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Summary

Environmental policies based on information provision are widespread, but have often proven ineffective. One possible explanation for information's low effectiveness is that people actively avoid it. We conduct an online field experiment on air conditioning usage to test the theory of moral wiggle room, according to which people avoid information that would compel them to act morally, against the standard theory of information acquisition, and identify conditions under which each theory applies. In the experiment, we observe how exogenously imposing a feeling of moral obligation to reduce air conditioning usage and exploiting natural variation in the cost of doing so, given by outside temperature, influences subjects' avoidance of information about their energy use impacts on the environment. Moral obligation increases information avoidance when it is hot outside, consistent with the moral wiggle room theory, but decreases it when outside temperature is low. Avoiding information positively correlates with air conditioning usage. These findings provide guidance about tailoring the use of nudges and informational tools to the decision environment.

Keywords: Information Avoidance, Energy Efficiency, Moral Wiggle Room

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Abstract

Environmental policies based on information provision are widespread, but have often proven ineffective. One possible explanation for information’s low effectiveness is that people actively avoid it. We conduct an online field experiment on air conditioning usage to test the theory of moral wiggle room, according to which people avoid information that would compel them to act morally, against the standard theory of information acquisition, and identify conditions under which each theory applies. In the experiment, we observe how exogenously imposing a feeling of moral obligation to reduce air conditioning usage and exploiting natural variation in the cost of doing so, given by outside temperature, influences subjects’ avoidance of information about their energy use impacts on the environment. Moral obligation increases information avoidance when it is hot outside, consistent with the moral wiggle room theory, but decreases it when outside temperature is low. Avoiding information positively correlates with air conditioning usage. These findings provide guidance about tailoring the use of nudges and informational tools to the decision environment.

1. Introduction

Reducing excessive household energy consumption is considered a promising way to mitigate climate change and save consumers money at the same time (Edenhofer et al. 2014). Almost all governments have put in place policies to promote energy efficiency, in the attempt to resolve what has been dubbed as the ‘Energy Paradox’ – the surprisingly slow diffusion of apparently cost-effective energy-conservation technologies (Jaffe and Stavins 1994). Decisions about energy consumption are generally plagued by a lack of information (Dietz 2010; Gillingham and Palmer 2014; Attari et al. 2010). But people often don’t respond to interventions that inform them of the potential benefits of energy-saving measures (Abrahamse et al., 2005, Allcott and Knittel 2017; Allcott and Greenstone 2017). Why is information provision often so ineffective in getting people to conserve energy? Several arguments have been discussed in the literature, including rebound effects, moral licensing, and lack of salience (Delmas, Fischlein, and Asensio 2013). This paper explores one mechanism, which has so far been disregarded: it may be that people just don’t want to hear about it (Golman, Hagmann, and Loewenstein, 2017).

The standard economics of information holds that people value information when, and to the extent that, it is useful, i.e., that people can use it to make better decisions. If the best choice option is the same regardless of what the information reveals, then the information is worthless. But if information reveals costs or benefits of a choice option that affect whether it is worth choosing, then people should be willing to pay some cost to obtain the information.

The theory of moral wiggle room, however, turns the traditional perspective on its head. Rather than obtaining information specifically when it can be used to behave better, the theory of moral wiggle room suggests that people sometimes avoid information specifically because they would feel obliged to behave better. Dana, Weber, and Kuang (2007) coined the term moral wiggle room to describe a constructed conception of ethical norms relating to fairness and altruism that allows people to excuse

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ambiguously selfish behaviors. They find in a laboratory experiment that people avoid information about the consequences of their choices for other people so that they can make the choice that is in their own monetary self-interest. Of course, they could make the self-interested choice even if they were to discover that it would harm others, but then they would feel guilt. Providing the option to avoid information about the externality increases the prevalence of the selfish action. It is not just people who would have been selfish in any case who choose to remain ignorant. This means that some people who have other-regarding preferences are avoiding precisely the information that would potentially change their behavior if they accepted it. In follow-up work demonstrating further violations of the standard economic account, Grossman and van der Weele (2017) find that people are less likely to inform themselves about the externality before making the payoff-relevant choice (i.e. when the information is still potentially useful) than after making the choice (i.e. when nothing can be done about it) and that people are even willing to pay to avoid this information.

The theory of moral wiggle room extends beyond monetary allocation decisions in the laboratory under the watchful eye of an experimenter. Psychologists believe that generally people who would reject blatantly immoral behavior still try to find justifications that allow them to behave selfishly without compromising their identity as ethical people (Shalvi et al., 2015). In an innovative and carefully done field study, Freddi (2017) finds evidence in newspaper click data that moral wiggle room underlies avoidance of information about a refugee crisis as part of a psychological coping strategy to suppress guilt and escape the responsibility of helping to welcome refugees in one's own community. Related field experiments from economics demonstrate the presence of what is called the 'avoiding the ask' phenomenon in charitable giving: when given the opportunity to avoid being asked for a donation, potential donors take it, resulting in significant decreases in giving (Andreoni, Rao, and Trachtman 2017; DellaVigna, List, and Malmendier 2012). These findings make us ask: do people also avoid information to create the moral wiggle room necessary to justify actions that contribute to climate change? What are the conditions under which moral wiggle room will be operative in this context?

In this paper we use an innovative online field study to investigate whether people avoid information about their energy usage and personal impacts on the environment while continuing to behave as usual. We find evidence that they do avoid information on personal impacts on the environment, thus demonstrating in a naturalistic setting that moral wiggle room helps explain people's reluctance to make personal sacrifices to deal with a serious societal problem like climate change. We reach subjects in their own homes on a hot summer day and offer them information about the potential cost savings and environmental benefits associated with setting a higher temperature on their thermostat (requiring less air conditioning usage). Then we ask if they want to set their thermostat to 78 degrees Fahrenheit (F) or higher and observe their chosen thermostat setting. We take advantage of natural variation in outdoor temperature, recognizing that the physical consequences of turning up the thermostat (i.e. decreased comfort, energy cost savings, and lower carbon emissions) are greater when the outdoor temperature is above 78 degrees whereas the psychological consequences (i.e., feeling good about oneself) are insensitive to outdoor temperature. Subjects experiencing high outdoor temperatures are at more immediate risk of discomfort if they turn up the thermostat. Also, because of projection bias in predicting comfort (Loewenstein, O'Donoghue, and Rabin 2003; Busse et al., 2012), subjects not experiencing high temperatures may think that being hot would not feel so uncomfortable. For both of these reasons, we believe that subjects experiencing high temperatures perceive turning up the thermostat to have higher (non-monetary) cost than subjects not experiencing high temperatures. This means that to the extent that moral wiggle room is operative, we should see less information acquisition when the outdoor temperature is above 78 degrees.

In this naturalistic setting, we then investigate the conditions under which people will seek moral wiggle room. In principle, two factors appear to be necessary for people to want to create moral wiggle room through information avoidance: there should be a conflict between what a person selfishly wants to do and what a person should do according to an ethical norm, and there should be ambiguity about whether the desirable action actually causes harm or violates the norm, which the relevant information should clear up. In the context of energy usage, a person might selfishly want to maintain high consumption and be unsure whether he really feels morally obliged to cut his energy usage. There are widespread misperceptions of energy costs, and air conditioning is one of the technologies with the largest difference between perceived and actual energy use – by one to two orders of magnitude (Attari et al. 2010). Even if an individual knows both the private and social costs of his air conditioning usage, the normative level of usage is also ambiguous, and he makes the decision in the privacy of his own home, subject to little or no social pressure. Without some intervention, a person may not recognize any social or ethical norm about his energy usage. When clear social norms about energy usage are triggered through clever interventions (e.g., informing people about their neighbors' usage), they do have a measurable impact on energy usage (Allcott, 2011b). We thus hypothesize that the desire for moral wiggle room leads to information avoidance specifically when avoiding the information would allow people to escape a sense of moral obligation to cut their energy usage.

We use two manipulations in a factorial design to try to impose a feeling of moral obligation to decrease air conditioning usage. One manipulation is to suggest a specific action to save energy, that is, to set one's thermostat to at least 78 degrees. This manipulation identifies for subjects a normative level of air conditioning usage. The second manipulation is to have an outside observer, identified as a volunteer with the Sierra Club (an environmental organization), monitor subjects' thermostat settings. This manipulation creates social pressure to conserve energy. In combination, they generate a norm about how much air conditioning usage is appropriate. The offered information about the potential benefits from higher temperature settings then becomes critical for subjects in determining whether deviating from this norm is actually harmful.

We find two effects: when it is hot outside, suggesting an action increases information acquisition, but when, additionally, there is an outside observer, information avoidance increases. We also find that information avoidance affects behavior as expected: data on thermostat temperature collected immediately after the experiment and one week later confirm that avoiding information is associated with higher thermostat temperature settings.

The paper is structured as follows: Section 2 presents the experimental setting and design, and spells out the hypotheses we will test in the empirical analysis; Section 3 discusses the results; and Section 4 concludes.

2. Experimental design and hypotheses

2.1. Design

Subjects in the experiment were recruited on the online labor platform Amazon Mechanical Turk in the U.S., during a high temperatures spell in July 2017. We purposefully conducted the experiment at a time when temperatures were high, to ensure that participants would perceive a cost, i.e. reduced comfort, associated with raising the air conditioning (AC) thermostat temperature. We exploit variations in temperatures across locations to examine the heterogeneous impact of our treatments depending on the cost of taking this action.

All participants in the experiment reported the current outside temperature and the temperature at which their AC thermostat was currently set. After being allocated to one of four experimental conditions, detailed below, subjects could choose to acquire two pieces of information: first, how much energy could be saved by setting a higher temperature; and second, how AC use affects greenhouse gas (GHG) emissions and the environment. The decision to acquire the two pieces of information or not is our main measure of information avoidance. Then, subjects were asked if they were willing to raise the temperature of their AC thermostat to at least 78 degrees F: answers to this question capture individual willingness to take action to conserve energy. Finally, participants uploaded a picture of their AC thermostat;[5] completed a short questionnaire on their AC use habits, demographic and socioeconomic characteristics; and gave us their contact information, so that we could send them a follow-up survey one week later. The follow-up survey again asked participants about the current outside and AC temperatures and again collected pictures of their AC thermostats.

The experimental design is articulated along two treatment dimensions. The first dimension varies whether participants receive information on the availability of remedial action, that is, on the possibility to act to reduce the impact of AC on emissions. Specifically, subjects in the 'Suggested action' treatment were informed that they could easily and significantly decrease the impact of AC on emissions, by raising the AC thermostat temperature to 78 degrees F on a hot day. Subjects in the 'No suggested action' treatment only saw a screen with a general sentence on the flow of the experiment

Along the second dimension, treatments vary whether subjects' AC thermostat pictures will be observed by a person volunteering for an environmental organization. Namely, participants in the 'Outside observer' treatment are shown a picture of, and given a brief statement by, a volunteer for the Sierra Club, a well-known US environmental NGO. They are then told that the volunteer will observe their choices and the pictures of their thermostats. Subjects in the 'No outside observer' treatment are simply shown a picture of a thermostat and told that they will be shortly asked to upload a picture of their own AC thermostat.

The outside observer treatment combines two features that have been proven to prime social norms: awareness that actions will be visible to others (Andreoni and Bernheim 2009), and the presence of a picture of a person watching (Haley and Fessler 2005; Ekström 2012). Both these features make salient that participants' behavior is being observed (and perhaps judged).

Table 1 summarizes the experimental design and reports the number of subjects per treatment. In total, we recruited 396 subjects at baseline, aiming for approximately 100 subjects per treatment with random assignment.

Table 1. Experimental design and sample size by treatment

	No outside observer	Outside observer
No suggested action	93	108
	(66)	(77)
Suggested action	99	96
	(76)	(69)

Note: the numbers outside the parentheses indicate the number of subjects per treatment at baseline, while the number of subjects per treatment at follow-up is reported in parentheses.

The follow-up data on AC temperature settings collected one week after the experiment provide a measure of the persistence of behavioral change involving AC use. On average, 73.5 per cent of participants returned for the follow-up survey (311 participants in total), with no statistically significant differences in attrition across treatments (Kruskal-Wallis test, $p = 0.801$).[6]

[5] The idea to use a photograph to confirm that MTurk workers have behaved in the privacy of their own homes as they have reported to us comes from Haggag and Pope's (2017) innovative lab-in-the-field experimental design.

[6] 18 participants did not leave their contact address at baseline, while the remaining ones did not answer the follow-up survey.

We coded the data from the pictures sent by participants, and have valid pictures from 390 subjects at baseline and 270 at follow-up. We also collected data on real outside temperatures in each participant's location at the time of answering the survey.[7]

The baseline and follow-up studies took 10 and 5 minutes on average, and subjects received $3 and $1 as compensation, respectively. Compensation was only a function of whether participants submitted a picture, not dependent on whether they acquired or avoided the information nor on how they set their AC thermostat temperature.

Table 2 presents summary statistics. Subjects are on average 36 years old (in line with previous experiments on the same platform (Mason and Suri 2012)), 51.5 per cent of them are women, and 35.4 per cent of them own an Energy Star AC system. On the day of the survey, the average temperature of AC systems was 73.4 F. The sample is balanced across treatments along all characteristics, apart from gender. For this reason, we control for gender, as well as for other individual characteristics, in all regressions in the empirical analysis.

Average outside temperature is 82 degrees F, ranging from 40 to 100 F, and is not significantly different across conditions. Table 2 reports also the share of participants who experience temperatures above 77, 78, 79 and 80 degrees F at the time of the study, since these are temperature thresholds that will be used to define high temperature locations in the analysis. 77, 74, 70 and 64 per cent of subjects on average experience temperatures above these three thresholds, respectively, with no significant difference across experimental conditions.

[7] We collected the data from https://www.wunderground.com. See Appendix B for the data scraping procedure.

Table 2. Summary statistics and balance

	Treatment					
	Control	Action only	Outside observer	Action and outside obs.	Total	KW p-value
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome variables						
Avoid information on environmental impact	0.645	0.556	0.574	0.625	0.598	0.671
	(0.481)	(0.499)	(0.497)	(0.487)	(0.491)	
Avoid information on energy savings	0.452	0.364	0.426	0.437	0.419	0.614
	(0.500)	(0.483)	(0.497)	(0.499)	(0.494)	
Willing to change AC temp.	0.516	0.616	0.519	0.448	0.525	0.24
	(0.502)	(0.489)	(0.502)	(0.500)	(0.500)	
Participants' characteristics						
Female	0.624	0.475	0.565	0.396	0.515	0.034
	(0.487)	(0.502)	(0.498)	(0.492)	(0.500)	
Age	36.62	35.88	35.57	34.48	35.63	0.541
	(10.72)	(9.02)	(11.16)	(9.4)	(10.13)	
Has children	0.516	0.434	0.546	0.479	0.495	0.544
	(0.502)	(0.498)	(0.500)	(0.502)	(0.501)	
Democrat	0.419	0.374	0.435	0.375	0.402	0.829
	(0.496)	(0.486)	(0.498)	(0.487)	(0.491)	
Republican	0.140	0.303	0.278	0.323	0.263	0.122
	(0.349)	(0.462)	(0.450)	(0.470)	(0.441)	
Knows CO2 emissions from AC	0.387	0.475	0.444	0.479	0.447	0.676
	(0.490)	(0.502)	(0.499)	(0.502)	(0.498)	
Home alone	0.538	0.616	0.481	0.521	0.538	0.403
	(0.501)	(0.489)	(0.502)	(0.502)	(0.499)	
AC energy star	0.355	0.303	0.435	0.313	0.354	0.335
	(0.481)	(0.462)	(0.498)	(0.466)	(0.479)	
Believes climate change is real	0.892	0.889	0.880	0.833	0.874	0.886
	(0.311)	(0.316)	(0.327)	(0.375)	(0.333)	
AC temperature baseline	73.51	73.61	73.69	72.81	73.42	0.42
	(4.806)	(3.914)	(4.467)	(4.473)	(4.418)	
Outside temperature (real)	80.965	82.348	82.873	81.57	81.983	0.611
	(6.859)	(6.146)	(7.222)	(7.423)	(6.607)	
High temperature (>77F)	0.731	0.778	0.808	0.760	0.770	0.650
	(0.446)	(0.418)	(0.398)	(0.429)	(0.421)	
High temperature (>78F)	0.710	0.758	0.750	0.729	0.737	0.874
	(0.456)	(0.431)	(0.435)	(0.447)	(0.441)	
High temperature (>79F)	0.656	0.747	0.694	0.687	0.697	0.577
	(0.478)	(0.437)	(0.463)	(0.466)	(0.460)	
High temperature (>80F)	0.656	0.677	0.657	0.583	0.644	0.544
	(0.478)	(0.470)	(0.477)	(0.496)	(0.479)	

Note: Standard deviations in parentheses. Column 6: p-values from Kruskal-Wallis rank test.

2.2. Hypotheses

We exploit three sources of variation within the experiment to generate testable hypotheses on patterns of information avoidance across our sample: whether the treatment condition makes salient to subjects that they can take remedial action; whether an outside observer is present, which, along with the suggestion of a normative action to take, may create a sense of moral obligation to conform to this norm; and whether the outside temperature is high, in which case the cost of conforming to this norm is greater, as argues in the introduction.

When moral wiggle room is not operative, we expect information acquisition to be determined by the (perceived) instrumental value of the information relative to the opportunity cost. The opportunity cost here is the time it takes to process requested information, and this should not vary across treatment or with temperature. The instrumental value of the information depends on the availability of an action that the individual may or may not wish to take, depending on the content of the information. The suggested action may remind subjects that they can make a decision about how to set their thermostats after getting the information we offer, so we expect to see more information acquisition in the treatment conditions with the suggested action.

When an outside observer is present, especially when coupled with a suggested action, we expect there to be a greater sense of moral obligation to increase the AC thermostat setting. At high temperatures, when the cost of complying is high, we may see moral wiggle room kick in. Thus, in the condition with an outside observer, and even more so in the condition with a suggested action together with an outside observer, we expect to see relatively less information acquisition (i.e. information avoidance) at high temperatures, as compared with the treatment conditions with low temperature and/or no outside observer.

In the next section, we thus test the following hypotheses:

H1: There should be less information avoidance, relative to the control condition, when there is a suggested action (based on the standard instrumental value of information);

H2: There should be a positive correlation between information avoidance and outside temperature when there is an outside observer (based on the theory of moral wiggle room);

H3: The correlation between information avoidance and outside temperature should be higher when there is an outside observer and a suggested action (which jointly create a sense of moral obligation) than when either the outside observer or the suggested action is missing (based on the theory of moral wiggle room).

3. Empirical analysis

We now examine how treatment and temperature affect subjects' avoidance of information about potential energy savings and the environmental impact associated with their AC use. We use a binary classification of high and low temperatures, distinguishing high temperatures as at or above 78 degrees F, the temperature we propose for their thermostats.[8] Of course, increasingly high temperatures may have amplifying effects, but the relationship is unlikely to be linear, and our objective is simply to distinguish situations in which subjects will feel less comfortable if they raise their AC thermostat setting from situations in which there will be little or no consequence.

[8] We discuss a series of robustness checks, including variations on the threshold distinguishing high from low temperatures, in Section 3.2.

We refer to the choice to decline information as information avoidance, though we acknowledge that some portion of individuals are not necessarily actively avoiding the information, but may simply already know it or just not want to spend the time on it. At a minimum, we would claim that the increase in information avoidance at high temperature in the treatment condition with both a suggested action and an outside observer represents active information avoidance, as the (material) opportunity cost of the information should not vary systematically across condition and the instrumental value of the information should, if anything, increase at high temperatures.

3.1. Main results

Many subjects did in fact decline the information: 59.8 per cent of participants declined to learn about the environmental impact of AC use, while 41.9 per cent of them did not want to know how they could save on their AC use costs. The two choices were highly correlated, and so 39.4 per cent of subjects avoided both types of information (Table 2). Overall the experimental treatments do not produce any statistically significant effects on information acquisition, as shown in Table 2 using non-parametric tests. However, according to the theory, we should observe differential treatment effects, depending on the cost of action. Specifically, we examine whether subjects are more likely to avoid information at high temperatures in any of the experimental treatment conditions. We then examine the consequences of avoiding information on their actual chosen AC temperature settings both immediately and at one-week follow-up.

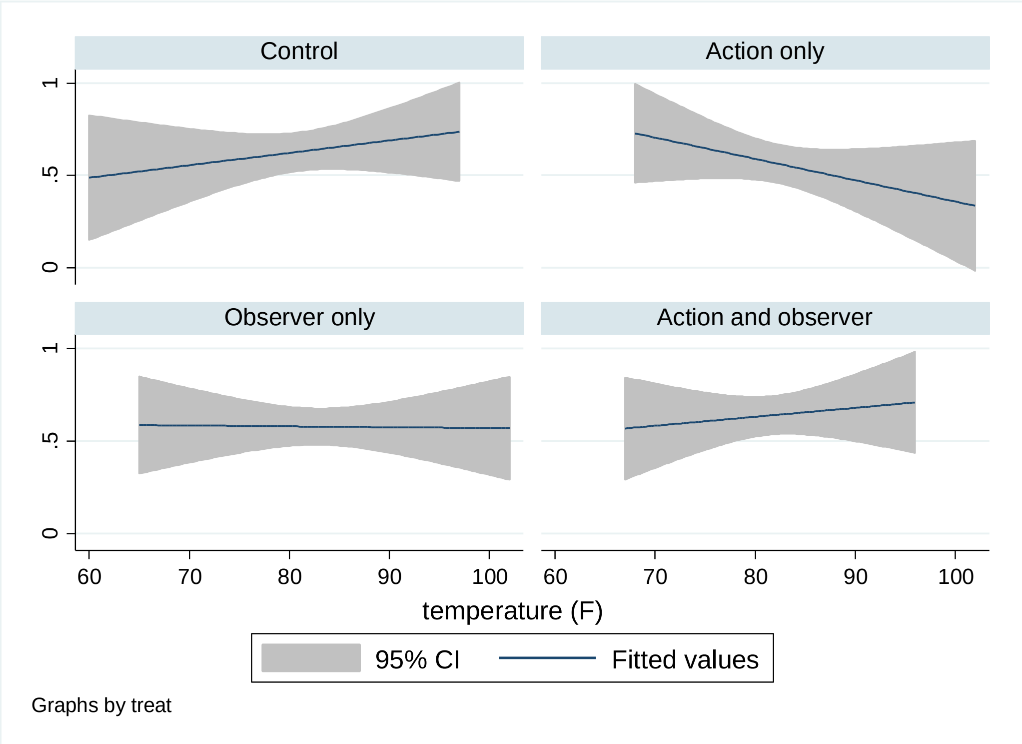
Before introducing temperature threshold in the regression analysis below, Figure 1 shows the share of subjects who avoid the information on the climate impact of AC (Top) and on potential savings from raising AC temperature (Bottom) as a function of real outside temperature. We disaggregate the results by experimental condition. Lines in the graph show the linear fit of information avoidance, and the shaded areas 95% confidence intervals.

We observe different correlations between information avoidance and temperature, depending on the moral connotation of the information, subsequent action and induced sense of moral obligation. In the control condition, without outside observer and suggested action, subjects appear to avoid the information on the environmental externalities from AC use more as temperature increases, while the opposite holds when the information is on private savings, that is, when it is less morally charged. Consistent with H1, suggesting an action turns the correlation between information avoidance and temperature negative, for both types of information: the information is more useful if subjects can act upon it, and the benefits from acting upon the information, in terms of savings and environmental impact, are increasing in outside temperature. In contrast to H2, the simple presence of an outside observer does not have much effect on the correlation between information acquisition and temperature. The combination of treatments (jointly inducing a sense of moral obligation) leads to an increase in the correlation between information avoidance and temperature for information on the environmental externalities from AC use. This correlation pattern is consistent with hypothesis H3.

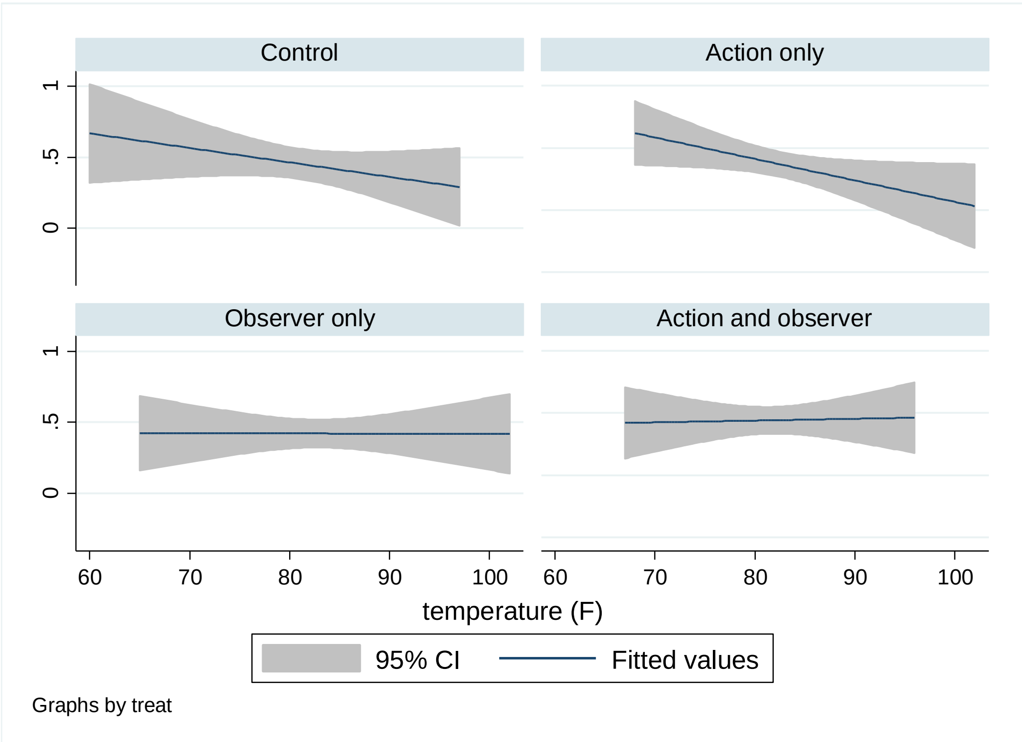
The effect of suggesting an action, alone and in combination with having an outside observer, appears attenuated when information concerns the possibility to privately save on energy costs. Moreover, the correlation between information avoidance and temperature in the control condition is positive when information is on environmental externalities and negative when it concerns private savings. These correlation patterns suggest that social pressure may be stronger when attention is focused on the social rather than on the private costs of one's energy consumption. The fact that moral wiggle room depends on social pressure would explain the stronger interaction effects observed for avoidance of information about the social benefits of increasing the AC thermostat setting than for information about the private benefits.

Figure 1. Correlation between information avoidance and outside temperature, by experimental condition

Top. Avoid information on environmental impact



Bottom. Avoid information on potential savings



Note: y-axis shows the share of subjects avoiding the information.

To assess the statistical significance of these patterns, we turn to regression analysis. In the regressions, we investigate the decision to avoid information as a function of the combination of experimental treatments, aimed at inducing a sense of moral obligation, and of the cost of following up with the information, which we proxy through an indicator of high outside temperature. Namely, we define outside temperature as high if it is higher than or equal to 78 F (>77F), the temperature that we ask subjects to set their AC thermostats on. Different temperature thresholds are explored in the robustness section.

Table 3 presents results from logit regressions of the decision to avoid information on the environmental impact of AC use. Column 1 shows treatment effects on the entire sample, by regressing the indicator of information avoidance on a dummy equal to one if an action is suggested, a dummy equal to one if an outside observer is present, and their interaction. Column 2 includes effects from high temperature (i.e., a dummy variable for outside temperatures above 77 degrees F) and interactions between treatment and high temperature. Columns 3 and 4 show the heterogeneity of treatment effects by outside temperature by adopting the first specification in two subsamples split by whether subjects experienced high temperature (Column 3) or not (Column 4). All regressions control for individual characteristics: gender, birth year, education, political affiliation, ownership of an Energy Star AC system and knowledge of the savings from raising AC temperature.

In specification 1, we thus estimate:

$$InfoAvoid_i = f(\alpha_0 + \alpha_1 OutObs_i + \alpha_2 ActSug_i + \alpha_3 OutObs_i \cdot ActSug_i + \alpha_4 \boldsymbol{X_i} + \varepsilon_i),$$

where f(▪) is the logit function, OutObs and ActSug are dummy variables for the treatments, and $\boldsymbol{X_i}$ are the individual characteristics. In specification 2, we instead estimate:

$$InfoAvoid_i = f(\alpha_0 + \alpha_1 OutObs_i + \alpha_2 ActSug_i + \alpha_3 OutObs_i \cdot ActSug_i + \alpha_4 HighTemp_i + \alpha_5 OutObs_i \cdot HighTemp_i + \alpha_6 ActSug_i \cdot HighTemp_i + \alpha_7 OutObs_i \cdot ActSug_i \cdot HighTemp_i + \alpha_8 \boldsymbol{X_i} + \varepsilon_i).$$

The results confirm the patterns we observed in Figure 1.[9] In Column 1, we see that suggesting a remedial action has a marginally significant negative effect on the log odds of information avoidance for the full sample (ignoring temperature effects). Suggesting an action is associated with a 41% decrease ($e^{-0.525}$) in the odds that an individual would avoid information on the environmental impact of AC use. This is consistent with hypothesis H1. Looking at Columns 3 and 4, we see that this result is driven by the subjects with high temperatures. Indeed, in Column 2, it appears that suggesting a remedial action has a non-significant positive effect on information avoidance, whereas the interaction between suggesting an action and having high temperature is significantly negative. Based on the standard theory of instrumental value of information, we shouldn't be surprised to see a stronger negative effect at high temperatures: information is more useful when it is actionable, and the remedial action produces larger benefits when the outside temperature is high. Still, we would caution against interpreting the lack of a significant negative effect at low temperatures to mean that there is no effect. Less than ¼ of our subjects experienced low temperatures, and we suspect that the absence of an effect in Column 4 (and the appearance of an interaction effect instead of a main effect in Column 2) is due to small sample size.

We find no support for hypothesis H2. Having one's action observed by a third party does not by itself have any statistically significant impact on information acquisition.

We do find support for hypothesis H3. Looking at Column 2, we see a significant positive interaction effect for suggesting an action and having an outside observer while experiencing high temperature.

[9] Looking at demographic correlates of information acquisition, we also find that women, democrats and owners of Energy Star AC systems tend to be less likely to avoid information about environmental impacts.

This means that the combination of treatments generates a higher correlation between high temperature and information avoidance than would be expected from the treatment effects in isolation. Columns 3 and 4 reinforce this result. Generating a sense of moral obligation, through the combination of treatments, leads to a significant increase in information avoidance only when outside temperature is high.

Table 3. Treatment effects on avoidance of information on the environmental impact of AC use, overall and by outside temperature

Dependent variable	Avoid information on environmental impact			
Sample	All	All	High temp (>77F)	No high temp (=<77F)
	(1)	(2)	(3)	(4)
Action suggested	-0.525*	0.654	-0.878**	0.413
	(0.310)	(0.607)	(0.375)	(0.757)
Outside observer	-0.287	0.227	-0.483	0.170
	(0.300)	(0.592)	(0.359)	(0.759)
Action suggested x Outside observer	0.570	-1.284	1.131**	-1.403
	(0.430)	(0.893)	(0.500)	(1.044)
High temperature (>77F)		0.404		
		(0.467)		
Action suggested x High temperature		-1.553**		
		(0.717)		
Outside observer x High temperature		-0.684		
		(0.697)		
Action suggested x Outside observer x High temperature		2.414**		
		(1.034)		
Female	-0.362	-0.422*	-0.538**	-0.070
	(0.224)	(0.229)	(0.263)	(0.537)
Birth year	0.019*	0.018	0.015	0.029
	(0.011)	(0.011)	(0.013)	(0.026)
Education: some college	-0.272	-0.326	-0.260	-0.723
	(0.382)	(0.393)	(0.458)	(0.750)
Education: associate degree	-0.099	-0.082	-0.225	0.565
	(0.461)	(0.471)	(0.532)	(1.108)
Education: bachelor degree	-0.168	-0.133	-0.138	-0.395
	(0.378)	(0.386)	(0.450)	(0.822)
Education: postgraduate degree	-0.643	-0.655	-0.910	0.767
	(0.486)	(0.508)	(0.562)	(1.128)
Democrat	-0.707***	-0.695***	-0.499**	-1.731***
	(0.221)	(0.223)	(0.251)	(0.631)
Owns energy star AC	-0.491**	-0.534**	-0.304	-1.203**
	(0.229)	(0.230)	(0.261)	(0.530)
Knows savings from higher AC temperature	-0.323	-0.296	-0.383	0.100
	(0.222)	(0.225)	(0.255)	(0.557)
Constant	-35.772*	-34.338	-27.826	-55.087
	(21.342)	(21.828)	(24.868)	(51.543)
Number of Obs	395	395	304	91
Pseudo R-Squared	0.060	0.073	0.060	0.206

Note: Logit regression, robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

It thus appears that the combination of suggested action and outside observer generates a sense of moral obligation that neither ingredient can create independently. Individuals, when exposed to both, may foresee that they would feel compelled to act on the information on the environmental impact of AC use by raising the AC temperature as suggested. When the cost of such behavior is high, because of the heat, subjects may be more inclined to avoid the information, so as to reduce the moral cost of not turning up their AC thermostat.

We find less evidence of moral wiggle room leading to avoidance of information about private savings from reduced AC use. Table 4 presents analogous regression results for information on private savings. The only statistically significant result is the negative effect of suggesting a remedial action on information avoidance, which is significant at the 5% level only when temperature is high and which remains marginally significant in the full sample. Otherwise, when the information concerns the private benefits from reduced AC use, all the effects observed for information on social benefits are smaller in magnitude and not statistically significant. Weaker (non-significant) effects here are consistent with the idea of the experimental treatments generating lower social pressure when information concerns private and not social costs of AC use.[10]

Table 4. Treatment effects on avoidance of information on the potential savings from AC use, overall and by outside temperature

Dependent variable	Avoid information on potential savings			
Sample	All	All	High temp (>77F)	No high temp (=<77F)
	(1)	(2)	(3)	(4)
Action suggested	-0.497*	0.275	-0.735**	0.144
	(0.302)	(0.580)	(0.370)	(0.664)
Outside observer	-0.142	-0.390	-0.091	-0.466
	(0.289)	(0.602)	(0.342)	(0.638)
Action suggested x Outside observer	0.462	-0.376	0.723	-0.360
	(0.419)	(0.879)	(0.493)	(0.929)
High temperature (>77F)		-0.114		
		(0.454)		
Action suggested x High temperature		-1.025		
		(0.690)		
Outside observer x High temperature		0.319		
		(0.691)		
Action suggested x Outside observer x High temperature		1.110		
		(1.010)		
Female	-0.260	-0.297	-0.345	-0.077
	(0.213)	(0.217)	(0.250)	(0.489)
Birth year	0.021**	0.020*	0.025**	0.002
	(0.011)	(0.011)	(0.012)	(0.024)
Education: some college	-0.681**	-0.721**	-0.670	-1.004
	(0.345)	(0.354)	(0.414)	(0.709)
Education: associate degree	-0.183	-0.178	-0.404	0.511
	(0.424)	(0.434)	(0.511)	(0.923)
Education: bachelor degree	-0.246	-0.216	-0.134	-0.793
	(0.337)	(0.345)	(0.406)	(0.714)

[10] However, testing formally the equality of coefficients on the interaction term *Action suggested x Outside observer* across the two types of information when temperature is high, we find that the two effects are not statistically different from each other. Results available upon request.

Education: postgraduate degree	-0.796*	-0.799	-0.767	-0.925
	(0.482)	(0.497)	(0.555)	(1.226)
Democrat	-0.240	-0.226	-0.147	-0.568
	(0.217)	(0.219)	(0.249)	(0.517)
Owns energy star AC	-0.003	-0.051	0.138	-0.614
	(0.231)	(0.231)	(0.265)	(0.499)
Knows savings from higher AC temperature	-0.091	-0.084	-0.151	0.215
	(0.215)	(0.216)	(0.249)	(0.487)
Constant	-41.895**	-39.152*	-48.317**	-2.133
	(21.201)	(21.484)	(24.453)	(47.478)
Number of Obs	395	395	304	91
Pseudo R-Squared	0.029	0.040	0.041	0.080

Note: Logit regression, robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

The explanation for information avoidance at high temperatures specifically when the treatments create a sense of moral obligation for subjects to reduce their AC usage, based on moral wiggle room, also has implications about the effect of information avoidance on AC usage. If subjects are avoiding information about environmental impact to try to escape this feeling of moral obligation, then we should expect that subjects who avoid this information keep their AC thermostats lower and use more energy. Indeed, we find that avoiding information is correlated with energy use. We regress AC use indicators on a dummy equal to one if a subject avoided the information. As dependent variables, we exploit information on participants' stated willingness to raise the temperature of their AC thermostats; on AC temperatures from baseline and follow-up thermostat pictures; and on participants' stated thermostat temperature at follow-up.

Table 5 shows regression results: Panel A focuses on the effect of avoiding information on the environmental impacts, and Panel B on avoiding information on the potential savings from AC use. At baseline, participants who avoid the information on environmental impacts are less likely to claim that they are willing to raise the temperature of their AC thermostat and keep it at a lower temperature. At follow-up, those who avoided the environmental information still claim to keep their AC at a lower temperature, although this result is not statistically significant, both when we use reported and actual AC temperature from the pictures. When we focus on information on energy savings, we find that willingness to turn up the AC thermostat and self-reported AC temperature at follow-up are significantly lower, at the 1 and 10 per cent level respectively, for subjects who avoided the information.

The lack of statistical significance for the follow-up results is not due to lower effect sizes – the magnitude of the coefficients on the information avoidance indicators is similar to that of the baseline regressions- but to larger standard errors. While it is possible that we lack the statistical power to detect the effect of avoiding information on behavioral outcomes at follow-up (because our sample size is smaller and because these outcomes are noisier),[11] it is also possible that AC setting behavior is not sticky, and thus inducing one-off changes does not generate persistent effects. We cannot test these alternative explanations with the data available.

To summarize, the acquisition of information is significantly correlated with AC use, especially in the short term. The consequences of avoiding information are large, leading to AC temperatures 1.1 degrees F lower on average. Starting from the average outdoor and indoor temperatures for the sample, the additional cooling associated with information avoidance represents an increase in

[11] Power calculations suggest that we would need a sample size of about 600 and 1200 subjects to detect the effect of information avoidance on self-reported and real AC temperatures at follow-up, respectively.

electricity usage of more than 10%[12]. However, since we do not randomly allocate information acquisition, we cannot interpret this correlation as causal: it may simply indicate that individuals who intend to behave in a more environmentally friendly way are also more willing to acquire information on the consequences of their behavior.

Table 5. Correlation between information avoidance and energy saving behavior

Time	Baseline:		Follow-up:	
Dependent variable	Willing to turn up AC	AC temperature (real)	AC temperature (self-report)	AC temperature (real)
	(1)	(2)	(3)	(4)
Panel A: Information on environmental impact				
Avoid information	-0.852***	-1.129***	-0.865	-0.855
	(0.220)	(0.426)	(0.557)	(0.569)
High temp (>77F)	0.287	1.310***	1.867***	0.850
	(0.250)	(0.473)	(0.565)	(0.672)
Woman	0.256	0.026	0.652	0.027
	(0.212)	(0.431)	(0.569)	(0.567)
Constant	7.955	120.288**	176.640***	74.932
	(22.509)	(46.964)	(57.756)	(72.496)
Number of Obs	395	389	234	269
(Pseudo) R-squared	0.042	0.071	0.137	0.090
Panel B: Information on potential savings				
Avoid information	-1.083***	-0.718	-1.132*	-0.911
	(0.216)	(0.439)	(0.606)	(0.584)
High temp (>77F)	0.263	1.297***	1.843***	0.798
	(0.252)	(0.474)	(0.556)	(0.666)
Woman	0.265	0.067	0.516	-0.032
	(0.213)	(0.433)	(0.565)	(0.564)
Constant	4.096	120.890***	179.095***	75.526
	(22.436)	(46.487)	(56.826)	(72.161)
Number of Obs	395	389	234	269
(Pseudo) R-squared	0.061	0.062	0.144	0.091

Note: Columns 1: logit regressions. Columns 2, 3 and 4: linear regressions. Robust standard errors in parentheses. All regressions control for birth year, education, political affiliation, ownership of Energy Star AC and knowledge of savings from higher AC temperatures. * significant at 10%; ** significant at 5%; *** significant at 1%.

3.2. Robustness

[12] This is based on the following formula: $Electricity\ Savings = \frac{(New\ Temp - Old\ Temp)}{(Outdoor\ Temp - Old\ Temp)}$ retrieved from the following online source: https://www.bijlibachao.com/air-conditioners/ideal-air-conditioner-temperature-for-electricity-saving.html . Obviously this is a rule of thumb and actual electricity savings will depend on technology and household characteristics.

This sub-section reports the results from a series of robustness checks. First, we test the robustness of our results to using different thresholds for the definition of high temperatures. In particular, Table A1 shows treatment effects on avoidance of information on environmental impact and potential savings using real outside temperatures of 78 (>78F), 79 (>79F) and 80 (>80F) degrees F as thresholds. We display results using the triple interaction regression presented in Column 2 of Tables 3 and 4. The results are robust to the different specifications. In particular, avoidance of information on environmental impact is negatively affected by the sense of moral obligation induced by the combination of experimental treatments when outside temperature is low. This effect turns positive when it is hot outside. These results are statistically significant at the 5 per cent level when the threshold is set at 79 and 80 degrees F, and at the 10 per cent level when it is set at 78 degrees F. We also confirm the lack of statistically significant treatment effects when the outcome variable is avoidance of information on energy savings, regardless of the threshold used.

The use of different temperature thresholds may also affect the statistical significance of the correlation between information avoidance and AC use. Table A2 shows the coefficients on information avoidance, using the same specification as in Table 5, when controlling for high temperature, defined as real outside temperatures above 78, 79, or 80 degrees F. The results are robust, and even stronger, as the temperature threshold changes. In particular, the correlation between information avoidance and AC temperature settings at follow-up gains statistical significance as we control for higher temperature thresholds, with significance levels ranging between 5 and 10 per cent level.

Second, we exclude from the sample subjects who had their AC thermostats already set at 78 degrees F or above at baseline, since for these subjects the cost of acting upon the information is zero. We again use the triple interaction specification to present these findings. Table A3 shows that the results are robust to this restriction of the sample, as the combination of treatments has a positive effect on avoidance of information on environmental impacts when it is hot: the coefficient on the interaction of the treatment dummies is statistically significant at the 10 per cent level for this sample (Column 2).

Third, it is possible that the cost of following up with the information given within the experiment does not depend on the actual outside temperature, but on the temperature perceived by subjects. We thus replicate the regressions of Column 2 in Tables 3 and 4, replacing real outside temperature with subjects' reports. Table A4 reports the results, focusing on environmental impact information in Panel A, and on information on potential energy savings in Panel B. We show results using the different temperature thresholds used so far in the analysis: temperature above 77, 78, 79 and 80 degrees F. The results are qualitatively consistent with the ones using real temperature: the sense of moral obligation induced by the combination of treatments increases avoidance of information on environmental externalities, but the level of statistical significance is greatly reduced. Only for one out of four thresholds the coefficient of the triple interaction term between the two treatments and high temperature is statistically significant at the 5 per cent level.[13] When considering information on energy savings, information avoidance is not significantly higher when moral obligation is induced by the combination of treatments and the perceived cost of following up with the information is high.

To summarize, we find that our main findings are robust to different specifications. In particular, when information concerns the social costs of low AC temperatures, our results generally retain statistical significance when considering different temperature thresholds.

4. Conclusions

[13] While highly correlated with real temperatures (correlation coefficient = 0.687, p = 0.000), stated temperatures display a higher variability (mean = 77.527, sd = 8.068, see the summary statistics on real temperature in Table 2), which may contribute to the lower statistical significance of these results.

Information programs, aimed at raising knowledge on the private and social costs of energy use, are prominent energy efficiency policies in several countries (Abrahamse et al. 2005). However, evidence on the effectiveness of such interventions in filling the energy-efficiency gap is mixed (Allcott and Taubinsky 2015; Houde et al. 2013; Newell and Siikamäki 2014). We focus on one potential reason for such mixed results: individuals may actively avoid information, in order to prevent the negative utility impact from acting upon it. Our experimental design and resulting hypotheses are based on the standard theory of the instrumental value of information, and on the theory of information avoidance based on the desire to avoid feelings of moral obligation, i.e. the theory of moral wiggle room (Dana et al., 2007).

We test the role of this channel through a field experiment on AC use, and find results consistent with our hypotheses: the combination of experimental treatments, which induces a sense of moral obligation to act upon the information among subjects, has a positive effect on information avoidance, but only when the cost of acting upon it are high, and when the information is morally charged. Avoiding information has real consequences on behavior, in terms of AC use, both immediately after the experiment and one week later. Results are statistically significant and large in magnitude: avoiding information leads to extra AC cooling associated with increased electricity usage of more than 10%.

These results have important policy implications: providing information is not enough to foster behavior change. Leveraging social norms in order to create a sense of moral obligation to act upon the information can be effective, but can backfire in settings where behavioral change is costly. Tailoring the use of nudges and informational tools to the decision environment can greatly improve their effectiveness.

This paper also makes a methodological contribution, through a novel use of online labor platforms, such as Amazon MTurk, for data collection. While such platforms have been increasingly used by researchers to conduct standard behavioral games, the external validity of the results of such experiments is often questioned in economics, due to lack of experimental control and the typically low stakes. In this paper, we use the platform to address a question that would have been impossible to tackle in a traditional laboratory setting, and to collect data on real world behavior as it naturally occurs. The use of outside temperature as part of our analysis ensures that the stakes within our experiment are the same that individuals face in their daily decisions on AC use.

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Appendix A. Additional results

Table A1. Treatment effect on avoidance of information, by outside temperature: robustness using different real temperature thresholds

Dependent variable	Avoid information					
Type of information	Environmental impact	Potential savings	Environmental impact	Potential savings	Environmental impact	Potential savings
High temperature threshold	Temperature > 78F		Temperature > 79F		Temperature > 80F	
	(1)	(2)	(3)	(4)	(5)	(6)
Action suggested	0.347	0.054	0.627	0.166	0.492	0.080
	(0.593)	(0.563)	(0.570)	(0.540)	(0.520)	(0.507)
Outside observer	-0.004	-0.443	0.246	-0.095	0.301	-0.104
	(0.533)	(0.542)	(0.488)	(0.491)	(0.476)	(0.480)
Action suggested x Outside observer	-0.807	-0.107	-1.102	-0.463	-0.898	-0.269
	(0.834)	(0.816)	(0.783)	(0.762)	(0.715)	(0.699)
High temperature	0.210	-0.369	0.576	-0.113	0.573	-0.114
	(0.460)	(0.446)	(0.452)	(0.437)	(0.453)	(0.438)
Action suggested x High temperature	-1.167*	-0.738	-1.633**	-0.911	-1.552**	-0.899
	(0.706)	(0.676)	(0.698)	(0.665)	(0.661)	(0.644)
Outside observer x High temperature	-0.394	0.425	-0.827	-0.064	-0.928	-0.065
	(0.649)	(0.644)	(0.628)	(0.615)	(0.623)	(0.611)
Action suggested x Outside observer x High temperature	1.851*	0.757	2.385**	1.280	2.265**	1.124
	(0.987)	(0.959)	(0.960)	(0.929)	(0.919)	(0.891)
Female	-0.406*	-0.276	-0.429*	-0.296	-0.435*	-0.301
	(0.228)	(0.217)	(0.229)	(0.217)	(0.229)	(0.217)
Constant	-33.631	-39.878*	-31.852	-39.694*	-36.389*	-43.068**
	(21.581)	(21.473)	(21.572)	(21.625)	(21.469)	(21.467)
Number of Obs	395	395	395	395	395	395
Pseudo R-Squared	0.069	0.040	0.073	0.038	0.073	0.039

Note: Logit regression. All regressions control for birth year, education, political affiliation, ownership of Energy Star AC and knowledge of savings from higher AC temperatures. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A2. Correlation between information avoidance and energy saving behavior: robustness controlling for different real temperature thresholds

Time	Baseline:		Follow-up:	
Dependent variable	Willing to turn up AC	AC temperature (real)	AC temperature (self-report)	AC temperature (real)
	(1)	(2)	(3)	(4)
Panel A: Avoid information on environmental impact				
Temperature > 78F	-0.853***	-1.130***	-0.931*	-0.860
	(0.221)	(0.428)	(0.560)	(0.574)
Temperature > 79F	-0.858***	-1.135***	-1.015*	-0.934
	(0.221)	(0.428)	(0.557)	(0.568)
Temperature > 80F	-0.854***	-1.116***	-1.041*	-0.963*
	(0.221)	(0.422)	(0.556)	(0.565)
Panel B: Avoid information on potential savings				
Temperature > 78F	-1.073***	-0.697	-1.236**	-0.929
	(0.217)	(0.441)	(0.609)	(0.593)
Temperature > 79F	-1.074***	-0.703	-1.273**	-0.960
	(0.216)	(0.442)	(0.613)	(0.594)
Temperature > 80F	-1.071***	-0.652	-1.281**	-0.966
	(0.217)	(0.435)	(0.614)	(0.594)
Number of Obs	395	389	234	269

Note: Logit regression. All regressions control for gender, birth year, education, political affiliation, ownership of Energy Star AC and knowledge of savings from higher AC temperatures. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A4. Treatment effect on information avoidance, by outside temperature: robustness to excluding subjects with AC set at 78F or above at baseline

Dependent variable	Avoid information	
Type of information	Environmental impact	Potential savings
	(1)	(2)
Action suggested	0.357	0.159
	(0.679)	(0.641)
Outside observer	-0.011	-0.595
	(0.634)	(0.625)
Action suggested x Outside observer	-1.063	-0.393
	(0.974)	(0.955)
High temperature (>77F)	0.023	-0.277
	(0.507)	(0.476)
Action suggested x High temperature	-1.009	-0.881
	(0.791)	(0.753)
Outside observer x High temperature	-0.339	0.517
	(0.754)	(0.728)
Action suggested x Outside observer x High temperature	1.988*	1.049
	(1.128)	(1.103)
Female	-0.379	-0.316
	(0.248)	(0.238)
Constant	-21.447	-23.601
	(24.813)	(24.100)
Number of Obs	329	329
Pseudo R-Squared	0.077	0.045

Note: Logit regressions, robust standard errors in parentheses. All regressions control for birth year, education, political affiliation, ownership of Energy Star AC and knowledge of savings from higher AC temperatures. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A5. Treatment effect on information avoidance, by outside temperature: robustness to using stated temperatures

Dependent variable	Avoid information							
Type of information	Environmental impact				Potential savings			
High temperature threshold	>77F	>78F	>79F	>80F	>77F	>78F	>79F	>80F
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Action suggested	-0.473	-0.253	-0.105	-0.477	-0.577	-0.407	-0.357	-0.597
	(0.459)	(0.436)	(0.417)	(0.400)	(0.452)	(0.426)	(0.403)	(0.381)
Outside observer	-0.012	-0.117	-0.053	-0.142	-0.110	-0.165	-0.176	-0.423
	(0.435)	(0.421)	(0.397)	(0.373)	(0.428)	(0.420)	(0.395)	(0.364)
Action suggested x Outside observer	0.121	-0.015	-0.178	0.001	0.448	0.398	0.216	0.537
	(0.628)	(0.598)	(0.570)	(0.548)	(0.627)	(0.598)	(0.565)	(0.535)
High temperature	0.342	0.348	0.432	-0.236	-0.174	-0.131	-0.122	-0.699
	(0.459)	(0.456)	(0.464)	(0.469)	(0.421)	(0.419)	(0.424)	(0.451)
Action suggested x High temperature	-0.127	-0.544	-0.939	-0.094	0.144	-0.189	-0.323	0.369
	(0.636)	(0.627)	(0.632)	(0.641)	(0.610)	(0.604)	(0.608)	(0.631)
Outside observer x High temperature	-0.515	-0.353	-0.540	-0.335	-0.038	0.052	0.076	0.812
	(0.613)	(0.610)	(0.618)	(0.635)	(0.592)	(0.590)	(0.590)	(0.617)
Action suggested x Outside observer x High temperature	0.901	1.252	1.816**	1.505	0.002	0.116	0.578	-0.293
	(0.891)	(0.884)	(0.901)	(0.916)	(0.862)	(0.853)	(0.858)	(0.878)
Female	-0.370	-0.368	0.000	-0.376*	-0.263	-0.270	-0.262	-0.256
	(0.226)	(0.226)	(.)	(0.227)	(0.215)	(0.214)	(0.215)	(0.215)
Constant	-34.350	-32.645	-32.286	-34.709	-43.084**	-42.688**	-41.427*	-43.340**
	(21.537)	(21.498)	(21.426)	(21.448)	(21.157)	(21.279)	(21.456)	(21.630)
Number of Obs	395	395	395	395	395	395	395	395
R-Squared								
Pseudo R-Squared	0.065	0.066	0.070	0.071	0.030	0.031	0.032	0.035
* p<0.10, ** p<0.05, *** p<0.01								

Note: Logit regression, robust standard errors in parentheses. All regressions control for birth year, education, political affiliation, ownership of Energy Star AC and knowledge of savings from higher AC temperatures. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix B. Weather data scraping procedure

We got the real temperature in the following steps:

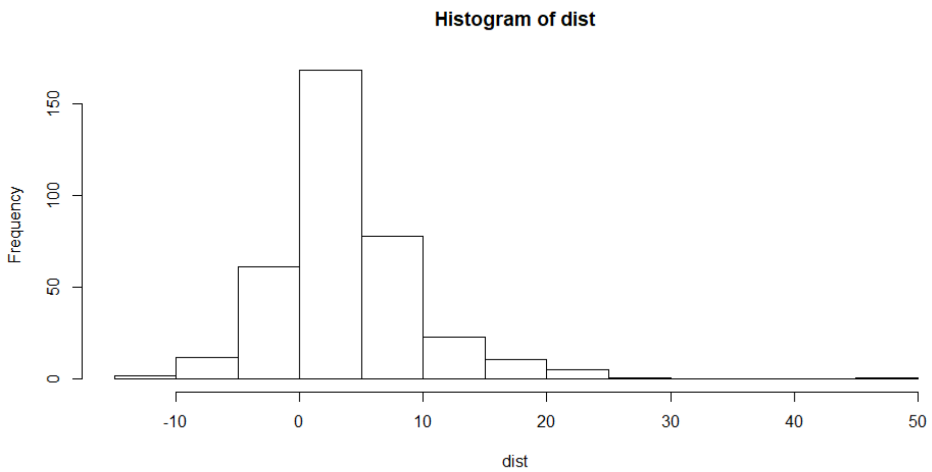
1. Find the list of airports in the US together with longitude and latitude information (1435 airports in the list).
2. Use the altitude and longitude of each subject in the Mturk file, and find the nearest airports from the subjects' home.
3. In the website address, we replace "airportcode" with the airport code we matched to each subject:
   "http://www.wunderground.com/history/airport/",airportcode, "/2017/7/03/DailyHistory.html"

   For example, if the airport code that is nearest to a subjects is PABA, then the program will search for http://www.wunderground.com/history/airport/PABA/2017/7/03/DailyHistory.html and find the temperature on the hour that the subject started answering the survey.

4. Out of 396 subjects, 33 could not find the actual temperature because the temperature was not provided by the website. For an example, please see: https://www.wunderground.com/history/airport/KCGX/2017/7/03/DailyHistory.html

It is expected that the temperature of the matched airport is not exactly the same as the reported temperature from subject at home. But as long as we assume that there is no systematic bias between the temperature at the airport and at home, the difference should be around zero.

We found the mean difference is 4.4F, as most subjects under reported the temperature. This might be because subjects were staying in AC rooms when answering the survey, that they projected the weather outside to be low.



Note: dist=actual temperature-reported temperature

Appendix C. Experiment instructions

Introduction

CARNEGIE MELLON UNIVERSITY Consent for Participation in Research - Individual decision making study

Principal Investigators: Giovanna d'Adda, Yu Gao, Russell Golman and Massimo Tavoni

This is a study being conducted by researchers at Carnegie Mellon University and Milan Polytechnic. We are studying individual decision making. In order to participate in this online study, you must satisfy the following conditions:

1. You are 18 or older

2. You are currently at home

3. You have AC in your home, and your AC has a thermostat for controlling the temperature

4. You have a camera and are willing and able to upload a photo of your AC display with your Worker ID number.

We will use the information that our subjects provide in published articles or academic presentations, but no information regarding your personal identity or your involvement as a research subject will be published or revealed. Information collected during this study will be retained by these researchers and may be used in future research projects, but this information will not be linked to you in any way. Please be aware that any work performed on Amazon MTurk can potentially be linked to information about you on your Amazon public profile page, depending on the settings you have for your Amazon profile. We will not be accessing any personally identifying information about you that you may have put on your Amazon public profile page. We will store your mTurk worker ID separately from the other information you provide to us. Participation is on a purely voluntary basis. Your participation in this study does not involve any physical risk or emotional risk to you beyond the risks of daily life. You will be asked to complete a survey. Your involvement in this experiment may benefit the field of economics by helping to advance theories about decision making. Your involvement in this study is appreciated, but you may omit responses to any questions that you wish, and you may quit participation altogether at any time without receiving any penalty or prejudice. Your compensation for successfully completing this survey will be $3.

If you complete the survey, you may be contacted in about 10 days with the opportunity to complete a follow-up survey for additional compensation. Your compensation for completing this survey is not tied to your participation in the subsequent survey.

This study has received ethical approval by the Carnegie Mellon Institutional Review Board (IRB ID: STUDY2016_00000479). If you have questions about this project, you may contact Giovanna d'Adda at giovanna.dadda@polimi.it or Russell Golman at:

Department of Social & Decision Sciences, Porter223J. Email: rgolman@andrew.cmu.edu. Phone: 412-268-3665. If you have any questions about your rights as a participant in this research, you can contact the Research Regulatory Compliance Office at Carnegie Mellon University. Email: irb-review@andrew.cmu.edu. Phone: 412-268-1901 or 412-268-5460. After you have reviewed the information provided above, please click on the "yes" button below if you wish to participate in this survey. To be eligible to participate, please remember that you must be 18 or older, be currently at home, have AC at home with a thermostat for setting the temperature, and have a camera and be willing to upload a photo.

o Yes, I wish to participate in this survey. (1)

o No, I decline the opportunity to participate in this survey (2)

Skip To: End of Survey If CARNEGIE MELLON UNIVERSITY Consent for Participation in Research Individual decision making... = No, I decline the opportunity to participate in this survey

---

Q1. What is the temperature outdoors right now (F)? If you don't know, you can check the weather on your phone or on the web.

▼ 33 (238) ... Above 125 (342)

Q2. At what temperature is your AC currently set (F)?

▼ 60 (1) ... 89 (30)

Treatment: Action suggested/Control (randomized)

Q3. [Action suggested] Saving energy and money, and reducing your greenhouse gas emission, is easy. You can just set your thermostat to at least 78 degrees F instead of 72 on a hot day.

Q3. [Control] Please proceed to receive further instructions.

Treatment: Outside observer/Control (randomized)

Q4. [Outside observer]

We will shortly ask you to send us a picture of your AC thermostat or AC remote control display.

Naomi Swerdlow will observe your survey responses and the picture of your AC thermostat. Naomi volunteers with the Sierra Club, the nation's largest and most influential grassroots environmental organization. She cares about the environment because she believes, "Everyone deserves clean water and clean air. People need to stay healthy and breathe free. Our planet needs to stay nice for our future."

Q4. [Control]

We will shortly ask you to send us a picture of your AC thermostat or AC remote control display.

Info avoidance

Q5. Would you like to find out how much you can save on you AC energy costs, by setting your thermostat to 78 degrees F instead of 72 on a hot day?

o Yes (1)

o No (2)

If Q5 = Yes

Q6. You could save up to 40% of your energy usage. According to the Department of Energy, it is one of the most effective ways to reduce your greenhouse gas emissions.

Q7. Would you like additional information on the impact of AC use on greenhouse gas emissions and the environment?

o Yes (1)

o No (2)

If Q7 = Yes

Q8. SOURCES OF AC'S IMPACT ON THE ENVIRONMENT

Energy Use: The electricity generated to power air conditioning carries both global and personal health consequences. In burning fossil fuels such as coal to supply electricity to homes and workplaces, power plants discharge clouds of soot and other pollutants into the atmosphere. Among these are mercury and carbon dioxide (CO_2). Air conditioner use in the U.S. results in an average of about 100 million tons of CO_2 emissions from power plants every year.

HCFCs: Formerly used as cooling agents, ozone-depleting chlorofluorocarbons (CFCs) have been replaced by hydrochlorofluorocarbons (HCFCs), which deplete 95 percent less ozone. However, booming demand for air conditioners in hot climates such as India and China has upped the chemical's output in developing countries 20 to 35 percent each year, causing damage at an alarming rate and possibly setting back ozone recovery by 25 years. In industrial countries, HCFCs are being replaced with ozone-safe cooling agents and will be banned in the U.S. by 2010. But HCFCs will be allowed in developing countries through 2040, and because they're still cheaper to use than ozone-safe chemicals, production in developing countries is expected to increase fivefold by 2010.

Disposal: Federal law requires that HCFCs be recovered from air conditioners and other appliances before they are dismantled for recycling or tossed in landfills, and the EPA is authorized to impose fines of up to $25,000 for failure to comply with regulations. Before discarding your old unit, search for a company that is EPA-certified to recover HCFCs. Share the Air has certified companies listed by region.

Personal Health: In the midst of sweltering heat waves, air conditioning can be a lifesaver, protecting against heat stroke and hyperthermia. But, without proper maintenance, air conditioners can also be a health hazard. Dirty filters can allow allergens, pesticides and other particulate matter to enter your home from the outside, posing threats to indoor air quality. Exposure to those pollutants can trigger a host of health problems, including allergies and asthma and eye, nose and throat irritation.

(Source: http://environment.nationalgeographic.com/environment/green-guide/buying-guide/air-conditioner/environmental-impact/)

Action

Q9. Are you willing to raise the temperature of your AC to at least 78 degrees F?

o Yes (1)

o No (2)

Q10. We now request that you take and upload a photo of your AC thermostat or your AC remote control. Please note that your compensation does not in any way depend on the temperature setting you choose.

INSTRUCTIONS FOR SENDING A VALID PHOTO:

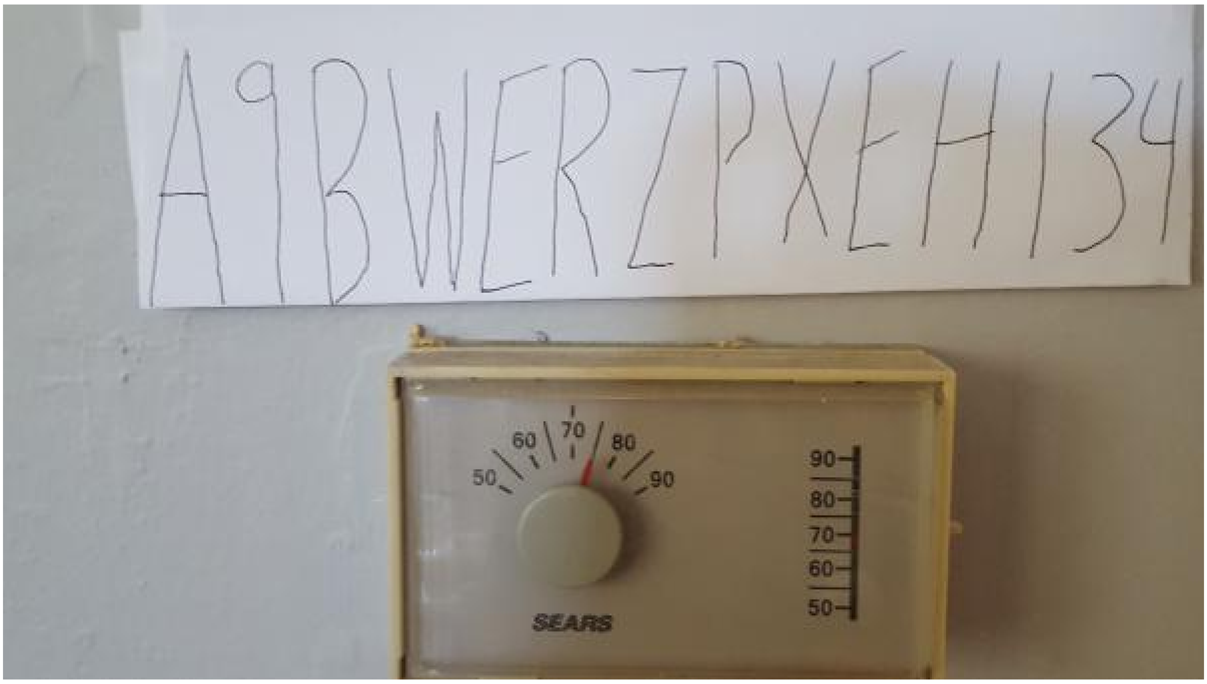
1. Make sure that the temperature, at which your thermostat is set, is clearly visible on the display you are taking a picture of

2. Place a piece of paper, on which you have written your Mechanical Turk Worker ID (handwritten and visible), next to the display.

3. Now, take a photo of the display and piece of paper and upload it below. Try to match the following photo as closely as possible:

4. If you have a webcam, you may go to Cameroid (http://www.cameroid.com) to take a snapshot from your web browser, which you may then download and upload below.

Now, take a photo of the above items and upload it below. Try to match the following photo as closely as possible:



Knowledge test

Q11. How many CO2 emissions from power plants does AC use produce in the US in a year on average?

o 10 million tons (1)

o 50 million tons (2)

o 100 million tons (3)

o 500 million tons (4)

Demographics

Q12. Are you at home or in your office?

o At home (1)

o In the office (2)

o Others (please specify) (3) ____

Q13. Are you alone in the house/office?

o Yes (4)

o No (5)

If Q13 = No

Q14. How many people are with you?

- o 1 (1)
- o 2 (2)
- o 3 (3)
- o 4 (4)
- o More than 4 (5)

Q15. At what temperature do you typically set your AC on a hot day(F)?

▼ 60 (1) ... 89 (30)

Q16. Do you normally keep your AC on when you leave the house?

- o Yes (1)
- o No (2)

Q17. Is your AC energy star?

- o Yes (1)
- o No (2)
- o I don't know (4)

Q18. On a hot day, how many hours on average is the AC on in your house?

▼ 0 (1) ... 24 (25)

Q19. Do you try to limit AC use?

- o Yes (1)
- o No (2)

Q20. What is your gender?

- o Male (1)
- o Female (2)

Q21. What year were you born?

▼ 1900 (1) ... 1997 (104)

Q22. What is the highest level of education that you have completed?

- o Some high school (1)
- o High school (2)
- o Some college (3)
- o Associate's degree (4)
- o Bachelor's degree (5)
- o Master's degree (6)
- o Professional or doctoral degree (7)

Q23. Please indicate your approximate yearly household income before taxes. (Include total income of all adults living in your household.)

- o Under $25,000 (1)
- o $25,001 - $49,999 (2)
- o $50,000 - $74,999 (3)
- o $75,000 - $99,999 (4)
- o $100,000 -$149,999 (5)
- o $150,000 and over (6)

Q24. Which political party do you most strongly support and/or identify with?

- o Democrat (9)
- o Republican (10)
- o Independent (11)
- o Libertarian (12)
- o Green (13)
- o Socialist (14)
- o Tea Party (15)
- o Other (16) ____________________
- o None (17)

Q25.

Recently you may have noticed that global warming has been getting some attention in the news. Global warming refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate may change as a result.

What do you think? Do you think that global warming is happening?

▢ Definitely not (13)

▢ Probably not (14)

▢ I don't know (15)

▢ Probably yes (16)

▢ Definitely yes (17)

Q26. Assuming global warming is happening, do you think it is ...

o Caused mostly by human activities (1)

o Caused mostly by natural changes in the environment (2)

o Other (3)

o None of the above because global warming isn't happening (4)

Q27. How much do you think global warming will harm future generations of people?

o Not at all (1)

o Only a little (2)

o A moderate amount (3)

o A great deal (4)

o Don't know (5)

Q28. Do you think citizens themselves should be doing more or less to address global warming?

o Much less (1)

o Less (2)

o Currently doing the right amount (3)

o More (4)

o Much more (5)

Q29. Over the past 12 months, how many times have you punished companies that are opposing steps to reduce global warming by NOT buying their products?

o Never (1)

o Once (2)

o A few times (2-3) (6)

o Several times (4-5) (7)

o Many times (6+) (3)

o Don't know (4)

Q30. Do you have children?

o Yes (1)

o No (2)

Q31. How often do you play the lottery?

o Daily (4)

o Weekly (5)

o Monthly (6)

o Yearly (7)

o Rarely (only a few times in my life) (8)

o I've never done it (9)

Q32. What is your marital status?

o Single, never married (1)

o Married or domestic partnership (2)

o Widowed (3)

o Divorced (4)

o Separated (5)

Q33. Did any part of this survey seem familiar to you?

o Yes (9)

o No (10)

Q34. For this study, it was important that you paid attention to all the descriptions and carefully read the question text. From the choices below, please select the city that begins with the letter B to indicate that you have been reading the questions.

o New York (1)

o Baltimore (2)

o Pittsburgh (3)

o Chicago (4)

o San Francisco (5)

If Q33 = Yes

Q35. Please explain what part of the survey seemed familiar to you and why it seemed familiar:

____

____

____

____

____

Q36. Do you have a guess for what the research question of this survey is?

____

Q37. Thank you for your participation! Do you have any comments for the researchers? (optional)

____

____

____

____

____

Email and code

We would like to contact you again in about 10 days, to ask you a few questions. You will receive $1 for your participation in the follow-up survey.

Please leave us your email address, so we can contact you again:

____

Thanks for completing this HIT! Please paste the following completion code into mechanical turk to receive your payment:

${rand://int/10000:99999}

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