

Energy conservation goals: What people adopt, what they recommend, and why

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Abstract

Failures to reduce greenhouse gas emissions by adopting policies, technologies, and lifestyle changes have led the world to the brink of crisis, or likely beyond. Here we use Internet surveys to attempt to understand these failures by studying factors that affect the adoption of personal energy conservation behaviors and also endorsement of energy conservation goals proposed for others. We demonstrate an asymmetry between goals for self and others (“I’ll do the easy thing, you do the hard thing”), but we show that this asymmetry is partly produced by actor/observer differences: people know what they do already (and generally do not propose those actions as personal goals) and also know their own situational constraints that are barriers to action. We also show, however, that endorsement of conservation goals decreases steeply as a function of perceived difficulty; this suggests a role for motivated cognition as a barrier to conservation: difficult things are perceived as less applicable to one’s situation.

Keywords: energy conservation, actor/observer bias, motivated reasoning

1 Introduction

As part of a study of perceptions of energy use and savings, Attari, DeKay, Davidson and Bruine de Bruin (2010) asked subjects to name “the most effective thing that you could do to conserve energy in your life”. Many answers (about 20%) involved variations on “turning off lights”, but others suggested more major changes in life style (e.g., “drive less”) or increased efficiency of cars or appliances. In the present studies we explore some factors that correlate with choice of these different answers. In particular, we ask how answers for oneself differ from answers proposed for others (the most effective thing that *Americans* can do). These explorations are important in order to understand both adoption of individual change goals and endorsement of energy conservation policies that would apply to all Americans.

We expected people to favor “low hanging fruit” both

for themselves and others: changes that are highly effective but not too difficult. Thus, two obvious factors that we expected to correlate with behavioral change goals (for self) and policy goals (changes that others should make) are the *perceived effectiveness* and the *perceived difficulty* of the changes. In addition, we expected people to omit goals not applicable to their lives: for example, urban dwellers who rely mostly on public transportation will not propose to conserve energy by driving less or buying energy-efficient cars (even though they may suggest these changes for others). Finally, there is a conversational rule (Grice, Cole & Morgan, 1975) that may be important: something that one does already is not usually put forward as a goal. Someone who is already assiduous about turning off lights is thus less likely to endorse that as a behavioral goal for self.

These obvious factors suggest reasons why goals for self and others might differ. Perceived effectiveness and difficulty should play a role in both; but perception of applicability to one’s life and knowledge of what one already does are factors that can affect behavioral goals for self but not recommendations for abstract others. A difference between answers for self and for others could thus derive from actor/observer differences or failures of perspective taking. People view their own behavior as more constrained by situational requirements and context than other people’s behavior, in part because they have more information about their own constraints. A somewhat different basis for self/other differences would be motivated cognition, affecting beliefs about the effectiveness of difficult behaviors (Campbell & Kay, 2014; Kunda, 1990). For example, in formulating personal goals, individuals could under-rate the effectiveness of

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Table 1: Percentage of open-ended endorsements provided in Study 1 and Study 2 for the single most effective behavior for self and Americans.

| Categories | Study 1 (N = 717) | | Study 2 (N = 685) | |
|-------------------------------------|-------------------|-----------|-------------------|-----------|
| | Self | Americans | Self | Americans |
| Turn off lights | 19.5 | 13.0 | 13.6 | 10.2 |
| Drive less | 19.3 | 31.8 | 19.3 | 31.8 |
| Turn off appliances | 10.9 | 7.8 | 12.6 | 10.7 |
| Change setting on the thermostat | 9.1 | 4.6 | 10.7 | 5.7 |
| Sleep/relax more | 7.3 | 4.6 | 1.8 | 1.3 |
| Use appliances less | 5.4 | 4.6 | 8.3 | 4.7 |
| Unplug appliances | 5.0 | 2.8 | 7.0 | 4.5 |
| Conserve water/energy | 4.6 | 4.5 | 4.2 | 1.5 |
| Use energy efficient bulbs | 2.8 | 3.6 | 2.8 | 3.6 |
| Consume less | 2.7 | 4.0 | 0.9 | 2.2 |
| Other (each only mentioned once) | 2.4 | 1.8 | 4.5 | 3.2 |
| Use efficient cars/hybrids | 2.2 | 2.2 | 2.3 | 6.7 |
| Use efficient appliances | 1.8 | 2.9 | 3.9 | 3.1 |
| Change my lifestyle | 1.8 | 2.5 | 1.3 | 0.9 |
| Buy green energy | 1.3 | 3.2 | 1.6 | 3.4 |
| Buy green products | 1.1 | 1.0 | 0.3 | 0.0 |
| Eat green | 1.0 | 1.0 | 0.6 | 0.3 |
| Recycle | 0.7 | 1.4 | 0.9 | 1.5 |
| Insulate my home/weatherize | 0.4 | 0.4 | 1.3 | 1.5 |
| There is no way/I don't know | 0.4 | 0.4 | 0.1 | 0.0 |
| Awareness/education; more attention | 0.1 | 1.4 | 1.8 | 2.8 |
| Phase out inefficient technologies | 0.1 | 0.4 | 0.0 | 0.6 |

behaviors they perceive as difficult, but might do this less in recommendations for others.

In this article we present a very brief Study 1, showing an asymmetry between goals for self and for others, and a more complex Study 2, which replicates the asymmetry and explores the factors that affect adoption of conservation goals for self and conservation policies for others.

2 Study 1

The first study (October, 2010) was designed very simply to test asymmetry between goals for oneself and for other Americans. We recruited 760 participants via Amazon's Mturk panel; of these, 717 gave complete data. Two open-ended questions were presented in a fixed order as shown:

In your opinion, what is the single most effective thing that **you** could do to use less energy in your life?

In your opinion, what is the single most effective thing that **Americans** could do to use less energy in their life?

Coding. The open-ended responses to both questions were sorted by two independent coders into 22 categories (see row labels in Table 1). These categories were devised by examining an initial subset of 40 surveys. All the survey responses were then coded independently by the two coders using these categories. Inter-rater agreement for the two coders yielded $\kappa = .78$, a reasonably high value for 22 categories.

Results. The first two numeric columns in Table 1 show the frequencies for the 22 categories for self and for Americans for Study 1. Note that the use of 'Turn off lights' for self is nearly 20%, similar to the finding of Attari, et al. (2010), while this category falls to 13% for Americans. (The columns on the right in Table 1 show frequencies for Study 2, introduced below).

Table 2: Joint distribution (percentages) of endorsement categories for self and for Americans from Study 1 ($N = 717$) from open-ended responses. Tests of the asymmetry in response shifts from Self to Americans, indicated by the arrow, are given as estimated log odds with estimated standard error.

| | | Open-ended Americans | | |
|------|------------|--|------------|-------|
| | | turn off | drive less | other |
| Self | turn off | 11.9 | 5.7 | 12.8 |
| | drive less | 0.8 | 12.8 | 5.6 |
| | other | 8.1 | 13.3 | 29.0 |
| | | diagonal asymmetry: $\log_e(5.7/0.8) = 1.96 \pm 0.45$ | | |

The first three rows of Table 1 already suggest a large asymmetry of goals for self versus recommendations for Americans. Both “turn off lights” and “turn off appliances” are a bit higher for self than Americans, while “drive less” is much higher for Americans than for self. To simplify analysis we recombined the data using just 3 categories, “turn off” (lights/appliances), “drive less”, and “other” (the 19 remaining categories). Table 2 shows the joint frequency distribution for self and for Americans after this recombination. (Tables 1 and 2 give percentages, for clarity; one multiplies by $N = 717$ to get counts for purpose of statistical analysis.)

The asymmetry between self and Americans manifests itself in two ways in Table 2. The most obvious is the discrepancy between the (1,2) and (2,1) cells (see arrow): 5.7% of the sample changes from “turn off” for self to “drive less” for Americans, while only 0.8% show the opposite pattern. This is statistically significant, given the large sample size.¹

The less obvious asymmetry in Table 2 comes from the last column and last row, cells (1,3) and (2,3) versus cells (3,1) and (3,2). One sees that for those choosing “other” for Americans, many more choose “turn off” than “drive less” for self, while among those choosing “other” for self, many more choose “drive less” than “turn off” for Americans. The log odds ratio based on this comparison of 4 cells is

$$\log_e(12.8/5.6) - \log_e(8.1/13.3) \approx 1.32 \pm 0.25.$$

The finding of asymmetry in this study led us to design Study 2. This second study had three goals. First, we wanted to investigate the asymmetry further by testing the role of order of asking the two questions. Second, we wanted to replicate the result with closed-ended as well as open-ended

¹Here and throughout, our statistical analysis presents estimated values along with their estimated standard errors. The estimated log odds for these two cells in Table 2 is $\log_e(5.7/0.8) \approx 1.96$ and the estimated s.e. is $\sqrt{[1/(.057 \times 717) + 1/(.008 \times 717)]} \approx 0.45$; thus, for a test of null hypothesis, $t = 1.96/0.45 \approx 4.36$ (in essence, a McNemar test of symmetry).

assessments of energy-conserving actions. Finally, we took the opportunity of using a closed-ended list of actions to assess perceptions of the effectiveness, difficulty, and applicability to one’s situation of these actions and the relationship of these latter perceptions to choices for oneself and for other Americans.

3 Study 2

Participants. In July 2012, we recruited 685 participants via Amazon’s Mturk. On completion, each participant received a \$3 gift certificate to Amazon. Median age was 27 years and 50% of the participants were male. The median family income was reported in the category \$20,000–\$50,000. Forty-one percent had a college degree or more education. Fifty-nine percent self-identified as liberals, 21% as moderates, and 20% as conservatives.

Survey Questions. At the beginning of the survey, participants answered the two open-ended questions of Study 1, but both orders were used (randomized assignment). The question order self/Americans was encountered by 341 participants and the opposite order, Americans/self, by 344 participants. After participants completed the open-ended questions, they were asked to complete two similar closed-ended questions retaining the initial ordering, self/Americans or Americans/self. The questions stated:

Which of the following behaviors is the single most effective behavior that **you** could do to use less energy in your life? (Please check one behavior.)

Which of the following behaviors is the single most effective behavior that **Americans** could do to use less energy in their lives? (Please check one behavior.)

Closed-ended response options. Seven response options were provided for each question: (1) Turn off lights and appliances when not in use, (2) Drive less and use other forms of transportation, (3) Buy green energy from your [their] utility provider, (4) Use energy-efficient bulbs, (5) Change settings on the thermostat (turning up air-conditioner in the summer and turning down thermostat in winter), (6) Consume less, and (7) Buy a fuel-efficient car. These seven actions were chosen based on Study 1’s open-ended responses. They vary widely in frequency of endorsements (19.5% of the participants in Study 1 endorsed “turn off lights” for self while only 1.1% endorsed “buy green energy” for self – see Table 1). They were also chosen based on a wide spread in difficulty, applicability, and effectiveness as judged by the authors. Note that all seven actions are somewhat or very ambiguous in terms of energy savings; especially “consume

less” (how much less?). The same ambiguity is obviously present in the open-ended responses.

Do it already/Difficulty. Next, participants answered questions about how easy or difficult they found each of the behaviors. As part of the probe of perceived difficulty, we asked respondents whether they claimed to do the action in question already. “Do it already” was placed as the extreme left end of a response scale, with the rest of the scale offering six levels from “Extremely easy” to “Extremely hard”. The probe was:

Please indicate how easy or hard it would be for you to make each of the following changes. Please consider all aspects of the changes, including the physical or mental effort required, the time or hassle involved, and any relevant monetary costs. If you already engage in the activity please check “do it already” (far left).

This design was motivated by two considerations: first, “do it already” provides a desired self-report of actions taken; second, we felt that difficulty judgments might have a different basis for actions experienced versus imagined. We opted to obtain only the latter, from those who did not claim to do it already, and to accept the consequent limitations on using the difficulty scale in data analysis. In this design we are able to correlate respondents’ self-reported energy conservation actions (whether they do the action already) with their perceptions of effectiveness and applicability for those same actions, and with other individual-level variables, but not with their individual perceptions of difficulty.

Effectiveness. Similarly, participants were asked to rate on a four-point scale how effective they found each behavior: Hardly effective at all, Somewhat effective, Substantially effective, Extremely effective. The question stated:

Please indicate how effective or ineffective each of the following behaviors is in terms of decreasing an individual’s energy use.

Applicability. Participants then were asked how applicable each behavior was to their lives with three response options: Very applicable, Somewhat applicable, and Not at all applicable. The question stated:

Please indicate how applicable or not applicable each of the following behaviors is to your life. In considering how applicable each behavior is, consider whether the behavior is relevant to your life.

Other survey items. Subsequent questions included the New Ecological Paradigm (NEP) scale, a 15-item instrument for assessing pro-environmental attitudes (Dunlap,

Van Liere, Mertig & Jones, 2000). We coded the original responses (1 = *completely disagree*, 7 = *completely agree*) in the pro-environmental direction and averaged them to yield an overall NEP score for each participant. Participants also rated four statements regarding personal efficacy and belief in climate change (e.g., “I believe that I need to change my lifestyle to address global warming and climate change”), which we used to calculate an overall *climate-change attitude* score. Next participants completed Schwartz et al.’s (1997) *numeracy* assessment, which consists of three open-ended questions. Demographic questions concluded the survey. The entire survey is available in the supplement.

3.1 Results for Study 2: Overview

We begin with this overview of all the results, then follow with detailed analyses in the same order as the overview. We first follow up Study 1 by analyzing the responses to the two open-ended questions (self and Americans); we add to this similar analyses for the endorsements for the closed-ended list of actions. This set of analyses shows that the asymmetries found in Study 1 are replicated, both for open-ended responses and endorsements for the closed-ended list. It also emerges that order of asking about self versus Americans has at most small effects.

Next we relate endorsements of the closed-ended list of actions to ratings of perceived effectiveness, to ratings of applicability of the actions, and to whether or not the actions have already been adopted. As predicted, endorsement of an action for self correlates with all three of these variables: people are more likely to endorse actions that they view as effective and as applicable to their lives, and are unlikely to endorse as goals actions that they do already. Endorsement of an action for Americans, on the other hand, depends mainly on perceived effectiveness of the action. This difference between factors underlying endorsement shows the importance of probing assumptions in formulating questionnaire items. Without applicability and do it already questions, we would misunderstand people’s endorsements for self.

These first two segments of results do not take account of the difficulty of the actions on the closed-ended list. Recall that difficulty was rated only for those actions not reported as “do it already”. Thus, perceived difficulty cannot easily be included in linear models for endorsement of an action. We can, however, relate both the perceived effectiveness of an action and the probability of endorsing that action to *average difficulty*, a consensus measure based on the ratings of those who do not report “do it already”. We find that perceived effectiveness increases with this difficulty average, but the slope is shallow. In contrast, perceived applicability to one’s life and reports of “do it already” decreases sharply with the consensus difficulty.

The final section of the results deals with the reports of “do it already”. We briefly discuss multivariate aspects of these reports: intercorrelations for the 7 actions are positive, though low. Not surprisingly, probability of “do it” increases with rating of applicability. Two results are surprising, however. Rated effectiveness is not correlated with “do it”; yet a consensus rating of applicability correlates strongly with “do it”. That is, the larger the percentage of people who think an action is applicable to their lives, the more likely people are to report that they do it.

3.2 Study 2: Symmetry and order effects for endorsements

The same 22 categories as in Study 1 were used to code the responses in Study 2. Inter-rater reliability was high ($\kappa = .86$). The last two columns of Table 1 show the distributions of category use in Study 2, combining data from the two orders of the open-ended questions. These results are roughly similar to those from Study 1; in particular the shift from “turn off” (self) to “drive less” (Americans) is apparent in the first 3 rows. (The fact that figures for “drive less” are identical in the two studies to 3 decimal places is surprising coincidence, not typographical error.)

The results for endorsements of an action from the closed-ended list introduced in Study 2 are quite similar to the open-ended results and are shown in Table 3.

Here, the shift from “turn off” for self to “drive less” for Americans is obvious in the first two columns of the table. There is also an interesting reduction in *adjust thermostat* from self to Americans. We analyze the shift from “turn off” to “drive less” in detail using the joint distributions (Table 4).

The left half of Table 4 is parallel to Table 2 from Study 1: it shows the joint distribution of responses for self and Americans, with categories combined to yield a 3×3 table. Both the diagonal asymmetry and the 3rd row/column asymmetry from Table 2 are seen again in Table 4. The statistical evaluation for the diagonal asymmetry is shown in the last row of the table. Again, in the 3rd column, those choosing “other” for Americans, tend to choose “turn off” rather than “drive less” for self, while in the 3rd row, those choosing “other” for self tend to choose “drive less” rather than “turn off” for Americans. The log odds ratio for this comparison of 4 cells is 1.18 ± 0.26 , similar to Study 1.

The 3×3 table in the right half of Table 4 was constructed using the choices to endorse “turn off”, “drive less” or one of the remaining 5 actions in the closed-ended list (grouped as “other”). The same asymmetries appear. The diagonal asymmetry is larger for these closed-ended endorsements while the 3rd row/column asymmetry is about the same. The log odds ratio for this latter asymmetry is 1.52 ± 0.26 . The largest difference between the open-ended and closed-ended results is the reduction in the (3,3) cell proportion (“other”

for both self and Americans).

It was perhaps plausible that part of the shift between self and Americans is attributable to the order of questions in Study 1. After choosing an action for self, some respondents may have self-instructed to choose some other action for Americans. On this hypothesis, the shift should be reversed, or at least be quite different, when the question order is reversed. Study 2 allows us to test this by a between-group comparison of the joint distributions for self and Americans with opposite orders. Table 4 can be reconstructed for each order (recall that the order of closed-ended questions was the same as for the open-ended). We do not find substantial differences between the joint distributions. The null hypothesis (identical joint distributions) cannot be rejected. For the open-ended responses, $\chi^2 = 9.52$ (LRT, 8 *df*), while for the closed-ended endorsements $\chi^2 = 14.7$ (LRT, 8 *df*, $p > .05$). For each order, both open-ended and closed-ended responses show the asymmetries of Table 4. We tentatively conclude that order effects are at any rate not large. Subsequent analyses combine the data from the two orders of presentation.

3.3 Study 2: Correlates of the closed-ended endorsements

Endorsements of actions from the closed-ended list, for other Americans, are mainly related to judged effectiveness of those same actions. Figure 1A graphs these relations.

Effectiveness rating 1 (not at all) was used infrequently and is thus combined with rating 2 (somewhat) to obtain stable percentages for Figure 1. The top endorsement percentages in Figure 1A range up to about 50%. For example, of the respondents who rate drive less as 4 (highly effective), over 50% endorsed drive less for other Americans. One should keep in mind that only one action of the 7 listed could be endorsed, while several might be rated as maximally effective (rating 4 or 3, depending on the individual). In fact, 80% of endorsements were made for an action that the respondent rated as maximally effective.

By contrast, endorsements of actions for self (Figure 1B) are related not only to *perceived effectiveness*; for most actions they are also related to *perceived applicability*, and (with strong negative regression coefficients) to *do it already*. All of these relations are indicated in Figure 1B, but for clarity this figure includes only the average of two endorsement proportions: “drive less” and “adjust thermostat” which are very similar. This simplification allows the figure to display three separate results, relating the endorsements also to *perceived applicability* and *do it already*. The direction of these relationships is representative for all 7 of the actions, but the magnitudes of the effects vary somewhat, as documented below in the table of regression coefficients.²

²The average curves look similar for all 7 actions but it seemed better to

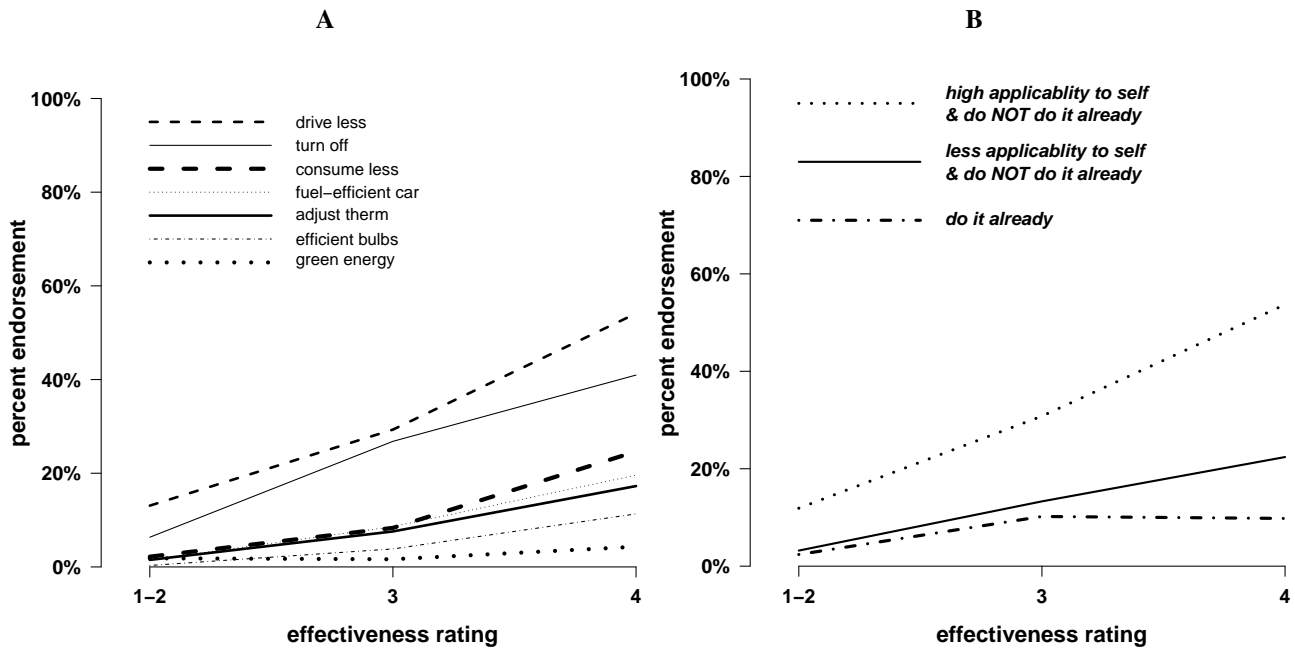
Table 3: Marginal percentages of closed-ended endorsements for self and Americans (Study 2).

| | turn off | drive less | consume less | fuel-effic car | adjust therm | efficient bulbs | green electric |
|-----------|----------|------------|--------------|----------------|--------------|-----------------|----------------|
| Self | 40.7 | 20.0 | 12.1 | 7.2 | 14.2 | 3.9 | 1.9 |
| Americans | 24.1 | 38.7 | 13.9 | 9.6 | 8.2 | 3.4 | 2.2 |

Table 4: Joint distributions (percentages) of endorsement categories for self and for Americans from Study 2 (N = 685) from open- and closed-ended responses. Tests of the asymmetry in response shifts from self to Americans, indicated by the arrows, are given as estimated log odds with estimated standard errors.

| | | Open-ended | | | Closed-ended | | |
|------|------------|--|------------|-------|---|------------|-------|
| | | Americans | | | Americans | | |
| | | turn off | drive less | other | turn off | drive less | other |
| Self | turn off | 10.2 | ↗ 6.0 | 11.5 | 15.6 | ↗ 12.0 | 13.1 |
| | drive less | 1.5 | ↖ 12.8 | 5.0 | 1.3 | ↖ 13.4 | 5.3 |
| | other | 9.2 | 13.0 | 30.8 | 7.2 | 13.3 | 18.8 |
| | | diagonal asymmetry: $\log_e(6.0/1.5) = 1.41 \pm 0.35$ | | | diagonal asymmetry: $\log_e(12.0/1.3) = 2.21 \pm 0.35$ | | |

Figure 1: (A) Endorsement of actions for other Americans related to judged effectiveness of the actions; (B) Endorsement for self of 'drive less' and 'adjust thermostat' related to judged effectiveness of those actions and to other factors. The endorsement for self is similar for these two actions and thus represents both well. Judged effectiveness operates similarly for the other actions (omitted). The figure also shows how judged effectiveness is moderated by applicability to self and by whether or not the participant already does that action.



average only two actions, with rather similar regression coefficients, than to average across heterogeneous regressions or to present a confusing display

with separate curves for the 7 actions. The simpler display allows separate curves as a function of perceived applicability and “do it already”.

Table 5: Logistic regression coefficients (± 1 estimated standard error).

| Endorsement for Self | | | | | |
|----------------------------------|------------------|------------------|------------------|------------------|------------------|
| Action | Intercept | Effective | Applicable | Do it already | |
| Drive less | -3.74 \pm 0.56 | +0.63 \pm 0.16 | +1.43 \pm 0.22 | -1.96 \pm 0.29 | |
| Turn off | -1.87 \pm 0.38 | +0.75 \pm 0.12 | +0.34 \pm 0.27 | -1.93 \pm 0.19 | |
| Consume less | -4.77 \pm 0.67 | +0.69 \pm 0.19 | +1.08 \pm 0.28 | -1.58 \pm 0.42 | |
| Fuel-efficient car | -5.44 \pm 0.77 | +0.90 \pm 0.22 | +0.42 \pm 0.38 | -1.04 \pm 0.66 | |
| Adjust thermostat | -4.82 \pm 0.57 | +0.93 \pm 0.17 | +0.93 \pm 0.29 | -1.44 \pm 0.26 | |
| Efficient bulbs | -5.62 \pm 0.85 | +1.01 \pm 0.27 | +0.93 \pm 0.52 | -0.26 \pm 0.48 | |
| Green electricity | -5.44 \pm 1.05 | +0.33 \pm 0.35 | +2.06 \pm 0.60 | -0.84 \pm 1.10 | |
| Endorsement for Americans | | | | | |
| Action | Intercept | Effective | Applicable | Do it already | Observed percent |
| Drive less | -3.79 \pm 0.45 | +0.96 \pm 0.13 | +0.02 \pm 0.18 | +0.17 \pm 0.19 | 38.7% |
| Turn off | -4.21 \pm 0.49 | +0.99 \pm 0.13 | +0.27 \pm 0.33 | -0.43 \pm 0.19 | 24.1% |
| Consume less | -6.41 \pm 0.77 | +1.24 \pm 0.21 | +0.59 \pm 0.26 | -0.42 \pm 0.30 | 13.9% |
| Fuel-efficient car | -5.95 \pm 0.73 | +1.13 \pm 0.21 | +0.28 \pm 0.34 | -0.15 \pm 0.46 | 9.6% |
| Adjust thermostat | -6.26 \pm 0.79 | +1.06 \pm 0.22 | +0.63 \pm 0.40 | -0.06 \pm 0.30 | 8.2% |
| Efficient bulbs | -8.46 \pm 1.27 | +1.46 \pm 0.33 | +1.07 \pm 0.80 | -0.48 \pm 0.48 | 3.4% |
| Green electricity | -4.74 \pm 0.91 | +0.28 \pm 0.31 | +0.51 \pm 0.69 | +0.70 \pm 0.88 | 2.2% |

We assessed the association of ratings of *do it already*, *perceived effectiveness*, and *perceived applicability* with endorsement of each of the 7 alternatives in the closed-ended list by separate logistic regressions (even though the dependent variables are not independent of each other). For *perceived applicability* the two lower levels of the scale, *somewhat* and *not at all applicable*, were combined, as they did not lead to distinct predictions. Thus *perceived applicability* was converted to a dichotomous variable for the regressions.³

Table 5 shows the coefficients for logistic regressions for each of the 7 actions in the closed-ended list.

For both self and Americans, the logistic regression coefficients for *perceived effectiveness* were statistically significant for all but one action. The exception was *green energy*, the action least endorsed.

The coefficients for *perceived applicability* for self were all positive; this factor was statistically significant and substantial for endorsement of *drive less*, *consume less*, *adjust thermostat*, and *green energy*. Note that *turn off* is judged highly applicable by 88% of respondents; as a result, *perceived Applicability* is not an important factor in endorsement of this action for self.

³Perceived effectiveness and perceived applicability are correlated around -0.2 for each action. This negative correlation somewhat resembles the results from Alhakami & Slovic (1994), who found an inverse relationship between judgments of risks and benefits.

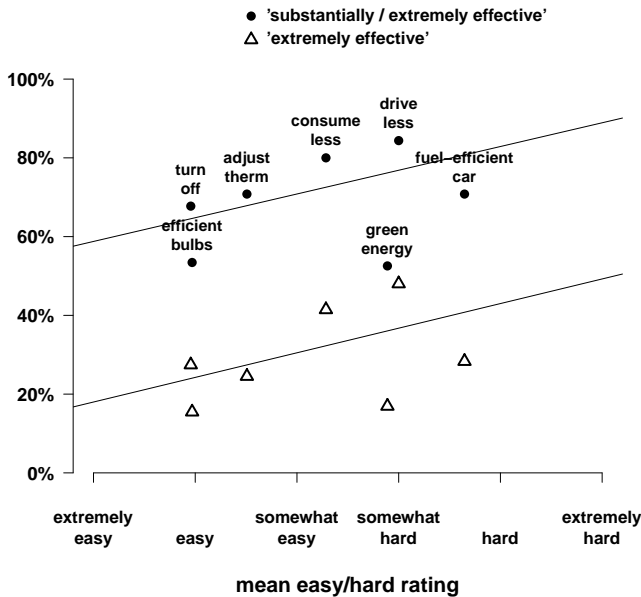
With respect to actions for self, the coefficients for *do it Already* are negative for all 7 actions, though statistically significant only for *drive less*, *turn off*, *consume less*, and *adjust thermostat*. Overall, 75% of respondents endorsed an action for themselves that they did not do already. A conversational norm – *endorse for yourself an action that you do not do already* – contributes to the asymmetry between self and Americans.

The results for self suggest that respondents know whether they already do a particular action and also readily think of reasons why an action is not personally applicable to their lives.

3.4 Study 2: Difficulty ratings and perceived effectiveness or applicability

It seems natural that perception of both effectiveness and applicability would relate to the difficulty of actions. Something that seems difficult might be judged more effective by some respondents, just for that reason, but might also be judged inapplicable for that same reason (a form of motivated cognition). Since difficulty was judged on an easy/hard scale only by respondents who did not report “do it already”, we examine these hypotheses by using the consensus rating of difficulty, the average rating by those who do not self-report doing the action. These average ratings

Figure 2: Perceived effectiveness related to mean difficulty of actions. The vertical axis indicates the percentage of respondents who gave each of the seven (labeled) actions the highest effectiveness rating (shown by open triangles) and also the two highest effectiveness ratings (shown by closed circles). The horizontal axis shows the mean difficulty rating of the seven actions based on the subset of participants who do not report “do it already”.

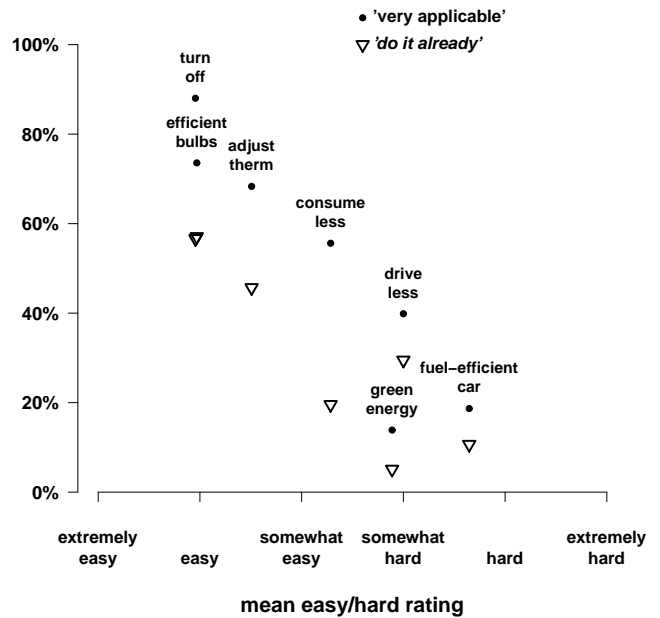


likely show higher difficulty than would difficulty ratings from a similar but unselected sample, but the relationship of the consensus rating to other average ratings is nonetheless interesting.

Figure 2 shows that judged effectiveness does increase somewhat with average perceived difficulty. Rather than looking at average judged effectiveness we examined the distribution, using two proportions: the percentage judging the action as “extremely effective” and the much larger percentage of those judging the action at one of the two highest levels, “substantially” or “extremely” effective. We examined the same two proportions for just the subgroups who did not report “do it already” for each action, i.e., the same groups that gave difficulty ratings; both proportions are slightly lower for these latter subgroups but the overall trend in the plot remains the same as shown by Figure 2.

The trend for each set of points is clearly increasing, with the major exception of the action “buy green energy”. To gauge the trend we fitted least-squares lines to the remaining 6 points, omitting this exception. These lines have a slope of about 6%, i.e., for each added point of difficulty between extremely easy and extremely hard, the proportion judging the action effective increases by about 6%. This fairly shall-

Figure 3: Perceived applicability and self-report of doing an action already related to mean difficulty of actions. Consensus (mean) difficulty judgments for each of the 7 behaviors (from those not doing it) is on the abscissa; the ordinates are percentages: those who find that action “very applicable” (black filled circles) and those reporting “do it already” (open triangles).

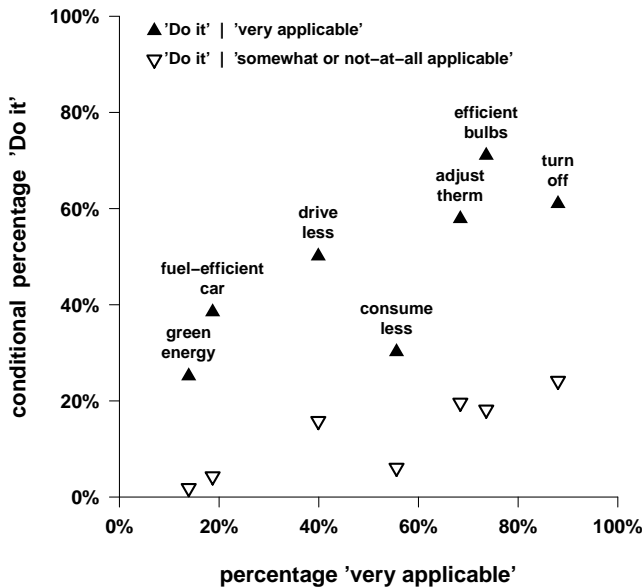


low increase in judged effectiveness with difficulty could be viewed as an information deficit if the true relation between difficulty and effectiveness is steeper. It is hard to argue rigorously for this, because some of the probed actions are vague. Is limitation on heating and cooling via thermostat adjustment much more effective or only slightly more effective than adopting the use of energy-efficient bulbs? This obviously depends on several details, not least, the degree of thermostat adjustment. We do tend to view this as an instance of information deficit – with better information people would realize that some of the more difficult actions are much more effective – but we don’t have converging evidence for this view.

We next examine the relationship between perceived difficulty and applicability. Figure 3 shows that increased (average) perceived difficulty is associated both with a reduction in perceived applicability of the behavior to one’s life and also with a reduction in the adoption of that behavior.

The plots show a very steep drop both in the proportion who view the action as very applicable and the proportion who report doing it already, as a function of average perceived difficulty. The steep drop in applicability as difficulty increases could be due in part to motivated cognition; again, we lack converging evidence for this interpretation.

Figure 4: Conditional relationships between perceived applicability and self-reported action.



3.5 Study 2: Self-reports of “do it already”

The percentage of respondents who reported “do it already” varied across the seven actions on the closed-ended list, from 57% (for *turn off* and also for *efficient bulbs*) down to 5% (for *green energy*). These reports are of course positively correlated: fully 14% of the sample report doing none of these actions (only 5% would be expected, under independence), while 22% report doing four or more out of seven. The total count of actions for which respondents reported “do it already” correlates only weakly with available measures of individual differences. The largest correlations are with Age ($r = +.20$), pro-environmental attitudes as measured by the NEP score ($r = +.19$), and Gender (women and men averaged 2.41 and 2.08 actions, respectively) ($r^2 = .01$ for gender). These relationships are all statistically significant, given the large sample size, but small in magnitude.

There are two important predictors of the probability of reporting “do it already” for an energy-saving action. One is the *perceived applicability* rating by the individual reporting; the second, surprisingly, is the group consensus rating of applicability for that action, i.e., the percentage of all respondents who rate the action as “very applicable”, see Figure 4.

In Figure 4, the differences between the filled circles and the open inverted triangles shows the effect of the first predictor: respondents who deem each particular action “very applicable” are fairly likely to do it already, while those who feel it is only somewhat or not at all applicable generally do not already do it. Second, the conditional percentages for different actions show a marked increasing trend as the consensus (overall percentage) of “very applicable” judgments

increases.

4 Discussion

When asked about the single most effective action they themselves can do to conserve energy, people tend to list easier and less effective behaviors such as turning off the light. In fact, as a choice for self, “turning off the light” has been a modal response documented in the 1980s (Kempton, Harris, Keith & Wehl, 1985). When asked about the single most effective action that Americans can do to conserve energy, people tend to list harder but more effective behaviors such as driving less. This finding holds when the order of the questions is reversed and is confirmed by respondents’ own ratings of effectiveness. This finding may have a rather complicated theoretical basis and it suggests approaches to promotion of conservation by individual efforts and by policy changes.

One possible explanation for the asymmetry is actor/observer bias: people understand the situational factors that constrain their own behavior much better than they understand similar constraints for others (Jones & Nisbett, 1971). In other words, people believe that Americans should do harder and more effective actions, even though they themselves cannot engage in these effective actions due to limitations posed by situational context. The asymmetry may reflect genuine differences between actions feasible for the individual, given his or her situation, from those perceived as feasible for the average American. Thus, the asymmetry may not be motivated by selfishness or by a social-dilemma calculus, but may be dictated by situational constraints. However, Figures 2 and 3 could be interpreted partly in terms of motivated cognition, not just situational constraints. Figure 3 shows that perceived applicability decreases rapidly with increased perceived difficulty of the action. It seems likely that part of this steep drop in perceived applicability represents motivated cognition: thinking of the action as inapplicable excuses not taking that action, particularly when the more difficult action is perceived as only somewhat more effective (Figure 2).

In the analysis predicting endorsement, only perceived effectiveness was consistently associated with endorsements for Americans, but all three explanatory variables (do it already, perceived effectiveness, and perceived applicability), had statistically significant coefficients in most of the logistic regressions for self. These findings suggest improvements in how to elicit information about what people deem effective: rather than just asking respondents about what is effective in their own lives, researchers should also ask about what is effective with regard to other Americans. Asking only about the self will lead to responses that show mixtures of information deficits and self/other biases. Asking about others will remove self-serving biases that are present

in the first case and show the extent of information deficits alone.

We acknowledge limitations of these results. The internet samples may differ somewhat from the general population, but see Buhrmester et al. (2011). Results may also have changed in some details since the data were collected (2010 to 2012). Self-reports of behaviors may not match actual respondent behaviors; and we do not fill in the gaps between perceived and actual effectiveness, difficulty or applicability. We are unable to disentangle sharply motivated cognition from actor/observer differences in awareness of situational constraints. Additionally, we do not link self-reports to real-world behaviors that could lead to systemic change, such as voting behaviors.

Individual and household behavior changes can play an active role in decreasing carbon dioxide emissions quickly and effectively through a variety of efficiency and conservation actions (Dietz, Gardner, Gilligan, Stern & Vandenberg, 2009). In recent work recommending design principles for carbon emissions reduction programs, Stern et al. (2010) highlight how to decrease behavioral barriers to adopting energy efficiency and conservation. As the authors point out, there is still a wide gap between the technical potential (the amount the action reduces emission) and behavioral plasticity (the proportion of people who can be induced to act), which together determine achievable emission reductions. Our study shows the persistence of informational deficits – there has been no decrease in the endorsement of relatively ineffective changes, such as turning off lights – but also suggests a role for a motivational barrier to adopting efficient technologies and conservation behavior.

It is also important to stress the increase in perceived effectiveness of actions that are difficult. Policy can be crafted to decrease the actual and apparent difficulty of effective actions, as perceived difficulty may be a significant barrier to incorporating effective behaviors. It may help to focus less on particular actions that conserve energy and more on integrated plans for energy conservation, designed to accommodate situational constraints. Energy conservation plans should be evidence-based, adaptable in the face of changing technology, and relevant to many aspects of behavior. Research should test whether such integrated plans, which both inform and motivate, are more appealing, more readily adopted, and more easily adhered to than piecemeal changes in behavior.

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