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Saving water to save the environment: contrasting the effectiveness of environmental and monetary appeals in a residential water saving intervention

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ABSTRACT

To convince people to reduce their energy consumption, two types of persuasive appeals often are used by environmental organizations: Monetary appeals (i.e., 'conserving energy will save you money') and environmental appeals (i.e., 'conserving energy will protect the environment'). In this field study we aimed to compare the effects of monetary and environmental appeals on showering habits. During two weeks we measured showering behavior in one hundred households. As compared to monetary appeals, environmental appeals were more effective in decreasing participants' shower frequency. Interestingly, the monetary appeal was judged as somewhat more motivating to save water than the environmental appeal. We discuss theoretical and practical implications of these findings.

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During the past century, daily energy consumption of households has grown exponentially, and the demand for energy resources will increase rapidly in the next decades (e.g., Cai & Jiang, 2008; Davison, 2008). While most people are aware of the fact that the use of energy affects the environment, its true impact tends to be underestimated (Delmas, Fischlein, & Asensio, 2013; Gardner & Stern, 2008; Steg, 2008). For example, people generally under-rate the amount of energy resources required to heat up water for showering (Steg, 2008). However, the environmental costs of hot showering are quite large. As a case in point, in the Netherlands (with a population of about 17 million inhabitants), it has been estimated that an average reduction of one minute per shower would save 31.25 million cubic liters of water, and would save 240 million cubic liters of natural gas (Milieu Centraal, 2017).

Environmental organizations attempt to alter misconceptions about resource usage by providing information about energy consumption and its consequences. These consequences are often expressed in terms of financial costs, environmental impact, or both (e.g.,

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Bolderdijk, Steg, Geller, Lehman, & Postmes, 2013; Evans et al., 2013). In a meta-analysis, Delmas et al. (2013) demonstrated that, depending on a number of factors (e.g., personal relevance; message attractiveness), information strategies may indeed lead to the conservation of energy. However, they found that information strategies that stress personal financial gains of preserving energy actually can have counter-productive effects on energy consumption. Despite such findings, monetary persuasive appeals are still gaining popularity in environmental campaigning (Evans et al., 2013). It is therefore important to further investigate to what extent persuasive appeals focusing on financial arguments are effective. In the wake of a growing body of support for the effectiveness of environmental appeals (e.g., Asensio & Delmas, 2015; Steinhorst & Matthies, 2016), in the present study we directly pit persuasive appeals that focus on financial gains against appeals that focus on environmental gains, and examine their respective influence on the reduction of energy consumption in the context of showering.

Understanding the differences between monetary and environmental appeals

One important reason why financial incentives are not always effective is that such appeals can activate what can be called the homo economicus (Henrich et al., 2001). When information is provided about financial gains of energy preservation, for example by alluding to the financial costs of showering, the target is essentially given a choice between saving money by not engaging in the behavior, or accepting the financial costs and enjoying the rewards of frequent hot and long showers. Appealing to financial gains induces people to make a rational cost-benefit calculus, which can lead people to decide to engage in energy-consuming behavior when its immediate and hedonic rewards outweigh its financial costs (Delmas et al., 2013).

Another reason for its ineffectiveness is suggested by research on human values (Maio, Pakizeh, Cheung, & Rees, 2009; Schwartz, 1992). This research has demonstrated that emphasizing values that concern self-interest (e.g., power; wealth) can inhibit values that transcend self-interest (i.e., self-transcendence values, such as helping, equality, or honesty). Indeed, human behavior is not merely motivated by self-interest, but often is motivated by values that transcend self-interest (e.g., Schwartz, 1992; cf. Batson, 1990). For example, research has shown that the salience of self-transcendence values such as benevolence can promote behavior that corresponds with the value (e.g., helping behavior; Karremans, 2007; Maio et al., 2009; Verplanken & Holland, 2002), while making salient self-interested values actually may reduce behavior that corresponds with self-transcendence values (Lindenberg & Steg, 2007; Maio et al., 2009; Schwartz, 1992).

According to this perspective, providing information about the environmental costs of energy-consumption (i.e., a self-transcendence value) should be more effective in promoting pro-environmental behavior, in our case the reduction of showering frequency. There are some recent findings in support of this prediction. Bolderdijk and colleagues (2013) found that, to promote a tire check among car drivers (to reduce gasoline usage), environmental appeals were more effective as compared to monetary appeals. Schwartz, Bruine de Bruin, Fischhoff, and Lave (2015) found similar results when gauging the willingness to enrol in an energy saving program. In another study, Asensio and Delmas (2015) found that the combination of environmental and health-related information outperformed financial information in reducing electricity energy consumption over a period of eight months.

Moreover, Steinhorst and Matthies (2016) found that environmental appeals as compared to financial appeals lead to more favorable attitudes towards low carbon policies, especially among individuals with strong ecological personal norms. Finally, Evans and colleagues (2013) demonstrated that environmental (but not financial) information about one type of pro-environmental behavior could spill over to promoting another pro-environmental behavior. Together, these findings suggest that activating self-transcending environmental concerns leads to corresponding pro-environmental behavior, while activating self-interested concerns may reduce it (or at least may be ineffective).

The promotion of water conservation is a relatively understudied topic (Fielding et al., 2013). While several previous studies have examined ways to reduce water consumption, for example by means of normative messages (Fielding et al., 2013; Schultz, Khazian, & Zaleski, 2008), no previous study has contrasted the effectiveness of monetary vs. environmental appeals to reduce showering. Given that showering is one of the most energy-consuming factors in Western households (Gardner & Stern, 2008), this is an important topic in and of itself.

Method

Participants and design

To test the effectiveness of environmental vs. financial appeals on showering behavior, we conducted a field experiment in which participants reported their showering behavior for two weeks. Participants were family members of one hundred households, including couples (40%), families with children (38%) and single households (22%). The households were recruited by using a recruitment text, which was spread through community websites, and social media sites. A requirement was that the households received private energy bills, so that their bills were independent of the energy use of neighbors (as is often the case in student apartments, for example). Furthermore, participants should shower at home (e.g., family members who always took baths, or always showered at the gym, were excluded from participation). The participating households were located in several towns and villages in the Netherlands.

Three households were excluded from the analysis: one family and one single household because the family members perceived it as too much effort to complete the experiment, and one couple that lost a form that contained essential data. This resulted in a total sample size of 224 participants from ninety-seven households (age $M = 36.76$, $SD = 18.9$, 50.9% female). As a baseline measure of showering behavior, showering behavior was measured during one week before the intervention materials were distributed. After receiving a booklet (i.e., the intervention) that contained either environmental (saving energy will protect our environment) or monetary appeals (saving energy will save you money), showering behavior was again measured during one week. The design of the study thus consisted of a 2 (time: pre vs. post) \times 2 (appeal: monetary vs. environmental) mixed design with repeated measures on the first factor. Ideally, the study had included a no intervention control condition. However, because we had access to part of our measuring equipment for only less than one month, and did not know in advance how many households we could recruit to participate in our study within this short timeframe, we decided to use only two conditions to assure sufficient power. We made the decision to use only two conditions, realizing that we can only draw conclusions about the relative effects of the monetary vs. environmental appeal interventions. We return to this issue in the Discussion.

Intervention

Interventions must be strategically designed to increase their effectiveness (e.g., Costanzo, Archer, Aronson, & Pettigrew, 1986). Some successful ingredients of interventions as found in previous research include modeling, commitment strategies, and simple prompts (Steg, 2008). The intervention in the current study (i.e., the booklets) contained a mix of such influencing techniques to motivate people to shower both for a shorter time and less frequently. The first page of each booklet depicted a cartoon character in the shape of a laughing drop of water, called 'Droppel,' who welcomed the participants. 'Droppel' is meaningless in Dutch, but is very close to the Dutch word for 'droplet' (i.e., 'druppel'). This character was featured on almost every page of the booklets and was meant as a reading guide for the participants: each time they encountered 'Droppel' they had to fulfill an assignment. Thus, participants were not only made aware of the impact of their showering behavior and their saving potential (in terms of euros vs. CO₂), but were also stimulated to actively process the information (goal setting; Locke & Latham, 2002). Specifically, participants were instructed to note down their conservation goals in the booklet (to increase commitment), to write down why they thought protecting the environment or saving money is important (self-persuasion; Aronson, 1999), and to make a drawing of themselves in between successful water savers on a 'wall of fame' (modeling; Winett et al., 1982). On the last page, they were instructed to hang a reminder to save water in the shower (prompting; Geller, Farris, & Post, 1973). The reminder was a hanger made out of blue colored plastic in the shape of 'Droppel'. The request to hang the reminder was accompanied by the following instruction: 'as soon as you see me in the shower, remember our goal: saving water to protect the environment' (vs. saving water to save money). In sum, all intervention materials were identical in both conditions, with the only difference that in one condition all materials and appeals referred to reducing showering duration and frequency to save the environment, while in the other condition all materials and appeals referred to reducing showering duration and frequency to save money.¹

Measures

When we set up the study, we initially had planned to measure both showering frequency and showering duration, but as explained shortly, due to technical problems we could only use *showering frequency* as dependent variable. The procedure was as follows: Each time participants took a shower, participants reported the starting time of their showers in a showering diary. In addition, so-called data loggers were placed on the shower pipe: small devices that can pick up the noise of water running through a shower pipe. Once all data were collected, for each starting time reported in the diary we checked in the logger data whether there was corresponding noise activity (i.e., indicating showering), which should have provided us measures of both showering frequency and mean duration per shower. However, although most loggers did seem to pick up showering events, it was difficult to extract the actual shower duration from them for various reasons. First of all, 38 out of 97 loggers did not reliably register noise in relation to showering. The measurements of the remaining loggers mostly corresponded with the reported starting times in the shower diaries, but still indicated some unlikely short and long showers. Due to these problems, we deemed the logger data unreliable, or at least too ambiguous to interpret accurately.²

Thus, instead, as our main dependent variable, we used the reported starting times of each shower in the diaries as an indicator of frequency of showering, with each reported starting time representing one shower. We summed up the total number of showering times in week 1 (i.e., pre-intervention) and the total number of showering times in week 2 (i.e., post-intervention) as indicators of showering frequency.

In addition to the main dependent measure, participants filled out a questionnaire pertaining to their showering behavior and the intervention at the end of the study (i.e., after they handed in their showering diaries). For practical reasons, the questionnaire was filled out by one family member of each participating household, which amounts to a total of ninety-seven completed questionnaires. The questionnaire included questions about perceived changes in showering behavior (i.e., ‘I think my household has used less water in the second week of the study compared with the first week of the experiment,’ ‘In the second week of the study I showered less often than in the first week of the experiment’), the extent to which the appeal was considered motivating (‘The booklet was motivating to use less showering water’), and evaluation of the booklet (‘The assignments in the booklet were enjoyable.’). To all questions, participants responded on a scale ranging from 1 = completely disagree to 7 = completely agree. Finally, participants were given the opportunity to leave comments about the study.

Procedure

Participants first signed a consent form, and measurement instruments (i.e., the shower diary and logger) were placed in the bathroom to measure showering behavior. At this point, participants were not yet assigned to a condition in order to prevent any experimenter bias. After the first visit, participants started to record the frequency of their showering behavior by reporting the shower starting times in the diary. Halfway through the study, on the seventh day, each household received a booklet in their mailbox. The households were randomly assigned to a condition: The monetary and environmental booklets were put in envelopes, and each envelope was then sent to one of the participating families without the experimenter being aware which of the two interventions was in the envelope.

Two weeks after the first visit, households were visited again, the measurement instruments were collected, and one of the family members present filled in the questionnaire.

Important to note: Before running the analyses, we made the a priori decision to only include days three to six of both the pretest and posttest, for three reasons. First, omitting the first two days of the post-test week gave participants sufficient time to read the intervention booklet (indeed, while a total of 62.6% of participants had indicated that they had read the booklet at the end of day 1 of the post-test week, 89.6% of participants indicated that they had done so at the end of day 2). Similarly, omitting the first two days of the pre-test week allowed participants some time to familiarize themselves with recording shower time. Thus, we omitted the first two days of both the pre-test and post-test weeks. Second, because the intervention booklets were delivered on day 7 of the pre-test week, and participants may have read the booklet on this day, we could not be sure whether day 7 should still be included in the pre-test, and thus decided to omit day 7 from the pre-test week. Third, to have an equal number of measurement days in both the pre-test week and post-test week, we also omitted day 7 from the post-test week. This thus left us with 4 measurement days – days 3–6 – in both the pre- and post-test weeks.

Results

The results of a mixed measures analysis including the factors time (pre vs. post) and appeal (monetary vs. environmental) revealed no main effect of time, $F(1, 222) = 2.69$, $p = .10$, $\eta_p^2 = .01$; overall, there was a non-significant trend that the average number of showers decreased from $M = 2.90$, $SD = 1.33$, to $M = 2.75$, $SD = 1.39$ (i.e., number of showers in the four day measurement period). More importantly, the analysis revealed a significant interaction between time and appeal, $F(1, 222) = 5.87$, $p = .02$, $\eta_p^2 = .03$ (see Figure 1). Among participants who received the environmental booklet, shower frequency was significantly reduced during the post-test period $M = 2.67$, $SD = 1.36$, as compared to the pre-test period, $M = 2.98$, $SD = 1.28$, $t(125) = 3.16$, $p < .01$. The shower frequency of participants who received the monetary booklet did not show any significant change from before, $M = 2.79$, $SD = 1.39$, to after receiving the booklet, $M = 2.85$, $SD = 1.42$, $t(97) = -.51$, $p = .62$. There were no effects of condition at pre-test, $t(222) = 1.11$, $p = .27$, or post-test, $t(222) = -.96$, $p = .34$. Thus, these findings indicate that the environmental appeal, but not the financial appeal, was effective in reducing showering frequency.³

No differences were found between the appeal conditions with regard to the question whether the appeal caused the household to save water, $t(89) = -.52$, $p = .60$; $M = 3.21$, $SD = 1.76$ vs. $M = 3.41$, $SD = 1.85$, respectively in the environmental and monetary appeal conditions. Similarly, participants in the environmental appeal condition, $M = 2.04$, $SD = 1.83$, did not perceive that they had reduced shower frequency more, or less, than participants in the monetary appeal condition, $M = 1.98$, $SD = 1.70$, $t(86) = .18$, $p = .86$. Unexpectedly, the assignments were perceived as significantly more enjoyable when containing monetary, $M = 5.24$, $SD = 1.45$, instead of environmental appeals, $M = 4.53$, $SD = 1.74$, $t(84) = -2.05$, $p = .04$. Finally, and interestingly, the monetary booklet, $M = 4.43$, $SD = 1.78$, tended to be perceived as more motivating to save water than the environmental booklet, $M = 3.80$, $SD = 1.87$, a small effect that approached significance, $t(94) = -.170$, $p = .09$. There were no significant relations between these questionnaire responses and shower frequency.

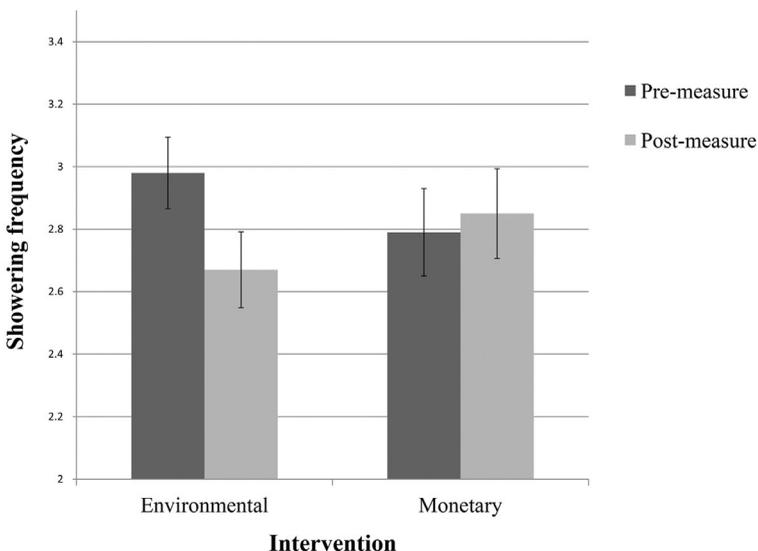


Figure 1. Showering frequency from pre- to post-measurement, separately for the environmental vs. monetary appeal intervention.

Discussion

This field experiment demonstrated that participants reduced their showering frequency following an environmental persuasive appeal, while a monetary persuasive appeal did not affect showering behavior. Using a combination of persuasive techniques (i.e., commitment, goal setting, and prompts), these results converge with previous findings that have found environmental appeals to be more effective than monetary appeals (e.g., Asensio & Delmas, 2015; Bolderdijk et al., 2013; Steinhorst & Matthies, 2016). The current findings suggest that, at least in the short term, environmental appeals (but not financial appeals) can alter the frequency of showering behavior. There may be several related explanations why the environmental appeals were effective. First, the environmental appeals that were part of our intervention likely have activated environmental values. Especially when such activated values match the value priorities of perceivers, they can be powerful in motivating behavior (Maio & Olson, 1998; Verplanken & Holland, 2002). Second, presuming that most people may agree with the environmental appeals (i.e., saving water for protecting the environment), not reducing showering frequency may induce feelings of hypocrisy (e.g., Stone, Wiegand, Cooper, & Aronson, 1997). Indeed, previous research has shown that an effective way to motivate people saving water is to remind them that they waste water by taking long and frequent showers while at the same time agreeing that water should be saved (Dickerson, Thibodeau, Aronson, & Miller, 1992). In our study, to prevent potential feelings of hypocrisy, participants may have reduced their showering frequency, provided that they agreed with the value of doing so.

Why was the financial appeal not effective? As we reasoned in the introduction, financial appeals may lead people to make a deliberate cost-benefit analysis: do I want to shower less to save money? If the answer to this question is negative, a financial appeal will not be effective. It seems that the financial gain that is associated with a lower frequency of showering was not sufficiently motivating to reduce showering frequency, or may even have reduced the motivation to do so. Another potential explanation may be that some family members (i.e., children) simply are not responsible for paying the monthly gas bill. This explanation relates to the more general idea that intervention appeals should be relevant to the goals and motivations of its targets.

These explanations should be seen in light of the fact that we can only make a relative comparison between the environmental and monetary appeal conditions, in that the environmental more than the monetary condition reduced showering behavior. Theoretically, it is possible that showering frequency was lower in the second week even without an intervention (for reasons not explored in our research, e.g., weather conditions), and the monetary appeal actually may have increased showering. However, the effect of the environmental appeal condition in reducing showering frequency seems the most likely explanation. As noted in the introduction, showering is a highly habitual and repetitive behavior (Kurz, Gardner, Verplanken, & Abraham, 2015), which is difficult to change (Webb & Sheeran, 2006). Whereas this usually stable pattern was observed in the monetary appeal condition across the two weeks, a significant reduction in shower frequency was found in the environmental appeal condition.

An interesting trend in the data is that participants in the monetary appeal condition as compared to the environmental appeal condition reported that the assignments were more motivating (and also more enjoyable). These explicit ratings did not match the participants'

actual behavior, and in fact seemed dissociated, given that the environmental appeals were more effective than the monetary appeals in changing behavior. Research shows that money indeed is strongly associated with reward and motivation (e.g., Bijleveld & Aarts, 2014), which may explain why participants at an explicit level indicated that the financial appeal was particularly motivating in lowering showering frequency. Perhaps environmental norms operated mostly at an unconscious level, not affecting the explicit motivation to reduce showering behavior, but affecting behavior through unconscious mechanisms (i.e., unconscious goal pursuit; Custers & Aarts, 2010). Interestingly, our findings are consistent with previous research by Nolan and colleagues (2008), who found that normative beliefs were predictive of conservation decisions, while such norms were rated as less important in guiding behavior as compared to other beliefs. Such results strongly suggest that explicit responses to the question what is motivating should not be used as a guideline to develop behavioral change interventions.

We should mention some limitations, while discussing future directions. First, as noted, ideally the study had included a no intervention condition. Second, we did not obtain reliable shower duration data due to technical problems, thus we cannot be sure whether our findings regarding shower frequency also applies to lowered shower durations as a result of the environmental appeal intervention. Third, it is not clear whether the effectiveness of the environmental vs. monetary appeal can be generalized to other populations. For example, it is possible that families who agreed to participate in our study on showering behavior were already relatively concerned about the environment, more so than the population average. An important future question is whether the effects we obtained are moderated by people's a priori endorsement of environmental values (cf. Maio & Olson, 1998). Fourth, and relatedly, it may be the case that monetary appeals may be effective among people with a relatively low socio-economic status, while our sample consisted mostly of families with a mid to high socio-economic status. Similarly, if the amount of financial gain by not showering would increase, a financial appeal might be more effective. More generally, any comparison of a financial vs. non-financial intervention will depend on the size of the financial incentive. Finally, our intervention may have temporarily reduced showering frequency, but the scientific literature on habit formation suggests that a one-week intervention may be too short to break and change a habit in the longer run (e.g., Holland, Aarts, & Langendam, 2006; Lally, van Jaarsveld, Potts, & Wardle, 2010). Such boundary conditions should be explored in future studies.

To conclude, albeit with some limitations, we obtained these results with a reasonable large sample size, an experimental design with a pre and post measurement of behavior, and in a real life setting instead of an artificial lab environment. As such, the present findings provide an empirical case challenging the widespread idea and use of monetary appeals to change people's energy consumption. Asking people to save the environment is more effective.

Notes

1. The full materials are available upon request with the first author.
2. For the sake of transparency, we note that the data of the remaining loggers were in line with the results of the self-reported showering behavior data, with a significant reduction in showering in the environmental appeal condition but no significant reduction in the monetary appeal condition. However, as we have reasons to doubt that the loggers reliably picked

up signals when showering, these results should be interpreted with great caution, and we therefore did not report them in the main body of the text.

3. To control for the nested design of this study, wherein individual participants are nested within households, we performed a multilevel analysis. In this analysis a mixed model was used to predict the showering frequency in the post-test period by the fixed factors appeal and showering frequency in the pre-test period. This model was then compared to a second model in which household was added as a random intercept. Results of the first model showed the same pattern of results as described above: When controlling for shower frequency in the pre-test period, shower frequency in the post-test period was significantly influenced by condition; $b = .31$, $t(1, 224) = 2.17$, $p = .031$. The same model with household added as a random intercept showed the exact same results and yielded an intraclass correlation of 0, demonstrating that the household participants were part of did not influence the results over prior showering frequency and appeal condition. Given these results, household does not need to be included as a second level in a mixed model analysis.

Disclosure statement

No potential conflict of interest was reported by the authors.

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