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Do Global Climate Summits Influence Public

Awareness and Policy Preferences Concerning Climate Change?

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Abstract

A survey-embedded experiment implemented around the time of the 2014 annual Conference of the Parties (COP) (N≈1200) examined whether such summits are able to increase citizens' awareness of climate problems. This study finds that exposure to positive or negative cues about the COP increases climate change awareness, particularly among participants who start out with a low level of awareness. Neither positive nor negative cues about the COP significantly affect people's policy preferences. Our finding resonates with Bernard Cohen's observation that the mass media may not often be successful in telling people what to think, but they are successful in telling readers what to think about.

Keywords: Climate change, COP, news, awareness, policy preferences, survey- embedded experiment.

Introduction

Climate change is a highly complex and long-term phenomenon that, in contrast to short-term environmental phenomena, most notably the weather, is hard for 'ordinary' citizens to grasp. Nonetheless, scientists and governments have made tremendous efforts to communicate the essentials of the challenge to citizens. One key reason is that, unlike other policy issues, such as trade or security, climate change mitigation requires behavioural change by virtually the entire population, as it necessitates a transition towards a carbon-neutral energy regime. This implies that public opinion sets important constraints on what policymakers can achieve in their attempts to reduce global warming.

Much public debate on climate change takes place via mass media such as TV, radio, and the press, where policymakers and stakeholders present information and express their policy preferences and demands. Existing studies of media reporting on climate change show that most of the time such debate is low-

intensity, but that it regularly peaks quite spectacularly around the time of the climate Conferences of the Parties (COPs), which have taken place in early December each year since 1995. For instance, in the United States (US), we see more newspaper coverage of climate change between November and December (McAllister et al. 2016). Climate COPs are *not* primarily held to affect public opinion in the participating countries. However, given the very high mass media attention and the need to obtain public support for climate mitigation measures, it is worthwhile to ask whether this 'informational shock' has any impact on people's awareness of climate change, and on whether people prefer or oppose greenhouse gas mitigation measures.

Most of the arguments and the related empirical evidence, in the existing literature, on individual attitudes towards climate change and climate policy pertain to personal characteristics of respondents (e.g., gender, age, income) and structural characteristics (e.g., country characteristics) (e.g., Leiserowitz 2006; Brulle et al. 2012). Other studies have examined whether exogenous shocks in the form of extreme weather conditions or economic downturns have an effect on people's climate change attitudes (Joireman et al. 2010). They find that extreme weather conditions tend to have a short-term positive effect on individuals' attitudes towards climate change (i.e., they increased perceived climate change risks), whereas the evidence with regard to the effects of economic downturns is ambiguous (Kahn and Kochen 2011; Scruggs and Benegal 2012; Kachi et al. 2015).

We do not know of any study that has examined the effect of climate COPs, and the strong attention they receive in the mass media, on public awareness and preferences concerning climate policy. Such an analysis faces two important hurdles that we seek to address here. First, existing surveys on climate change attitudes and the data they have generated do not allow for a pre- / post-COP comparison, neither at the aggregate level (comparison of overall distributions of attitudes before and after the COP) nor at the within-subject level (focusing on whether individuals change their views) (Leiserowitz 2005, 2006). Second, even if we had panel survey data for pre- and post-COP attitudes, drawing causal inferences about the effect of COPs would be next to impossible. For instance, it is likely that individuals who differ in education levels and interest in and knowledge of environmental and climate issues also differ with respect to (self-selected)

media exposure during COPs. This, in turn, is likely to influence how media reporting on climate COPs affects them.

We address these two hurdles by means of a survey experiment implemented in the US and referring to the COP 2014 that took place in Lima. In contrast to the standard setup used by most survey experiments, where treatments are administered and responses measured (and compared with those of a control group) at one particular point in time, we used a panel approach for the study reported here. Before the COP (that is, before media reporting on the COP became ubiquitous) we asked participants to complete a survey on climate change awareness and policy preferences. Once the COP was under way, we randomly assigned two brief texts with positive or negative cues about the COP to some participants of the first survey, and no cues to others (control group). After the COP finished, we again asked all participants to complete a survey on climate change awareness and policy preferences. This experimental approach implies that participants with differing predispositions with respect to self-selected media exposure and interest in climate change issues are randomly (and in effect, evenly) distributed across the two treatment groups and the control group. This approach thus allows for causal inferences concerning the effect of media reporting on the COP. The main finding is that media coverage of the COP appears to heighten awareness among bystander publics. Nonetheless, it does not affect participants' opinion about climate change mitigation.

Effects of COP-related Media Reporting on Awareness and Policy Preferences

The amount of information on climate change issues available to the public has increased dramatically over recent decades. Such information is now easily accessible to citizens who watch television, listen to the radio, read newspapers, or surf the web (e.g., Kellstedt et al. 2008; Anderson 2009; Kahan et al. 2012). The broader question arising is whether and how mass media coverage of climate change issues affects public opinion. We are interested in whether and how the strong intensification of media reporting on climate change issues (triggered by COPs at regular intervals) influences public opinion on climate change issues. Existing research suggests that mass media played an important role in creating public awareness of environmental issues in the past (Slovic 2000). Staats et al. (1996), for instance, found that mass media coverage of climate change issues increased knowledge of the greenhouse gas effect (Druckman 2005;

Dolan et al. 2012). Many other studies conclude, however, that mass media have only a modest influence on citizens' views and attitudes concerning politics and particular policies (Bonfadelli 2002; Fishbein and Ajzen 2011; Elenbaas et al. 2013). Whether and how mass media influence citizens' awareness and preferences concerning climate change and climate change policy is thus far from obvious.

Many surveys measure citizens' awareness and attitudes or preferences concerning climate change and climate change mitigation policy (Stamm et al. 2000; Leiserowitz 2006; Aoyagi-Usui 2008; Sampei and Usui 2009; Dolan et al. 2012). They show that people do express attitudes and preferences when prompted to do so in surveys; in most surveys only rather few respondents select the 'don't know' category when asked to respond to questions about climate change awareness and policy preferences (Blake 2001; Kollmus and Agyeman 2002). Generally, survey-based studies find that awareness and policy preferences are shaped by socio-demographic factors and pre-existing world-views (e.g., age, gender, income, education, political ideology) as well as structural characteristics of the country in which the respondent lives. Weber (2010) explains that people are influenced by their own experience. Experience, however, is a weak determinant, given that climate change-related hazards (i.e. floods, droughts) might be rare in some areas, and that people perceive climatic changes differently (depending on whether and to what degree they are affected) (Keller et al. 2006; Weber 2010). Compared to some other policy issues (e.g., economic, or foreign policies), climate change appears to be an issue of (relatively) low salience, and many people are thus probably rationally (quite) ignorant about it or hold only weak opinions about the issue (Upham et al. 2009; Whitmarsh 2011).

Low saliency and limited knowledge imply that certain events, and cues are likely to have an effect on people's awareness of and attitudes concerning climate change (Gerber et al. 2011; Seth et al. 2013). Some studies show, for instance, that extreme weather events affect climate risk perceptions (e.g., Nisbet and Myers 2007), others that economic downturns do not uniformly have the widely expected negative effect on support for climate mitigation policies (e.g., Scruggs and Benegal 2012; Kachi et al. 2015). Moreover, various survey experiments suggest that certain types of cues or frames have an effect on people's awareness and attitudes about climate change (Barabas and Jerit 2009; Jerit et al. 2013).

These findings leave us with some ambiguity about how well developed people's attitudes towards climate change and climate change mitigation policy really are, and to what extent certain types of events

and cues or frames matter. We think that the effects of events and cues or frames should be studied together. Political stakeholders and the mass media, through which stakeholders communicate with citizens, can (and often do) add cues or frames to such events in order to shape their impact on citizens. For instance, stakeholders and mass media may frame a hurricane or drought to demonstrate the urgency of adopting climate change mitigation policies. But hurricanes or droughts may also be framed as natural events that simply happen due to bad luck, and may happen again regardless of humanity's reduction in greenhouse gas emissions.

We address this issue from the perspective of climate summits at which governments and non-governmental actors from around the world gather for a very large-scale and highly visible international event: the COPs. These events tend to create a dramatic spike in mass media reporting on climate change issues and global climate change negotiations (McAllister et al. 2016). This reporting includes many cues, about the respective COP itself, and about climate change policy in general.

Iyengar and Kinder (2010) argue that the mass media have a political agenda setting effect, which also shapes the attention citizens pay to certain issues. In addition, issues that make it onto the public agenda can be framed in a variety of ways, and these frames can affect public opinion. Framing is the process of communicating some aspects of a perceived reality, which promotes a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation (Joslyn and Haider-Markel 2001). Framing can cause 'framing effects', which may include 'issue' framing effects and 'equivalence' framing effects. Issue framing effects refer to the particular emphasis of a subset of potentially relevant considerations that lead individuals to focus on these considerations while they are forming an opinion about an issue (Druckman 2001). Equivalence framing effects refer to the use of logically equivalent, but distinct words or phrases that create different preferences. In our experiment, we focus on both issue and equivalence framing effects. We suggest that both issue and equivalent framing effects are likely to matter for climate change awareness, and that neither of these is likely to matter for climate change policy preferences to a significant degree.

The issue framing effect on awareness is straightforward and derives from a large body of research on the relationship between the mass media and politics (Ansolabehere et al. 1993; Druckman 2001; De

Vreese 2004; Iyengar and Kinder 2010). It holds that COPs have an awareness increasing effect because they trigger a large amount of mass media reporting, irrespective of whether the reporting is positively or negatively slanted with respect to the COP.

Hypothesis 1a: Exposure to media reporting about the COP increases awareness of the issue of climate change.

Whether positive or negative reporting on the COP is likely to have a larger effect on awareness is less obvious. We look at equivalence framing effects by distinguishing between media reporting that refers to the 2014 COP either positively or negatively. A positive piece of information on the COP is one with the potential to create favourable perceptions regarding the effectiveness of COPs. For instance, in September 2014, Fox News reported a statement by Peru's Environment Minister Manuel Pulgar-Vidal: 'Anything that we can reach after this Summit is a step towards success'. Conversely, negative information intends to generate pessimistic feelings regarding the issue at stake and the COP (Siegrist and Cvetkovich 2001). Most authors agree that negative bias tends to make people more skeptical (Wason 1959; Siegrist and Cvetkovich 2001). Such information was reported in *the Guardian* by Peru's foreign minister: 'the Lima meeting in December must produce a first draft of a deal to cut carbon emissions, which will be the first of its kind after efforts to get legally binding agreement for cuts from most of the world's countries failed at a blockbuster meeting in Copenhagen in 2009' (Vaughan and Vidal 2014).

Negative frames tend to have a stronger awareness increasing effect than positive frames (Broandbent 1971; Eysenck 1976; Peeters and Czapinski 1990; Schwartz 1990). It appears that a piece of negative information catches individuals' attention more than a piece of positive information. It triggers potential interest in the topic and leads people to look deeper into the issue. If an individual already has some experience or interest in climate change issues, a piece of negative information tends to enhance this interest. In addition, negative information motivates people to focus their interest specifically on features that elicited the negative state (Eysenck 1976; Schwartz 1990). For instance, Taylor (1991) notes that negative events evoke stronger and more rapid physiological, cognitive, and emotional responses, i.e., opinion shifts.

In our case, this means that when people receive negative information about the COP they could become more alarmed and consequently increase their awareness of climate change. Negative aspects of an object, event, choice or information are weighted more heavily than positive or neutral aspects. In tasks that involve forming impressions, negative information tends to be given more weight than positive information. This occurs because negative information is often unexpected, and unexpectedness provides an alternative version for the impact of negative information on perspectives (Skowronski and Carlston 1989; Peeters and Czapinski 1990). Positive information about the COP is potentially expected and, thus, no further interest is triggered.

Hypothesis 1b: Negative media reporting about the COP increases awareness of the climate change issue more than positive reporting.

In examining effects on policy preferences, a common assumption is that when people are exposed to the particulars of the global warming debate (the COP in our analysis), then one should expect to see individual responsibility for mitigation of global warming (Kellstedt et al. 2008). When it comes to information provided by the mass media, however, existing research has shown that nearly every policy problem (e.g., human rights violations, unemployment)—not only global warming—is presented by the media as a debate. This appears to contribute to lower perceived salience amongst citizens (Jamieson and Waldman 2003; Kellstedt et al. 2008). That is, the existing literature suggests that mass media reporting does not affect people's perceived responsibility and efficacy with respect to measures against global warming (Boykoff and Boykoff 2004). The main reason is that although reporting on the COP via the mass media prompts reflection on and awareness of the climate change issue, this reporting is evaluated mostly on the basis of pre-existing world-views, including for instance, political ideology. Previous research has shown that such world-views serve as cognitive short cuts and help people make sense of an otherwise highly complex issue (Jamieson and Waldman 2003; Boykoff and Boykoff 2004; Kellstedt et al. 2008). This means that mass media reports do not affect people's policy preferences. In other words, it is more difficult and complex to change people's perceptions on climate policy through the news. Thus, we expect to find empirical support for Hypotheses 2a and 2b.

Hypothesis 2a: General exposure to media reporting on the COP does not have a significant effect on participants' preferences concerning climate change mitigation (policy preferences).
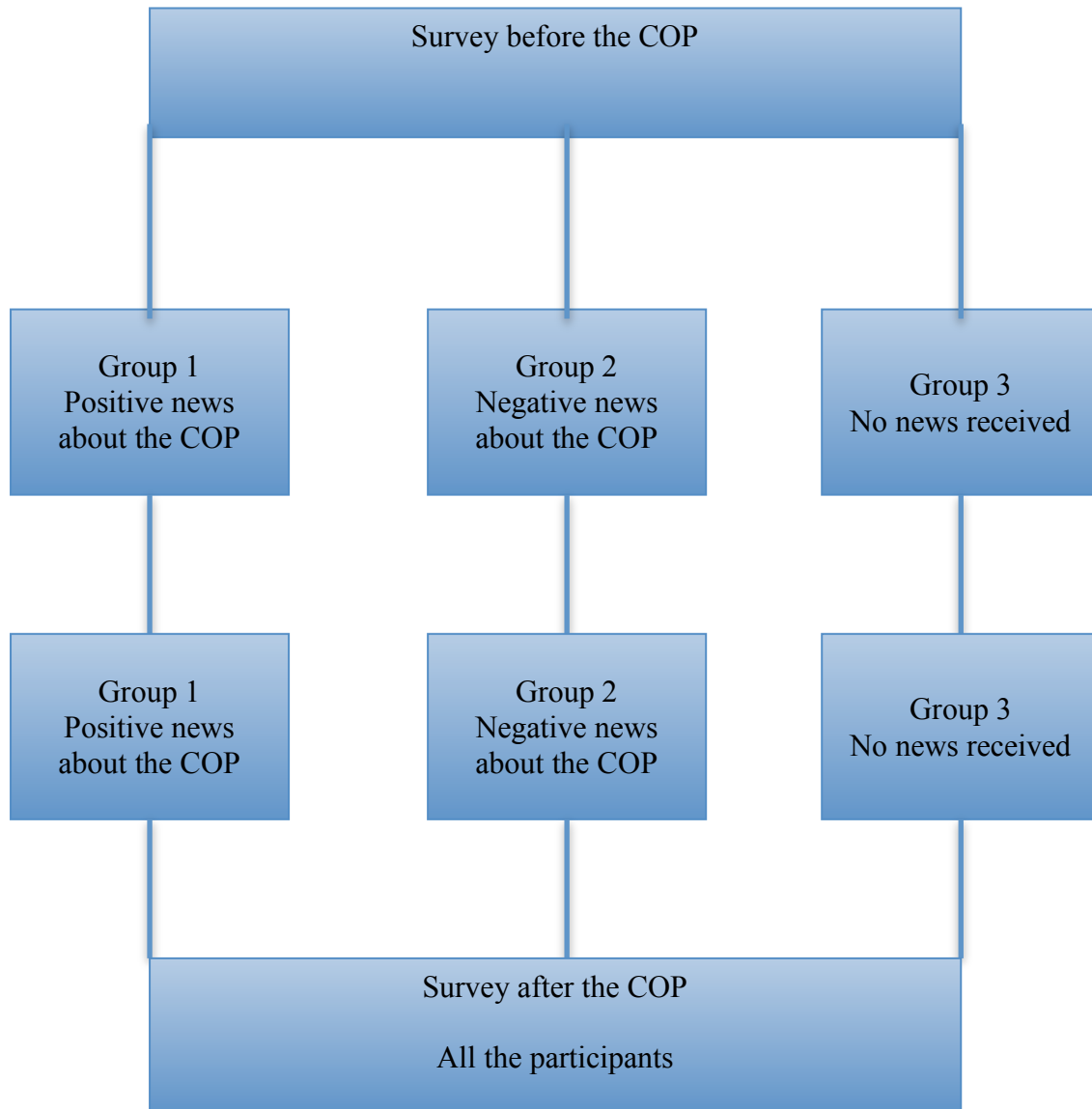
Hypothesis 2b: Neither positive nor negative media reporting on the COP has a significant effect on participants' preferences concerning climate change mitigation (policy preferences).

Study Design

Experimental Setup and Sample

We rely on a panel design that involves within- and between-subject comparisons. Figure 1 illustrates the design of the survey-embedded experiment, presenting the different participant groups along with the different waves of surveys. We first measure climate change awareness and policy preferences (main dependent variables). We randomly assign information treatments concerning the climate COP to subsamples, with the control group receiving no treatment. We then measure climate change awareness and policy preferences again. This measurement – treatment – measurement process took place within around 20 days. This design differs from the standard design of survey experiments in which one single survey is administered to all participants, and information treatments within that survey are randomly assigned to participants. We think that our panel design provides enhanced realism, as it allows us to examine whether climate change awareness and policy preferences change over time as a result of repeated information treatments.

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Figure 1: Survey design

Survey before the COP

Group 1 Positive news about the COP	Group 2 Negative news about the COP	Group 3 No news received
Group 1 Positive news about the COP	Group 2 Negative news about the COP	Group 3 No news received

Survey after the COP

All the participants

We are interested in average treatment effects, and not in a representative picture of public opinion in a given country. That is, we are not interested in what citizens of a specific country think about climate change. We are only interested in whether exposure to information about climate summits affects people's climate change awareness and policy preferences. In view of this research interest, a convenience sampling strategy, which is more cost efficient than national proportional random sampling, is appropriate. Participants in our study were recruited on the crowd-sourcing platform Amazon Mechanical Turk (AMT) (Amazon Mechanical Turk, 2014) and the experiments were implemented in Qualtrics (Qualtrics 2014).

An increasing number of survey experiments in academic research have used AMT to recruit participants (Horton et al., 2011; Berinsky et al. 2012; Mason and Suri 2012). Previous studies have shown that sample demographics for US-based respondents recruited via AMT are similar to distributions for the United States as a whole, with the exception that education levels are higher and respondents are more democratic (liberal) than the US population average. Similarly, previous studies have shown that the quality of survey data obtained from participants recruited via AMT is as good as the quality of data obtained via other sampling approaches[1] (Barabas and Jerit 2010; Ipeirotis 2010; Paolacci et al. 2010). When examining our sample more closely we find that when comparing treatment and control groups, the mean values of the socio-demographic variables are very similar (Figure 1 in the online appendix). We can thus safely move to the analysis of treatment effects (Mutz 2011, p. 83).

The initial survey was administered to 2000 participants from the US on 25 November 2014 (the survey was open for 48 hours). Randomly selected participants were then exposed to two treatments within around two days (followed by the final survey on 15 December 2014; the final survey was open for 72 hours). We excluded from the analysis participants whom we were unable to expose to both treatments. The first treatment took place on 3 December (the treatment survey was open for 36 hours), whilst the second treatment survey took place on 5 December (the treatment survey was open for 36 hours). 398 participants received two treatments with positive cues about the COP. A total of 395 participants received two treatments with negative cues about the COP. To simplify the analysis, we did not use mixed positive and negative treatments. Due to initial participants' lack of exposure to both treatment rounds or non-participation in the final survey, we ended up with a sample that includes 793 participants in the treatment groups and 399 participants in the control group (N=1192). Besides dropouts (common in panel surveys), the sample also shrank after elimination of respondents who clicked through the (online) survey at very high speed (making it very unlikely that they answered carefully). For instance, the initial and final surveys suggested that participants needed around 12 minutes to carefully complete the questionnaire. Given that the average answering time in our sample was 8 minutes, we kept those participants who completed the surveys within 6 to 20 minutes[2]. In addition, we dropped observations with 'don't know' responses.

To prevent participants in the treatment groups from simply clicking through the survey experiment

without reading the treatment texts, we included comprehension check questions about facts included in the treatment information. We excluded participants who provided wrong answers to these control questions from our sample. Additionally, we used several attentiveness checks. For instance, we asked a question twice to test whether respondents gave the same response to the same question. Approximately 250 participants were dropped from our sample because they failed the aforementioned control checks. However, when we include all participants in our analysis the results we present below remain largely unchanged (see online Appendix, Table 2).

Climate Change Awareness and Policy Preferences (Dependent Variables)

The two outcome variables in the analysis, *Awareness* and *Policy Preferences*, were constructed based on batteries of survey items (Table 1). We used confirmatory factor analysis (CFA) to statistically evaluate whether the survey data fit our measurement model, i.e., whether the selected survey questions indeed reveal the latent constructs of awareness (4 items) and policy preferences (4 items). Table 2 illustrates the results of the CFA along with the eigenvalue for each factor variable. As can be seen in Table 2, most of the factor loading for the awareness t (initial survey) and awareness t+1 (final survey) variables remain in the 0.4-0.7 range. For Policy Preferences t (initial survey) and Policy Preferences t+1 (final survey), the factor loading range is between 0.4 and 0.6.

Table 1: Survey items used to construct the dependent variables

Awareness	
Questions	Answers
1. How much had you thought about global warming before today?	1 A lot 2 Some 3 A little 4 Not at all
2. Do you think you would be able to describe in very simple terms to another person what the problem of global warming is?	1 Yes 2 To some extent 3 No
3. How often do you watch, listen to, or read news media reporting on global warming or discuss the issue with colleagues, friends, or family?	1 Never 2 Rarely 3 Sometimes 4 Often 5 Very often
4. Would you be able to explain, in simple terms, to another person what the annual Conference of the Parties to the UN Convention on Climate Change is?	1 No 2 To some extent 3 Yes
Policy Preferences	
People hold different views about whether policy-makers should give priority to measures against global warming, even if such measures are costly and have a negative effect on the economy. What is your view?	1 Should give priority to measures against global warming 2 Should not give priority to measures against global warming 3 Don't know
Do you favor or oppose expanding forests, even if this means less land for agriculture or construction?	1 Favour strongly 2 Favour somewhat 3 Oppose somewhat 4 Oppose strongly 5 Don't know
Do you favor or oppose increasing the requirements for fuel efficiency (this means more miles per gallon of fuel) of automobiles, even if this raises the cost of cars as well as bus and airfares?	1 Favour strongly 2 Favour somewhat 3 Oppose somewhat 4 Oppose strongly 5 Don't know

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Imagine that taking effective steps against global warming would increase energy costs to the average household in the United States by 30 dollars per month. Would you be willing or not be willing to pay this additional cost as part of taking steps against global warming?	1 Would be willing 2 Would not be willing 3 Don't know

Table 2: Results of confirmatory factor analysis

	Awareness t	Awareness t+1	Policy Preferences t	Policy Preferences t+1
Heard about global warming	0.63	0.67		
Describe global warming	0.48	0.52		
Watch, listen, discuss global warming	0.65	0.67		
Explain the COP	0.41	0.42		
Tax increase for policies			0.45	0.44
Policy makers should give priority			0.48	0.52
Favor or oppose expanding forests			0.47	0.58
Favor or oppose increasing the requirements for fuel efficiency of automobiles			0.58	0.46
N	1192	1192	1192	1192
Eigenvalue	1.24	1.36	1.02	1.21

Note: only a single factor resulted in an eigenvalue greater than 1 in all four latent constructs. The eigenvalue for the significant factor is reported in the last row.

The data analysis below focuses on how much the composite variables Awareness and Policy Preferences (both of which are continuous variables) change from the first to the final survey, i.e.:

Awareness = Awareness t+1 - Awareness t

Policy Preferences = Policy preferences t+1 - Policy preferences t

We first examine whether exposure to any *treatment* has an effect on Awareness and Policy Preferences, and then look separately at whether treatments with *positive* or *negative* information on the COP matter more. We employ dummy variables that measure the exposure to information.

Treatment Conditions (Independent Variables)

Participants randomly selected into the treatment conditions and received two treatments within approximately two days. Each treated participant received two treatments with positive information about the climate COP, or two treatments with negative information about the COP. To make the analysis simpler and clearer, we did not use mixed information. The treatment texts are shown in Table 3. We acknowledge that people usually select their news sources respecting their own general interests. An experimental design of self-selection of news outlets, though, does not allow examination of treatment effects (as treatments will not be the same)[3]. The treatments' wording is heavily based on news media reporting on the 2014 COP in Lima (notably in the New York Times, The Guardian, and Fox News). To avoid 'messenger' and other types of effects on participants that are not of interest in this paper (e.g., length and format of a report), we made the treatments similar in structure and wording (except of course the positive or negative perspectives on the COP), and kept the treatment texts short and clear. That is, we use stylized treatment wordings, rather than copies of text from specific media outlets or entire media reports. Each treatment was followed by a very brief survey, with two questions about the treatment text. This brief add-on survey was meant to ensure that the participant received and read the treatment text, and that we know that they were treated.

Table 3: Treatments

Treatment	Description
	1ˢᵗ wave of treatments
1. Positive information on COP	As you may have heard or read, governments from around the world are currently meeting in Lima, the capital of Peru, to negotiate an agreement against global warming, also known as climate change. Most journalist and academics who have observed such negotiations for a long time agree that an agreement against global warming is very difficult to achieve. The reason is that almost 200 countries are involved in these negotiations, and these countries have different national interests. Experts also agree, however, that the global warming issue is relevant to all countries worldwide. For that reason, they think that involving all countries in these negotiations is the right thing to do. Moreover, despite this complicated negotiation process and different national interests, they think that the results achieved so far are useful and are contributing towards solving the global warming problem.
2. Negative information on COP	As you may have heard or read, governments from around the world are currently meeting in Lima, the capital of Peru, to negotiate an agreement against global warming, also known as climate change. Most journalist and academics who have observed such negotiations for a long time agree that an agreement against global warming is very difficult to achieve. The reason is that almost 200 countries are involved in these negotiations, and these countries have different national interests. Experts also agree that, because of this complicated negotiation process and different national interests, the results achieved so far are not useful and are not contributing towards solving the global warming problem.
	2ⁿᵈ wave of treatments
1. Positive information on COP	According to news reports, negotiations on an agreement against global warming, also known as climate change, which are currently taking place in Lima, Peru, have made considerable progress. Most of the 200 countries participating in the negotiations agree that an agreement against global warming will be reached by the end of 2015. In addition, most industrialized countries, including the United States and European countries, have agreed to provide substantial amounts of funding to help poorer countries reduce their carbon dioxide emissions, which cause global warming, and to help them protect against negative effects of global warming (e.g. storms, floods, droughts). Thus, it seems that world leaders are going to reach an agreement against global warming. Many experts are therefore quite optimistic about the results of negotiations currently held in Lima, Peru.
2. Negative information on COP	According to news reports, negotiations on an agreement against global warming, also known as climate change, which are currently taking place in Lima, Peru, have made almost no progress. The 200 countries participating in the negotiations

	disagree over whether an agreement against global warming can be reached by the end of 2015. In addition, most industrialized countries, including the United States and European countries, have only agreed to provide very small amounts of funding to help poorer countries reduce their carbon dioxide emissions, which cause global warming, and to help them protect against negative effects of global warming (e.g. storms, floods, droughts). Thus, it seems that world leaders are not going to reach an agreement against global warming. Many experts are therefore quite pessimistic about the results of negotiations currently held in Lima, Peru.

Since our (stylized) treatments were administered during the climate COP in Lima, it is obviously possible that participants both in the treatment and control groups were exposed to other, additional information about the COP (e.g., when watching television between our first and last survey). We deliberately chose this timing, however, in order to expose our hypotheses to a hard test. Implementing the survey experiment around the time of the climate COP increases the possibility of additional exposure of participants to 'real world' information about the COP –because media reporting is usually more intense during climate COPs than before or after. This setting should make it harder to identify statistically significant treatment effects. It is also realistic, in the sense that we do not treat people with news about a COP that, in reality, does not take place – and where this might confuse or evoke negative reactions by respondents who are more aware of climate change issues. From a purely methodological standpoint, our choice of timing is fine as long as our random assignment to treatment and control conditions is effective. This is because effective randomization homogenizes the probability of exposure to additional (non-experimental) information across treatment and control groups. For instance, participating in the initial survey may motivate some respondents more than others to read more about the COP in the media during the event. Yet, subsequent random assignment of participants to treatment and control groups ensures that individuals who were more (or less) motivated and acquired more or less additional information outside the experiment do *not* cluster in one of our experimental groups.[4]

Control variables

Although participants are randomly assigned to treatment or control conditions, we still employ some control variables to increase the precision of the estimate but, by design, they should have no effect on the coefficient on the treatment variables (Imai et al. 2011). We thus take into consideration that participants are likely to differ in their knowledge of climate change issues. Our empirical models control for climate change-related knowledge at time t (initial survey) and changes in knowledge from the first to the last survey. The number of correct answers measures the knowledge of each individual about climate change issues.[5] Other research has shown that climate change awareness and policy preferences are influenced by

socio-demographic factors (Blake 2001; Kollmus and Agyeman 2002). We thus include two demographic variables, *gender* and *age*. *Gender* is a dummy variable, 1 for male and 2 for female. *Age* is a categorical variable that assigns each individual to an age band (18-30, 31-50, and 51 or older). We also consider *income*, *education,* and political *ideology. Income* captures the annual income of a participant and is measured by the following categories: up to $50,000, $50,000-$150,000, and more than $150,000. *Education* captures the highest level of education of a participant. The categories are: Low (Some High School, no degree, High School, Some College, no degree), medium (Associate degree, Bachelor), and high (Graduate: Master, PhD., Professional Degree/MD). *Ideology* is a categorical variable that measures individuals' political position on a scale of 1 to 7, from Independent to strong Republican.

Results

Figure 2 shows to what degree the positive or negative information combined, or with positive or negative information separately, have changed participants' levels of climate-change awareness.[6] It shows that the mean value of Awareness in the *control* group (where participants did not receive any treatment concerning the climate COP) is 3.1 percentage points smaller than the mean value in the *treated* group. The mean value of Awareness in the group that did *not* receive positive information about the COP is 1.1 percentage points smaller than the mean value of those treated with positive information. The mean value of Awareness in the group that did *not* receive negative information is 1.9 percentage points smaller than the mean value of those treated with negative reporting. The difference between the positive and the negative treatment is observable, as expected, but not statistically significant.
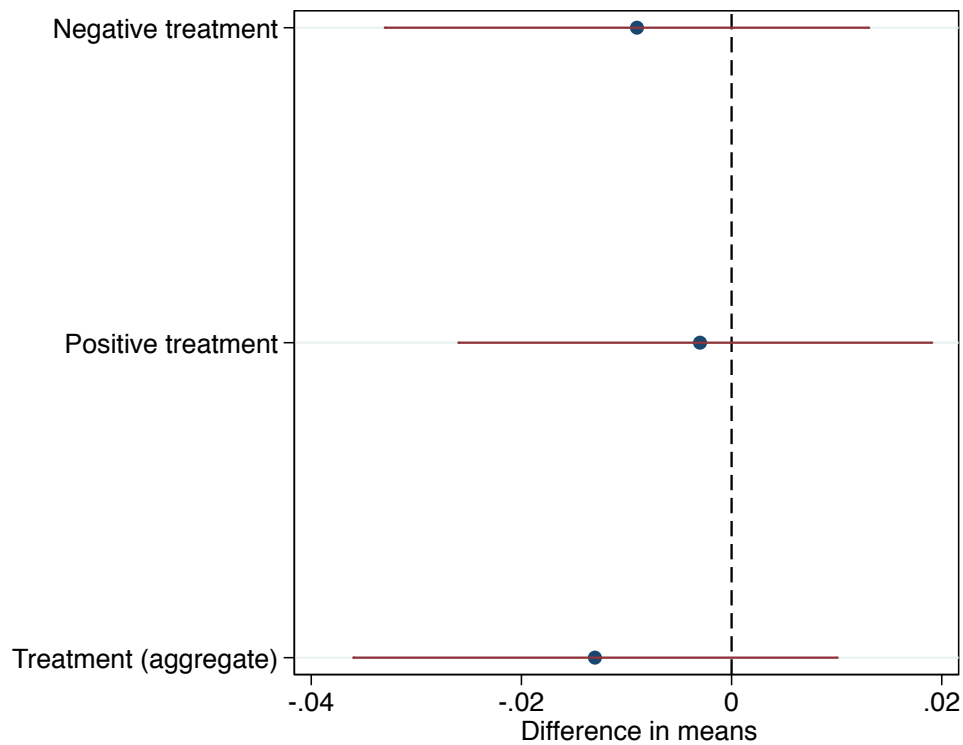
Figure 2: Treatment effects, changes in Awareness
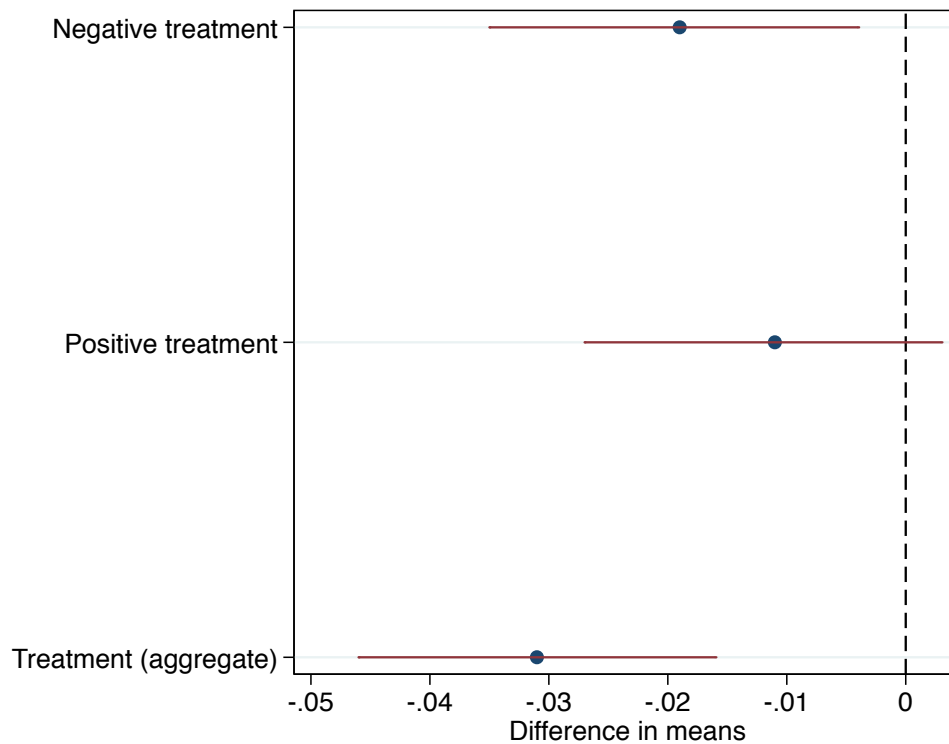
Note: percentage points denote mean differences between treatment (aggregate, positive and negative) and control groups. Where whiskers cross the 0-dashed line the estimated treatment effect is not statistically significant at the 5% level. All response items are scaled from 0 to 1, so that differences in means can be read as percentage-point change of Awareness. For example, the mean Awareness score of individuals treated with negative news about the COP is 1.9 percentage points higher in comparison to the mean of respondents treated with positive news.

Similarly, we calculated the differences in the means for changes in policy preferences. Figure 3 shows that the treatment effect for all groups crosses the 0-dashed line. This means that treatment effects are not statistically significant. Thus, from a statistical viewpoint, our treatments do not have an impact on Policy Preferences.

Figure 3: Treatment effects, changes in Policy Preferences

Note: percentage points denote mean differences between treatment (aggregate, positive and negative) and control groups. Where whiskers cross the 0-dashed line the estimated treatment effect is not statistically significant at the 5% level. All response items are scaled from 0 to 1, so that differences in means can be read as percentage-point changes of Policy Preferences.

Table 4 shows the results of all statistical models. Models 1 and 2 indicate the effects of positive and negative information about the COP on changes in Awareness and changes in Policy Preferences.[7] Treatments with any information on the COP (positive or negative) result in a 0.03 points increase in Awareness. An effect of the same magnitude is observed for treatments with either positive or negative information. This finding supports *Hypothesis 1a,* which holds that the COP and associated mass media reporting have a positive effect on citizens' awareness of climate change. To some degree we also find support for *Hypothesis 1b*; although negative and positive media reporting has an effect in the expected direction, the two treatment effects are not significantly different from each other. This means that individuals' awareness of climate change shifts positively, irrespective of the tone of the information received. This finding resonates with existing research focused on the media's effects on public opinion. This research suggests that the level of public awareness concerning environmental issues tends to be

affected by media attention as such, rather than by the substantive content of media reports (Mazur and Lee 1993; Boykoff and Boykoff 2004).

Regarding climate Policy Preferences, Model 3 shows that exposure to positive or negative media information on the COP has no significant effect on Policy Preferences. This result also upholds in Model 4 (Table 4), which examines positive and negative reporting in disaggregated form. These results are thus consistent with *Hypotheses 2a* and *2b*.

Although people receive information about the COP that indeed increases their awareness of climate change (Model 1 and 2 in Table 4), the legitimacy and the importance of these negotiations do not overcome a condition Boykoff and Boykoff (2004) refer to as 'balance as bias'. In this context, the COP concerns a scientific issue—climate change—however, the news present it as a debate between politicians and policymakers and this makes people neglect the importance of the issue, and therefore, the necessity of mitigation policies. In addition, the element of trust often determines people's decisions and preferences (Corbett and Durfee 2004; Hmielowski et al. 2014) and often media do not appear as a reliable source. Grundaman (2007) shows that the Intergovernmental Panel on Climate Change (IPCC) is highly visible both in the US and German news. The difference though lies on the fact that sceptics are more visible on the US media than the German media. In a later study Gauchat (2012) notes that the United States media neglect to present highly scientific evidence regarding climate change that decreases the salience of climate change and / or that challenges the scientific community. This in turn distracts people from the climate change reality (i.e., providing scientific evidence) mostly because they focus on ideological debates about climate change (Gauchat 2012).

With respect to the control variables, prior knowledge and changes in knowledge of climate change issues do not have a significant effect on changes in Awareness and Policy Preferences. Socio-demographic variables behave according to our expectations, with little statistical significance in the models. As with other studies, we find significant differences between Democrats and Republicans (Nisbet et al. 2015). Notably, we find that conservatives are more affected by our treatments than participants with liberal views.[8] The main reason is likely to be that liberal participants enter the experiment with already higher levels of climate change awareness, reducing the marginal effect of our treatments.

Table 4: OLS regression models

	(Model 1) Awareness (Δ)	(Model 2) Awareness (Δ)	(Model 3) Policy Preferences (Δ)	(Model 4) Policy Preferences (Δ)
Treatment	0.03***		0.01	
	(0.00)		(0.02)	
Positive		0.03***		0.01
		(0.00)		(0.02)
Negative		0.03***		0.00
		(0.00)		(0.02)
Knowledge (t)	-0.01	-0.01	-0.00	-0.00
	(0.01)	(0.0)	(0.02)	(0.02)
Knowledge (Δ)	0.00	0.00	-0.01	-0.01
	(0.00)	(0.00)	(0.01)	(0.01)
Income	0.01***	0.02***	0.01	0.01
	(0.00)	(0.0)	(0.01)	(0.01)
Ideology	0.02***	0.02***	0.14***	0.13***
	(0.00)	(0.00)	(0.00)	(0.00)
Education	-0.02***	-0.02***	-0.04**	-0.04**
	(0.00)	(0.00)	(0.01)	(0.01)
Age	0.00	0.00	0.06**	-0.05**
	(0.01)	(0.00)	(0.02)	(0.02)
Gender	0.00	0.00	0.02	0.03
	(0.01)	(0.00)	(0.02)	(0.02)
Constant	-0.16***	-0.16***	-0.75***	-0.75
	(0.03)	(0.03)	(0.07)	(0.07)
N	1192	1192	1192	1192
F-Test	0.000	0.000	0.000	0.000

Note: standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. We also estimated weighted regressions for Models 1 and 3 in order to obtain a sample more representative of the underlying population. The statistical results virtually remain the same as those presented in Table 4.

Existing studies show that people with higher levels of climate problem awareness tend to be more willing to support climate risk mitigation measures (Lorenzoni et al. 2007; Weber 2010). Therefore, they might also react differently to exposure to information about climate COPs. Figures 4 and 5 examine whether and how initial awareness of the climate change problem and initial policy preferences, respectively, condition the treatment effect of interest.[9] First, with regards to the left panel (Figure 4(a)), there is a significant difference between the treatment and control group until the value of about 0.6 in

Awareness at time *t* (*Initial Awareness*). Beyond a value of 0.6 in Awareness, however, the treated and control groups converge and, in fact, overlap; that is, there is no difference between the two groups anymore. Moreover, *Change in Awareness* decreases with the level of initial awareness. Hence, respondents who do not have any initial awareness (*Initial Awareness*=0) and have received the treatment, experience an increase in Awareness of about 0.58 points. Conversely, a treated participant with an initial awareness level of 1 only experiences an increase of about 0.25. These two different levels of Awareness increases (0.58 vs. 0.25) are statistically different from each other.

Similarly, comparing participants *within* the positive and negative treatment groups, we observe greater positive changes in awareness for those participants with lower starting values (Figure 5(a)). Accordingly, participants with no initial Awareness (*Initial Awareness*=0) who received the positive treatment experienced an increase of about 0.59 points. Although in the earlier analysis, positive and negative treatments were not significantly different from each other, there *is* a difference when examining different levels of initial awareness.

Concerning policy preferences, there is no significant difference between the treatment and the control groups: the two graphs in the right side panels of both Figure 4(b) and Figure 5(b) overlap for each value of the initial policy preference. In other words, media reporting does not affect preferences concerning climate-change policies conditional on initial preferences. Overall, respondents with initially weaker preferences for climate policy increase their support of mitigation policies more strongly than individuals with more positive initial policy preferences. This finding applies to both the treatment and control groups.

Figure 4: Moderating effect of *Initial Awareness* and *Initial Policy Preferences*

(treatment aggregate; positive or negative)
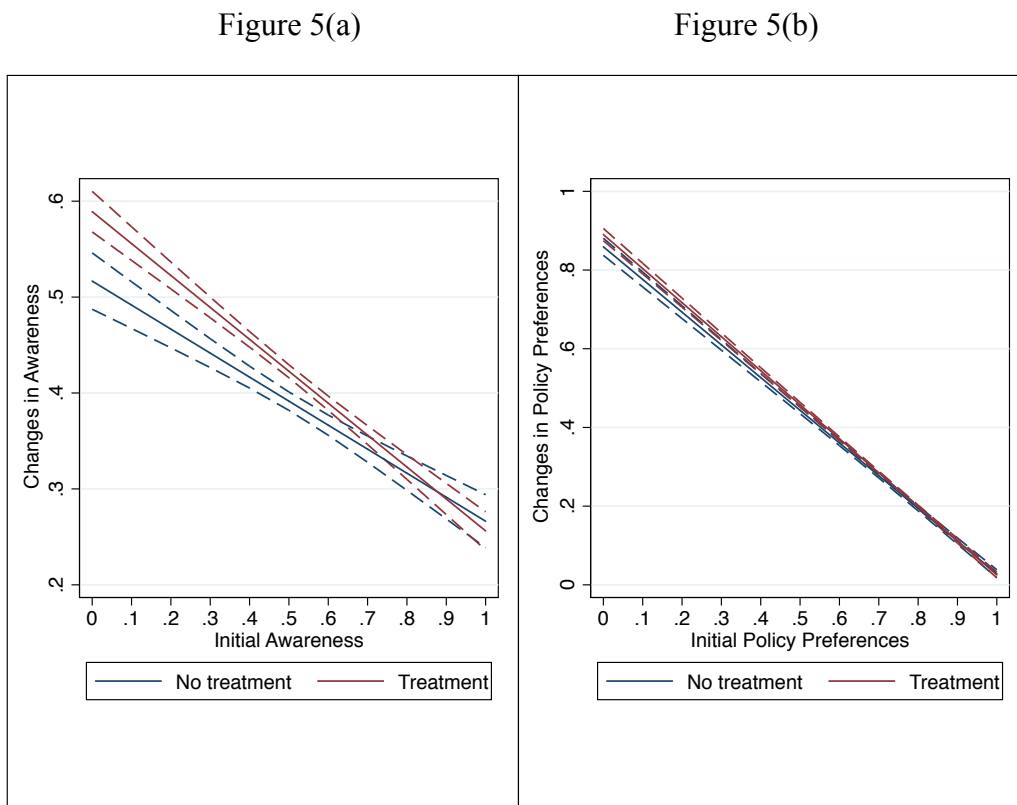
Figure 4(a)   Figure 4(b)
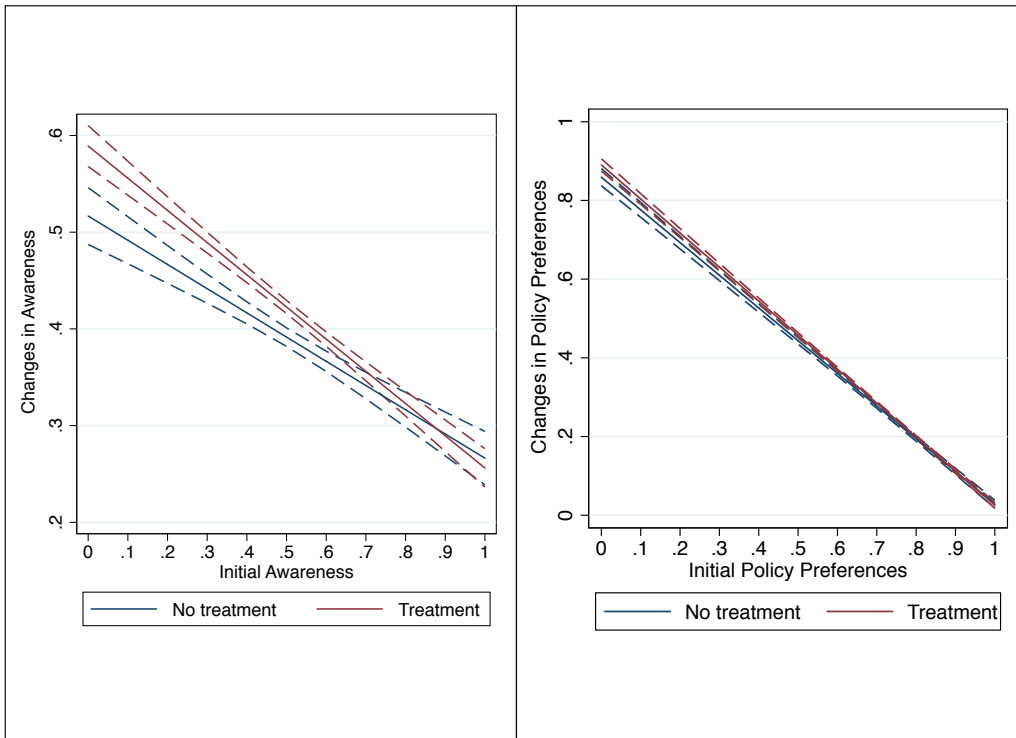
Note: solid lines indicate marginal effects; dashed lines indicate 90% confidence intervals.

Figure 5: Moderating effect of *Initial Awareness* and *Initial Policy Preferences*
(positive and negative treatments)

Figure 5(a)   Figure 5(b)

Note: solid lines indicate marginal effects; dashed lines indicate 90% confidence intervals.

Conclusion

Our study is based on the presumption that public opinion is important in climate policymaking. This is because effective climate policy requires fundamental changes in individual citizens' behaviour, and democratic policymakers are largely concerned with what citizens want. As such, we are interested in whether the quasi-annual 'bombardment' of citizens with news about the climate COP has an impact, and whether it works in favour of or against attempts to reduce greenhouse gas emissions. To overcome endogeneity and causal inference problems in studying this question we use an experimental approach.

We find that exposure to news about the COP, and by implication the COP itself, increases awareness of climate change, particularly among participants whose initial awareness is low. However, it has no significant effect on citizens' climate policy preferences. Our sample shows somewhat different rates in some of the sociological drivers by comparison with the US population average (i.e., education, ideology, income), and this is why we primarily focus on treatments' effects, avoiding generalizability. Furthermore, research comparing treatment effects between nationally representative and convenience samples finds that

both show similar results (Mullinix et al. 2015). Overall, our finding resonates with Bernard Cohen's dictum that 'the press may not be successful much of the time in telling people what to think, but it is stunningly successful in telling its readers what to think about' (Cohen 1963: 13).

This is the first survey we know of that uses an experimental approach and a pre- / post- COP design to study whether climate COPs leave an imprint on citizens. Of course, we cannot randomly assign people to settings where they are exposed to the mass media, and settings where they are completely cut off from mass media, which implies that our experiment cannot exclude the possibility that many participants in the control group are also treated, and that participants in the control and treatment groups self-select into additional 'real world' information treatments. We believe that our approach—random assignment to treatment or control conditions—effectively deals with these challenges. However, further research could explore whether treatment effects change in size and direction outside the COP period, when subjects are less exposed to climate change information outside the experiment. Moreover, one could consider different treatment condition designs, such as exposure to multiple treatments, including treatments with ambiguous (rather than positive or negative) information about the COP.

Finally, some recent work on the media - public opinion nexus suggests that relatively simple information treatment designs such as the ones used in our experiments should be complemented by media exposure experiments that let participants self-select into particular types and forms of information about the phenomenon of interest (in our case climate change). Arceneaux and Johnson (2010), for instance, argue that media effects may weaken or even disappear once participants can self-select media exposure. One of our main findings, that media exposure does not change climate policy preferences, is unlikely to differ if self-selection of media consumption was made a part of our experimental design. However, future work could assess whether the 'COP effect' on awareness still holds up when participants self-select into media exposure. At the same time, further research should also investigate any potential difference between content effects and news outlet effects. This would shed further light on the importance of self-selection of news outlets.

In an era where global governance efforts are increasingly characterized by political 'mega-events', it is worthwhile to ask whether such events not only influence policymakers' and general elite awareness

and preferences, but also problem awareness and policy preferences among the general public. Understanding such impacts seems particularly valuable in policy areas where solutions to global challenges, for instance gender equality, human rights, or environmental protection, cannot be achieved by simple top-down policies instituted by government representatives, but require widespread involvement and support of the general public.

Notes

[1] Table 1 in the online appendix offers a comparison between US census socio-demographics and the corresponding distributions in our sample.

[2] We set the limit at 20 minutes because AMT participants usually (as in our study) leave feedback and comments at the end of a survey before they log out of the system and survey time formally ends.

[3] Studies employing self-selection of news or news outlets still provide participants with a few options. This is ultimately a "controlled" selection of options (see also Arceneaux and Johnson (2010))

[4] For more on media exposure refer to Figures 2 & 3 in the online appendix.

[5] Refer to the online appendix, Table 3, for survey questions.

[6] The purpose of calculating the difference in means is to compare the treatment groups to the control group. Note that the treatment in aggregate level appears larger in comparison to the individual treatment groups of positive (N=398) and negative (N=395) news because this group refers to all the participants that have been treated with either positive or negative news (N= 793).

[7] See online appendix for an illustration of first differences estimations for changes in Awareness and Policy Preferences (Figures 4 & 5).

[8] See online appendix: Figures 6 & 7.

[9] Refer to the online appendix in Table 4 for the models' specifications.

Acknowledgements

References

Amazon Mechanical Turk. 2012. Amazon Mechanical Turk. Available at: www.mturk.com/mturk/welcome (accessed September 2016).

Anderson, A., 2009. Media, politics and climate change: Towards a new research agenda. *Sociology Compass*, 3(2), 166-182.

Ansolabehere, S., Behr, R., Iyengar, S., 1993. *Media Game: American Politics in the Television Age.* New York: Macmillan.

Aoyagi-Usui, M., 2008. An analysis of the effective factors for promoting proenvironmental actions from the information gain and social capital point of view. *Review of Environmental Economics and Policy Studies,* 1(2), 37-50.

Arceneaux, K., and Martin J., 2010. Does media fragmentation produce mass polarization? Selective exposure and a new era of minimal effects. Selective Exposure and a New Era of Minimal Effects. Unpublished manuscript.

Barabas, J., Jerit, J., 2009. Estimating the Causal Effects of Media Coverage on Policy-Specific Knowledge. *American Journal of Political Science,* 53(1), 73-89.

Barabas, J., and Jerit, J., 2010. Are survey experiments externally valid? *American Political Science Review*, 104(02), 226-242.

Berinsky, A. J., Huber, G. A., and Lenz, G. S., 2012 Evaluating Online Labor Markets for Experimental Research: Amazon. com's Mechanical Turk. *Political Analysis*, 20(3): 351-368.

Blake, D. E., 2001. Contextual effects on environmental attitudes and behavior. *Environmental Behaviour*, 33(5), 708-725.

Bonfadelli, H., 2002. *Medieninhaltsforschung: Grundlagen, Methoden, Anwendungen (Vol. 2354).* UTB.

Boykoff, M. T., and Boykoff, J. M., 2004. Balance as bias: global warming and the US prestige press. *Global environmental change*, 14(2), 125-136.

Broadbent, T. A., 1971. A hierarchical interaction-allocation model for a two-level spatial system. *Regional Studies,* 5(1), 23-27.

Brulle, R. J., Carmichael, J., Jenkins, J. C., 2012. Shifting public opinion on climate change: an empirical assessment of factors influencing concern over climate change in the US, 2002–2010. *Climatic change,* 114(2), 169-188.

Cohen, B.C., 1963. *The press and foreign policy*. Princeton, NJ: Princeton.

Corbett, J.B., Durfee, J.L., 2004. Testing public (un) certainty of science: media representations of global warming. *Science Communication*, 26(2), 129–151.

De Vreese, C. H., 2005. News framing: Theory and typology. *Information design journal+ document design*, 13(1), 51-62.

Dolan, P., Hallsworth, M., Halpern, D., King, D., Metcalfe, R., Vlaev, I., 2012. Influencing behaviour: The mindspace way. *Journal of Economic Psychology,* 33(1), 264-277.

Druckman, J. N., 2005. Does political information matter? *Political Communication*, 22(4), 515-519.

Druckman, J. N., 2001. On the limits of framing effects: who can frame? *Journal of Politics,* 63(4), 1041-1066.

Elenbaas, M., Boomgaarden, H. G., Schuck, A. R., de Vreese, C. H., 2013. The impact of media coverage and motivation on performance-relevant information. *Political Communication*, 30(1), 1-16.

Erikson, R. S., Wright, G. C., McIver, J. P., 1993. *Statehouse democracy: Public opinion and policy in the American states.* New York: Cambridge University Press.

Eysenck, M. W.,1976. Arousal, learning, and memory. *Psychological Bulletin,* 83(3), 389-404.

Fishbein, M., Ajzen, I., 2011. *Predicting and changing behavior: The reasoned action approach.* New York: Taylor & Francis.

Gauchat, G., 2012. Politicization of science in the public sphere: A study of public trust in the United States, 1974 to 2010. *American Sociological Review*, 77(2), 167–87.

Gerber, A. S., Gimpel, J. G., Green, D. P., and Shaw, D. R., 2011. How large and long-lasting are the

persuasive effects of televised campaign ads? Results from a randomized field experiment. *American Political Science Review*, 105 (1), 135–150.

Grundmann, R., 2007. Climate change and knowledge politics. *Environmental politics* 16(3), 414-432.

Herbst, S., 1998. *Reading public opinion: How political actors view the democratic process*. Chicago: University of Chicago Press.

Hmielowski, J. D., Feldman, L., Myers, T. A., Leiserowitz, A., and Maibach, E., 2014. An attack on science? Media use, trust in scientists, and perceptions of global warming. *Public Understanding of Science*, 23(7), 866-883.

Horton, J. J., Rand, D. G. and Zeckhauser, R. J., 2011. The online laboratory: Conducting experiments in a real labor market. *Experimental Economics*, 4(3), 399-425.

Imai, K., Keele, L., Tingley, D and Yamamoto, T., 2011. Unpacking the black box of causality: Learning about causal mechanisms from experimental and observational studies. *American Political Science Review*, 105(04), 765-789.

Ipeirotis, P., 2010. The new demographics of mechanical turk. Available at: http://www.behind-the-enemy-lines.com/2010/03/new-demographics-of-mechanical-turk.html (accessed September 2015).

Iyengar, S., Kinder, D. R., 2010. *News that matters: Television and American opinion.* University of Chicago Press.

Jamieson, K.H., and Waldman, P., 2003. *The Press Effect: Politicians Journalists, and the Stories that Shape the Political World*. New York: Oxford University Press.

Joireman, J., Truelove, H. B., Duell, B., 2010. Effect of outdoor temperature, heat primes and anchoring on belief in global warming. *Journal of Environmental Psychology* , 30(4), 358-367.

Jerit, J., Barabas, J., and Clifford, S., 2013. Comparing Contemporaneous Laboratory and Field experiments on media effects. *Public Opinion Quarterly*, 77(1), 256-282.

Joslyn, M. R., Haider-Markel, D. P., 2001. The two faces of issue framing: examining framing effects on personal opinion and perception of public opinion. In *Annual meeting of the Western Political Science Association.* Las Vegas, NV.

Kachi, A., Bernauer, T., and Gampfer, R., 2015. Climate Policy in Hard Times: Are the Pessimists Right? *Ecological Economics*, forthcoming.

Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L. L., Braman, D., and Mandel, G., 2012. The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature Climate Change*, 2(10), 732-735.

Kahn, M. E. and Kotchen, M. J., 2011. Business Cycle Effects on Concern about Climate Change: The Chilling Effect of Recession. *Climate Change Economics* 2(3), 257-273

Keller, C., Siegrist, M., and Gutscher, H., 2006. The role of the affect and availability heuristic in risk communication. *Risk Analysis*, 26(3), 631-639.

Kellstedt, P. M., Zahran, S., Vedlitz, A., 2008. Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States. *Risk Analysis,* 28(1), 113-126.

King, G., Tomz, M., Wittenberg, J., 2000. Making the most of statistical analyses: Improving interpretation and presentation. *American journal of political science*, 44(2), 347-361.

Kollmuss, A., Agyeman, J., 2002. Mind the Gap: why do people act environmentally and what are the barriers to pro-environmental behaviour? *Environmental Education Research,* 8(3), 239-260.

Leiserowitz, A. A., 2005. American risk perceptions: Is climate change dangerous? *Risk analysis,* 25(6), 1433-1442.

Leiserowitz, A., 2006. Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Climatic change,* 77(1-2), 45-72.

Lorenzoni, I., Nicholson-Cole, S., and Whitmarsh, L., 2007. Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global environmental change*, 17(3), 445-459.

Mason, W. and Suri, S., 2012. Conducting behavioral research on Amazon's Mechanical Turk. *Behavior Research Methods*, 44(1), 1-23.

Mazur, A., and Lee, J., 1993. Sounding the global alarm: Environmental issues in the US national news. *Social Studies of Science*, 23(4), 681-720.

Mutz, D. C., 2011. *Population-based survey experiments*. Princeton, NJ: Princeton University Press.

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Mullinix, K., Leeper, T., Druckman, J., and Freese, J., 2015. The Generalizability of Survey Experiments. *Journal of Experimental Political Science* 2(2), 109-138.

Nisbet, E. C., Myers, T. 2007. The polls—trends twenty years of public opinion about global warming. *Public Opinion Quarterly,* 71 (3), 444-470.

Nisbet, E. C., Cooper, K. E, Garret, R. K., 2015. The Partisan Brain: How Dissonant Science Messages Lead Conservatives and Liberals to (Dis)Trust Science. *The ANNALS of the American Academy of Political and Social Science*, 658(1), 36-66.

Paolacci, G., Chandler, J., and Ipeirotis, P., 2010. Running experiments on amazon mechanical turk. *Judgment and Decision Making* 5(5), 411-419.

Page, B. I., Shapiro, R. Y., 1983. Effects of public opinion on policy. *American political science review,* 77(01), 175-190.

Page, B. I., Shapiro, R. Y., Dempsey, G. R., 1987. What moves public opinion? *American Political Science Review,* 81(01), 23-43.

Peeters, G., Czapinski, J., 1990. Positive-Negative Asymmetry in Evaluations: The Distinction between Affective and Informational Negativity Effects. *European Review of Social Psychology*, 1(2), 34-60.

Qualtrics. 2015. Qualtrics-online survey software. Provo, Utah, USA. Available at: www.qualtrics.com (accessed September 2015).

Rogers, J. 2014. US outlines climate plan ahead of New York Summit. *Fox News.* Available at www.foxnews.com/science/2014/09/18/us-outlines-climate-plan-ahead-new-york-summit.html (accessed September, 2016).

Sampei, Y., Aoyagi-Usui, M., 2009. Mass-media coverage, its influence on public awareness of climate-change issues, and implications for Japan's national campaign to reduce greenhouse gas emissions. *Global Environmental Change*, 19(2), 203-212.

Schwarz, N., 1990. Feelings as information: Informational and motivational functions of affective states. In E. T. Higgins, & R. Sorrentino (Eds.), *Handbook of motivation and cognition:Foundations of social behavior* (Vol. 2, pp. 527-561). New York: Guilford Press.

Scruggs, L., and Benegal, S., 2012. Declining public concern about climate change: Can we blame the great recession? *Global Environmental Change*, 22(2), 505-515.

Seth J. H., Lo, J. Lo, Vavreck, L. and Zaller, J., 2013. How Quickly We Forget: The Duration of Persuasion Effects From Mass Communication, *Political Communication*, 30(4), 521-547.

Siegrist, M., Cvetkovich, G., 2001. Better negative than positive? Evidence of a bias for negative information about possible health dangers. *Risk Analysis*, 21(1), 199-206.

Skowronski, J. J., Carlston, D. E., 1989. Negativity and Extremity Biases in Impression Formation: A Review of Explanations. *Psychological Bulletin*, 105(1), 131-142.

Slovic, P. E., 2000. *The perception of risk.* London: Earthscan.

Staats, H. J., Wit, A. P., Midden, C. Y. H., 1996. Communicating the greenhouse effect to the public: Evaluation of a mass media campaign from a social dilemma perspective. *Journal of environmental management,* 46(2), 189-203.

Stamm, K. R., Clark, F., Eblacas, P. R., 2000. Mass communication and public understanding of environmental problems: the case of global warming. *Public Understanding of Science,* 9(3), 219-237.

Taylor, S. E., 1991. Asymmetrical effects of positive and negative events: the mobilization-minimization hypothesis. *Psychological bulletin,* 110(1), 67-85.

Upham, P., Whitmarsh, L., Poortinga, W., Purdam, K., Darnton, A., McLachlan, C.,

Wason, P. C., 1959. The processing of positive and negative information *Quarterly Journal of experimental Psychology,* 11(2), 92-107.

Vaughan, A., Vidal, J., 2014. Extreme weather is 'silver lining' for climate action: Christiana Figueres. *The guardian*. Available at www.theguardian.com /environment/2014/mar/05/extreme-weather-climate-change-political-christiana-figueres-un (accessed September, 2016).

Weber, E. U., 2010. What shapes perceptions of climate change? *Wiley Interdisciplinary Reviews: Climate Change*, 1(3), 332-342.

Whitmarsh, L., 2011. Scepticism and uncertainty about climate change: dimensions, determinants and change over time. *Global Environmental Change,* 21(2), 690-700.

Appendix:

Figure 1: Sample balance
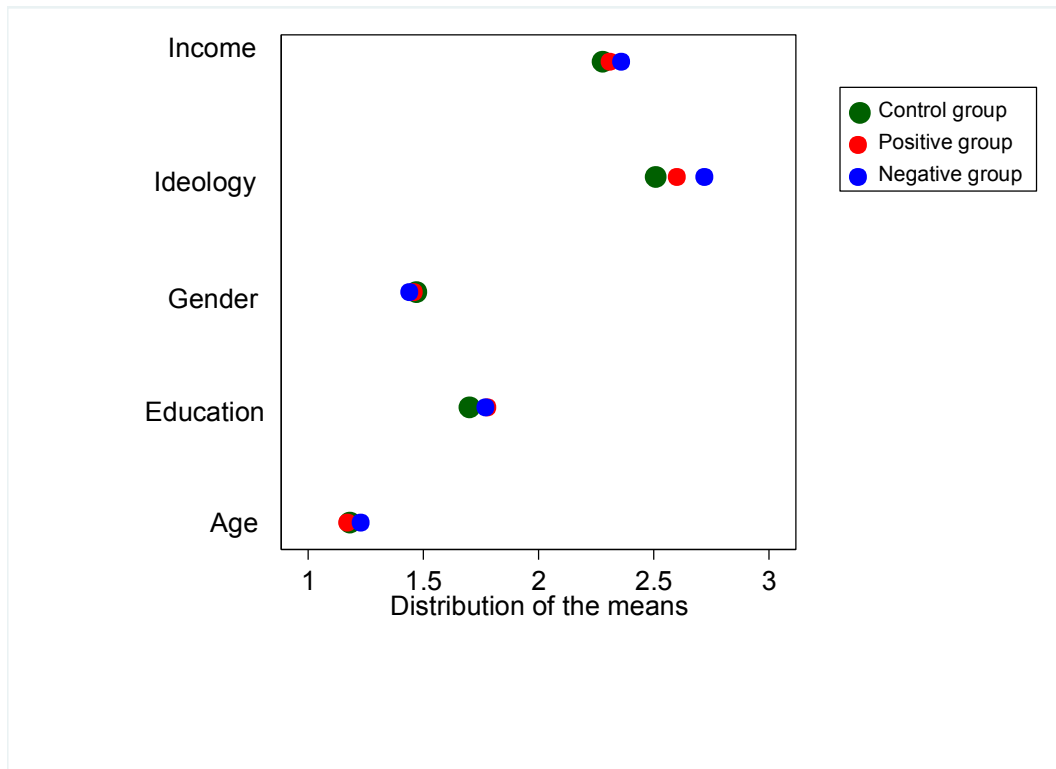
Note: the figure compares socio-demographic variables across the control and two treatment groups. For example, for age, the results indicate that the control, positive and negative groups' mean converge at around 1.3.

Table 1: Socio-demographic characteristics of our sample (USA)

|	Our sample	Population	Source of population data
Ideology	Liberal: 52%	Liberal: 34%	ANES 2008-2009 Panel study
	Conservative: 18%	Conservative: 45%	
Education	Some High School, no degree: 0.42%	Less than 9th grade: 5%	U.S. Census Bureau, Current
	Some college, no degree: 26%	9th to 12th grade, no diploma: 8%	Population Survey, November 2008
	High school: 9%	High school graduate: 31%	
	Associate degree: 11%	Some college or associate's degree: 28%	
	Bachelor: 41%	Bachelor's degree: 18%	
	Graduate (Master, PhD, Professional degree/MD): 12%	Advanced degree: 9%	
Income	The median category in our sample is: $120,000 - $149,999	The 2013 U.S. median household income was $52,250	U.S. Census Bureau: total median income for household Retrieved April 2015
Gender	1.17 m/f ratio	15-64 years: 1 m/f 65-: 0.77 m/f Total population: 0.97 m/f (2011 est.)	The World Factbook (CIA)
Age	The median category in our sample is 30 years old and below	Median age (or total pop) Total: 37.1 years	The World Factbook (CIA)

Table 2: OLS regression models (total sample)

	(Model 1)	(Model 2)	(Model 3)	(Model 4)
	Awareness (Δ)	Awareness (Δ)	Policy Preferences (Δ)	Policy Preferences (Δ)
Treatment	0.03***		-0.00	
	(0.00)		(0.02)	
Positive		0.03***		-0.01
		(0.00)		(0.02)
Negative		0.04***		-0.00
		(0.00)		(0.02)
Knowledge (t)	-0.01*	-0.01*	0.01	0.01
	(0.01)	(0.0)	(0.02)	(0.02)
Knowledge (Δ)	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.01)	(0.01)
Income	0.01**	0.01**	0.01	0.00
	(0.00)	(0.0)	(0.01)	(0.01)
Ideology	0.02***	0.02***	0.14***	0.15***
	(0.00)	(0.00)	(0.00)	(0.00)
Education	-0.01***	-0.01***	-0.02**	-0.02**
	(0.00)	(0.00)	(0.01)	(0.01)
Age	0.00	0.00	-0.01	-0.01
	(0.01)	(0.00)	(0.02)	(0.02)
Gender	0.00	0.00	0.00	0.00
	(0.01)	(0.00)	(0.01)	(0.02)
Constant	-0.16***	-0.16***	-0.76***	-0.76
	(0.03)	(0.03)	(0.05)	(0.06)
N	**1463**	**1463**	**1463**	**1463**
F-Test	0.000	0.000	0.000	0.000

Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To obtain additional information we asked participants in the last survey whether they searched for additional information on global warming and policies against global warming in the meantime, and if so what motivated them. Descriptive statistics indicate that most of our participants did not search for additional information, but that, as one would expect, respondents in the treatment conditions were somewhat more likely to do so.

Figure 2: Motivations of participants to search for additional information
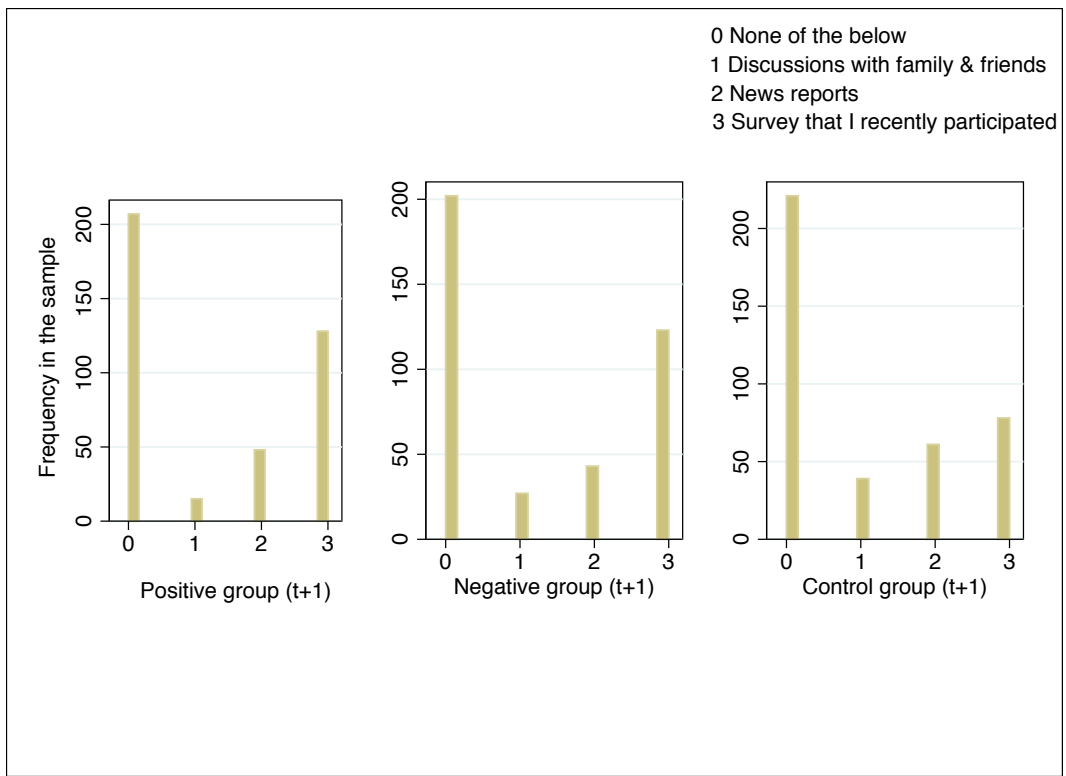
Note: Frequency indicates the number of participants in each group. Positive group: N=398. Negative group: N=395. Control group N=399. Participants were asked in the last survey about whether and if so why they were looking for additional information on global warming and policies against global warming. The results suggest that respondents in the treatment groups (positive & negative) were motivated more by our previous survey than other motivations.

Figure 3: Distribution of the means: exposure to media about global warming
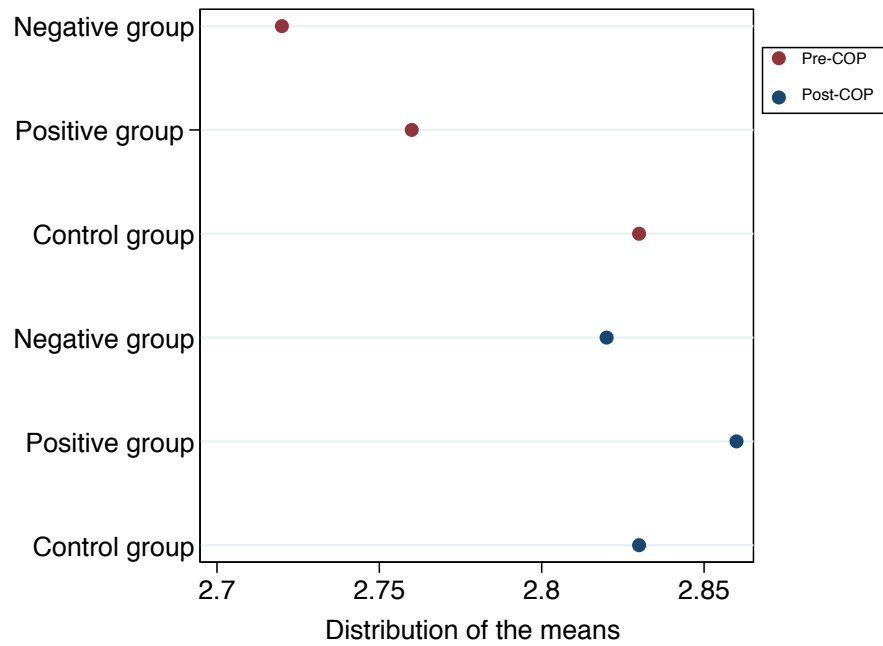
Note: the figure compares the means of the control and two treatment groups for the exposure to media about global warming. The results indicate that the control, positive and negative groups' means are different either we ask before (red points) or after the COP (blue points). For example the control group's exposure to media about global warming before the COP is around 2.84, the positive group is about 2.86 and the negative group is at 2.83.

Table 3: Survey questions for control variables

Questions	Answers
Socio-demographics	
What is the highest level of education you have completed?	1 Some High School, no degree 2 High School 3 Some College, no degree 4 Associate degree 5 Bachelor 6 Graduate (Master, PhD., Professional degree/MD) 7 Other
In what year were you born?	
Thinking back over the last year, what was your family's annual income?	1 Less than $10,000 2 $10,000 - $19,999 3 $20,000 - $29,999 4 $30,000 - $39,999 5 $40,000 - $49,999 6 $50,000 - $59,999 7 $60,000 - $69,999 8 $70,000 - $79,999 9 $80,000 - $99,999 10 $100,000 - $119,999 11 $120,000 - $149,999 12 $150,000 - $199,999 13 $200,000 - $249,999 14 $250,000 - $349,999 15 $350,000 - $499,999 16 $500,000 or more 17 Prefer not to say
Thinking about politics these days, how would you describe your own political viewpoint?	1 Very liberal 2 Liberal 3 Moderate 4 Conservative 5 Very conservative
What is your gender	1 Male 2 Female
Knowledge about climate change	
When you think of carbon dioxide emissions worldwide, what percentage of those worldwide emissions takes place within the United States?	0% to 100% (continuous scale)

| In your opinion what is the main goal of policies against global warming that most countries tend to agree with. The goal is to keep the global temperature increase within/below	1 1 degree Celsius 2 2 degrees Celsius 3 3 degrees Celsius 4 4 degrees Celsius 5 5 degrees Celsius 6 6 degrees Celsius 7 7 degrees Celsius 8 8 degrees Celsius 9 9 degrees Celsius 10 10 degrees Celsius 11 Do not know
The "greenhouse effect", as debated in international negotiations on global warming, refers to:	1 Gases in the atmosphere that trap heat 2 The Earth's protective ozone layer 3 Pollution that causes acid rain 4 How plants grow 5 Do not know

Figures 4 and 5 show first differences estimations for changes in Awareness and Policy Preferences respectively. Both figures depict first differences and their 95% confidence intervals resulting from changes in values on the main explanatory variables. The other variables are held constant at their respective medians (King et al., 2000). For instance, changing the extent of news reporting about the COP from 0 (no treatment) to 1 (treatment), results in an increase of 0.03 points in Awareness (Figure 4). Yet, media reporting does not have a significant effect on Policy Preferences (Figure 5). These results are consistent with our previous findings concerning treatment effects (Table 4 in main analysis). The results for the control variables are also similar to those in shown in Models 1 and 3 (Table 4 in main analysis).

Figure 4: First difference estimates: changes in Awareness (treatment aggregate; positive or negative)
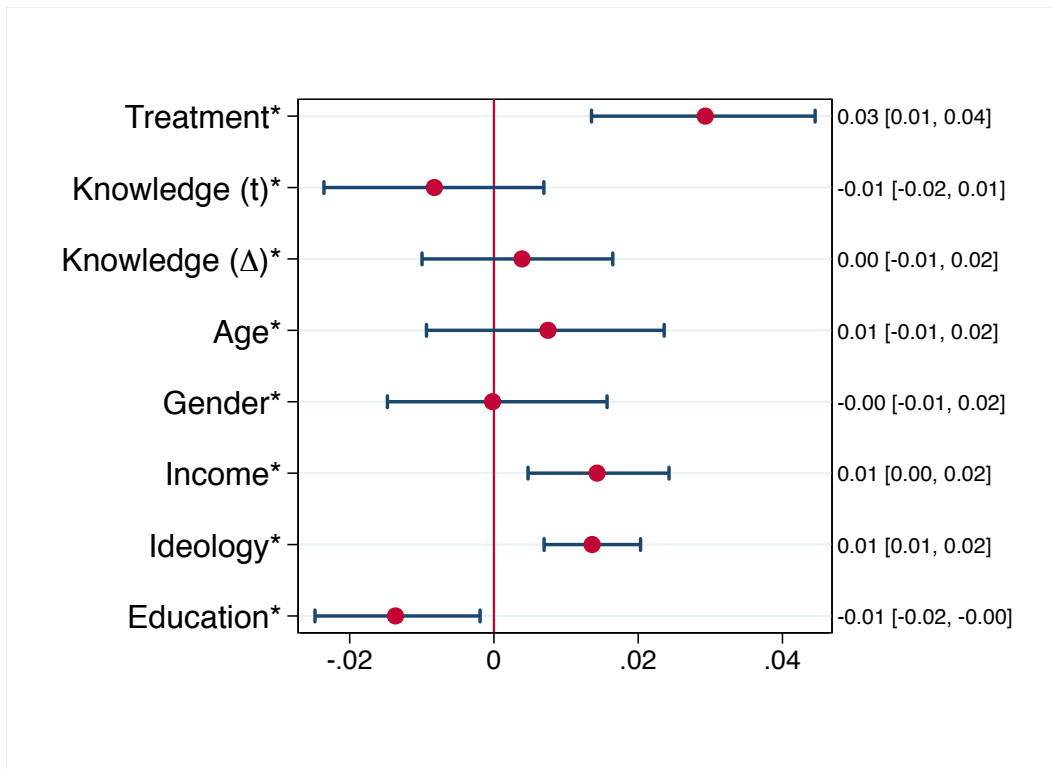
Note: the First Difference indicates the unit change in the dependent variable when changing the respective explanatory variable from its minimum to its maximum (binary variables: 0 to 1), while holding all other variables at their median values. Effects where whiskers cross the 0-line are not statistically significant at the 5% level.

Figure 5: First differences estimates: changes in Policy Preferences (treatment aggregate; positive or
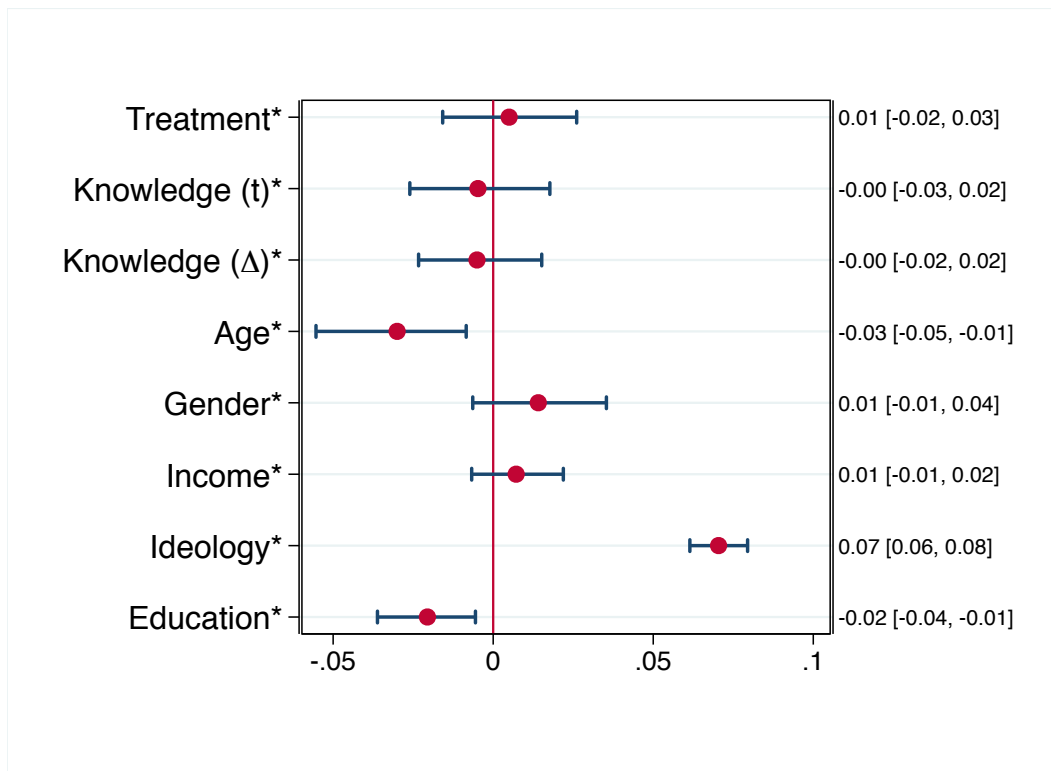
negative)

Note: the First Difference indicates the unit change in the dependent variable when changing the respective explanatory variable from its minimum to its maximum (binary variables: 0 to 1), while holding all other variables at their median values. Effects where whiskers cross the 0-line are not statistically significant at the 5% level.

Table 4: OLS regression models (Model specifications for Figures 4 & 5 in the main analysis)

	(Model 1 Figure 4(a)) Awareness (Δ)	(Model 2, Figure 4 (b)) Policy Preferences (Δ)	(Model 3 Figure 5(a)) Awareness (Δ)	(Model 4 Figure 5(b)) Policy Preferences (Δ)
Treatment	0.07*** (0.02)	0.03** (0.01)		
Type of news (positive and negative)			-0.01 (0.02)	-0.02 (0.01)
Awareness (t)	-0.25*** (0.03)		-0.33*** (0.02)	
Policy preferences (t)		-0.83*** (0.02)		0.87*** (0.02)
Knowledge (t)	0.00 (0.01)	-0.00 (0.0)	0.00 (0.00)	0.00 (0.00)
Knowledge (Δ)	0.00 (0.01)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Income	0.01** (0.00)	0.00 (0.0)	0.00 (0.00)	-0.00 (0.01)
Ideology	0.00 (0.00)	0.00*** (0.00)	0.00 (0.00)	0.00*** (0.00)
Education	0.00 (0.01)	0.01 (0.00)	-0.01 (0.00)	0.00 (0.00)
Age	0.02** (0.01)	-0.00 (0.00)	0.02** (0.00)	-0.00 (0.00)
Gender	-0.01 (0.01)	-0.00 (0.00)	-0.00 (0.01)	-0.00 (0.00)
Initial Awareness*treatment (aggregate)	-0.08** (0.04)			
Initial Policy Preferences*treatment (aggregate)		-0.74*** (0.02)		
Initial Awareness *type of news (positive & negative)			0.02 (0.04)	
Initial Policy Preferences*type of news (positive & negative)				**-0.74*** (0.02)**
Constant	0.47*** (0.03)	-0.836*** (0.02)	0.556*** (0.03)	0.87*** (0.02)
N	**1192**	**1192**	**793**	**793**
F-Test	0.000	0.000	0.000	0.000

Note: standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Models 3 and 4 refer to within the treatment group examination. In this case the participants have been treated with either positive or negative news.

Figure 6 demonstrates that our treatment affects differently citizens along their ideological views. The results indicate that individuals in our sample with liberal views do not seem to be affected by the treatment. It is common that liberals are more aware about climate change issues in comparison to conservatives. Therefore, we see that people that are conservative and received the treatment have largely increased their awareness about climate change. However, there is not difference for liberals and conservatives regarding the Policy Preferences about climate change (Figure 7).

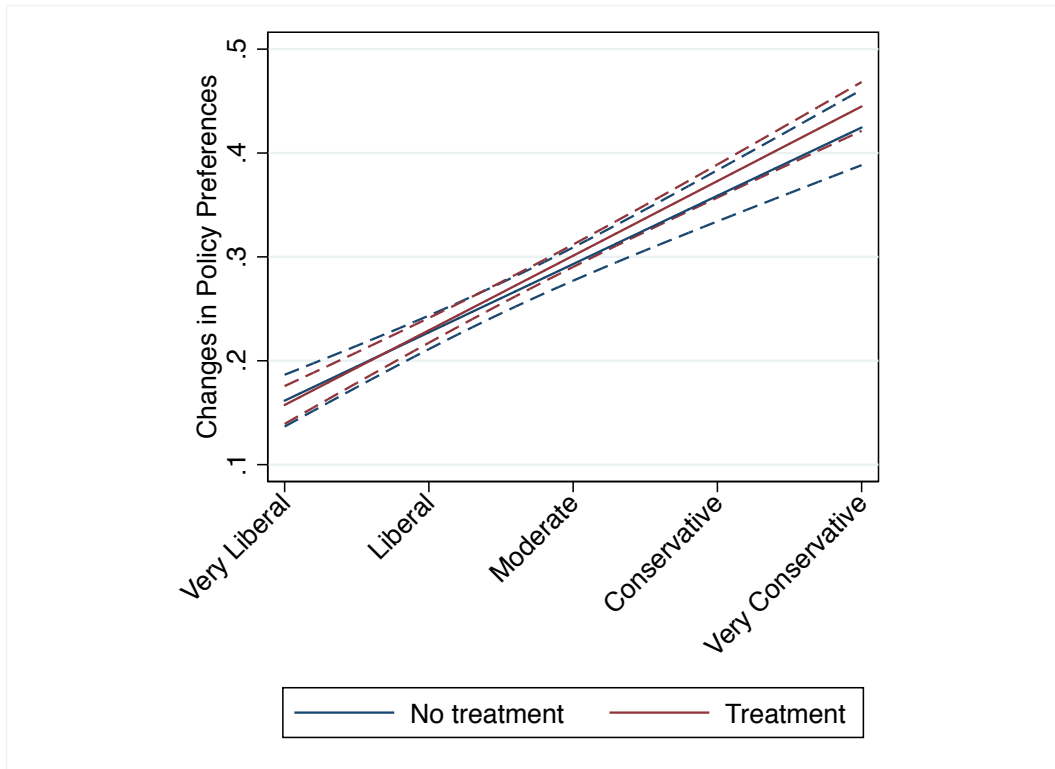Figure 6: Moderating effect of *ideology* and *changes in Awareness*
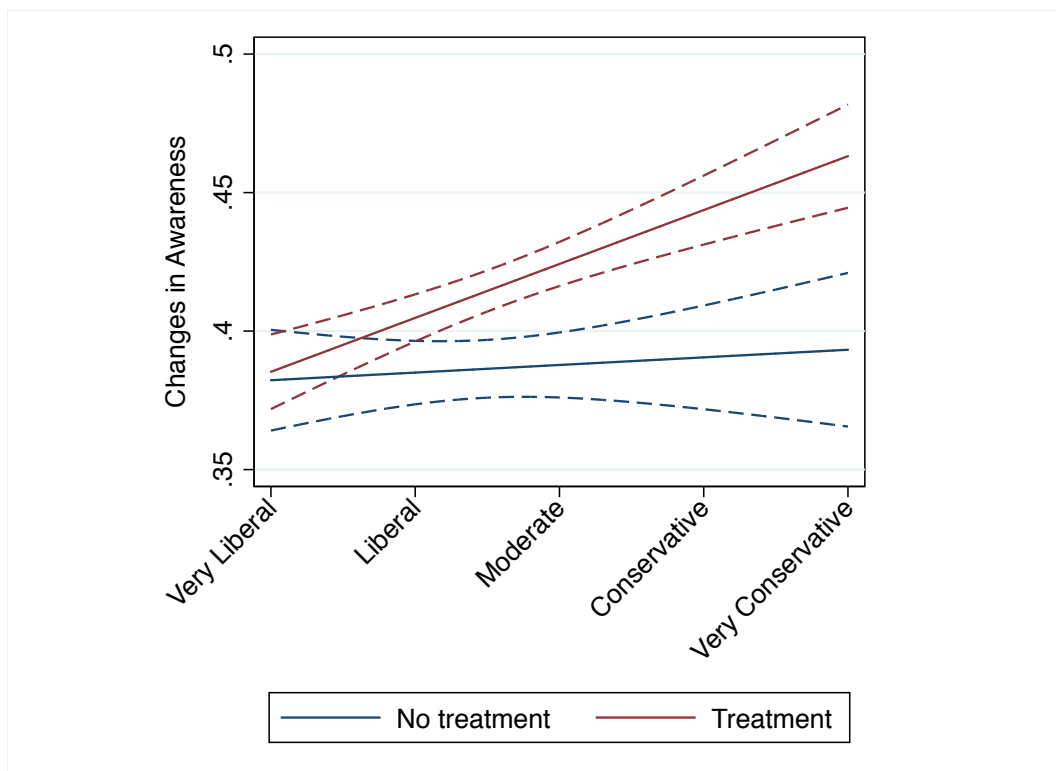
(treatment aggregate; positive or negative)

Note: solid lines indicate marginal effects; dashed lines indicate 90% confidence intervals.

Figure 7: Moderating effect of *ideology* and *changes in Policy Preferences*

(treatment aggregate; positive or negative)

Note: solid lines indicate marginal effects; dashed lines indicate 90% confidence intervals.