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PREDICTING WATER CONSUMPTION FROM HOMEOWNERS' ATTITUDES

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ABSTRACT

Previous research has failed to find a significant correlation between attitudes and water consumption. We believe this result has occurred because the earlier studies measured attitudes during drought conditions and used self-report measures that are unreliable. The present research studied a sample of 333 households in Perth, Australia, measured the homeowners' attitudes during a drought-free period, and collected actual, household water consumption data for an entire year. The results showed that attitudes pertaining to the importance of the garden as a house investment and a source of recreation were significant predictors of water use, as were homeowners' attitudes toward the current cost of water. The results are consistent with other research that shows that specific attitudes are correlated with resource consumption. The respondents' attitudes toward the economic implications of their water consumption were discussed with regard to conservation appeals.

The supply and quality of water required to meet a variety of human needs are threatened. Problems of water pollution, endangered aquatic ecosystems, irrigated agriculture, and the like are well known. Water policies that evolve to meet this management challenge are complex and subject to political forces from business, agriculture, public interest groups, and government [1]. To be successful, water

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policy must satisfy the concerns of its various constituencies. For example, residential water conservation campaigns must be seen as credible, fair, and propose remedies that are acceptable to and feasible for the homeowner [2]. In short, the audience or targets of conservation programs, and of other water policies, must be taken into account.

Heberlein has argued that dozens of environmental projects have been stopped because the public's concerns were not considered [3]. As part of the effort to resolve this impasse, he recommends that environmental attitudes should be collected routinely in the planning process. He states that attitudes are useful to environmental managers because they provide information about public support and preferences and suggest the likely behavior of relevant participants. One assumption, of course, is that attitudes and future behavior are strongly linked.

Although previously there has been controversy about the extent to which attitudes predict behavior, both theoretically (e.g., [4]) and in application to the environment [5], recent discussions have been far more encouraging [6]. The research of Ajzen and Fishbein [7] and Fazio [8] have greatly elaborated the attitude-behavior link, emphasizing the important role of salience and accessibility. Within the environmental field, there has been a recognition that general attitudes toward environmental issues do not predict very well peoples' specific environmental behaviors [5, 9]. However, Seligman and his colleagues have demonstrated, at least for energy consumption, that specific attitudes toward thermal comfort and health are significant predictors of household energy consumption in both the winter and summer [10-12].

With regard to water consumption, a significant correlation has not been found between attitudes and consumption. Past researchers have looked at peoples' beliefs, motives, and attitudes during periods of drought, and often used self-report measures of actual or intended consumption. This raises two concerns. First, drought conditions likely produce a narrowing of the range of expressed attitudes about water use, especially toward excessive consumption, and perhaps even a consensus about the issue. That is, during a drought people are forced to confront the inconvenience of water restrictions which are often dictated by regulation and penalties [2]. Because of the possible truncated range of the attitude measure and similarity of consumption responses to conservation demands, it may be difficult to show attitude-behavior consistency. Syme, Kantola, and Thomas [9], for example, during a drought in Perth, Western Australia found a poor correlation between attitudes toward garden benefits [13], pricing, garden production, and water conservation attitudes on the one hand, and household water consumption on the other.

A second concern with previous research is the use of self-report measures. People have little knowledge of their resource consumption use ([14, 15] for energy) and self-report measures have been found to be unreliable ([14] for water; [16] for energy). Nonetheless, and with these caveates in mind, the previous literature does hint at a possible relation between attitudes and water consumption.

Hamilton found that idealistic motives for saving water (as opposed to economic motives) were related to self-reported water saving behavior, although not to actual water conservation during the drought [17]. Kantola, Syme, and Campbell applied the theory of reasoned action to intentions to conserve water [18]. They found that the best predictor of water consumption was the variable of subjective norms. Whereas attitudes did not add significantly to the regression equation predicting consumption once subjective norms were included, attitudes did interact with age. Attitude was a significant predictor of consumption for homeowners under thirty-five years of age, beyond the contribution of subjective norms.

The purpose of the present research was to investigate the relation between water consumption and homeowners' attitudes, using procedures that benefitted from the earlier research. In the present study, first, attitudes were measured during non-drought conditions, in the expectation that attitudes would more likely reflect typical evaluations of water use than might be expressed during a stressful period of coping with drought. Second, actual water consumption was measured thereby eliminating the problems with self-report measures. Related to this point, water consumption was measured for the same complete year for each participant, thus yielding a reliable measure of consumption, unlikely to be greatly affected by short term changes in consumption due to vacations, extra guests, and the like. Third, as discussed, because the previous literature is quite clear that specific attitudes are the ones that are likely to be related to consumption, attitude measures in the present study were largely organized around the topic of the garden, which is very important to Australian homeowners. For example, Weeks and McMahon [19] report that 50-70 percent of total water consumption in the summer is used for the garden in Australia, and over the entire year outdoor water use is still over 40 percent of total usage [20]. With these changes made to the attitude survey, it was hypothesized that attitudes would predict water consumption more strongly than was found in past research.

METHOD

Respondents

The respondents consisted of 333 households, which formed a subsample of the 973 households who were administered a socio-economic questionnaire as part of the Perth Domestic Water Use Study [20]. The subsample was a random selection of respondents, living in detached houses, who did not own their own bores (i.e., wells), and from whom complete data were collected from both husband and wife and for total water usage. The mean household size was 3.5 persons and the average family income was Aus$18,732. The average age was 40.7 years for males and 38.8 years for the females. The respondents were interviewed by four

male and five female interviewers, ranging in age from nineteen to thirty-six. The interviewers had received 30 hours training.

Procedure

Respondents were interviewed in their homes. Interviews with all of the respondents were completed within a twelve-week period during the summer. Respondents had previously agreed to allow survey personnel to read their water meters to record total usage. These water consumption data were recorded for one entire year.

Questionnaire

The first part of the questionnaire was concerned primarily with obtaining recollections of past factual events and was answered together by both adults. Respondents were asked a variety of questions related to ownership of appliances, swimming pools, and other water saving or using devices. Questions pertinent to the present analysis were garden expenditure and time spent gardening. The couples were asked to estimate how much money they had spent on recurrent garden items such as plants, seeds and seedlings; turf; fertilizer, insecticides, top dressing; sprinklers and hoses; lawnmowers and other garden tools; gardeners, lawnmowers and rubbish contractors. The couples were also asked to estimate the time they spent in maintaining and caring for the garden in each of the seasons of the year.

The second part of the questionnaire was answered by the two adults separately and consisted of a series of forty statements to which participants could respond on 5-point scales varying from strongly agree (1) to strongly disagree (5). The items dealing with ownership of bores (wells) were omitted from the present analysis, because none of the respondents in this sample owned a bore. The remaining items were grouped into four scales that had been previously pretested. The scales were labelled as follows:

Garden interest scale — This scale consisted of eight items: I enjoy growing some of my own food; I enjoy watching things grow; It's great to grow your own vegetables and garden; I get great satisfaction from working in the garden; gardening is a waste of time; gardening is a pleasant break from the household or work routine; I have a strong desire to work with the soil; I don't like gardening. Lower scores indicated greater agreement with statements favorable to gardening. This scale was reliable (Cronbach's alpha = 0.85).

Garden recreation attitudes scale — This scale comprised five items: I never enjoy showing friends around the garden; I never entertain friends in the garden; I hardly ever use the garden for recreation; all of our family make a lot of use of the garden; the garden is an important place for my leisure activities. Low scores refer

to a high appreciation of the recreational value of gardens. The reliability of this scale is 0.75 (Cronbach's alpha).

Water quality scale — This scale listed ten items: I am happy with the taste of our mains water; Perth has good quality water; the salt problem in Perth's water supply is exaggerated; mains water around here is usually brown; our drinking water never smells of chemicals; our mains water looks clear; I am concerned about the level of salt in my drinking water; Perth's water quality is poor; our mains water smells of chlorine, too much for my liking; the quality of Perth's water is good. Lower scores reflect a positive evaluation of water quality. Cronbach's alpha for this scale is 0.81.

Attitudes toward price — This scale consisted of seven items: The basic water allowance of 150 Kiloliters should be decreased; excess water is too cheap; the charge for the basic water allowance is too high; Perth residents will have to accept that water will become more expensive in the future; the cost of the basic water allowance is too low; compared to other things, excess water is a cheap commodity; excess water charges are much too high. Lower scores showed unhappiness with the current price of water. The reliability of this scale is 0.77 (Cronbach's alpha).

Respondents were also asked to indicate what water conservation techniques, if any, they had used in the past to save indoor or outdoor water by changing their behavior or by making structural changes. Each conservation measure reported received a score of one.

Finally, husbands and wives were asked individually to estimate (in dollars) how much the "way your yard has been developed adds to the resale value of this property."

RESULTS

Table 1 presents the means and standard deviations for each of the variables in the study, with data shown for males and females for those variables where the data were collected separately. There were no significant differences between males and females for garden interest, garden recreation, water quality, or attitudes toward price. Males did give statistically significantly higher estimates for the contribution of the garden to the resale value of the house than females, $t = 2.88$, $p < .01$. Males also reported taking significantly more conservation actions than females, $t = 20.0$, $p < .001$.

Table 2 provides the correlations between husbands and wives for each of the variables where husbands and wives filled out their responses individually. Except for conservation measures, all correlations reported in Table 2 are statistically significant at the $p < .001$ level.

Table 1. Means and Standard Deviations of Variables

1982 Total water consumption (kiloliters)	415.8	(218.8)
Garden expenditure	$184.19	181.59
Time spent gardening (hours per week)	7.2	(3.5)

	Males		*Females*	
Garden Interest Scale	17.3	(4.1)	16.7	(4.1)
Garden Recreation Attitudes Scale	10.8	(3.6)	10.9	(3.9)
Water Quality Scale	29.5	(7.5)	30.6	(7.4)
Attitudes toward Price Scale	25.4	(5.3)	26.0	(5.4)
Contribution of garden to resale value of house	$3,556	($2,193)	$3,069	($2,177)
Conservation measures	1.23	(.84)	.20	(.43)

Note: Standard deviations are given in parenthesis.

Table 2. Correlations between Husbands and Wives

Garden Interest Scale	.23*
Garden Recreation Attitudes Scale	.43*
Water Quality Scale	.39*
Attitudes toward Price Scale	.26*
Contribution of garden to resale value of house	.64*
Conservation measures	.01

* $p < .001$.

Table 3 shows the individual and multiple correlations between the predictor variables and total yearly water consumption. Because of the large sample size (N = 333), we opted to use a conservative alpha level, namely $p < .001$. Using this criterion of statistical significance, four statistically significant correlations were found between the predictor variables and yearly water consumption. As shown in Table 3, these are: garden expenditure, garden recreation, attitudes toward price, and contribution of the garden to the resale value of the house. Additionally, the pattern of correlations is similar for males and females.

DISCUSSION

The homeowners' estimates of the contribution of the garden to the resale value of the house and their garden expenditures were the best predictors of water consumption. The greater the garden's perceived value to the resale of the house

Table 3. Correlations between Predictor Varibles and Total Yearly Water Consumption

Garden Expenditure	.33*
Time Spent Gardening	.15

	Multiple r	*r*	
	(Males and Females Together)	*Male*	*Female*
Garden Interest Scale	.09	.05	.08
Garden Recreation Attitudes Scale	-.24*	-.20*	-.20*
Water Quality Scale	.08	.05	.03
Attitudes toward Price Scale	.19*	.14	.15
Contribution of garden to resale value of house	.38*	.35*	.33*
Conservation measures	.05	.05	.01

* $p < .001$.

and the more money spent on the garden, the more water the household consumed. These results are consistent with household energy consumption research [10] that suggests that specific attitudes about the use of a resource are important correlates of energy consumption.

Psychological water consumption research is similar to psychological energy consumption research in another respect. Engineering studies in both water consumption [20] and energy consumption [21] are not able to predict as much of the variance in consumption as expected from their technical models. Attitudes and perceptions of homeowners seemed to be important in explaining additional variance in energy consumption [21]. The present findings suggest that this outcome is likely to be the case for water consumption as well.

It is noteworthy that both the homeowners' interest in the garden and the time spent gardening, which perhaps might be seen as measures of intrinsic interest in gardening, were not significantly correlated with water consumption. These findings are similar to the earlier study conducted in drought conditions [9] in which gardening benefits were not found to correlate with consumption. The significance of the resale value of the house and garden expenditure were not investigated in this earlier study. It should be noted, however, that interest in gardening was high in both samples and this lack of correlation may be partially because of lack of variation in the community. Most people like gardening [22]. It may be that with regard to water consumption the garden is better viewed as an extrinsic activity. This notion is supported by the significant correlations of water

consumption with both the garden as an investment and with the garden as a source of recreation and entertainment.

Economic concerns were also revealed in the finding that attitudes toward pricing significantly correlated with water consumption. The more satisfied homeowners were with the current price of water the more they used. When these same attitudes were measured during drought, no significant correlation was found [9]. This result suggests that homeowners will continue to consume as much water as they wish, so long as they can afford to when water is available. This conclusion is consistent with research that has actively attempted to curtail the household's water consumption. Both an Australian study (reported in [23]) and a study by Geller, Erikson, and Buttram [24] were unable to reduce homeowners' consumption of water, using rebates, educational instruction, or feedback. Geller et al., however, did show that giving homeowners shower flow restrictors was effective, although less than expected [24]. The authors of both of these studies suggested that the cost of water was too low to motivate homeowners to conserve. Thomas and Syme demonstrated a low price elasticity in a contingent valuation study in which behavioral intentions for water savings were elicited under different pricing levels and different feedback about the amount of savings achieved [25]. This again shows the reluctance of consumers to use less water at the prevailing price levels. Interestingly, those respondents who agreed that price affects their water use had a higher price elasticity than the rest of the sample. This tends to support the present results.

Winkler and Winett have shown that energy feedback techniques to reduce consumption are more successful the higher the energy costs are as a proportion of the household's budget [26]. Their findings suggest that psychological techniques to reduce resource use are somewhat dependent on the cost of the resource. This especially seems to be the case with water consumption, because it is believed to play an important and inexpensive role in increasing the resale value of the house.

In introducing this study it was suggested that the poor correlation between attitudes and water consumption in past studies may have been because the studies were conducted in a drought and used inadequate measures of water use. The comparison between the present study and the earlier study of attitudes and water use during a drought in Perth [9] is therefore of interest, because both had adequate consumption statistics and shared some common variables: garden interest and attitudes toward pricing. Both studies showed a lack of correlation between the garden interest scale and consumption. A correlation between attitudes toward price and consumption was not evident in the earlier drought study, but was found in the present investigation. One reason for the difference between the two studies may have been because the pricing structure had changed in the interim. During the earlier study, a large "free" allowance was available based on the rateable value of the house property. During the present study, this system had been replaced by a relatively more "pay-for-use" system in which a modest and fixed 150 kiloliter allowance was provided for all

consumers, with a fixed charge levied for each kiloliter consumed above this level. Indeed, Thomas and Syme found that the change in the pricing structure in itself had an effect of reducing demand [25]. Water planners therefore need to consider the psychological significance of the structure of their pricing policies as well as the absolute pricing levels.

A number of major water authorities have moved to introduce pay for use systems in recent years. In response to attitudinal studies [27], the pay for use philosophy has been enacted as a rebate program in Sydney, Australia. With these types of pricing structures, psychologists may play an important role in evaluating the effect of pricing level on consumption and assist in ongoing demand forecasting.

Two additional measures deserve mention because they did not correlate significantly with water consumption. First, the number of conservation techniques homeowners reported undertaking did not significantly predict water consumption. Interestingly, this was the only variable that did not show a significant correlation between husband and wife. Most likely both low correlations reflect the fact that neither husbands nor wives listed very many conservation activities; men reported only slightly more than one on average, while women listed much less than one on average. It is possible that the homeowners were reporting accurately, but it is also the case that homeowners may not have been aware of which actions constituted meaningful conservation. Recall the earlier discussion of the unreliability of self-reports of conservation behavior and homeowners' poor knowledge of their resource use.

The remaining measure that did not significantly predict water conservation was water quality. Generally Perth residents were satisfied with their water quality, average responses being about the midpoint of the scale. Since in fact the water quality is reasonably good, it is not surprising that homeowners' water use was unaffected by water quality, especially because toilet flushes account for about a third of indoor water consumption [20].

The results showing the importance of the garden for water use have implications for planners. When water use must be reduced because of drought, it is likely that conservation appeals will meet with resistance if homeowners believe their gardens will be threatened. Thus it might be more effective during non-crisis times to encourage consumers to switch to native plants that require less water and to consider alternate, low water-use landscaping (such as bark chips and decorative stones) than to expect and demand that consumers abruptly curtail their water use during a drought.

Finally, the present results demonstrate that what homeowners think about their water consumption is important to consider in planning. Attitudes regarding the value of the garden in enhancing the resale value of the house are significant. While the economic implications of water consumption have been emphasized in the current discussion, it is worth remembering that the garden also plays a role in presenting oneself to one's neighbors. The garden is another indictor of status and personality, and as Seligman and Finegan have suggested [28], the

public presentation aspects of water use must be considered in conservation campaigns. The findings of Kantola et al. [18] that social norms are important correlates of behavioral intentions to save water and the results of a study by Wilk and Wilhite [29] that homeowners are more interested in energy saving actions that are visible to their neighbors (e.g., solar collectors vs. insulation) complement the present analysis. Similarly, the value we place on cleanliness in our society influences the amount of water that we consume [30]. These social and cultural factors are necessary to understand in developing water consumption policies, if we are to avoid relying simply on punitive measures to control water consumption, particularly during droughts.

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