Conserving Energy by Inducing People to Drive Less

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We attempted to reduce college students’ use of their cars with an online intervention. Every other day for 2 weeks, students reported the number of miles they had avoided driving. In a 2 × 2 design, participants received feedback about pollution avoided (e.g., CO₂ saved), financial feedback (e.g., gas money saved), or no feedback. A control group did not monitor their driving. Participants in all Web conditions reported driving less than the no-Web control group. In addition, Web participants who received both kinds of feedback reported driving less than did those who received one kind or none. We discuss implications for research on energy conservation and offer an online feedback form to help readers reduce their own driving.

One of the best ways to address global warming is to reduce the consumption of fossil fuels. Such efforts are particularly important in the United States, given that Americans consume 22.5% of the world’s energy while comprising only 4.6% of the world’s population (Energy Information Administration, 2006). A substantial proportion of that energy is used to power automobiles; there are over 240 million registered vehicles in the U.S., which is more than one vehicle per licensed driver (U.S. Census Bureau, n.d.). Convincing Americans to drive less could thus have a significant impact on energy conservation and global warming.

The recent rise in gas prices has convinced some Americans to use public transportation or to buy more fuel-efficient cars (Mouawad & Navarro, 2008), and has resulted in the first large-scale decrease in U.S. highway driving in decades (Federal Highway Administration, 2008). Nonetheless, many people still endure long solo commutes to work, punctuated by traffic jams of increasing severity, instead of carpooling or taking public

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transportation. This problem seems an ideal opportunity to apply social psychology’s findings in persuasion and social cognition to reduce energy consumption (Gonzales, Aronson, & Costanzo, 1988). In the present study, we designed and tested an intervention to try to get college students to reduce the use of their cars.

Previous Intervention Attempts to Change Driving Habits

There have been attempts by local governments to get people to drive less. Many cities encourage carpooling by providing dedicated high-occupancy lanes or parking for those vehicles with multiple occupants (e.g., Letzkus & Scharfe, 1975; MacCalden & Davis, 1972; Rose & Hinds, 1976). These efforts have had some success, though their effects tend to be limited to peak commuter traffic hours (Nickerson, 2003; Reichel & Geller, 1981; Rose & Hinds, 1976). Another approach, providing all students at a university with bus passes in return for reduced fees, has been shown to increase students’ use of the bus system and reduce their use of cars (Bamberg, Ajzen, & Schmidt, 2003; Bamberg & Schmidt, 2001).

There have been a few attempts to apply social psychological research to increase the use of public transportation, with mixed success. Some researchers have directly reinforced people (e.g., paying passengers $0.10 as they boarded a bus; Deslauriers & Everett, 1977; Everett, Hayward, & Meyers, 1974). Although these interventions increased ridership when the rewards were given, ridership dropped to normal levels after the program ended, possibly because the conservation behaviors were tied to the extrinsic rewards, rather than intrinsic motivations to conserve energy (e.g., Lepper, Greene, & Nisbett, 1973). In another study, college students were encouraged to use a new bus route one time in the following week. Those who were asked to form a specific goal-implementation strategy by writing down which day and in what situation they would ride the bus (Gollwitzer, 1999) were more likely to actually do so (Bamberg, 2002). There were no follow-up measures, however, to see whether this intervention increased ridership beyond this one time.

Experimentally Testing a Less Expensive and More Accessible Intervention

We tested a new intervention that applies social psychological theory to get drivers to use their cars less. Although we used college student participants in our initial test of the intervention, it has the potential to be used with any population that has access to the Internet. We asked students who owned
cars to visit a Webpage every other day for 2 weeks. At each visit, they reported the number of times they had decided not to use their car in the previous 2 days and how many miles they avoided driving on each trip not taken.

Our first hypothesis is that simply monitoring and recording one’s driving habits will reduce the amount that people drive. Self-monitoring (usually accompanied by some written record of a desirable or undesirable behavior)³ is thought to have value, both for assessment of behaviors and as a treatment in itself for changing those behaviors (Korotitsch & Nelson-Gray, 1999). Research has shown that record keeping is sufficient to reduce the frequency of undesired behaviors and to increase the frequency of desired behaviors (Febbraro & Clum, 1998; Shapiro & Cole, 1993), including drinking less alcohol (Sobell & Sobell, 1973), reducing the use of other drugs (Hay, Hay, & Angle, 1977), and increasing physical exercise (Conn, Valentine, & Cooper, 2002).

Record-keeping interventions have also been used successfully to reduce dangerous driving behaviors, such as driving under the influence (Rosenberg, 1988), risky driving among young people (Hickman, 2005), and inattentive driving by the elderly (Kiernan, Cox, & Kovatchev, 1999). Rothstein (1980) found a “group monitoring” effect on energy conservation, whereby publicizing a community’s use of gasoline (how many gallons of gasoline had been sold the previous day) reduced gasoline consumption, but the monitoring was accompanied by other information (e.g., conservation tips, competition with a neighboring city), thus making it difficult to detect the effects of monitoring alone. Runnion, Watson, and McWhorter (1978) found that giving truck drivers feedback about the miles per gallon they achieved made them drive more efficiently, though the feedback was provided in combination with other reinforcement, such as personal letters of recognition and lotteries for small prizes.

The mechanisms by which record keeping changes behavior are not well understood. Keeping track of a desirable behavior, we suspect, can increase its frequency in at least four ways. First, record keeping might make the goal to perform the behavior more accessible in memory, thereby increasing the probability that people will act on it (Higgins, 1996). Second, the record-keeping process can remind the person of the ultimate external environmental consequences that control behavior frequency by increasing the salience of the relationship between the behavior and its consequences (Nelson & Hayes, 1981). Third, keeping track of a behavior might make people more

³Research on keeping track of one’s behavior, which has been conducted primarily by clinical psychologists, uses the term self-monitoring. Because this term has another meaning in social psychology (Snyder, 1974), we use the term record keeping in the present article.
likely to notice the antecedent conditions that contribute to it, giving them more control over their behavior. Fourth, keeping track of their behavior might increase people’s sense of self-efficacy that they can control the behavior (Bandura, 1997). For all of these reasons, we assume that asking college students to record the number of miles they avoid driving each day will reduce the amount they drive.

This assumes, of course, that college students are motivated to reduce their driving. Although it seems reasonable to assume that most students want to save money and pollute less, there are also obvious benefits to driving; for example, it takes less time than walking or taking public transportation. We thus reason that it might help to connect the decision of not driving to specific goals that are consistent with driving less. One reason people fail to change their behavior in desired ways is because their attitudes and values are inconsistent with the new behavior. People might not want to reduce the number of miles they drive, for example, because they do not believe that global warming is a problem. Often, however, people hold attitudes that are consistent with a desired set of behaviors, but fail to connect those attitudes with specific actions (Ajzen & Fishbein, 1980, 2005). People might believe that global warming is a serious threat, but fail to connect that attitude to their decision about whether to drive or walk to the store on a given Tuesday. Emphasizing this connection might motivate people to drive less.

There have been attempts to get people to act in more environmentally friendly ways by connecting their behavior to social approval. De Leon and Fuqua (1995) found that people recycled more if they received feedback (i.e., number of pounds of material they recycled each week) and they made a public commitment to recycle (i.e., their names were published in the newspaper). Becker (1978) found that people used less electricity if they received feedback about how much electricity they were using and they made a public commitment to reduce their use by 20%. Schultz, Nolan, Cialdini, Goldstein, and Griskevicius (2007) found that giving people feedback about how much electricity they used, compared to their neighbors, worked best if the feedback was accompanied by messages of social approval (for low energy use) or disapproval (for high energy use). No study, however, has attempted to reduce driving behavior by connecting feedback to goals, nor has any study manipulated more than one goal to see if they have additive or competing effects.

We manipulated the kind of feedback participants received each time they reported that they had avoided driving. Some participants learned the amount of pollutants that were not emitted by their car as a result of not driving. Others learned how much money they had saved on gasoline and maintenance costs. We employed a 2 (Pollution Feedback: yes or no) × 2
(Monetary Feedback: yes or no) factorial design, such that people received no feedback, one of the different types of feedback, or both types of feedback.4

We purposefully chose different kinds of feedback—one prosocial (helping the environment) and the other personal (saving money)—to see if one or the other goal would be more effective with our college student sample. We also wanted to see if the two different kinds of feedback would have additive, redundant, or conflicting effects. A subset of our sample ($n = 36$) took part in a mass testing session at the beginning of the semester, at which they rated the importance of 14 goals, including “acting in environmentally friendly ways” and “making or saving money” on a 7-point scale ranging from 1 (not at all important) to 7 (very important). Making money and acting in environmentally friendly ways were both rated as important, but the former more so than the latter ($M_s = 5.89$ and $4.83$; $SD_s = 1.06$ and $1.48$), $t(35) = 3.57$, $p = .001$. Thus, one possibility is that the monetary feedback would work better than the pollution feedback. Another possibility is that the two kinds of feedback would counteract each other because one is prosocial and the other is personal (Deci & Ryan, 2002; Lepper & Henderlong, 2000). A third possibility is that reminding people of one goal alone is not sufficient to counteract what people can gain by driving, and that only giving feedback about both goals will motivate people to drive less and forgo the advantages of driving.

Research has shown that changing commuting preferences is most effective when both personal and prosocial goals are activated (Joireman et al., 2001; van Lange, van Vugt, Meertens, & Ruiter, 1998). Driving habits are hard to change, and it might be that only people who see that driving less has both a personal advantage (i.e., saving money) and a prosocial one (i.e., helping the environment) are motivated to reduce their driving.

Method

Participants

Participants were 128 University of Virginia students (83 female, 45 male) who participated in exchange for partial course credit or a bookstore gift.

4We also attempted to give a third kind of feedback; namely, the number of calories people burned if they walked or rode a bike instead of driving. A sizable percentage (35%) of people in this condition, however, never reported walking or riding a bike, or did so only once. Thus, they received little or no feedback about health benefits. Therefore, in all analyses, we collapsed across the exercise feedback and focused instead on the effects of the pollution and monetary feedback.
certificate. Students in the Department of Psychology participant pool were invited to participate if they had indicated, on a pretest questionnaire, that they had a car and a valid driver’s license and lived within 2 miles of the campus. Other students responded to fliers posted around campus that advertised for people who met the aforementioned criteria.

**Procedure**

We sent potential participants an e-mail with a description of the study and a consent form. Those who chose to participate returned the consent form and a reading of their car’s odometer. We then randomly assigned participants to the Web conditions or a no-Web control condition. People in the Web conditions received a follow-up e-mail that described the study in more detail and asked how often they used their car. They were instructed to visit a Website every other day for 2 weeks (for a total of seven visits) and answer questions about their car usage. The first time people visited the Website, they reported the manufacturer, model, and year of their cars and their cars’ gas mileage. These data were used to calculate the Web feedback people received (described later).

On each visit to the Webpage, people reported how many times in the previous 2 days they had avoided using their cars, defined as any instance in which they walked or rode a bike instead of driving somewhere, took public transportation, got a ride with someone, or “had definite plans to drive somewhere, but decided to stay home or do something else instead.” For each trip not taken, people indicated the number of miles they avoided driving and whether they walked, rode a bike, took public transportation or got a ride, or stayed home.

At the end of each session, if people had reported avoiding use of their cars, they received either feedback about the amount of money they had saved, feedback about the amount of pollution their cars did not emit, or no feedback, according to a $2 \times 2$ (Monetary Feedback) \times (Pollution Feedback) design. That is, people were assigned to one of four conditions, and remained in that condition on each of the seven visits to the Website. The feedback was given as follows (values in brackets were based on how many miles people said they avoided driving, their model of car, and so forth):

**Monetary feedback:**

Congratulations! By not using your car, you have saved money on gasoline and maintenance costs.

Since you completed the previous survey: You saved [\$x].
Pollution feedback:

Congratulations! By not using your car, you have avoided emitting the following pollutants:

1. pounds of carbon dioxide not emitted: [x]
2. pounds of carbon monoxide not emitted: [x]
3. pounds of hydrocarbons not emitted: [x]
4. pounds of nitrogen oxides not emitted: [x]
5. Total pounds of pollutants not emitted: [x]

In addition to the aforementioned information, people received a running total of what they had saved since the study began (e.g., total amount of money saved).

Then, 2 weeks after participants completed the final Web survey, they received an e-mail questionnaire asking about their recent driving habits, including the question “During the past 2 weeks, would you say that you used your car less often than usual, the same, or more often than usual?” Responses were rated on a 9-point scale ranging from 1 (much less) to 5 (the same) to 9 (much more). An additional 13 people, who had been randomly assigned to a no-Web control group, completed the follow-up questions but did not do the Web exercise.

Results

We tested the following main hypotheses:

_Hypothesis 1_. Monitoring one’s driving habits will reduce car usage, regardless of the kind of feedback received.

_Hypothesis 2_. Receiving feedback will decrease car usage even further.

To test these hypotheses, we examined people’s response to the question about whether they had used their car more or less than usual in the 2 weeks after the Web exercise. Of the 115 participants in the Web conditions, 95 (83%) completed the follow-up survey, as did 9 of 13 participants in the no-Web control condition. Both predictions were confirmed.

A one-way ANOVA on the four Money Feedback × Pollution Feedback conditions plus the no-Web control condition reveals a significant effect, $F(4, 99) = 3.05, p = .02$. As can be seen in Table 1, people who received both the monetary and pollution feedback reported using their car the least, whereas people in the no-Web control group reported using it the most.
We performed planned comparisons to test the two hypotheses. The first tested whether people who completed the Web survey reported using their cars less than did people who did not (in the no-Web control condition), by assigning a contrast weight of +4 to the no-Web control group and −1 to each of the Web conditions. This contrast was significant, $F(1, 99) = 6.42, p = .01$, suggesting that simply keeping track of one’s driving on the Web, independent of the feedback people received, reduced the amount that they used their cars. The second contrast tested the hypothesis that receiving both the financial and pollution feedback influenced people more than did receiving no feedback or just one type of feedback, by assigning a weight of 0 to the no-Web control; −1 to Web no feedback, pollution feedback, and financial feedback conditions; and −3 to both kinds of feedback condition. This contrast was also significant, $F(1, 99) = 6.79, p = .01$, suggesting that receiving both kinds of feedback benefited people above and beyond simply keeping track of one’s driving habits.

We also tested whether the Web feedback influenced the amount of driving people said they avoided when completing the Web questionnaires. We averaged the number of miles people reported avoiding at Times 2 through 6, because they did not begin receiving feedback until after their first entry at Time 1. Consistent with the previous analyses, people who received both monetary and pollution feedback avoided driving more miles ($M = 85.68, SD = 128.16$), than did people who received just the monetary feedback ($M = 49.71, SD = 87.81$), just the pollution feedback ($M = 48.28, SD = 62.61$), or no feedback ($M = 34.04, SD = 59.52$). A contrast that assigned a weight of +3 to the condition that received both types of

<table>
<thead>
<tr>
<th>Condition</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
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<tbody>
<tr>
<td>No Web (control)</td>
<td>6.44</td>
<td>1.59</td>
</tr>
<tr>
<td>Web, no feedback</td>
<td>5.52</td>
<td>1.91</td>
</tr>
<tr>
<td>Pollution feedback</td>
<td>5.64</td>
<td>1.59</td>
</tr>
<tr>
<td>Financial feedback</td>
<td>5.63</td>
<td>1.86</td>
</tr>
<tr>
<td>Both kinds of feedback</td>
<td>4.36</td>
<td>1.50</td>
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feedback and \(-1\) to the other three cells was significant, \(F(1, 107) = 5.06, p = .03\).\(^5\)

**Discussion**

People who completed the Web exercise, keeping track of the number of times they avoided using their car, subsequently reported using their car less than did people who did not complete the exercise. This finding is consistent with previous work on monitoring and recording one's behavior, which has found that when people keep track of their undesired behaviors, those behaviors decrease in frequency (Febbraro & Clum, 1998; Korotitsch & Nelson-Gray, 1999). While this intervention was aimed at reducing an undesirable behavior (i.e., unnecessary driving), the record keeping and feedback were framed in terms of the desirable behavior of choosing not to drive on particular occasions. The act of recording this positive negation of an undesirable behavior may have drawn participants' attention to opportunities in which they could avoid trips (or avoid driving for those trips), in part for the satisfaction of being able to record the positive act. In addition, people who received feedback during the Web exercise about the positive consequences of avoiding car trips avoided driving even more—but only if they received both types of feedback (i.e., money saved and pollution avoided). This suggests that personal and prosocial types of feedback can have additive, rather than counteractive effects.

The fact that receiving both types of feedback worked—whereas receiving one type of feedback alone did not work—suggests that the rewards of driving might outweigh a little money saved or pollution prevented, but they pale in comparison to the combined benefits of both rewards. The resistance to decreasing driving may be a deeply entrenched habit. If this is the case, these findings suggest that the combination of personal and prosocial feedback may be especially effective in overcoming the inertia of driving habits (Becker, 1978; van Lange et al., 1998). If so, adding a third or fourth type of feedback might motivate people to reduce their driving even further. Alternatively, connecting people's behavior to too many goals might backfire, confusing them about exactly why they are leaving their car in the garage and taking the bus. An interesting question for future research is whether there is a curvilinear relationship between the number of perceived reasons for one's behavior and their motivation to change. Nevertheless, these results suggest that connecting the record keeping to two unrelated goals via feedback is helpful, rather than harmful, to the overall aim of changing driving behavior.

\(^5\)Although there were no significant effects of gender, the number of men and women in the different cells varied from 6 to 22. Thus, these analyses used unweighted means.
One limitation of the present research is that we relied on people’s reports about how many miles they avoided driving as well as their reports about whether they drove more or less than usual after the intervention. It seems unlikely that people in some conditions were motivated to distort their answers more than were people in other conditions. Nonetheless, future research should attempt to use more objective measures of people’s use of their cars.

The present study represents a cost-efficient way to get people to conserve energy by driving less. To the extent that this and similar efforts are successful and widely applied, substantial savings in oil use could result. Most previous studies that have shown success in reducing driving miles or increasing miles per gallon employed reinforcement methods, such as giving prizes, exchangeable tokens, lottery contests (e.g., Foxx & Hake, 1977; Reichel & Geller, 1981), or changing regulations, such as priority lane restrictions (MacCalden & Davis, 1972).

One of the major drawbacks of these techniques is cost efficiency. It would not be feasible, for example, to give everyone in the country a prize for using their cars less. The Web exercise that we used could easily be adapted for general use with little cost. In fact, we have written a simple Excel program in which people can enter the number of miles they have avoided and receive monetary and pollution feedback.6

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6 The program can be downloaded at http://people.virginia.edu/~tdw/Driving.file.htm


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