

Cognitive Dissonance and Energy Conservation

S. J. Kantola and G. J. Syme

Division of Groundwater Research, Commonwealth Scientific and Industrial
Research Organization, Wembley, Australia

N. A. Campbell

Division of Mathematics and Statistics, Commonwealth Scientific and Industrial
Research Organization, Wembley, Australia

A study was conducted to establish whether high consumers of electricity placed in a cognitively dissonant situation would conserve electricity over a 4-week period. Households in Perth, Western Australia owning ducted air conditioning and consuming above average amounts of electricity were included in the study. Four experimental groups were compared. The four groups were as follows: (a) the dissonance plus tips plus feedback group, who were informed of an inconsistency between their previously measured attitudes toward conservation and actual high consumption of electricity; (b) the feedback plus tips group, who were notified that they were high consumers of electricity; (c) the tips-only group, who were sent information on ways to conserve electricity (also sent to Groups 1 and 2); and (d) the control group, who were sent a thank-you letter for participating in the study. It was found, in keeping with bolstering behavior predictions of cognitive dissonance theory, that the dissonance group conserved more electricity than all other groups in the first 2-week measurement period. For the second 2-week measurement period, the dissonance group differed only from the control group. The study also found that self-reported behavior change and number of requests for additional conservation materials are not reliable indicators of actual conservation behavior.

In recent years, psychologists have become increasingly interested in finding ways to promote energy conservation in households. Studies have concentrated on the effectiveness, either alone or in combination, of three approaches: (a) monetary rebates, (b) feedback about consumption, and (c) information about conservation.

Reviews have shown that information in the form of educational material alone has little, if any, effect on energy consumption. Providing feedback on consumption levels sometimes decreases consumption, and monetary rebates appear to be the most effective method of promoting conservation (see Cone & Hayes, 1977; Katzev, Cooper, & Fisher, 1980-81).

But before the use of information to promote conservation is dismissed, there is a need to distinguish between information that presents tips on how to save energy and information that attempts to motivate householders to act on these tips; these two aspects have often been confounded in past studies. Very few studies have evaluated the effectiveness of the motivational content of the message (see Hass, Bagley, & Rogers, 1975, for an exception).

Additionally, although feedback and rebates have shown most promise for promoting conservation, it is inappropriate to view them as competing with the informational/motivational approach. If applications of feedback and/or rebate systems are shown to be effective, (see, for reviews, Cook & Berrenberg, 1981; Shippee, 1980), then the need for the informational approach with a motivational content will be enhanced because of the need to sustain interest in any feedback or rebate programs.

The study reported here is based on cognitive dissonance theory (see Festinger, 1957). The central premise of this theory is that when

The authors would like to thank the Perth office of the Australian Bureau of Statistics for their assistance with the data collection and Philip Fry for his substantial contribution to the design and conduct of this study.

Requests for reprints should be sent to G. J. Syme, CSIRO, Institute of Energy and Earth Resources, Division of Groundwater Research, Private Bag P.O., Wembley, Western Australia, 6014.

a person has two beliefs or items of knowledge that are not consistent with each other, then there is a tendency to reduce this dissonant state.

Sherman and Ghorkin (1980) discuss the likely ways of resolving dissonance when a behavior performed without coercion is inconsistent with an attitude. The usual method of dissonance reduction is an attitude change in the direction of the discrepant behavior. This is particularly the case when the attitude is not highly central, when there is no external justification for the behavior, when there is a sense of responsibility for adopting the behavior, and when negative consequences due to the behavior are foreseen or foreseeable (see also Cialdini, Petty, & Cacioppo, 1981; Wicklund & Brehm, 1976).

However, if a central attitude is involved that is resistant to change and the behavior cannot be discounted, then there is a likelihood that bolstering (reaffirmation) of the initial central attitude will occur (see Abelson, 1959; Sherman & Ghorkin, 1980). In a demonstration of this phenomenon, Sherman and Ghorkin (1980) showed that a freely adopted behavior (failure of a sex role logic problem) discrepant with a central attitude (women's rights) resulted in a reaffirmation of this attitude in subsequent behaviors (response to affirmative hiring measures).

In the present study, subjects in a dissonance condition were informed that their attitude toward energy conservation was inconsistent with the level of their household electricity consumption and were given tips about how to conserve energy. Subsequently electricity consumption was taken as the response variable to assess bolstering behavior. Self-reported electricity conservation and requests for conservation information were used as alternate response variables. This study tests the hypothesis that the dissonance-aroused group with feedback and tips will conserve more electricity than either a feedback plus tips group, or a tips-only group, or a control group (i.e., no dissonance arousal, no feedback, no tips). It was also predicted that self-reported electricity conservation and requests for conservation information would be greatest for the dissonance group. Because of the increased level of intervention, it was hypothesized that the feedback group would conserve more elec-

tricity than the tips group. It was assumed that the control group would conserve least. Because dissonance reduction was predicted to be accomplished through bolstering behavior, the dissonance group was expected to be similar to all the other groups on attitudinal measures of duty to conserve energy, importance of energy, and derogation of the source of the dissonance information.

Method

Subjects

Subjects were selected from warranty lists of houses having ducted refrigerated air conditioning units. Several suburbs in the middle to upper socioeconomic range in Perth, Western Australia were included in the sample. The adult spending most time in the home was selected as the respondent for each household.

Procedure and Stimulus Materials

The experiment was conducted in the hot part of the year but outside the peak holiday period. A personal questionnaire measuring attitudes toward energy conservation and demographic characteristics of the household was first administered to a sample of 272 subjects. This sample came from a list of 439 addresses supplied by air conditioning companies. There were 18 refusals, 91 noncontacts with two callbacks, 49 incorrect or business addresses, and 9 incomplete questionnaires due to language difficulties.

The first question from this questionnaire was "Would you please indicate how important the following issues are to you?" This was followed by a list of six social issues, one of which was household energy conservation. A 5-point unipolar scale ranging from *extremely* (+5) to *not* (+1) followed each issue. These responses were recorded before the subject was aware that the survey was related to energy.

The statement measuring personal duty was "It is your personal duty as a responsible citizen to save as much electricity as possible." This was followed by a bipolar scale with responses ranging from *strongly agree* (+3) to *strongly disagree* (-3). Subjects were also asked whether they had ducted air conditioning or a dishwasher.

Family size and income, age, and sex of family members were also recorded. Subjects were also asked if there were going to be any absences or visitors during the following two months. Finally, subjects were asked for permission to read their electricity meters in the next 2 months and to obtain annual gas and electricity consumption figures from the State Energy Commission.

From this initial sample, subjects were selected for the experiment (a) if they agreed or strongly agreed that it was their personal duty as citizens to conserve electricity (97% of respondents were in these two categories); (b) if there were only minor visitors or absences (less than 3 days visit or absence) expected during the experiment; and (c) if they gave permission to have their consumption monitored. Also, subjects in this initial sample were checked

to see if they were high yearly consumers of electricity and gas. High consumption was defined as being greater than the average consumption for a household in the Perth metropolitan area with the same number of occupants.

The 203 subjects who met the above criteria then had their electricity consumption measured for a 2-week baseline period. All consumption readings were made unobtrusively, without the subject observing the reading. However, because permission was given to have their electricity monitored, the subjects were aware that meter readings might be taking place. On the day of final reading for this baseline period, one of four different letters was dropped in the subject's mail box. Groups were matched for income, electricity consumption, perceived duty to save electricity, and dishwasher ownership. Specifically, the subjects were stratified by dishwasher ownership or lack of it, their response to the question measuring personal duty (only two responses—*strongly agree* and *agree*—were used by the respondents) and their income (in 6 categories). Within each of the resulting classes, subjects were ranked by electricity and gas consumption during the previous 12 months. The first four subjects from this ranked list in each of the classes were then allocated at random to one of the four experimental groups, then the next four subjects, and so on. An allocation decision based on consumption was used when the number of subjects in a class was not a multiple of four.

The four letters represented the four different experimental conditions used in this study. All four versions of the letter thanked people for answering the initial questionnaire. Also, a postage-paid postcard was included, which the subjects could return if they wanted information about ways to conserve electricity. The variations in the letters were as follows:

1. *Dissonance plus feedback group plus tips (dissonance group)* Subjects in this group were informed that they were high consumers of electricity and that they had said in the earlier survey that they felt it was their duty to save electricity. They also received a pamphlet and card listing ways to reduce the electricity consumed by air conditioners, together with a note informing them that dishwashers also use a lot of electricity.

2. *Feedback plus tips group (feedback group)* Subjects in this group were notified that they were high consumers of electricity; they also received a pamphlet and card listing ways to reduce electricity consumption. No mention of "duty to save" was included in this letter.

3. *Tips-only group (tips group)* Subjects in this group received only the pamphlet and card listing ways to reduce electricity consumption.

4. *Control group* Subjects in this group received only the thank-you letter and the postage-paid postcard requesting further conservation information that was sent to all groups.

Following the presentation of the letter, electricity consumption over two consecutive 2-week periods was recorded. The average maximum temperature during the first 2-week experimental period was 26.5 °C (79.7 °F), for the second 2-week period the average was 30.1 °C (86.2 °F).

Approximately 1 week after the final reading of electricity consumption was taken, the second questionnaire was administered. This was again a personal interview with the same subject who responded to the first survey.

This second questionnaire included questions on the

following: (a) any absences or visitors during the experimental period, (b) a retest of the perceived importance of energy conservation, (c) a retest of the respondent's perception of their duty to save electricity, (d) the respondent's self-report of whether energy conservation was attempted over the study period, (e) which electricity-conserving behaviors were adopted (i.e., dishwasher, air conditioner usage), (f) open-ended comments on any phase of the study, subsequently coded as *no comment*, *positive*, *neutral*, and *negative*, and (g) whether the respondent was interested in participating in future studies, with response choices of *definitely*, *possibly* and *not interested*.

For this study, the four response variables that assessed the effect of experimental manipulations on behavior or reported behavior were as follows: (a) whether the person returned the postcard requesting more information on conservation, (b) whether the person reported that an attempt was made to conserve electricity, (c) the electricity consumption during the first 2-week experimental period, and (d) the electricity consumption during the second 2-week experimental period.

The four measures of the effects of the experimental manipulations on attitudes were as follows: (a) attitude with respect to the personal duty of the respondent to conserve energy; (b) attitude with respect to the importance of energy conservation; (c) derogation of the source of the dissonant information (reflected in a negative comment about the study or lack of willingness to participate in further studies), and (d) intentions to conserve energy.

The final sample size was 118, obtained after removing households with significant absences or visitors (i.e., more than 3 days visit or absence) and noncontacts. Numbers in the experimental groups were as follows: dissonance, 31; feedback, 32; tips, 30; and control, 25. Analysis of covariance was used to adjust for any resulting differences in the composition of the groups with respect to the factors used for stratification (see below).

Results

Questionnaire Responses (Attitude and Self-Reported Behavior Change)

The response of an individual to any one of the questions in the questionnaire is qualitative, with two or more categories of response. For each individual in a particular treatment group, we may assume that the response is multinomial (or binomial when the response is binary).

Our interest is in examining whether the proportions for the underlying multinomial distributions are the same for the four experimental groups or for subsets of the groups (e.g., for the contrast between the dissonance group and the feedback group). Maximum likelihood estimates for the parameters for the various multinomials can be computed using log-linear model methodology, with terms included in the model to ensure that appropriate margins are fixed (in the case of two groups

logistic linear regression methodology can be used). A description of the approach is given in Nelder (1974, Section 3). Comparisons of the different (subsets of) groups can be evaluated using chi-squared statistics based on the ratios of likelihoods under the assumption of different multinomial probabilities for the (subset of) groups and common multinomial probabilities for the (subset of) groups.

For a binary response, the stratification adopted to allocate subjects to the four experimental groups was incorporated into the analysis by adopting logistic linear regression methodology, with the stratification factors as covariates. Because of the simplicity of this approach, we also chose to examine the effects of the stratification factors on the multinomial responses by treating the latter as a series of binary responses (e.g., for a response with levels *strongly agree*, *agree*, and *neutral*, we analyzed *strongly agree* versus [*agree*, *neutral*], and [*strongly agree*, *agree*] versus *neutral* as two alternative binary responses). For only a few of the responses was one or more of the covariates significant, and in none of these cases did the significance or otherwise of the differences between the experimental groups (or of contrasts between the groups) change.

In general, we chose to examine contrasts among the intervention groups in the same order as the degree of intervention. For example, tips would be compared with feedback, and if there was no difference these groups would be combined and compared with the dissonance condition. That is, we combined responses for "adjacent" treatments when they did not differ significantly and compared the combined response with adjacent remaining groups. The control group is then compared with tips and those groups similar to tips. An exception was made for the consumption variable where means obviously did not follow the linear pattern assumed by our general approach.

Evidence of dissonance reduction by means of verbal report from the follow-up questionnaire is now examined.

Duty to save There was a trend ($p = .07$) for fewer in the dissonant group to *strongly agree* that it is their personal duty to save electricity than in the remaining groups. The proportions were as follows: dissonance (.61); feedback (.87); tips (.83); and control (.76).

Importance of energy conservation. There was no significant difference between the groups in the rating of the importance of energy conservation. Overall proportions were as follows: extremely, .27; very, .59; and moderately, .14.

Comments on study There was no difference between the groups in the rated favorability of the comments. Overall proportions were as follows: no comment, .48; positive comment, .22; neutral comment, .18; and negative comment, .12.

Willingness to participate in further studies There was no difference between the groups in the willingness to participate in further studies. The overall proportions were as follows: definitely, .49; possibly, .33; and not interested, .18.

Self-reported attempts to reduce use of electricity Significantly fewer in the tips and control groups reported that they attempted to reduce their usage of electricity than in the dissonance and feedback groups ($p < .05$). The proportions were as follows: dissonance, 0.69; feedback, 0.65; tips, 0.39; and control, 0.48.

Cut down on use of dishwashers Of the 44 subjects owning dishwashers, significantly fewer in the control group stated that they reduced their use of dishwashers than in the remaining groups. The proportions were as follows: dissonance, .36 ($n = 11$); feedback, .10 ($n = 10$); tips, .30 ($n = 10$); and control, .00 ($n = 13$).

Cut down on use of air conditioner Significantly fewer in the control group stated that they cut down on the use of air conditioners than in the remaining groups ($p < .05$). The proportions were as follows: dissonance, .43; feedback, .46; tips, .54; and control, .24.

Changed air conditioning setting There was no difference between the groups in the proportion that reported that they changed the thermostat setting on their air conditioner. The overall proportion was .17.

Postcard Returns

This analysis was restricted to the experimental groups that received tips initially. Significantly fewer in the dissonance group returned postcards than in the feedback group ($p < .05$). The proportions were as follows: dissonance, .00; feedback, .23; and tips, .14.

Electricity Consumption

Household electricity consumption during the two 2-week measurement periods and during the total 4-week period was analyzed. Electricity consumption figures for the 2-week prestudy baseline period and for the previous 12 months were considered as covariates. There was a highly significant adjustment for the consumption for the previous 12 months ($p < .001$), and this was similar for all four experimental groups. The mean consumption figures (in kilowatt hours) adjusted for yearly electricity consumption are shown in Table 1.

The consumption for the dissonance group was significantly lower than that in the control group for the total 4-week experimental period ($p < .05$) and for the first 2-week experimental period ($p < .05$); factors for the covariates and the treatment groups explained approximately 70% of the variation in the response for the 4-week period.

Discussion

As hypothesized, the results indicate that there was some effect of dissonance on consumption but none on attitudes. The dissonance group for a 2-week period consumed less electricity than the other three groups. This effect did not persist in the second 2-week measurement period. Although the observed effects were limited to the first fortnight, the findings are promising when the level of intervention (a single resident in a multiple resident dwelling) and the minimal treatment difference between groups (all manipulated within a few lines of a standardized letter) are considered. The diminution of our effect is also similar to that often observed when financial incentives such as rebates or fines are used to encourage conservation behavior (Cook & Berrenberg 1981).

Although dissonance effects were demonstrated at a behavioral level, this was not the case for the alternative measures: reported behavior change and postcard returns. In the first case more subjects in the dissonance and feedback groups reported that they attempted to reduce electricity consumption than in the tips and control groups. Although the feedback group had greater proportions of individuals reporting that they attempted to reduce electricity consumption than the tips or control

Table 1
Electricity Consumption of the Four Groups (Kilowatt Hours Adjusted for Yearly Electricity Consumption)

Group	Time after intervention		
	First 2 weeks	Second 2 weeks	4 weeks
Dissonance	256	383	640
Feedback	289	416	705
Tips	285	382	667
Control	297	432	729
Standard error (approx)	13	19	29

groups, this group did not actually consume significantly less electricity than these groups. This may have been because this group were motivated only enough to say they made some attempts to conserve or that the attempts they did make were not as diligent as the dissonance group.

When the reported changes in specific conservation behaviors (i.e., dishwasher and air conditioner usage) and postcard returns are considered, the importance of a valid response variable (i.e., actual electricity figures) becomes even more obvious. From the reported reductions in dishwasher and air conditioner usage it is only possible to conclude that the control group probably conserved less than the other three groups. This is not totally inconsistent with the consumption data, but it does not indicate the superior conservation behavior of the dissonance group. Thus, the importance of gaining consumption data in addition to self-report measures is emphasized.

The second behavioral measure, that of postcard returns, showed opposite results to that of consumption. Lowest returns occurred in the dissonance group. The use of data from postcard returns as an indicator of motivation to conserve electricity may, therefore, lead to erroneous conclusions. The failure of the dissonance group to return any postcards could lead to the assumption that these people are not motivated to conserve or had even shown reactance (Brehm, 1966) to the dissonance manipulation. This is not consistent with the findings from the analysis of the actual electricity consumption figures nor with the attitudes of the respondents in the final survey.

It is also incompatible with the study of Craig and McCann (1978) on the effects of credibility and repetition of a message on electricity consumption, which found similar responses for consumption and postcard returns.

Because of subject availability, a number of control groups that would have aided interpretation had to be omitted. In interpreting the superior conservation of the dissonance group, it should be recognized that the design of the study omitted a condition of reminding people of their values without informing them of their high consumption. It could be assumed that if such a group conserved as much as the dissonance condition then subjects were responding to a reminder of their values rather than to dissonance per se. In practice some "value reminder" influence was present to a significant degree throughout the three non-dissonance groups. When they received their letter, they were inevitably reminded of a highly conservation-orientated interview, especially in the feedback condition. Thus, the dissonance effect had to be measured above three implicitly value-influenced control conditions. A design incorporating both a no-letter group and a values reminder only would, therefore, be desirable.

A further design issue is that of assessing the relative effects of information and feedback or dissonance when they are used in combination. Groups receiving either dissonance induction or feedback *without* information could also have been incorporated in the design to give an indication of possible interaction between both dissonance and feedback and information. In this study, as in many in behavior modification (Cook & Berrenberg 1981), we have assessed the effects of each variable in an additive sense, with the effects of information being considered as being "controlled for" in comparisons between feedback and dissonance. For this reason our analysis makes statistical comparisons sequentially. It was, of course, impossible to have a dissonance group without feedback.

Finally, this study, although mainly addressing itself to motivational issues in relation to information, also suggests a different di-

rection for attitudinal research. Many studies (see Olsen, 1981) have found a poor correlation between attitudes towards conservation and actual patterns of consumption. However this study suggests that if consumers are made aware of a discrepancy between their attitudes and behavior then more consistency might be observed.

References

- Abelson, R P (1959) Models of resolution of belief dilemmas *Journal of Conflict Resolution*, 3, 343-352
- Brehm, J W (1966) *A theory of psychological reactance* New York: Academic Press
- Cialdini, R B, Petty, R E, & Cacioppo, J T (1981) Attitude and attitude change *Annual Review of Psychology*, 32, 357-404
- Cone, J D, & Hayes, S C (1977) Applied behavior analysis and the solution of environmental problems. In I Altman & Wohwill J F (Eds), *Human behavior and environment* (Vol 2, pp 129-176) New York: Plenum Press
- Cook, S W, & Berrenberg, J L (1981) Approaches to encouraging conservation behavior: A review and conceptual framework *Journal of Social Issues*, 37, 73-107
- Craig, C S, & McCann, J M. (1978) Assessing communication effects on energy conservation *Journal of Consumer Research*, 5, 82-88
- Festinger, L (1957) *A theory of cognitive dissonance* Stanford CA: Stanford University Press
- Hass, J W, Bagley, G S, & Rogers, R W (1975) Coping with the energy crisis: Effects of fear appeals upon attitudes toward energy consumption *Journal of Applied Psychology*, 60, 754-756
- Katzev, R, Cooper, L, & Fisher, P (1980-81) The effect of feedback and social reinforcement on residential electricity consumption *Journal of Environmental Systems*, 10(3), 215-227
- Nelder, J A (1974) Log linear models for contingency tables: A generalization of classical least squares. *Applied Statistics*, 23, 323-329
- Olsen, M E (1981) Consumers' attitudes toward energy conservation *Journal of Social Issues*, 37, 108-31
- Sherman, S J., & Gorkin, L (1980) Attitude bolstering when behavior is inconsistent with central attitudes. *Journal of Experimental Social Psychology*, 16, 388-403
- Shippee, G (1980) Energy consumption and conservation psychology: A review and conceptual analysis *Environmental Management*, 4, 297-314
- Wicklund, R A, & Brehm, J W (1976) *Perspectives on cognitive dissonance* Hillsdale, NJ: Erlbaum

Received May 23, 1983

Revision received February 7, 1984 ■