Utilizing a Social-Ecological Framework to Promote Water and Energy Conservation: A Field Experiment[1]

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The present study utilized a social-ecological framework to design an intervention to reduce residential water and energy use in a local community. An experimental design was used to study the influence of information leaflets, attunement labels, and socially comparative feedback on the actual levels of energy and water consumption in 166 households over a 6-month period. The results suggest that the labels, designed to attune residents to the environmental-impact affordances of various appliances around their homes, led to a 23% reduction in water consumption. Neither information leaflets nor socially comparative feedback produced significant reductions in water use, compared to controls. No significant reductions in energy consumption were observed for any of the intervention conditions. The results are discussed in terms of their theoretical implications and their application to public policy promoting environmentally sustainable behavior.

Protecting the earth's natural environment from the damaging effects of human activity has become an increasingly important concern over recent decades. Issues such as global warming, ozone depletion, pollution of waterways, and scarcity of fresh water have begun to receive serious attention from the scientific community, the media, politicians, and the wider community. As most forms of environmental damage result from human behavior, psychology as a discipline has taken an interest in promoting more environmentally sustainable patterns of behavior within societies (Oskamp, 2000). Many different psychological approaches have been

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taken to this issue, including rational-economic, social-dilemma, attitudinal, and behaviorist approaches (for reviews, see Kurz, 2002; Winter, 2000). In the current study, we aim to reduce household water and energy consumption by using a holistic social-ecological framework that combines principles of environmental psychology and social psychology.

A Social-Ecological Framework for Promoting Environmentally Sustainable Behavior

A social-ecological framework for promoting environmentally sustainable behavior (ESB; Kurz, 2002) combines Hormuth's (1999) ecopsychological approach to ESB and Baron and Misovich's (1993) social-ecological framework of attitude and behavioral change. The central tenet of this approach is that attempts to understand and change ESB must consider the psychological relationship between people and their physical and social environments. ESB can be understood as involving the way that we interact with "things" around us in our everyday lives (Hormuth, 1999). Examples of environmentally relevant things include objects such as automobiles, trashcans, lawn sprinklers, and home heating systems. In this approach, the unit of analysis becomes the interactional event (in both a physical and a psychological sense) involving the person and the relevant thing with which they engage to cause an environmental impact.

In attempting to understand the way in which we interact with our physical and social environments, Baron and Misovich (1993) suggested that it is necessary to consider three key principles. The first is Gibson's (1979) notion of *affordances*, which can be defined as the potential utility (either positive or negative) that an object in the environment is perceived by a person to be capable of offering. Therefore, when encountering an aspect of his or her environment, a person will perceive objects in terms of what he or she can do with the object or what it affords. For example, a fire may be perceived as affording heat, but it also may afford burning one's hand.

Although Gibson's (1979) original conceptualization of affordances was in relation to a theory of visual perception, the notion of affordances also has been used in relation to perception of the social world, rather than simply the perception of qualities of the physical environment (Costall, 1995; Ginsberg, 1990; Reed, 1993). For example, a friend who shares common interests may be perceived as affording more relaxed and enjoyable conversation than a stranger who does not. Similarly, Kurz (2002) extended the notion of affordances to include the perception of affordances that relate to environmental impact. For example, an automobile may be perceived to afford efficient transport, but it also may be perceived as affording the production of greenhouse gases.

The second key principle is the concept of *attunements*. As there are almost always multiple affordances that persons can perceive in objects or things in their

environments, people can be differently attuned to various types of affordances. For example, in the case of a household shower, a person potentially could be attuned to perceiving it as providing cleanliness, hygiene, and thermal comfort. However, one also could be attuned to the shower affording the consumption of potentially scarce water resources, the production of greenhouse gases, or the consumption of household income in the form of utility bills.

The third key principle is the concept of *effectivities*, which refers to the skills and knowledge required to utilize an object's affordance once it has been perceived. For example, once a person has come to perceive a public-transportation system as affording more environmentally friendly travel than his or her car, he or she also needs to be equipped with certain knowledge (e.g., information about public-transportation options between home and work) and skills (e.g., being able to coordinate the various transportation options successfully) before acting to utilize these affordances. This concept is similar to Corral-Verdugo's (2002) recent notion of *proenvironmental competency.*

Often, when we are engaged in using the things around us that are environmentally relevant, we do not perceive them in terms of their environmental impact (Hormuth, 1999). Rather, we tend to perceive them in terms of their primary, instrumental functions, such as transportation or personal hygiene. We argue that one of the goals of attempts to foster ESB should be to try to attune people to the environmental-impact affordances of environmentally relevant things while they are using them in their everyday lives, and to equip them with the skills and knowledge that they need to utilize these affordances.

It is also important to consider the social environment in which environmental behavior takes place. In a social-ecological approach, it is argued that ESB should be seen as being socially embedded, rather than simply being influenced by situational factors (Kurz, 2002). As such, the social environment will both influence and be influenced by the affordances to which people are attuned and the effectivities with which they are equipped.

Fitting Existing Intervention Strategies Into a Social-Ecological Framework

An array of psychological tools have been identified as being at the disposal of those wishing to conduct interventions designed to promote ESB. These tools include concepts such as inducing commitment, prompting behavior, developing community norms, communicating information, providing incentives or feedback, and removing structural barriers (McKenzie-Mohr & Smith, 1999).

Commitment typically has been induced through community involvement, goal setting, or by delivering an intervention in such a way as to involve personal contact. For example, Burn's (1991) *block-leader approach* to the promotion of participation in curbside recycling involved community volunteers eliciting

commitments to participate from other residents on their block. Attempts to prompt environmentally friendly behaviors have involved the use of labels and signs, as well as postal or verbal reminders (e.g., Luyben, 1984). Community norms have been developed through the processes of social diffusion and social modeling (e.g., Cialdini, Reno, & Kallgren, 1990). Communication strategies typically have included education programs to increase knowledge, as well as various specific techniques, such as appealing to fear, framing information in particular ways, and presenting information that is vivid (e.g., Gonzales, Aronson, & Costanzo, 1988; Hungerford & Volk, 1990).

Interventions utilizing an incentive approach often have relied on financial incentives to promote ESBs (e.g., McClelland & Cook, 1980). Feedback, in contrast, relies on more intrinsic motivations to change behaviors. This technique, most typically used to promote behaviors such as energy or water conservation and recycling, involves providing feedback to households or businesses on their individual levels of consumption (e.g., Hayes & Cone, 1981). Feedback comparing one's own and others' behavior has also been utilized (Midden, Meter, Weenig, & Zieverink, 1983; Schultz, 1999; Siero, Bakker, Dekker, & van den Burg, 1996). Programs designed to remove structural barriers to ESB have usually focused on making the desired behavior more convenient for individuals to perform, such as through improving the facilities available for recycling (Jacobs, Bailey, & Crews, 1984).

It is possible to locate these intervention tools conceptually within the social-ecological framework of ESB outlined earlier. First, the use of prompts can be seen as an attempt to attune people to the environmental-impact affordances of objects in their environments. However, it should be noted that the context in which prompts are used is likely to make a large difference in their effectiveness. For example, Aronson and O'Leary (1983) argued against the utility of prompts, as a result of their failure to achieve changes in showering behavior using a sign erected by an external authority in a university locker room. The social environment in which the prompt was embedded in Aronson and O'Leary's study can be contrasted with that of another study reported by McKenzie-Mohr (2000) in which prompts were used to promote conservative lawn watering. In this case, individuals erected prompts voluntarily in their own homes. When used in this context, the prompts were found to be successful in changing water-use behaviors.

Second, intervention strategies can lead to the creation of new affordances to which people can be potentially attuned. The provision of incentives can lead to individuals perceiving ESBs as affording material (e.g., saving money) or more social (e.g., public recognition) rewards. Similarly, removing structural barriers to ESB can lead to individuals perceiving ESBs as also affording a convenient use of the relevant object. For example, improvements in the public-transportation system can lead people to perceive buses and trains as affording convenient transportation, rather than hours of waiting in the cold.

Third, interventions can equip individuals with the skills and knowledge needed to utilize these new sets of environmentally related affordances through the effective communication of this information using the techniques outlined in the previous section. Finally, the process of behavioral change can be embedded within the social environment through the use of techniques such as social diffusion, social modeling, development of community norms, and use of socially comparative feedback.

The Present Study

The present study applies a social-ecological framework to conduct an intervention, in conjunction with a local council (City of Melville), which addressed an environmental issue of significance to the local community of Perth,[3] Western Australia. Residential water conservation and residential energy conservation were chosen as the behaviors to be targeted by the intervention. Residential water conservation has been an important issue in Perth for many years because of the relatively dry, Mediterranean climate of the area. The importance of conserving water has become particularly prominent recently as a result of unexpectedly low levels of rainfall during 2001 and 2002, a situation that has led to the imposition of restrictions on sprinkler use.[4] Residential energy conservation also was targeted as a result of the local council's participation in the Cities for Climate Protection (CCP) initiative.[5]

The present study investigates the influence of three variables on residents' water and energy consumption. The first of these variables is a series of labels that were placed around the home, which aim to attune residents to the water- and energy-use affordances of various objects and appliances.

In order to separate the effect of this variable from that of simply providing the information itself, a second information variable was included that involved the provision of the same information present on the labels, but in a simple leaflet form. That is, it provided residents with the same information, but did not do so at the point of interaction between themselves and the environmentally relevant objects in their home.

The third variable, socially comparative feedback, was included to investigate whether consumption behaviors also could be influenced by allowing residents to

[3]A city of approximately 1.2 million people.

[4]In addition, Perth's rainfall has declined markedly in the past 25 years (in comparison to all previously recorded rainfall periods), leading some to predict that current water sources will fail to meet demand as early as the year 2030 (Imberger, 2003)

[5]This initiative is a collaborative project, involving local government authorities from all around the globe, which aims to address global warming by reducing greenhouse-gas emissions at a local level. Additional information can be obtained from http://www.iclei.org/co2

compare their consumption with others, thus making these behaviors somewhat more social in nature. The study aims to evaluate the effect of each of these variables within an experimental design and utilizes direct behavioral data (i.e., consumption figures), rather than self-report data as the dependent variable (for discussions of the advantages of direct behavioral data over self-report data in this field of research, see Geller, 1981; Hamilton, 1985).

Method

Design

The study involved a 2 × 2 × 2 design (Information: Present or Absent × Attunement Labels: Present or Absent × Socially Comparative Feedback: Present or Absent).

Participants

A sample of 166 households within the City of Melville (Perth, Western Australia) participated in the study. The sample was taken across four adjoining suburbs that were judged to be similar in socioeconomic status. All participants took part in the study voluntarily. Participants were recruited by way of an initial information letter detailing the nature of the study, and a follow-up visit to their home by the experimenter during the subsequent 2 weeks. The response rates for each cell of the design are detailed in Table 1.

Assignment to conditions was pseudorandom. Target households who were sent the initial information letter were assigned randomly to their potential conditions. However, the final assignment was not strictly random because of the response rates being less than 100% (Table 1).[6] Household demographic information (other than number of residents) was not sought because the non-anonymous nature of participation highlighted participants' concerns about privacy and personal security.

Materials

Information leaflets. The color leaflets included information for residents detailing the importance of conserving energy and water in their homes. They also included information relating to the energy- and water-use affordances of various appliances in the home and ways to reduce this usage (i.e., effectivities).

[6]It was not possible to assign conditions after participants had been recruited, as ethical considerations made it necessary to inform residents of the exact nature of their involvement in the research prior to them agreeing to participate.

Table 1

Response Rates in Each Cell of the Design

Condition	Response rate (%)	*n*
Control group	41.3	23
Information	37.5	21
Information + Labels	30.2	19
Information + Labels + Socially comparative feedback	32.7	18
Socially comparative feedback	48.9	22
Labels	29.1	19
Labels + Socially comparative feedback	30.2	21
Information + Socially comparative feedback	33.5	23

Note. Response rates are expressed as a percentage of eligible households visited by the experimenter who agreed to participate. Households who used underground bores (i.e., wells) to water their gardens or whose water, electricity, or gas meters were not easily accessible were excluded from the study.

Attunement labels. A series of attunement labels was provided to participants in the label condition to install around their home and garden. Each pack was tailored to the particular appliances used in each household and was designed to attune residents to the environmental-impact affordances of using the appliance in question. Labels were made for refrigerators, air conditioners, showers, washing machines, clothes dryers, dishwashers, toilets, and outdoor taps/reticulation systems. Labels for the shower were fitted with a small waterproof digital clock to enable residents to more easily monitor the amount of time spent in the shower (Figure 1). The labels contained the same information as did the leaflets relating to the environmental impact of using particular appliances and behaviors that could be performed to reduce this impact (see example in Figure 2).

Feedback sheets. Households in the socially comparative feedback condition received feedback sheets by mail. These sheets provided residents with graphical feedback on their levels of water and energy consumption and how these levels compared to "other households of similar size who are participating in the research."

Attitude scales. General attitudes toward the environment were measured using Dunlap, Van Liere, Mertig and Jones' (2000) revised version of the New Environmental Paradigm (NEP) scale. The scale consists of 15 items that were answered on a 5-point Likert scale. Specific attitudes toward water and energy conservation were assessed by a single item that also used a 5-point Likert scale.

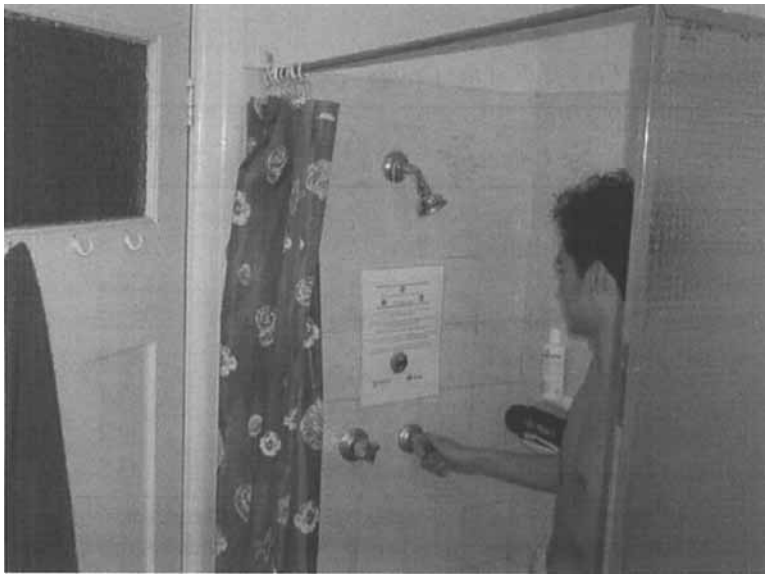

Figure 1. An attunement label in action.

Procedure

Following the initial recruitment phase outlined previously, an initial reading was taken of participant households' water, electricity, and gas meters (October 24, 2001), and again at the completion of a 5-week baseline period (November 21, 2001). The attitude questionnaire was mailed out to all participants halfway through this baseline period and was returned by mail. The response rate for this questionnaire was 56%, which was relatively evenly distributed across each condition.

At the completion of the baseline period, households in the attunement-labels-present condition were delivered a pack that contained their labels and included instructions on how to use them. Participants in the information-leaflet-present condition were delivered their information leaflets. Regular meter readings were then taken over the intervention period, which lasted for 14 weeks. These readings were conducted biweekly, with the exception of the 6-week period between the December 19, 2001, and February 6, 2002[7] (Figure 3). During the intervention period, households in the socially comparative feedback

[7]A longer measurement period was adopted over this period to dampen the increased variability created by the summer-vacation period that is held at this time in Australia.

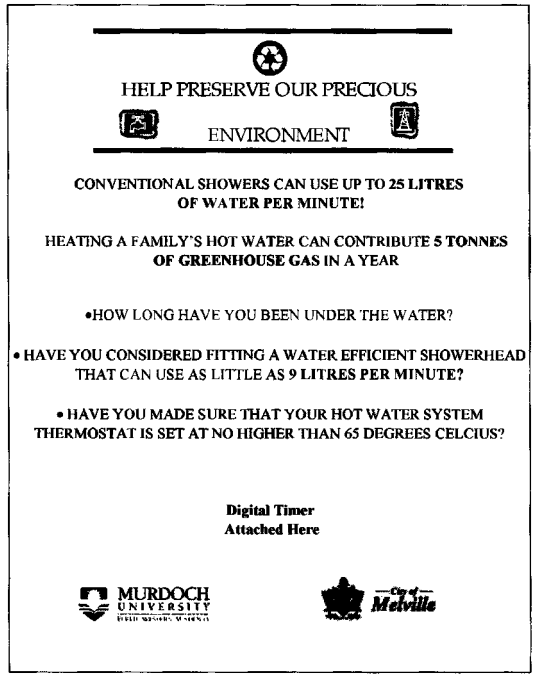

Figure 2. An example of an attunement label used in the shower.

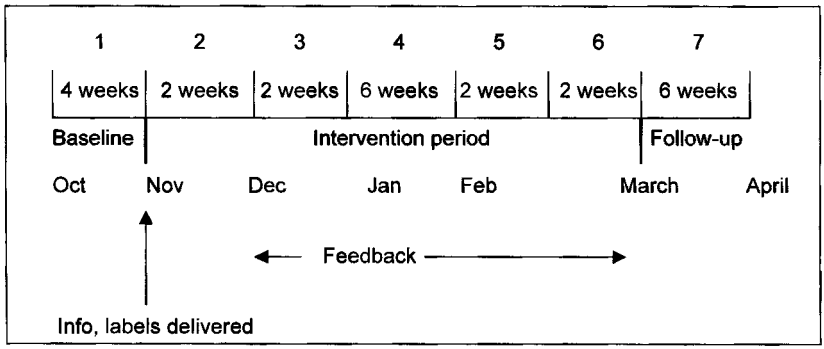

Figure 3. Time-line of the study.

condition were mailed out biweekly comparative feedback on their water and energy consumption.

Follow-up readings of meters were taken 6 weeks after the completion of the intervention period. Participants were then sent a letter thanking them for their participation, as well as a follow-up questionnaire that included manipulation checks and gave them the opportunity to comment on their perceptions of whether the program had changed their behavior.

Results

Manipulation Checks

Information from the follow-up questionnaires was used to establish that the intervention conditions had been created successfully. Of households in the information condition, 85.4% reported having received and read their information leaflets, with 12.5% stating that they were "not sure." On average, it was reported that 71.3% (SD = 30.5) of household members over the age of 12 years had read the information leaflets.

For households in the socially comparative feedback condition, the mean percentage of household members over 12 years of age who were reported to have read the feedback provided was 83.0% (SD = 24.0). Of those households who had been provided with the attunement label packs, 67.6% reported having installed the labels around their home. Of those who did not install their labels, the most common reason cited was that they felt that the labels were "preaching to the converted" (with 62.6% citing this reason). Other reasons given included the labels being "aesthetically displeasing" (25%), "hard to attach" (6.3%), or that the household had decided to discuss the issues instead (6.3%). When asked the length of time that the labels had remained installed in their home, 45.8% of respondents stated that the labels were still installed at the time of completing the follow-up questionnaire. For those who had taken the labels down, 25.0% said they had kept them up for 1 to 2 months, 8.3% had used them for 1 to 4 weeks, 4.2% used them less than a week, and 16.7% said that duration of installation had varied among the different labels.

Attitude Questionnaires

Participants' general environmental attitudes were found to be approximately normally distributed, with a mean that fell marginally toward the proenvironmentalism side of the midpoint (3) on the NEP scale (M = 3.62, SD = 0.44). Participants' attitudes toward water conservation were found to be strongly proconservation (M = 4.40, SD = 0.79). Attitudes toward the importance of energy conservation were also proconservation (M = 4.10, SD = 0.67). However, they were not as strongly proconservation as attitudes toward water conservation,

$t(92) = 2.84$, $p = .005$. NEP scores were significantly correlated with both energy attitudes ($r = .40$, $p < .01$) and water attitudes ($r = .22$, $p = .03$). Energy and water attitudes were not, however, significantly correlated with one another ($r = .11$, $p = .29$).

Energy and Water Consumption

Each household's water-consumption figures for each data-recording period were calculated by subtracting the meter reading at the beginning of the period (expressed in kiloliters) from that taken at the end of the period. Calculating each household's energy consumption for each period involved a similar procedure. However, as different households were utilizing different sources of energy (i.e., electricity only, or a mixture of electricity and natural gas), it was necessary to convert the kilowatt hours of electricity and cubic meters of natural gas into the common unit of kilojoules in order to make households comparable.

Both the energy- and water-consumption data were analyzed using 7 × 2 × 2 × 2 (Time × Information × Labels × Feedback) mixed-model ANOVA. Time was a repeated-measure variable, and the remaining variables were between-subjects variables.

Water-consumption data. As expected, a main effect of time on mean water consumption was found, reflecting seasonal variation in water use, $F(3.6, 500.7^{8} = 5.80$, $p = .00$. The only other significant main effect obtained for water consumption was a main effect of labels, $F(1, 140) = 5.51$, $p = .02$, with households that received labels using less water than those that did not receive labels.

The main effect of labels was conditioned by a significant Label × Time interaction, $F(3.60, 500.7) = 3.47$, $p = .01$. The effect of labels over time on water consumption is presented in Figure 4. The results of two-way comparisons performed between the label and no-label groups' water consumption for each data-recording period are presented in Table 2. As can be seen, there was no significant difference between the two groups at baseline. By the second intervention period, however, households in the label condition were consuming significantly less water than were those in the no-label condition. This difference was maintained at each measurement period through to the completion of the follow-up period.

No significant interactions between information and time for water consumption were found, $F(6, 840) = 0.67$, $p = .67$. There was also no evidence of any significant Time × Socially Comparative Feedback interaction for water consumption, $F(6, 840) = 0.47$, $p = .83$.

[8]Degrees of freedom for each of the mixed-model ANOVAs were adjusted using Huynh-Feldt epsilon as a result of violations of the assumption of sphericity.

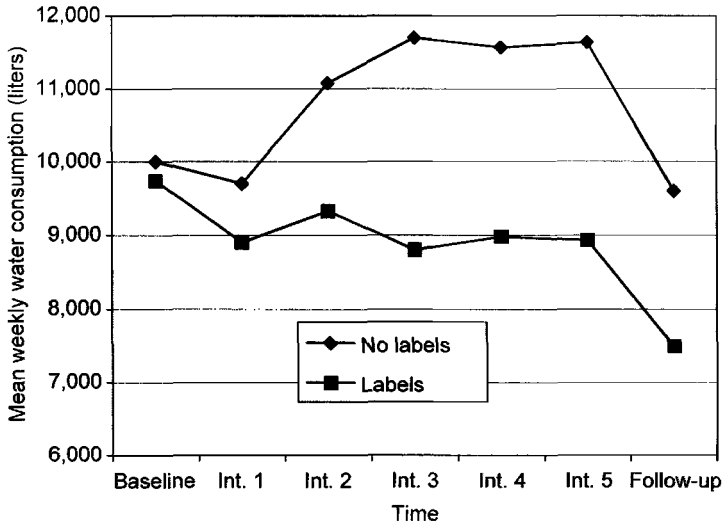

Figure 4. Effect of labels on weekly water consumption.

Energy-consumption data. No significant main effects were obtained for the energy-consumption data other than the expected main effect of time, produced by seasonal variation in energy use, $F(4.9, 718.4) = 9.48$, $p < .001$. In contrast to the water-consumption data, a significant Time × Labels interaction was not found for energy consumption, $F(5.1, 749.0) = 0.38$, $p = .85$. There was also no significant Information × Time interaction for energy consumption, $F(6, 876) = 1.09$, $p = .36$, nor Socially Comparative Feedback × Time interaction, $F(6, 876) = 1.70$, $p = .11$. There were no significant three-way interactions between the variables (information, labels, and feedback) for either water or energy consumption.

There was no significant correlation between residents' attitudes toward conservation of the particular resource and their baseline levels of consumption for either water ($r = .02$, $p = .49$) or energy ($r = -.08$, $p = .84$). Scores on the NEP were not significantly correlated with baseline energy consumption ($r = -.02$, $p = .83$) or baseline water consumption ($r = .04$, $p = .72$).

Comparisons of Initially High, Low, and Average Consumers

A separate Time × Feedback × Baseline consumption-level ANOVA was conducted to investigate whether the failure to find an effect of feedback may have been the result of a differential effect of feedback on households that were initially high, low, or average in their baseline levels of consumption.

Table 2

Two-Way Comparisons Performed Between the Labels and No-Labels Groups' Weekly Water Consumption (in Liters) for Each Data-Recording Period

	Condition	*M*	*SD*	*t*(146)	*p* (two-tailed)
Baseline	No labels	10,000	4,840	0.25	.81
	Labels	9,740	7,750		
Intervention 1	No labels	9,720	4,720	0.81	.42
	Labels	8,900	7,640		
Intervention 2	No labels	11,080	4,950	1.98	.05
	Labels	9,330	5,800		
Intervention 3	No labels	11,700	5,660	3.18	.002
	Labels	8,800	5,250		
Intervention 4	No labels	11,580	5,310	2.79	.006
	Labels	8,980	5,410		
Intervention 5	No labels	11,640	5,410	2.94	.004
	Labels	8,930	5,730		
Follow-up	No labels	9,620	3,900	3.01	.003
	Labels	7,520	4,540		

Households were grouped separately for energy and water consumption into one of three groups (above average, average, or below average) based on a comparison between their baseline levels of consumption and the average baseline level of consumption among all other households in the study with the same number of residents. These analyses reveal no significant Time × Feedback × Baseline Consumption Level interaction for either water consumption, $F(8.7, 536.9) = 0.60$, $p = .79$; or energy consumption, $F(10.6, 692.0) = 0.98$, $p = .46$.

Residents' Perceptions of Their Behavioral Changes

Table 3 details the results of the section in the follow-up questionnaires that asked participants to self-report on the extent to which they felt that their participation in the program had brought about changes in specific types of water- and energy-consumption behaviors. As can be seen in Table 3, many households that participated in the program believed their involvement had brought about behavioral changes in a variety of areas. The most commonly reported areas of change were those relating to water conservation; namely, reducing water use in the

Table 3

Percentage of Respondents Indicating That the Program Caused Behavior Changes

Behavior change	Percentage
Using less water in the garden	85.7
Not leaving lights on	68.8
Reducing shower time	62.3
Not leaving the refrigerator door open	55.8
Using the half flush on the toilet more often	55.8
Using the electric clothes dryer less	54.1
Carefully setting water level in washing machine	53.2
Limiting the use of air conditioners	52.9
Running the dishwasher/washing machine less often	49.4
Checking refrigerator door seals	32.5
Energy and water behavior at work[a]	21.9
Adjusting the thermostat on the hot-water system	16.9
Using the car less[a]	16.9
Purchasing low-flow shower heads	15.6
Installing insulation	3.9
Switching to natural power[a]	3.8

Note. This table applies to all respondents, regardless of the forms of intervention that they received.

[a]This behavior was not targeted directly by the intervention.

garden and reducing showering time. Although a large proportion of households reported an increased vigilance in turning off lights, it should be remembered that lighting only accounts for approximately 5% of a typical household's power use.

The behavioral self-report data were analyzed to compare the responses of those who received each form of intervention with those who did not receive that particular form of intervention. Two interesting results emerged from this analysis. First, participants who received labels (including the shower label with timer) were more likely to report having reduced their shower times than those who did not receive labels (with 75.0% reporting having reduced shower time, as compared to 51.2%). Second, participants who received the information leaflets (which discussed reasons to save water and energy, as well as ways do this) were more likely than those who did not receive the leaflets to have reported

performing the once-off behaviors of adjusting the thermostat on their hot-water system (13.6%, as compared to 2.4%) or purchasing low-flow showerheads (12.3%, as compared to 2.4%).

Discussion

The purpose of the present study was to examine the effect of the three intervention strategies of information, attunement labels, and socially comparative feedback on residential water and energy consumption. The results suggest that, for this intervention program at least, the use of attunement labels had an impact on water conservation. This impact could not be attributed simply to the information provided on these labels, as no significant effects were obtained for those who were presented the same information in the form of an information leaflet. It seems that placement of the information in the form of a label at the actual point of interaction between residents and the environmentally relevant objects in question caused changes in the amount of water being consumed, relative to those who were not provided with this intervention. In terms of the social-ecological framework outlined earlier, this supports the utility of interventions that aim to attune people to the environmental-impact affordances of the relevant appliances and objects in their everyday lives at the point of interaction between the person and the object.

At its peak during the third intervention period, the effect of labels on water consumption represented a 23% reduction; and over the course of the 5-month intervention/follow-up period, residents in the labels condition saved over 1 million liters of water.[9] The effect of labels on water consumption was surprisingly large, when one considers that the imposition of lawn-watering restrictions by the Western Australian government over the period in which the study was conducted reportedly reduced Perth's overall water domestic consumption by 25% (Western Australian Water Corporation, 2002). This suggests that, if anything, the effect size obtained in the current study would be an underestimate of the potential effect size that would be expected in a nonrestricted setting. In fact, this was the case for a small pilot study conducted during the summer of 2000-2001 (prior to water restrictions) in which a 30% reduction in water consumption was obtained.[10]

The generalizability of the current findings regarding reductions in water consumption may be questioned because of the proconservation nature of the voluntary sample employed. The crucial question is whether people who participated

[9]Assuming that their rate of consumption relative to the nonlabels condition would have remained as it was during baseline had they not been delivered the intervention.

[10]This pilot study included only two conditions: one in which information, labels, and socially comparative feedback were all present; and a control group in which none were present.

are systematically more conservationistic than those who did not, and whether being more conservationistic makes one more susceptible to the experimental manipulation. This point can be addressed in two ways. First, current community attitudes in Perth are generally skewed toward the proconservation end of the scale as a consequence of the severity of the current water situation. For example, a recent survey of 408 Perth residents found that 85.3% of residents supported the concept of permanent watering restrictions to get people to use less water, with 12.5% supporting water restrictions only in times of drought, and only 2.2% advocating no use of restrictions (Nancarrow, Kaercher, & Po, 2002). Therefore, this particular sample of participants can be seen as quite representative of the wider Perth community. Second, we would regard proconservation attitudes as necessary but not sufficient in the pursuit of behavioral change. Therefore, although there is little doubt that promoting proconservation attitudes within communities is a crucial first step in bringing about changes in behavior, the current research was more concerned with investigating ways in which one might be able to translate these proconservation attitudes into action. It is our position that unless individuals actually perceive environmentally relevant objects in their surroundings as affording environmental impact, then proconservation attitudes remain largely irrelevant.[11]

It was interesting that, despite the positive effect of labels on water conservation, the same effect was not found for energy conservation. This discrepancy can be attributed to two potential causes. The first of these concerns differences in the social environment in which the use of the two resources is embedded. With the recent drought and resulting garden-watering restrictions in Perth, there has been an increase in the discussion of water-conservation issues in political debate, the mass media, and everyday public discourse. The greater effect on water conservation of specific prompting of behaviors at the point of interaction by the labels may have been a result of the behavior being embedded within a social environment that also facilitated attunement to water-use affordances to a greater degree than energy-use affordances.

A second potential cause of the discrepancy relates to the difference in the perceptual nature of the two resources. Put simply, one can "see" water as it runs out of the tap, but one cannot see energy. It may be easier for people to become attuned to the water-consumption affordances of appliances in their homes than energy-consumption affordances as a result of this difference in the perceptual nature of the two resources. As a result of the possible psychological invisibility of many forms of energy consumption, it may be necessary to develop ways of making energy consumption somehow more "visible" to consumers of the resource.

[11]For a more detailed discussion of attitudes within a social ecological framework, see Kurz (2002).

Another interesting result of the study is the failure to find an effect of socially comparative feedback on either energy or water consumption. A social-ecological framework would have predicted a significant main effect of feedback, as well as potential interactions between feedback and the information and labels variables, with the influence of attuning individuals to the water/energy affordances of objects in their homes being accentuated by embedding these private behaviors within some form of social structure.

The failure to find any effect of socially comparative feedback can be explained in a number of ways. It may have been the case that the comparisons often were not strong enough to elicit a reaction from residents. For example, residents who were consuming at an average level were receiving feedback that was informing them of exactly that. Other residents were being informed that they were consuming less than average.[12] Socially comparative feedback may be effective only when it is used to target specific households that have been predetermined to be consuming at levels far above the average. As was previously discussed, there was no evidence found in the current study to support this hypothesis; however, the analyses involving high, average, and low consumer groupings were limited by cell size. A previous study by Aitken et al. (1994) did find feedback to be more effective in reducing consumption among high consumers of water.

Although socially comparative feedback was used as an attempt to socially embed the otherwise relatively private behaviors of water consumption[13] and energy consumption, the way in which feedback was received was still fairly private. The effect of this variable may have been more pronounced if, for example, all participants had received feedback that included a ranking of all the households in terms of their energy and water use and included names and addresses. For ethical reasons, studies utilizing such approaches have been rare. Pallak, Cook, and Sullivan (1980) did, however, find that participants who signed a commitment to conserve energy in their homes and who were *told* that the results of the study (including their names) would be publicized were more likely to conserve energy than those who were not told that the results would be publicized.[14]

As well as being relatively nonpublic in nature, the method used to socially embed behavior in the present study may have been too contrived in that the comparisons drawn did not relate to any preexisting social structures or groups, but rather ones created by the experimenter. It may be useful in the future to

[12]This can be contrasted to other studies (e.g., Aitken, McMahon, Wearing, & Finlayson, 1994) in which households have been provided with comparative feedback against data that were adjusted to be falsely low.

[13]Obviously, water consumption outside the home (e.g., front garden) is a public behavior.

[14]No results or names were actually made public at the completion of the study.

consider utilizing preexisting social structures and groups in the local community (e.g., schools) to make the comparisons more socially meaningful.

The results of this study have three important implications for those working in the area of promoting ESB. First, our results support the argument that has been made by other authors (e.g., Geller, 1992) that simply providing people with information alone is not enough to change their resource-consuming behaviors. Our findings also suggest that it is useful to target the actual point of interaction between consumers and the aspects of their physical environment that are relevant to the conservation of the resource. Future research in this field should explore further the interactional event involving people and the environmentally relevant aspects of their physical environments, and also the ways in which this is influenced by the social environment in which the behavior is embedded.

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