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Using social norm to promote energy conservation in a public building

Yaqin Liu*, Diogo Veríssimo, Faraz Farhidi

Department of Economics, Andrew Young School of Policy Studies, Georgia State University, Atlanta, GA, United States

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ABSTRACT

In the last decade, there have been an increasing number of interventions that rely on social norms to leverage support for changes in behavior. Many of these interventions target environmentally relevant behaviors such as water and energy consumption, most commonly at the household level. In this paper, we present a field experiment that examines the impact of social norms on petition signing addressing energy consumption in a University campus building. Our results indicate that social norms have an impact on student's support for the initiative, with 5% more students signing a petition to adjust the building's thermostat by 2 °F when informed that 90% of students initially agreed to sign the petition. Our research highlights that social norms can be used to influence individual behavior in a petition signing context, which is more likely to lead to permanent change, than those contexts where individuals need to repeatedly sustain these changes individually over time.

1. Introduction

As climate change becomes increasingly recognized as the key environmental issue of our times [1], there is overwhelming scientific consensus that only a large reduction in greenhouse gas emissions can reduce the risks and impacts associated with climate change [2]. Yet, to achieve meaningful reductions, we will need to change our energy use patterns. One of the more immediate and cost-effective paths to accomplish this is to increase energy conservation and improve use efficiency [3].

Historically, this challenge has been tackled through technological innovation, such as the development of more energy efficient electrical and mechanical equipment [4]. However, using energy more efficiently is not just a technological issue, human behavior plays a crucial role in it. In fact, there is a rapidly growing body of evidence supporting the idea that "energy use is not determined just by the equipment we purchase, but how we use it" [4]. Behavioral adjustments and prospects have a great impact on thermal adaptation [5]. Yet the challenge remains, how can we incentivize individuals to change their behavior in a lasting way?

Previous research on human behavior and the environment has shown that while people stated they engaged in energy conservation behaviors because of economic or environmental concerns, these factors were weak predictors of actual behavior. The strongest predictor of energy conservation intentions was in fact, social norms, group-based standards or rules regarding appropriate attitudes and behaviors [6].

Social norms play an essential role in shaping how individuals interpret and act [7–9]. There are two types of norms: injunctive norms and descriptive norms [10]. Injunctive norms reflect perceptions of what others approve or disapprove of, and motivate action because of the social rewards and punishments associated with engaging, or not engaging, in the behavior. Descriptive norms reflect perceptions of whether other people actually engage in the normative behavior themselves, and motivate action by informing people about what is likely to be effective or adaptive behavior in a particular context. Considering the differences between the two types of norms [11,12], our research focuses on the latter, as they tend to motivate behavior in the immediate context in which others' behavior occurs or can be observed. The effectiveness of descriptive social norms has been observed in pro-environmental behaviors, including energy and water conservation [6,13,14]. However, published studies have so far mostly focused on private behaviors that affect individual outcomes such as household's energy or water consumption. Despite a few previous studies addressing group norms [15–17], we know relatively little about how social norms influence private behaviors that affect collective outcomes, a situation considered in this paper that is particularly common when considering pro-environmental behaviors.

In this paper, we consider an initiative to save energy in a public building by adjusting the general thermostat. Our target is a teaching building on Georgia State University campus. The thermostat of the whole building is preset and controlled by building main-

* Corresponding author at: 556R, 14th Marietta Street, Atlanta, GA 30303, United States.
E-mail address: yliu64@student.gsu.edu (Y. Liu).

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tenance. The users (students and teachers) of the building do not have access to the thermostat. Contrary to energy and water conservation in households, adjusting the thermostat of the building needs consent from a large majority of the users. In the experiment, we ask users to sign a petition to adjust the thermostat up in summer and turn it down in winter. An important difference from household conservation choice is that once the change is implemented, the new temperature settings will be permanent. Unlike in a household where individuals need to make choices repeatedly and treatment effect decays, we target a long-lasting conservation that only requires a single decision from users.

Within this context, we examine the effect of descriptive social norms on petition signing. Descriptive social norms have been shown to influence voter turnout [18–20]. Coleman [21] also shows that social conformity shifts individual's choices on which party to vote for. This connection has been examined only in a few studies such as Margetts [22] who investigated the idea of how social norms impact petition signing but did not look into environmental issues. Our research tries to leverage the predicted impact of social norms on petition signing behavior to achieve a permanent change in public building energy consumption.

2. Energy efficiency in public buildings

An evaluation by the U.S. Department of Energy uncovered that buildings account for 40% of all energy use in the United States, more than either industry or transportation. US Buildings also account for about 9% of worldwide carbon dioxide emissions, more than Japan, France and the United Kingdom combined [23]. Energy use has grown in both residential and commercial buildings across the US, and while residential energy consumption exceeds commercial, the latter has been increasing more rapidly, from 14% of total U.S. energy consumption in 1980 to 18% by 2005 [23]. This substantial overall energy consumption means that even proportionally small energy savings can produce meaningful environmental benefits allied to reductions in economic costs. Nevertheless, most of the literature on social norms and energy conservation focuses on energy consumption at the household level [14,24,25].

This is an important gap on our knowledge as there are major differences between the way energy is managed in the residential and commercial sectors. In residential buildings, occupants are directly in charge of controlling energy use and also response for the energy costs. There is therefore a motivation to keep the balance between comfort and energy consumption. However, in commercial buildings, the majority of buildings are managed centrally, with the owner being responsible for the energy cost. In this case, users typically do not have a direct financial interest to conserve energy at work as they do at home [26]. Even among those who are motivated to conserve energy for non-financial reasons, the presence of a general control set by the building manager or owner, may impact the perceived ability of an individual to influence change and make it more difficult to access information on how much energy is being used.

The target building in this paper is the Aderhold Learning Center building situated in Atlanta, Georgia, which is one the biggest classroom buildings on the Georgia State University (GSU) campus, with an area of about 200,000 square feet. It is also one of the most used, with 20,000 students using it every semester. The total energy use of the Aderhold Learning Center building in 2013 was about 2.9 million of KWh, which is equivalent to 260 U.S. household's yearly consumptions. According to the U.S. Energy Information Administration, the average annual electricity consumption for a U.S. residential utility customer was 10,908 KWH in 2013.

The largest energy expense in US buildings, more than a quarter total energy consumption, is around cooling and heating [23]. In the Aderhold Learning Center building the temperature range has been centrally set between 64 and 72 °F. If the thermostat of Aderhold Learning Center building is adjusted by 2°, the degree days of cooling and heating will be reduced by 21% and reduce overall energy consumption of Aderhold Learning Center building by about 5% (Appendix A). This motivated us to investigate how social norms could be used to influence the support of the users of this publicly owned building for a voluntary permanent thermostat adjustment to save energy and reduce costs to GSU.

3. Experimental methods

3.1. Overview

The experiment took place in the Aderhold Learning Center Building of Georgia State University (GSU) from Nov to Dec 2014. As we mentioned above, Aderhold Learning Center building is one of the largest and most used buildings and it is open to students of all years and majors. The experiment was implemented both in the morning and afternoon of Monday through Friday to cover all possible majors. The entire sample covers over 50 different majors in the five main categories: arts and humanities, science, business, engineer and education.

The temperature of the building is controlled by a central control and it has been set at the range 64–72 °F for the past decades. The windows cannot be opened or closed by students in the building. Also, using personal air conditioner or heater is strictly prohibited on such buildings in the university. Since 2011, there have been 77 complaints regarding rooms being too hot or too cold at Aderhold Learning Center building. Considering that around 20,000 students use Aderhold Learning Center building each semester, the perceived actual comfort level in general is satisfactory. More technical information on the HVAC system of Aderhold Learning Center building is provided in Appendix A.

Over the course of the months of November and December in Atlanta, the temperature is characterized by rapidly falling daily high temperatures, with daily highs decreasing from 68 °F to 58 °F and from 58 °F to 52 °F respectively [27]. The thermostat was set at 65 °F during the period that the experiment was carried out.

The data collection was carried out in collaboration with the Sustainable Energy Tribe (SET), an active student association at GSU. SET frequently runs petitions for promoting energy and water conservation across the GSU campus. We had six interviewers, half male and half female, who are undergraduate and graduate students from GSU. The age ranges from 20 to 31. We had both white and black interviewers and one Asian interviewer. The nationalities are Portuguese, American, Chinese and Iranian.

It was stated in script that the petition will be submitted to the President of GSU. The Georgia State University has specific rules for University-level policy waiver or variance petitions. If the petition is approved by the university committee, the thermostat in the Aderhold Learning Center building will be reset. If the petition is rejected, no adjustment will be made. Subjects were aware that they only signed a petition that may or may not lead to an actual change.

3.2. Field experiment procedure and data collecting

We conducted a randomized field experiment. The petition was modified to include two phases. In phase one, in the first three days of the experiment, a random sample of students in the Aderhold Learning Center building were asked by SET members about the petition and the percentage of people who signed was recorded.