Supplemental Material for: **Weather, Climate and Worldviews: The Sources and Consequences of Public Perceptions of Changes in Local Weather Patterns**

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May 2012

This document provides the supplemental material referenced in companion paper, "Weather, Climate and Worldviews: The Sources and Consequences of Perceptions of Changes in Local Weather Patterns".

1. Survey Data

The data employed in this study are taken from the Energy and Environmental Security (EES) survey series, fielded annually by the University of Oklahoma's Center for Applied Social Research. The EES focuses broadly on energy and environmental issues, and contains a module directed at climate and weather issues that has been included in the series since 2006. Some of the important measures of the independent variables in this study were not added to the EES until 2008; the result is that we are able to utilize the 2008 – 2011 surveys for this analysis.

The EES survey data were collected in two modes – Internet and telephone. The purpose of the continuing multi-mode approach is to permit comparison the patterns of responses across the two modes for cross-validation purposes. The characteristics of both phone and Internet survey penetration and representativeness are changing rapidly; the fraction of households with Internet access is rising, while the number of homes with wired (as opposed to wireless-only) phone access is declining (Blumberg and Luke 2011). For that reason, we are tracking the changes over time in key variables, and the relationships among variables, across the two modes.

In 2008 the full survey instrument was implemented in both modes, while in 2009 we fielded only the Internet survey. In 2010 and 2011 we implemented the full questionnaire in the Internet modes, but only part of the questionnaire (roughly half of the entire Internet version of the survey) in the telephone mode. The 2010 and 2011 telephone surveys contain

the "marker" questions that permit us to track the comparability of responses across modes and over time. The telephone survey collection was times to assure that it spanned the timing for the Internet survey data collection. Table S1 shows the year, mode, samples sizes and months of data collection for each survey.

Table S1: Survey Mode, Size and Collection Periods

Year	Mode	Sample Size	Collection Dates
2008	Internet	1,767	May 28-30
	Telephone	608	April 11-June 26
2009	Internet	1,698	May 28-29
2010	Internet	1,890	June 8-9
	Telephone*	529	June 1-July 5
2011	Internet	2,004	June 1-2
	Telephone*	593	May 17-June 12

* Telephone data in these years included only partial survey questionnaires, and are therefore not included in the analysis.

Internet Survey Data Collection. Samples for the Internet versions of the EES were purchased from Survey Sampling International (SSI). In the United States, SSI maintains an Internet panel, titled SurveySpot, consisting of volunteer members from many sources, including several thousand Web properties, multiple online recruitment methods, and random digit dialing telephone recruitment. SurveySpot members are recruited exclusively using permission-based techniques. Unsolicited email is not employed; membership requires a double opt-in, and all applicants are screened for eligibility. The membership of SurveySpot is continuously changing, but typically includes more than a million panelists representing a similar number of US households (only one member in each household can participate in any SurveySpot panel for the same survey). SSI maintains a subpanel of approximately 400,000 members whose demographics are roughly proportional to national census characteristics. Our samples were randomly drawn from this census-balanced subpanel. Each member of the samples received an email invitation to participate in the survey describing the general nature and subject matter of the study. As an incentive to participate, each respondent who completed the survey received a five-dollar stipend and was entered into a drawing for a larger cash award.

Samples for both surveys were drawn using the following procedures:

- The total available universe (population) of eligible respondents was identified.
- The available universe was sorted by ZIP codes.
- The available universe was divided by the required sample size to create a selection interval.

- A random number greater than or equal to zero and less than the selection interval was generated to provide a starting point. Generation was done via a standard Oracle random number generation algorithm.

- Using this starting point, every *n*th record was selected according to the selection interval. When there were requirements to eliminate duplicate or otherwise ineligible panelists (age, household, etc.), the next record was selected as a replacement. The *n*th intervals were not recalculated as a result of eliminating ineligibles.

- The resulting sample was randomly sorted using a standard Oracle random sorting algorithm.

- After the sample was randomly sorted, sample units (e-mail addresses) were randomly assigned to batch mailings. When samples were batch mailed, each batch represented a mini version of the entire overall sample, virtually identical in demographics, geography, etc. to every other batch.

Telephone Survey Data Collection. For the telephone versions of the EES, national sample frames of randomly selected and randomly ordered households having one or more telephones were purchased from Survey Sampling, International (SSI). The sample frames were drawn from a random digit database, stratified by county, in which each telephone exchange and working block had a probability of selection equal to its share of listed telephone households. This was accomplished as follows. All blocks within a county were organized in ascending order by area code, exchange, and block number. After a proportional quota had been allocated to all counties in the frame, a sampling interval was calculated by summing the number of listed residential numbers in each eligible block within the county and dividing that sum by the number of sampling points assigned to the county. From a random start between zero and the sampling interval, blocks were systematically selected in proportion to their density of listed households. After a block was selected, a two-digit random number in the range 00–99 was appended to the exchange and block to form a ten-digit telephone number. Known business numbers were eliminated.

For each survey, the sample frame was loaded into a computer-assisted telephone interviewing system at the Survey Research Center of the University of Oklahoma's Public Opinion Learning Laboratory that selected and dialed the individual numbers. Each household in each sample had an equal chance of being called. Probability sampling was extended within each household by interviewing only the member of the household over the age of 18 with the most recent birthday. Up to ten attempts were made to contact the individual selected for the sample. No substitutions were made.

Response rates were calculated for the telephone surveys, with AAPOR cooperation rates of 60.7%, 78.4%, and 56.4% in 2008, 2010 and 2011 respectively (AAPOR 2004).

2. Demographic Representativeness of the Samples

Table S2.1-S2.4 compare key national and regional population parameters to the demographic characteristics of respondents to the Internet and telephone surveys in each of the survey years.

Table S2.1: Demographic Representativeness of Respondents in 2011 Surveys

Demographic Category	US Population	Web 2011 (%)	Phone 2011 (%)
Gender[1]			
Men	48.2	47.7	45.4
Women	51.8	52.3	54.6
Age			
18–24	13.2	11.4	2.9
25–49	43.6	42.9	25.9
50 and above	43.2	45.7	71.2
Education			
H.S. Grad or Higher	85.3	97.0	96.8
Bachelor's or >	25.7	39.2	46.5
Race / Ethnicity			
White, non-Hispanic	69.6	82.7	87.2
African Am. / Black	12.1	6.9	5.0
Hispanic (any race)	12.9	5.8	3.4
Am. Indian	0.7	0.7	2.2
Asian / Pacific Is.	4.7	3.4	1.6
Other	NA	0.5	0.6
Household Income			
$0–49,999	50.2	56.5	34.5
$50,000–99,999	29.6	33.6	39.6
$100,000 and above	20.2	9.9	25.9
Region			
Northeast	18.5	18.3	16.4
Midwest	21.8	21.5	26.6
South	36.6	36.7	36.5
West	23.1	23.5	20.5

[1] The national population data in Tables S2.1 – S2.4 are taken from the following sources: U.S. Census Bureau 2000a; U.S. Census Bureau 2000b; U.S. Census Bureau 2010a; U.S. Census Bureau 2010b ; U.S. Census Bureau 2011. The phone sample frames include lower-48 states only. Regional population data include only 18 years of age and older.

As is evident in the tables, the samples provide a close approximation of the populations on gender, age and regional variables. As is typical of both online and phone surveys, the education levels of respondents is higher than that of the general population, and White respondents are over-represented in the samples.

Table S2.2: Demographic Representativeness of Respondents in 2010 Surveys

Demographic Category	US Population	Web 2010 (%)	Phone 2010 (%)
Gender			
Men	48.2 [2]	47.7	43.9
Women	51.8 [3]	52.3	56.1
Age[4]			
18–24	13.2	18.7	7.3
25–49	44.2	33.6	26.0
50 and above	42.6	47.7	66.7
Education			
H.S. Grad or Higher	79.7	97.5	97.3
Bachelor's or >	22.3	38.4	45.9
Race / Ethnicity			
White, non-Hispanic	70.0	85.4	85.7
African Am. / Black	12.0	5.9	6.6
Hispanic (any race)	12.6	3.3	2.8
Am. Indian	0.7	1.2	2.4
Asian / Pacific Is.	4.6	3.5	0.9
Other	NA	0.7	1.6
Household Income			
$0–49,999	50.2	61.7	39.3
$50,000–99,999	29.6	30.7	32.9
$100,000 and above	20.2	7.6	27.8
Region			
Northeast	18.5	19.3	18.1
Midwest	21.8	26.7	26.3
South	36.6	34.2	35.5
West	23.1	19.8	20.2

Table S2.3: Demographic Representativeness of Respondents in 2009 Survey

Demographic Category	US National Population (%)	Internet 2009 (%)
Gender		
Men	48.2	47.8
Women	51.8	52.2
Age[4]		
18–24	13.2	12.1
25–49	44.8	46.6
50+	42.0	41.3
Education		
H.S. Graduate or Higher	79.7	97.8
Bachelor's or Higher	22.3	40.7
Race / Ethnicity		
White, non-Hispanic	70.5	81.4
Black	11.9	6.4
Hispanic (any race)	12.4	4.5
Am. Indian / AK Native	0.7	1.1
Asian / Pacific Islander	4.5	5.2
Other	NA	1.4
Household Income		
$0–49,999	49.7	50.0
$50,000–99,999	29.8	37.3
$100,000 and above	20.5	12.7
Region		
Northeast	18.5	22.3
Midwest	21.8	23.5
South	36.6	33.5
West	23.1	20.7

Table S2.4: Demographic Representativeness of Respondents in 2008 Surveys

Demographic Category	US National Population (%)	Phone 2008 (%)	Internet 2008 (%)
Gender			
Men	48.2	42.4	47.6
Women	51.8	57.6	52.4
Age[4]			
18–24	13.1	4.8	12.4
25–49	45.4	35.5	49.8
50+	41.5	59.7	37.7
Education			
H.S. Graduate or Higher	79.7	97.0	98.2
Bachelor's or Higher	22.3	41.2	43.7
Race / Ethnicity			
White, non-Hispanic	70.8	85.1	82.2
Black	11.8	5.4	6.3
Hispanic (any race)	12.2	3.3	4.2
Am. Indian / AK Native	0.7	3.1	0.9
Asian / Pacific Islander	4.5	1.8	5.8
Other	NA	1.3	0.7
Household Income			
$0–49,999	51.4	40.3	47.9
$50,000–99,999	29.5	36.0	37.6
$100,000 and above	19.1	23.7	14.5
Region			
Northeast	18.7	17.1	21.2
Midwest	22.1	27.6	24.8
South	36.3	36.7	34.6
West	23.0	18.6	19.4

The complete descriptions of the survey collection and response rates can be found in the annual survey reports, which are available online at http://crcm.ou.edu/projects/nuclear/.

3. Survey Question Wording

The items used in this study were collected using a questionnaire that includes modules on broad array policy preferences, including those concerning energy security, climate change; preferences across different sources of energy; risk perceptions of environmental threats and energy sources; individual-level and household characteristics and other items. Roughly half of the survey items are asked annually, and in the same order within the survey instrument. The number of questions ranges from 110-125 in each of the surveys. The specific questionnaire items used in the analysis described in the paper are discussed here.

Weather Perception Items. The questionnaire includes measurement of three dimensions of local weather change. These include:

Temp: In your personal experience, over the past few years have average temperatures where you live been rising, falling, or staying about the same as previous years?

Drought: In your personal experience, over the past few years has drought where you live been more frequent, less frequent, or stayed about the same as previous years?

Floods: In your personal experience, over the past few years has flooding where you live been more frequent, less frequent, or stayed about the same as previous years?

Political Ideology Measure. Respondents' self-placement of political ideology was bsed on the following question wording:

> **ideology** On a scale of political ideology, individuals can be arranged from strongly liberal to strongly conservative. Which of the following best describes your views? Would you say that you are: stongly liberal, liberal, slightly liberal, middle of the road, slightly conservative, conservative, or strongly conservative?

For purposes of analysis, a strong liberal was coded a value of 1, and a strong conservative was coded a value of 7.

Cultural Disposition Items and Scales. Measurement of cultural dispositions employed updated questions, based on those initially developed in Dake (1991) and Ripberger, Jenkins-Smith and Herron (2011). These items are intended to register the relatively enduring preferences for social relations that flow from each of the grid/group combinations.

The following measures, which when combined generate a scale alpha of 0.77, were used to capture the *egalitarian* disposition:

> **egal1** What society needs is a fairness revolution to make the distribution of goods more equal.
> **egal2** Society works best if power is shared equally.
> **egal3** It is our responsibility to reduce differences in income between the rich and the poor.

For the *hierarch* disposition, we used the following question set. These items produce a scale alpha of 0.67.

> **hier1** The best way to get ahead in life is to work hard to do what you are told to do.
> **hier2** Society is in trouble because people do not obey those in authority.
> **hier3** Society would be much better off if we imposed strict and swift punishment on those who break the rules.

The *individualist* disposition was measured using the following questions. These items generate a scale alpha of 0.70:

> **indiv1** Even if some people are at a disadvantage, it is best for society to let people succeed or fail on their own.
> **indiv2** Even the disadvantaged should have to make their own way in the world.
> **indiv3** We are all better off when we compete as individuals.

Factor analysis confirms that these items load primarily on separate scales, as shown in Table S3. The factor loadings shown in Table S3 are based on principal component analysis of the cultural disposition indicators, using varimax rotation. As noted the text of the paper, the scales used in the ordinal logit models were constructed by taking the average scores across all three items for each o the cultural dispositions. Cases with missing observations were omitted from the analysis.

Table S3: Factor Analysis of the Cultural Disposition Scales

Indicator Variable	Egalitarian Factor	Individualist Factor	Hierarchy Factor
Egal1	**.843**	-.153	.147
Egal2	**.779**	.084	.036
Egal3	**.828**	-.155	.055
Indiv1	-.137	**.801**	.187
Indiv2	.019	**.776**	.177
Indiv3	-.088	**.726**	.110
Hier1	.060	.260	**.679**
Hier2	.133	.037	**.827**
Hier3	.034	.193	**.750**

4. Cross Correlations of Modeled Variables

The variables used in the ordinal logit models (Tables 4, 5 and 6 in the paper) are listed in the matrix shown in Table S4, with their Pearson correlation coefficients. The stars indicate the levels of statistical significance of the correlations. Note that the variables in the first three columns (temp, drought, and floods) are ordinal variables, and therefore the correlation coefficients should be interpreted with care.

Table S4: Correlation Matrix

	temp	drought	floods	age	male	white	education	income	ideology	egal	hier
temp											
drought	0.33***										
floods	0.08***	-0.10***									
age	-0.05***	0.02	-0.06***								
male	-0.04**	-0.03*	-0.04***	0.02							
white	-0.02	-0.02	-0.02	0.14***	-0.01						
education	0.03*	0.03**	0.04**	0.08***	0.10***	0.00					
income	-0.03*	0.01	0.01	-0.01	0.10***	0.01	0.35***				
ideology	-0.19***	-0.10***	-0.09***	0.18***	0.07***	0.07***	-0.08***	0.01			
egal	0.19***	0.10***	0.09***	-0.18***	-0.07***	-0.11***	-0.09***	-0.13***	-0.35***		
hier	-0.02	0.01	0.00	0.02	0.00	-0.02*	-0.08***	0.03*	0.17***	0.17***	
indiv	-0.12***	-0.08***	-0.05***	0.04***	0.11***	0.02	0.04***	0.12***	0.25***	-0.16***	0.38***

significant at * $p < .05$; ** $p < .01$;*** $p < .001$

5. Tests for "Priming" of Weather Perception Measures

The measures of perceived changes in local weather patterns were asked annually, and included in a battery of items that also explored perceptions of climate change. In the annual sequence of questions, the weather perception measures followed this question:

> On a scale from zero to ten where zero means *not at all informed* and ten means *completely informed*, how well informed to you consider yourself to be about the issue of global climate change?

Because the "informed" item was directly prior to the set of randomly ordered questions about weather perceptions in the survey instrument, we were concerned that we might have inadvertently "primed" respondents to connect weather changes with the broader issue of climate change, and thereby inflate respondents' propensity to link weather perceptions with the cultural disposition items.

To address this possible threat to the validity of our model results, we created an experiment in the 2011 iteration of the survey in which respondents were randomly assigned to one of two groups; one group (Group A) was given a revised version of the survey instrument in which the weather perception questions were asked prior to the "informed" item; the second group (Group B) was given the original question wording.

To test for priming effects, we modeled the effects of the cultural indices on perceived temperature change for the two groups, as shown in Table S5. We included a dummy variable to capture mean differences in perceived weather changes for Group A (as compared to Group B), and interaction terms for the effects of the revised ordering on the predicted coefficients for each of the cultural orientation items. None of the estimated coefficients were substantively or statistically significant.

Table S5: Ordered Logistic Regression Models of Perceived Change in Local Weather by Cultural Type and Climate Change Questions

	Temperature	Droughts	Floods
Group A	0.444	-0.326	-0.592
	(0.540)	(0.523)	(0.524)
Egalitarian (1-7 scale)	0.260***	0.076*	0.035
	(0.049)	(0.048)	(0.048)
Hierarch (1-7 scale)	0.046	0.011	0.070
	(0.058)	(0.056)	(0.057)
Individualist (1-7 scale)	-0.092**	-0.107*	-0.104
	(0.060)	(0.057)	(0.057)
Egalitarian*Group A	-0.040	0.021	0.070
	(0.70)	(0.068)	(0.068)
Hierarch*Group A	-0.020	0.060	-0.104
	(0.079)	(0.077)	(0.077)
Individualist*Group A	-0.057	0.009	0.145
	(0.085)	(0.082)	(0.082)
BIC	3159.403	3403.088	3283.287
N	1595	1583	1596

Standard errors in parentheses
± significant at $p <$. 10;* $p < .05$; ** $p < .01$;*** $p < .001$

Based on these results, we are reasonably confident that the measures of perceived temperature change were not contaminated (or primed) by their placement following the climate change "informed" question in the survey questionnaire.

6. References for Supplemental Materials

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