were affected by the national frame, while egocentric goals (self-enhancement) were associated with the individual frame (Graham and Abrahamse 2017). I argue that both yearly-aggregated frames result in high-level processing compared to, for example, a footprint of a single action – In line with the construal-level perspective given by Brügger et al. (2016). Further strengthening the above idea is that either frame resulted in higher intentions to change diet than the control frame, without significant differences between the two.

1.4 Environmental Vegetarians

Because I was interested in communicating the environmental footprint of a single action, I chose an outcome behavior that has a relatively high impact on the environment. Surprisingly, such an approach is not shared with all climate change communicators. A recent analysis of pro-environmental behaviors recommended in Canadian Science high-school textbooks indicates that the pedagogical emphasis is often misdirected. Certain behaviors, such as conserving energy or recycling, are represented in a majority of textbooks, while other rarely or never. One might reasonably assume that textbooks would recommend actions that have high impact, but this does not seem to be the case: many of the most highly impactful actions an individual can take are underrepresented in science textbooks (Wynes & Nichols 2017).

Consuming a plant-based diet is considered a high-impact behavior because the resources used to produce a calorie of meat protein are vastly greater than the resources used to produce a calorie of plant protein (Pimental & Pimental 2003, Perignon et al., 2017). In addition, a great percentage of the Western diet is comprised of animal-protein: meat consumption is at a par-capita all time high (Ruby 2012). Finally, people eat too many calories in general, as evident by the Obesity Pandemic (Wallace & Wallace, 2016). Taken together, the decision to adopt a plant-based diet is, in carbon-dioxide emissions equivalents (CO₂e) saved per year, 8 times more effective than recycling, or dry-hanging one’s clothes (Wynes & Nichols 2017), for example. However, Wynes and Nichols’ analysis reveals that not a single Canadian high school textbook highlighted a plant-based diet as a sustainable behavior. Thus it should not be surprising that
only a small minority of people (both in Europe and in north America) are aware of the role that food choices plays on the climate (de Boer, de Witt, & Aiking, 2016).

In addition to the lack of public awareness on the subject, there is a lack of research attention on environmental concerns in the meat consumption literature. In Rozin’s seminal work on the moralization of meat consumption, he and his colleagues asked participants about their environmental motives, in addition to health and welfare reasons for avoiding meat, yet only investigated the latter two (Rozin et al. 1997). Despite recent interest in studying meat abstention in social psychology (for a review: Ruby 2012), the study of vegetarianism has been mostly investigated as an animal welfare issue (e.g., Loughnan, Haslam and Bastian 2010; Bastian et al., 2011; Kunst and Hohle 2016). Much of the findings, however, have indicated that advocating for vegetarianism via animal welfare issues often leads to undesired reactance and motivated distortions, which compromise the message’s effectiveness. Such findings suggest that alternative approaches might be more effective. I find the lack of research attention on environmental reasons for vegetarianism especially interesting because participants (n=121) in Rozin’s seminal work reported environmental reasons as frequently as they recounted welfare concerns (Rozin et al. 1997, Table 1).

Only a few studies have investigated the framing of a plant-based diet. Klöckler and Ofstad (2016) tested the provision of tailored information about meat and the environment, taking a stage-model approach (Bamberg 2013). They showed that providing concrete information (How one can reduce meat consumption) worked for people who already have intentions to reduce meat, while providing abstract information (Why one should reduce their meat consumption) increased intentions. Loy et al. (2016)’s intervention for promoting a “sustainable diet” did not isolate environmental arguments, such that participants received them in addition to animal welfare and health arguments. Interestingly, and in line with Rozin et al. (1997), post-hoc analyses indicated that participants (across all conditions) rated environmental reasons for meat reduction as more important than all other reasons (Loy et al. 2016).

1.5 Current Research

The primary purpose of the present studies was to examine the effect of presenting environmental footprint information in two contrasting way. On one side of the spectrum is what I refer to as the “Nation” frame of reference – i.e., presenting the aggregate footprint of an entire
industry, a common frame in many climate change messages (Gifford 2011). On the other end is what I refer to as the “Meal” message. This type of message focuses on the footprint of a single action, which I believe allows one to connect to the consequences of their behavior. Here, a single action is presented as the environmental footprint of a single dish.

We conducted two studies, one of which was a longitudinal study that allowed us to capture the persistence of the proposed effect. In addition, we examined whether implementation intentions (“II”, Gollwitzer 1999), an established action planning intervention, will modulate the message framing effect. IIs have been shown to help people to bridge the gap from intentions to actual behavior change across a wide range of different domains (Gollwitzer and Sheeran 2006). II manipulations typically exhibit a medium-to-large effect size and have been recently implemented in online research (Gollwitzer et al., 2017).

1.5.1 Study 1 rationale and question

Study 1 was designed to observe whether the two ways of presenting the same information would differentially affect participants’ values and behavioral intentions regarding meat consumption.

1.5.2 Study 2 rationale and question

Study 2 was a longitudinal study that allowed us to go beyond behavioral intentions and measure self-reported consumption of different types of food. We also tested for a potential interaction with implementation intentions. This study was meant to address the following questions:

1) Does the “Meal” footprint increase moralization of the behavior, or does the “Nation” footprint demoralize the behavior?

2) Does any effect of Meal versus Nation extend to actual dietary choices, in addition to behavioral intentions?

3) Will including implementation intentions enhance the relationship between the Meal vs. Nation manipulation and dietary choices?
2 STUDY 1

2.1 Methods

2.1.1 Participants

200 participants were recruited using the online platform Amazon Mechanical Turk (mTurk). We limited the survey to users who completed at least 100 HITs, who were approved on 95% of the studies they took, and who were registered as US residents. Data were collected on a single day. The study was advertised as “Survey about Food and the Environment”. Participants were compensated 50 cents for their participation.

2.1.2 Stimuli

2.1.2.1 Survey

After being recruited, participants were redirected to an external survey programmed on Qualtrics (Qualtrics, Provo, UT). After signing a consent form, participants answered demographics questions. These included age, gender, education level, income (with a drop-down menu using 10,000$ increments), and an item assessing political orientation (on a 1-7 scale anchored with “extremely liberal” and “extremely conservative”, and 4 indicating “neither liberal or conservative”). In addition, participants were asked whether they consider themselves “vegetarian”, “vegan”, “omnivore”, or “none of the above”.

2.1.2.2 Experimental conditions

Participants were randomly assigned to one of two experimental conditions. Regardless of condition, three types of resources were discussed in randomized order: Water Footprint, CO\textsubscript{2} Equivalents (Methane), and feed/grain. Each of the three resources included a description of how the footprint is calculated (without using numerical descriptors), a relevant clipart for illustrative purposes, and a statement about how much of that resource is used in meat production. (All information packets can be found in Appendix A) The only difference between conditions was the frame of reference used to portray that resource. In the “Meal” condition, the frame of reference was a single burger. In the “Nation” condition, the frame of reference was the entire US beef industry.
2.1.2.3 Questionnaires

Unless indicated otherwise, all questions were likert-type, with answers ranging from 1 to 7, with higher numbers indicating more endorsement of the item.

Moral Meaning: Participants completed a subset of the Meaning of Food in Life Questionnaire (MFLQ, Albit, Roby and Rozin 2017), which aims to assess values embedded in dietary choices. The authors originally used the MFLQ as an independent variable, but we found the questions assessing the Moral subset of the questionnaire (e.g., “My food choices are an important way that I can affect the world”; appendix D) to be directly related to the outcome variable of interest to us. The five Moral questions were contrasted with the five Health questions from the MFLQ (“I get satisfaction from knowing that the food I eat is good for my body”, for example) in order to distinguish between “moral” change per se versus a general change in food values.

Meat “attachment”: Participants completed three questions assessing the extent to which they value meat as part of their diet. These questions addressed whether one finds meat to be “an important part of their diet”, an “unavoidable part of their diet”, as well as whether they are “willing to reconsider their meat consumption in the near future” (reverse coded).

An attention check was randomly presented within the questionnaires “block”. It notified participants that it is an attention check, and asked them to check “completely disagree”.

2.1.3 Scoring and Exclusion Criteria.

Subsets of the MFLQ – Moral subset (Cronbach’s α=0.87) and the Health subset (0.84) – were merged to form a single score with possible range of 1-7. The three items assessing “attachment” and behavioral intentions (Cronbach α=0.71) were merged to form a single score.

Participants who failed the attention check (19 participants) were removed from analysis. In addition, participants who completed the survey in less than 150 seconds (11 participants) were removed from analysis. This left 168 participants in the final analysis.
2.2 Results

2.2.1 Demographics

Of the 168 participants, 68% were female. The mean age was 38 (sd = 12.9), with a range of 18-70. Average endorsement of the political affiliation item was 3.32 (sd = 1.78), suggesting participants tended to be more liberal than conservative. Fifteen participants self-identified as either vegetarians or vegan.

T-tests confirmed that the distribution of gender, age, and political affiliation (all ns≥0.3) across conditions as similar.

Table 1

Correlation Matrix for Study 1.

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender (Female)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Age</td>
<td>0.10</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Political</td>
<td>-0.11</td>
<td>0.08</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Vegetarian (Yes)</td>
<td>-0.07</td>
<td>0.06</td>
<td>0.04</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Moral Meaning</td>
<td>0.13</td>
<td>0.02</td>
<td>-0.08</td>
<td>-0.32***</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>6. Meat Attachment</td>
<td>-0.15</td>
<td>-0.12</td>
<td>0.17*</td>
<td>-0.26***</td>
<td>-0.47***</td>
<td>-</td>
</tr>
</tbody>
</table>

Significance Codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1

2.2.2 Moral Meaning

Average endorsement of the Moral subset was 4.41 (SD=1.29) and average endorsement of the Health subset was 5.54 (SD=1.08). An independent-samples t-test compared each subset of the MFLQ in the Meal versus Nation conditions. Participants in the Meal condition (M = 4.65, SD=1.38) endorsed moral concerns more highly than did those in the Nation condition (M=4.18, SD=1.16); t(168) =2.3, p = 0.018. There was no significant difference in endorsement of the Health subset between the Meal (M = 5.61, SD=1.01) and the Nation (M=5.45, SD=0.99) conditions; t(168) =0.8, p =0.35.

2.2.3 Meat “Attachment”

The average endorsement of the combined score was 4.30 (SD=1.59). An independent-samples t-test compared the aggregated score in the Meal versus Nation conditions. There was a significant
difference between the Meal (M = 4.04, SD= 1.57) and the Nation (M=4.57 , SD=1.59 ) conditions; t(168) =2.17 , p = 0.03. This indicated that those in the Nation condition reported, on average, that they place higher value on meat as part of their diet, and are less willing to reconsider changing their diet.

**Figure 1.** Effects of Frame of Reference on the Meat Attachment (left) and Moral Meaning (right), Study 1.

2.2.4 Interactions with Demographics

A multiple linear regression was used to test the effect of political affiliation and/or gender on the responses. Across the two dependent variables, we compared a partial model, which only included condition as a predictor variable, to an unrestricted model that also included gender and political affiliation.

Moral meaning: The unrestricted model [F(1,168) = 5.69, p = 0.018 ] and the restricted model [F(1,168) = 2.88, p = 0.033] did not significantly differ from one another: [F(2,166) = 1.46, p = 0.23]. These analysis indicates that the effect of the Meal versus Nation manipulation did not vary meaningfully as a function of political orientation and gender.
Meat attachment: The unrestricted model \( F(1,168) = 2.11, p = 0.04 \) and the restricted model \( F(1,168) = 2.17, p = 0.03 \) did differ from one another: \( F(2,166) = 3.82, p = 0.023 \). Even when controlling for political affiliation the frame-of-reference effect remained intact, \( F(1,168) = 2.09, p = 0.04 \)

2.3 Discussion

The main purpose of the first study was to assess whether participants would be sensitive to information presented in a Meal versus a Nation frame of reference. As hypothesized, there were significant differences between conditions, such that presenting the resources used in producing a single meal, compared to the entire industry, led to stronger moralization of food choices. The fact that the health subset of the MFLQ did not show this pattern strengthens the interpretation that the frame-of-reference effect was limited to environmental concerns and did not reflect a general tendency to find meaning in food. Furthermore, the inverse relation between conditions and “meat attachment” is also in line with this interpretation.

2.3.1 Limitations

Several limitations are evident in the study. While a significant difference was observed between the conditions, we could not assess which condition deviated from baseline. Arbit, Ruby and Rozin (2017) reported average endorsement of the moral subset at 3.99 out of 7 (N=221), which suggests our “Meal” information (M = 4.65) increased moral considerations of participants, but more direct evidence is needed. In addition, the brief study allowed us to make few inferences about any lasting effect of the interventions, and whether the effect would result in actual behavior change. Lastly, the single-item political affiliation variable did not show the expected response pattern, (i.e., that self-identified conservatives would be less influenced by the Meal versus Nation manipulation).

3 STUDY 2

Study 1 indicated that participants moralized their dietary choices to a greater extent when a single dish was used as the frame of reference. Study 2 had multiple purposes. First, by including a control condition, we could assess whether presenting the footprint in an individual-level (“Meal”) frame moralized dietary choices or whether the macro-level (“Nation”) frame demoralized dietary choices, relative to baseline. Second, Study 2 assessed actual, self-reported
behavior change and the persistence of the effect, by tracking participants longitudinally over four days. Lastly, the inclusion of an established planning intervention allowed us to test Hypothesis 3: The inclusion of implementation intentions will strengthen the effects of frame of reference on moralization and actual behavior change.

3.1 Methods

3.1.1 Participants

3.1.1.1 Wave 1 and Power Analysis

A total of 1172 mTurk Workers were recruited to Wave 1 and were paid 10-15 cents for the initial session (higher rates were given to later batches, in order to incentivize recruitment). We used the same participation requirements as in Study 1. The study description was “Environment and Meat Consumption”, informing participants about 4 additional HITs that will become available daily, and included the compensation for each session.

An a priori power analysis required 100 (80) participants per cell to find a medium effect size, with alpha of 0.05 and 90% (80%) power. As some level of attrition was expected, we recruited more participants than we were planning to analyze. While aiming for the higher level of power, we only managed to reach the lower level (80%).

3.1.1.2 Follow-ups (Wave 2-5)

Every day between 8-9 pm (Eastern), a follow-up HIT became available to participants who completed the earlier HIT. Two follow-ups were shorter (Wave 2 and 4) and were associated with 10 cent payments, while Wave 3 and 5 participants were compensated 20 and 50 cents, respectively. In addition, participants were told that 4 bonuses of 25$ will be randomly distributed among those who completed all of the follow-ups.

3.1.2 Stimuli

3.1.2.1 Wave 1

After signing the consent form, participants completed similar demographics to Study 1. Participants who indicated being either Vegetarians or Vegan were asked their reason(s) for doing so. The options were “Ethical/Moral”, “Health”, and “Environmental”. In addition,
participants were asked how many days a week, on average, they consume a variety of food items (beef, other meat, fish, fruit, vegetables) with options ranging from “0 / Never” to “7/Every day”.

Before finishing the HIT, participants were told that they will be asked about their meat consumption in the next HITs, and were asked to remember what they eat each day. Lastly, participants were informed they will receive email notifications when new HITs become available.

3.1.2.2 Email Notifications

When a new HIT launched, those in the relevant batch were notified that it was now available, and that they have 24 hours to complete it. In addition, a reminder was sent to those who did not complete a HIT 12 hours after it was released.

3.1.2.3 Daily Intake

Each follow up study (four in total) began with a brief food intake. Participants indicated whether they consumed each of several items (beef, meat other than beef, seafood, fruit, and vegetables) for each meal in the past day (with a separate column for breakfast, lunch, dinner, and for “snacks/in between meals”).

In addition, participants were asked if they consumed less or more meat than usual, as well as if they “thought about their food choices” less or more than usual. These questions were answered using a slider scale, anchored at “0 / As usual” with a range “-5 / less than usual” – “5 / more than usual”.

3.1.2.4 Experimental material

After completing the daily intake of Wave 3, participants were randomly assigned to one of the two footprint modules from Study 1, or to a no-information (control) condition.

Participants were also randomly assigned to either the implementation intentions condition or the control condition. The implementation intentions exercise asked participants to “take the challenge of reducing their meat consumption for the remainder of the study”. They were told that “challenges might come up”, and that “we are offering a simple technique.” Participants
were asked to imagine one challenge and to type it in a text box. Then they were asked to imagine what they could do if that challenge came up, and typed it in another text box. Participants’ input was inserted in the following page, telling participants that their plan for the remainder of the study is “If <Participant’s challenge>, then <Participant’s solution>”. They were asked to retype the plan “to correct for grammatical errors”, and saw the corrected plan once again on the final page (full instructions can be found in appendix B).

The control exercise asked participants to spend the next minute writing “at least four sentences about their day, without using the words Home, Sleep, and Work.” Participants could only submit the page after one minute and when the text box included at least 40 characters.

3.1.2.5 Weekly DV’s

After the daily intake in Wave 5, participants filled a relative consumption survey, asking them whether they consumed “less or more of the following items in the past week, compared to recent weeks”, with the same items listed as in the daily intake.

Participants then answered the same outcome variables as in Study 1: the Moral subset of the MFLQ (without the Health subset) and the “meat attachment” items. For the attachment items, instead of answering the extent to which they were “willing to reconsider your meat consumption in the near future”, participants were asked the extent to which they agreed with the statement “after taking part in this study, I am planning to change my meat consumption” (reverse correlated).

3.1.2.6 Exploratory variables

In addition to the variable of interest, we included questionnaires that aimed to assess possible moderators for future analysis. General numerical ability was assessed via seven questions originally developed by Lipkus, Samsa, and Rimer (2001), in line with previous research that has indicated that numeracy moderates the effectiveness of climate change messages that include numerical information (Hart 2013).

An extended political orientation measure was administered via the Attitude Based Political Affiliation scale (Burton 2016). This 33-item questionnaire measures the endorsement of three factors of conservatism. Of particular interest was the Masculine Independence subset, which,
among other fiscal subjects, includes items about environmental issues (for example, “Proposed laws to reduce carbon emissions are urgently needed”).

3.1.3 Exclusion and Scoring

Responses to each survey were matched according to the worker ID provided by mTurk. Five responses were unidentifiable and were removed from analysis. Twenty-three participants failed the attention tests and were also removed from analysis. Completion time for all studies was aggregated and exclusion criteria was more conservative than in Study 1: respondents whose total duration time was in the bottom percentile were removed from analysis (6 participants).

Measures that were used in Study 1 were scored in the same way, after a consistency analysis, yielded the following: Moral subset of the MFLQ (α=0.86), Meat “attachment” (α=0.62). Consistency analysis was also conducted on the three subscales of the ABPO (Masculine Independence: α=0.95, Religious Traditionalism: α=0.95, and Ethnic Separateness: α=0.80).

Daily intake was coded between 0 and 4, given that participants had 4 opportunities to eat meat (three meals and “snacks/in-between) for each day. Responses from Waves 2 and 3 were combined to make the “Pre intervention” variable, and responses from Waves 4 and 5 were combined to make the “Post intervention” variable.

3.2 Results

The final dataset consisted of 520 participants. Sixty four percent of participants were female. The mean age of participants was 38 (sd = 11.2), with a range of 19-75. Participants were more likely to be liberal than conservative (M = 3.38, sd = 1.78). Thirty two participants were identified as either vegetarians or vegan (6% of the sample).

Average meat consumption: Participants indicated that prior to the experiment they consumed meat about 3.0 days a week (sd=1.38). Ninety percent of participants reported consuming meat at least once a week. Men (M = 3.28) reported eating more meat than women (M = 2.88), t(515) =3.1, p = 0.01. The correlation between the single-item political affiliation (higher scores represent conservatism) and prior meat consumption was positive, but not large in magnitude, r=0.14, t(515)=3.30, p < 0.001.
An independent-samples t-test compared the demographics of participants who dropped after taking the first survey (n = 592) to those who completed the survey (n = 520). There was a trend in political affiliation (higher numbers indicate conservatism) between those who dropped (M = 3.54, SD = 1.78) and those who completed (M = 3.34, SD = 1.68) the study; t(1145) = 1.79, p = 0.07. In addition there was a significant difference in average meat consumption between those who dropped (M = 2.66, sd = 1.78) and those who completed (M = 2.93, sd = 1.51) the study; t(1145) = -3.04, such that participants who dropped the study consumed less meat on average. I will address these attrition data in the General Discussion. There were no significant differences in age or gender across those who completed the study or dropped out.

### 3.2.1 Replicating Study 1

We first analyzed only the participants who did not receive the Implementation Intention intervention (n = 248). A one-way ANOVA compared the MFLQ Moral scale across Meal (4.64), Nation (3.99), and control (4.46) conditions. There was a significant effect; F(2,245) = 5.1, p < 0.01. Planned comparisons indicated that the Meal and Control were not significantly different from one another, F = 0.86, p = 0.30. The value in the Nation condition, however, was significantly lower than the two other conditions, F = 9.47, p < 0.01. In other words, participants

---

**Table 2**

*Correlation Matrix for Study 2.* "Political – MI" = The Masculine Independence subset of the ABPO. “Meat – before” is participants’ approximation of weekly meat consumption, taken at Wave 1. “Subjective Meat” is participants’ relative meat consumption in the duration of the study, taken at Wave 5.

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender (female)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Political - MI</td>
<td>-0.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Age</td>
<td>0.06</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Meat - before</td>
<td>0.15***</td>
<td>0.11</td>
<td>-0.13**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Vegetarian (Yes)</td>
<td>0.13**</td>
<td>-0.11</td>
<td>-0.05</td>
<td>-0.51***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Moral Meaning</td>
<td>0.01</td>
<td>-0.33**</td>
<td>0.07</td>
<td>-0.31***</td>
<td>0.28***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Meat Attachment</td>
<td>-0.10**</td>
<td>0.26***</td>
<td>-0.08</td>
<td>0.42***</td>
<td>-0.22***</td>
<td>-0.47***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Subjective Meat</td>
<td>-0.03</td>
<td>0.08</td>
<td>-0.14**</td>
<td>0.08</td>
<td>-0.01</td>
<td>-0.17***</td>
<td>0.28***</td>
<td></td>
</tr>
</tbody>
</table>

N= 518. Signif. Codes: 0 ‘****’ 0.001 ‘***’ 0.01 ‘**’ 0.05 ‘*’ 0.1
who received footprint information presented at the Nation level expressed lower moral concern about food than did participants in the other two conditions.

A one-way between subjects ANOVA compared the three “attachment” items (lower scores reflect more attachment to meat) across Meal (3.52), Nation (4.09), and control (3.68). There was a near-significant trend; F(2,245) = 2.48, p < 0.09. Planned comparisons demonstrated significant differences between the Nation and the two other conditions, F = 4.25, p = 0.04. No significant difference was observed between the Meal and control, F = 0.62, p = 0.40. Thus, the attachment to meat dependent variable followed a pattern that was similar to the moral concerns dependent variable.

**Figure 2.** Effects of footprint and implementation intentions on the Meat Attachment (top left), Moral Meaning (top right), and relative weekly meat consumption (bottom).
Next, a one-way ANOVA compared subjective weekly consumption across the Meal (-0.75), Nation (-0.01) and Control (-0.32 conditions). The omnibus assessment showed a trend; F(2,229) = 1.93, p = 0.14. However, an analysis that excluded the Control condition revealed that participants in the Meal condition recalled eating less meat than those in the Nation condition, t = 1.99, p < .05. When controlling for weekly meat consumption prior to the experiment, however, the difference was not significant, t = 1.6, p = 0.09.

### 3.2.2 Main Effects and Interactions

**Moralization:** A factorial ANOVA was conducted to compare the effects of footprint frame of reference, implementation intentions, and the interaction on the endorsement of the moral subset of the MFLQ. There was a marginally significant main effect of frame or reference \([F(2,514) = 2.35, p = 0.09]\), and no main effect of implementation intentions \((p > 0.5)\). The interaction was significant, \(F = 3.24, p = 0.04\). Simple effects analyses indicated that the effect of frame of reference without the implementation intentions intervention (reported in 3.2.1) disappeared once implementation intentions were introduced, \(F = 0.718, p =0.43\).

**Meat attachment:** A factorial ANOVA indicated a marginally significant main effect of frame of reference, \(F = 2.65, p = 0.07\), a marginally significant main effect of implementation intentions, \(F = 2.8, p = 0.09\). The interaction was not significant \((p > 0.5)\).

**Subjective weekly consumption:** On average, participants reported consuming less meat in the duration of the study, compared to “recent weeks” \((M = -0.43, sd = 1.29)\). Forty percent of the sample indicated consuming less meat than usual, 33 percent reported it was the same as usual, and 20 percent reported eating *more* meat than usual. (Twenty-nine participants did not answer this question.) A factorial ANOVA was conducted to compare the main effects of frame of reference and implementation intention and the interaction effect on subjective weekly consumption. There was no significant main effect of frame of reference \([F(2,514) = 0.8, p < 0.40]\), but there was a significant main effect of implementation intentions, \(F = 16.1, (p < 0.001)\). The interaction was not significant, \(F = 2.0, p = 0.13\).

**Meat consumption:** a factorial ANCOVA [between-subjects factor: frame of reference, implementation; covariate: consumption before intervention] revealed a main effect of
implementation intentions \[F(2,513) = 15.2, p < 0.001\], no main effect of frame of reference, \(F = 0.33, p > 0.70\), and no interaction, \(F = 0.31, p > 0.70\).

### 3.2.3 Political Affiliation

Moralization: A one-way ANCOVA [between-subjects factor: frame of reference, covariates: each of the ABPO subsets] revealed that frame of reference remained a significant predictor of moralization \([F(2,217) = 3.5, p = 0.03]\) after controlling for the Masculine Independence, \(F = 43.8, p < 0.001\), Religious Traditionalism, \(F = 3.2, p = 0.07\), and Ethnic Separateness, \(F = 3.1, p = 0.08\).

Meat attachment: A one-way ANCOVA [between-subjects factor: frame of reference, covariates: each of the ABPO subsets] revealed that frame of reference did not remain a significant predictor of moralization \([F(2,217) = 1.3, p = 0.25]\) after controlling for the Masculine Independence, \(F = 21.4, p < 0.001\), Religious Traditionalism, \(F = 3.2, p = 0.07\), and Ethnic Separateness, \(F = 3.0, p = 0.08\).

Subjective weekly consumption: A one-way ANCOVA [between-subjects factor: frame of reference, covariates: each of the ABPO subsets] revealed a near-significant effect of frame of reference \([F(2,217) = 3.2, p = 0.07]\) after controlling for the Masculine Independence, \(F = 2.8, p < 0.10\), Religious Traditionalism, \(F = 0.9, p = 0.34\), and Ethnic Separateness, \(F = 0.8, p = 0.38\).

### 3.3 Discussion

The replication of key findings from Study 1 strengthens the assertion that frame of reference makes a difference when presenting environmental footprint information. The inclusion of a control condition gives rise to the possibility that the “national” frame of reference demoralized dietary choices and weakened behavioral intentions to change diet. In addition, the fact that these effects persisted two days after the intervention is encouraging.

Almost all participants, regardless of condition, reported consuming less meat during the study compared to weeks preceding it. Such deviations from baseline make sense given that participants were knowingly part of a study about “meat and the environment” and were asked about their meat consumption (among other items) on a daily basis. We obtained initial evidence that actual, self-reported meat consumption varied as a result of frame of reference. I would also
note that participants in the Nation condition (without implementation intentions) were the most resistant to report a reduction in meat consumption; Seventy five percent of those in the Nation condition reported “0” or a positive change (which indicates consuming more meat than usual), in contrast to 55 and 65 percent in the Meal and control conditions, respectively. While only exploratory in nature, this is a pattern of results in line with our other findings.

Although frame of reference affected actual meat consumption, the effect of implementation intentions was greater. If we exclude the variance explained by prior meat consumption (which, unsurprisingly, accounted for 78 percent of the variance), the effect of including implementation intentions on reported meat consumption explained 13 percent of the variance. In total, implementation intentions accounted for 3 percent of the variance in meat consumption – a small-to-medium effect size according to the guidelines set by Cohen (1988).

4 GENERAL DISCUSSION

Global climate change is a human-caused phenomenon. Many people, however, find it hard to see how their own individual actions contribute to the problem. Intuitively, it might be appealing to use aggregate data when discussing the environment, because such information captures the extent to which collective actions contribute to numerically astonishing outcomes. Our studies point to the possibility that, ironically, using such global frames might dilute one’s individual actions. These data represent initial evidence that presenting environmental information at a macro-level harms pro-environmental behavior more than presenting the information at an individual level helps, and may contribute to what recent scholars have termed “climate change helplessness” (Salomon et al. 2017).

Of foremost importance for future directions will be to test the role of emotion in these interventions. As mentioned in the introduction, both the literature on climate change helplessness as well as on the meat paradox scrutinize the role of emotions in these processes. It is possible that the Meal condition, by being (too) proximate, actually increases the dread associated with climate change messages; it can be overwhelming to think that every time you eat a burger, 400 gallons of water were used. While our data do not support the undermining of efficacy by the proximate message (as measured by the moral meaning of food), we also did not see an increase in efficacy compared to control.
Given that the Meal condition did not increase behavioral intentions above the control condition, I cannot infer that participants left the experiment with heightened behavioral intentions to adopt a sustainable diet. At most, the current findings can advise what types of communication to avoid. Ideally, however, we would gain a greater understanding of what communicators should emphasize.

Our footprint material, in addition to the frame of reference, contained other differences that are worth examining. The Nation reference to the stars in the milky way (to illustrate the 128 billion) and the GDP of Egypt (To illustrate 250 billion) was intended to further distance the Nation condition, but one might argue that the equivalent references in the Meal condition – water consumed in 2 years, driving for 16 km – not only uses more digestible numbers but also more relatable terms. Future findings should control for these differences, and also scrutinize the type of information that will motivate people above a baseline. Additionally, the arbitrary choice of a burger as the item of reference might have been another impediment, as burgers might not be part of many omnivores’ diets, especially in non-Western countries. One solution could be an interactive intervention – one that uses dietary input from participants and return their footprint – to make the intervention personally meaningful.

I find it likely that other domains of pro-environmental behavior could benefit from similar framing of individual actions. To the extent that small environmental gains are more meaningful than small financial gains (Dogan et al., 2014), it would be interesting to present household energy consumption in a relatable frame-of-reference. Instead of showing cents that could have been saved by dry-hanging your clothes, or the miniscule CO₂e savings (0.21 tons a year, according to Wynes and Nichols’ analysis), we could express the amount of electricity saved in other relatable terms, such as the number of days one could charge one’s iPhone with a single load of clothes (approximately 400 days, by my unofficial calculations).

It is worth noting additional potential impediments to capturing actual dietary change. Diet tends to fluctuate across days of the week, and health-psychology research, for example, often uses the week (rather than day) as the unit of analysis (Loy et al., 2016). A future, robust longitudinal study could account for such fluctuations by including a much longer time frame – perhaps one year. In addition, our measure of how much meat people eat suffers from external validity. Open-ended questions included in the survey suggest that at least some participants decreased the
portion of their meals. We used binary coding for the consumption of meat in each meal, hence could not assess any changes to portion sizes. Moreover, there is a possibility that our studies were underpowered. We assumed a small-to-medium effect size ($d=0.35$) for our footprint interventions, given the findings from Study1, and managed to recruit enough participants for 80% power. If the effect size of our interventions was small ($d=0.2$), Study 2 would have had 52% power. In other words, we would have been as likely to reject or accept the null hypothesis, even in the presence of a real effect.

Finally, our sample of online workers, as noted in recent analyses (Paolacci and Chandler 2014), is not representative of the general population (though arguably more representative than undergraduate student population). In addition, the demographic differences between those who completed the study and those who dropped is worth exploring. Participants who dropped the study prematurely consumed less meat (prior to the experiment) than those who finished all waves. It is possible that those who dropped had less interest in meat consumption because it was lower to begin with. On the other hand, those who dropped were more conservative (measured by a single-item) and more likely to be male – two variables that were associated with higher meat consumption. The relationships among our message framing variables and political attitudes should be the subject of a more systematic future investigation.
References


Behavior and Human Decision Processes, 102(2), 143-153.


Appendices

Appendix A. Footprint Information Material.

(Underlined text was used in the material)

<table>
<thead>
<tr>
<th>Water Footprint:</th>
<th>CO2e</th>
<th>Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyone received</td>
<td>Everything we eat requires many resources during production, processing, and shipping. Examples for such resources are the water used to feed animals or water crops, greenhouse gases released to the atmosphere in the process, and land used for grazing or for crops.</td>
<td>Most US cattle are being fed with grain – soy and corn, primarily. The average cow eats up to 60 pounds of grain daily.</td>
</tr>
<tr>
<td></td>
<td>In the following part of the survey, we will present actual data that portrays how much resources are used in the animal agriculture.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Each of us uses water at home for cooking, bathing, laundry but our larger water footprint is the ‘hidden’ water in all the products we use or consume. Depending upon what we eat and our lifestyle, we can have a larger or smaller water footprint.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beef products are consistently found to be the most water-intensive food products.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carbon dioxide (CO2) is the most common GHG emitted by human activities, in terms of the quantity released and the total impact on global warming.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>As a result the term “CO2” is sometimes used as a shorthand expression for all greenhouse gases, however, this can cause confusion, and a more accurate way of referring to a number of GHGs collectively is to use the term “carbon dioxide equivalent” or “CO2e”.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beef-rich diets have higher CO2e footprint than plant-based diets, primarily due to the release of Methane, which is much more potent that CO2.</td>
<td></td>
</tr>
</tbody>
</table>
### Nation Condition

| Every day, the beef industry in the US has a water footprint of approximately 128 billion gallons of water. |
| To put this in perspective, 128 billion is more than the number of stars in the milky way. |
| Every year, beef production in the US releases approximately 265 billion CO2e to the atmosphere. |
| To put this in perspective, 265 billion is the projected 2017 GDP of Egypt. |
| Lifetime grain consumption multiplied by the number of cows in the US suggests that about 650 billion pounds of grain is fed to beef cows in the US annually. |

### Meal Condition

| A single beef burger, for example, has a water footprint of approximately 450 gallons of water. |
| To put this in perspective, 450 gallons is more than what an average person drinks in two years! |
| An average beef meal releases approximately 7.2 KG CO2e to the atmosphere. |
| To put this in perspective, 7.2 KG CO2e is equivalent to driving 17 miles with a car. |
| Lifetime grain consumption divided by the amount of meat produced from a cow suggests that three pounds of grain is used in the production of a single burger. |

---

**Appendix B. Implementation Intentions Example (adapted from Ottingen 2017)**

“For the last two days of the study, we suggest taking the challenge of consuming less meat than usual (or not at all). We know it can be difficult to change habits, so we want to offer a simple strategy.

-Next page-

We want you to identify an obstacle that holds you back from consuming less meat. What stands in the way of changing your diet? What is your main inner obstacle?”
Please describe the obstacle in a few words: (for example, you can write "I will be hungry after work", or "I will have little time to prepare lunch")

-Next page-

The situation you identified is <Participant’s Obstacle>  
What can you do to overcome this obstacle?  
Name one action you can take or thought you can think to overcome your obstacle.  
(For example, you can write " I will think about my health" or "I will ask my friend for advice")  
-Next page-

So now we identified a specific plan that can help when it gets difficult.

Your plan is: <Participant’s Obstacle>, <Participant’s Solution>

Because we automatically generated this sentence, the grammar might be off.  
Please type your plan in the box below, correcting for grammatical errors.  
-Next page-

Hopefully now your plan looks good.  
Your plan for the next two days is: <Typed plan>

Now repeat the plan a couple of times, so you won't forget it (or write it down if you wish).

**Appendix C. Demographics and Attrition, Study 2**

<table>
<thead>
<tr>
<th>Wave</th>
<th>N</th>
<th>% of Wave 1</th>
<th>% of yesterday</th>
<th>% Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave 1</td>
<td>1172</td>
<td>100</td>
<td>-</td>
<td>55</td>
</tr>
<tr>
<td>Wave 2</td>
<td>788</td>
<td>66</td>
<td>67</td>
<td>61</td>
</tr>
<tr>
<td>Wave 3</td>
<td>697</td>
<td>59</td>
<td>88</td>
<td>61</td>
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<tr>
<td>Wave 4</td>
<td>581</td>
<td>58</td>
<td>83</td>
<td>62</td>
</tr>
<tr>
<td>Wave 5</td>
<td>520</td>
<td>45</td>
<td>89</td>
<td>64</td>
</tr>
</tbody>
</table>
Appendix D. Moral meaning items.

Moral meaning (Arbit et al. 2017)

1. I care about the impact of my food choice on the world
2. My food choices are an important way that I can affect the world
3. I eat in a way that expresses care for the world
4. When I eat food I think about where it came from
5. My food choices reflect my connection to nature
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