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The effects on memory and self-reported behaviour of four types of information about water conservation

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THE EFFECTS ON MEMORY AND SELF-REPORTED BEHAVIOUR OF FOUR TYPES OF INFORMATION ABOUT WATER CONSERVATION

BY

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Abstract

Education campaigns conducted by water management agencies are intended to motivate people to conserve water. However, there has been little research to determine what kind of information best achieves this goal. Four types of information partly based on Stern, Dietz and Kalof's (1993) social-psychological model of environmental value orientations were examined in this study: action information about ways to conserve water; abstract factual information about water and its use; anthropocentric information about how people are affected by water use; and ecocentric information about how the environment is affected by water use. Using cluster sampling techniques 160 participants were selected from four Perth suburbs (two upper-middle income suburbs, and two lower-middle income suburbs). Brochures containing the four different types of information (all including action information) were randomly distributed to participants who were then asked to rate the perceived importance of each information item. Three weeks after distribution participants were assessed on their memory of the information, and on their self-reported water conservation behaviours. There was an interaction of information with income on importance ratings, with the lower-middle income group rating ecocentric information as relatively important, while the upper-middle income group rated it as relatively unimportant. There was a main effect for memory, with post hoc tests indicating that abstract information was remembered significantly better than anthropocentric information. In addition to having higher memory scores, people receiving abstract information reported

the most behaviour change. However, post hoc tests revealed that this was significantly different only from ecocentric information, for which people reported the least behaviour change. The relative effectiveness of the abstract information may be explained by the simple and novel nature of many of the items. The failure of ecocentric information to lead to behaviour change appears inconsistent with previous findings that suggest environmental concern motivates conservation behaviour. This failure was not surprising in the upper-middle income group which found the information relatively unimportant. For people in the lower-middle income group it is possible that a) they feel helpless in the face of environmental problems, or b) their perceived importance ratings were based on symbolic attitudes which have little influence on behaviour when self-interests also prevail.

Declaration

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Date.....28/6/96.....

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CHAPTER ONE

INTRODUCTION

Background

Less than 3% of the world's water is fresh. Furthermore, fresh water that is easily accessible constitutes less than three ten-thousandths of the world's water (Tolba & El-Kholy, 1992). The United Nations predicts that because of worldwide growth in population sizes and water consumption per capita, and the lack of new water sources, it is "highly likely that water, like energy in the 1970s, will become the most critical resource issue in most parts of the world by the late 1990s and the early part of the twenty-first century" (Tolba & El-Kholy, 1992, p.101).

Perth, Western Australia, is located in a semi-arid region and fresh water is an important resource that requires careful conservation. The city is presently experiencing one of the highest population growth rates in Australia, and the domestic use of water is increasing at one to two percent per person every year (Water Authority of Western Australia, 1992). Combined, these areas of growth are leading to a doubling of water consumption approximately every 12 years (Metropolitan Water Board, 1989). Particularly low rainfall in recent years has lowered fresh water supplies so that in the middle of winter (or July) of 1995 dam levels were at only 28% of capacity (S. Fewster, personal communication, July 31, 1995). By the end of October when most of the year's rain would usually have fallen, dams were only 40% full (Amalfi, 1995).

Due to previous periods of drought in Perth, attitudes to water conservation in times of shortage are generally very favourable. Based on 1981-1982 data, a study by Syme and Salerian (1987) found that only 8.9% of a stratified sample of 973 Perth residents intended to use no water saving method (e.g., reducing showering time) in the future, and only 18% reported having used none in the past. More recently, two surveys commissioned by Perth's water utility company on bore ownership and water restrictions have also indicated that attitudes to water conservation are positive. When asked if the use of bore water should be restricted to the same times as for watering the garden with scheme water in summer, the majority (61% with a bore and 72% without a bore) of the 11,400 suburban residents surveyed believed that it should be restricted (Water Authority of Western Australia, 1995a). This agreement with restrictions may have been due to people's perceptions of unfairness in having restrictions apply only to non-bore owners. However, another survey (Water Authority of Western Australia, 1995b) found that 89.8% of respondents perceived it as very important for Western Australians to conserve water by using water efficiently in the home and garden. Less than 1.0% perceived it to be unimportant. These findings are consistent with attitudes in other Australian centres (e.g., Melbourne, as reported by Moore, Murphy, & Watson, 1994; Murphy, Watson, & Moore, 1991).

The use of educational information is a popular strategy for dealing with environmental problems worldwide because it is relatively inexpensive. Positive attitudes to conservation have been encouraged by Perth's local water utility through information campaigns in the hope that they will motivate conservation behaviour. However, only within the past year has relatively comprehensive information about

water sources, water use, and water conservation been made available to the community. Evaluation of the campaign's effectiveness has so far been limited to an analysis of overall consumption through the recent summer period when restrictions on domestic consumption were in place (J. Schlafrig, personal communication, August 3, 1995). During that time, consumption in the metropolitan area was 7% less than during the previous summer when there were no restrictions. However, this fell short of the 10% target that was made public (Amalfi, 1995). Thus, there is an opportunity to assess the effectiveness of educational information already used by the local water authority (the Water Authority of Western Australia), and to examine motivation for conservation behaviour where attitudes are already highly positive. This thesis assesses the effects of environmental education based on different values, on individuals' water conservation behaviours in their homes.

Overview

Chapter two begins with an overview of the model of behaviour change upon which much environmental education is based. In Schwartz's (1968a) norm-activation model, beliefs about the consequences of behaviour do not guarantee behaviour change, but are a prerequisite. Research using this theory shows that being aware of the consequences of one's actions is an important influence on behaviour, providing a basis from which to assess empirical findings relevant to the effectiveness of environmental education. Empirical evidence for relationships between information and knowledge; knowledge and attitude; and information, knowledge and behaviour is reviewed. This research demonstrates that environmental education can be useful. An inconsistency between the

strongly positive environmental attitudes pervasive in today's world and the notable lack of relevant behaviours is described and discussed. It is argued that the discrepancy between attitudes and behaviours may be partly due to a lack in much environmental education of information about value-relevant consequences.

An integrated value orientations model put forward by Stern, Dietz and Kalof (1993) is introduced to identify environmentally relevant values, and empirical evidence is provided which demonstrates the potential of using information about the consequences of environmental problems to motivate environmentally responsible behaviour. Studies cited show that value orientations can predict behaviour, and that information appealing to value orientations can influence behaviour significantly more than information that does not. In addition, it is argued that some environmental education by utility companies does not provide information about consequences, but rather abstract facts and statistics, and that much of the information on consequences that *is* provided concerns costs and benefits to people only, rather than to the environment.

Against this background, the present study aims to discover the relative effects on behaviour of four types of information about water conservation. The first type is based on the consequences of conserving and of not conserving water for the environment. This 'ecocentric' information appeals to environmental values. The second type is based on consequences of conserving and of not conserving water to society and individuals. This 'anthropocentric' information appeals to self-interest values and also to social-altruistic values akin to the social and personal norms incorporated in Schwartz's (1968a) model. In contrast, 'abstract' information does not concern

consequences for valued objects, but rather includes non-consequential facts and statistics about domestic water sources and their use. The fourth type of information is 'action' information, which informs people of action strategies they can use or behaviours they can take to conserve water effectively. In other words action information tells people *how* to conserve. All participants in the present experiment received action information so they could conserve if they so desired. There was one condition in which participants received only action information.

It was hypothesised that both ecocentric and anthropocentric information would be rated as more important by participants than either abstract information or action information on its own, because Schwartz's (1968a) model suggested that information based on consequences for valued objects would be more motivating than information not based on such consequences. For the same reason, it was expected that ecocentric and anthropocentric information would lead to higher scores on memory for the information and also for self-reported behaviour change. Memory was included as a dependent variable because it was hypothesised in accordance with the assumptions of environmental education that people must remember information before they can be influenced by it. For income level, the other major independent variable along with type of information, no prediction was made regarding its effects on either importance ratings or memory scores. However, on the basis of previous findings (Thompson & Stoutemeyer, 1991) it was expected that lower-middle income participants would show a greater behaviour change in response to educational information than would upper-middle income participants, as for the former group financial savings are likely to be a powerful motivator for acting on new knowledge.

CHAPTER TWO

LITERATURE REVIEW

A Theoretical Basis for Environmental Education

Education is a common strategy for addressing environmental issues. Environmental education tends to be based on the assumption that information will automatically lead to changes in knowledge and attitudes, and subsequently to behaviour change (Black, Stern, & Elsworth, 1985; Hungerford & Volk, 1990; Ramsey & Rickson, 1976). This cognitive model of environmental education can be linked to formal theoretical models regarding the effects of knowledge and beliefs on behaviour.

Concurrently with the first rapid growth in concern about environmental degradation, Schwartz (1968a) proposed a cognitive theory of norm-activation to help explain people's behaviour toward others. He conceptualised norms as internal constructs representing the individual's beliefs and their perception of others' beliefs about how they should act in certain situations. Schwartz's theory of norm-activation specifically concerned the effects on moral behaviour of people's awareness of the consequences of their actions for others. In Schwartz's model, if one is unaware of the potential consequences of one's behaviour, there can be no perception that the situation requires a decision based on one's moral norms. Schwartz hypothesised that in a moral situation awareness of consequences would therefore mediate the influence of norms on behaviour.

This theory is also relevant to environmental behaviours such as water conservation. Moral behaviour is performed in order to avoid some type of harm being inflicted upon another. Environmental behaviour may be considered a kind of moral behaviour because it is performed in order to avoid harm being inflicted upon the environment, including animals, plants, and biosystems.

In his study (Schwartz, 1968b), 118 males from nine undergraduate residential units, selected to obtain a diverse sample, were measured on their *awareness of consequences* for others in a hypothetical situation, their (perceived) *social norms* about how others would expect them to react in several commonly encountered moral situations, and their *personal norms* about how they thought they themselves should act in these same situations. To measure their awareness of consequences, participants read a scenario in which a man (Bob) was faced with a typical social-moral dilemma. To assess participants' awareness of the consequences of Bob's behavioural choices, they were asked, "What thoughts and feelings might be going through Bob's mind as he debates with himself about what to do now?" (p.359). For the measurement of social and personal norms, participants were presented with nine vignettes about everyday moral dilemmas, which were different from the scenario about Bob. For perceived group norms the participants were asked to give free responses to the question, "How would the fellows in your house feel you ought to act?" (p.361), for each of the nine scenarios. Personal norms were measured by asking participants how they would feel they *themselves* ought to act in each of the scenarios. A behavioural measure was obtained using peer ratings. That is, each participants' fellow unit residents were asked to assess the likelihood of the participant behaving morally in each of the situations

described in the nine vignettes. Additionally they were asked to assess his general considerateness, reliability, and helpfulness, which were also included in the peer rating of behaviour.

Results showed that scores for both awareness of consequences and personal norms were consistently and positively related to peer ratings, although the relationships were weak. Perceived social norms were unrelated to peer ratings of behaviour, and all three independent variables were unrelated to each other. However, it was found that awareness of consequences in the Bob scenario mediated the relationship between personal norms and peer ratings of behaviour in the nine vignettes. Only when awareness was high was there a significant positive relationship between personal norms and peer ratings. There was a similar relationship for social norms, although it was not significant. The findings for personal norms were consistent with Schwartz's (1968b) hypothesis that awareness of possible consequences of one's behaviour for others is necessary for other personal beliefs to influence moral behaviour.

Elsewhere, Schwartz (1968a) reported additional results of the above study, and proposed that the ascription of personal responsibility to oneself for actions and consequences was also a prerequisite for the activation of moral norms. The same 118 male participants used in the study described above (Schwartz, 1986b) were given 24 statements expressing moral beliefs and asked to indicate how strongly they agreed or disagreed with the statements. Some statements were in the form of general opinions, for example, "Being very upset or preoccupied does not excuse a person for doing anything he would not ordinarily do", and some were self-descriptive, for example, "If a

person is nasty to me, I feel very little responsibility to treat him well" (Schwartz, 1968a, p.235).

Awareness of the consequences of one's actions for others in a hypothetical moral situation (as measured in Schwartz, 1968b) and ascription of responsibility scores were used to assign participants to four groups: The first group was high on both awareness and responsibility, the second was high on awareness but low on responsibility, the third group was low on awareness but high on responsibility, and the last group was low on both awareness and responsibility. Correlations between personal norms and peer ratings of behaviour as reported in Schwartz (1968b) were calculated for each of these groups. The strongest correlation, $r(33)=.47$, $p<.01$, was significant and was obtained for the group that was high on both awareness and responsibility (Schwartz, 1968a, p.238). For none of the other groups was there a significant correlation between personal norms and peer ratings of behaviour. In the condition where both awareness and responsibility were low, there was virtually no correlation at all, $r(27)=.01$, $p>.05$. Schwartz's hypothesis that both awareness of consequences and ascription of responsibility are necessary for the activation of moral norms was thus supported by the results, although causality could not be inferred from the correlational design of the study. There were additional problems with this study.

The main problem with the study was the method of measurement of behaviour, where peers were the assessors of the likelihood of each participant displaying moral behaviour. The validity of this measurement of behaviour is questionable, despite the fact that the residents probably had much contact with each other. Another issue was the use of different scenarios in the measurement of awareness compared to those used

in the measurement of both norms and behaviour. Possibly, the analysis of effects across different scenarios did not lead to valid results, either. However, other researchers (e.g., Heberlein, 1971 as cited in Heberlein, 1972; Van Liere & Dunlap, 1978; Black et al., 1985; Hopper & Nielson, 1991) have demonstrated that when behaviour measurement is observational or self-report, and all measures correspond to the same issue, results support those found by Schwartz.

Soon after Schwartz conducted his research Heberlein (1972) argued that to consider a decision moral there must be available to decision-makers a course of action which is less harmful than an alternative course of action. This means that the decision-makers are responsible for a choice about which action to take. Heberlein claimed that environmental decisions become moral decisions when: 1) people become aware of the consequences of environmental degradation on human populations, and 2) technology makes available less environmentally harmful alternatives, so that responsibility can legitimately be ascribed to decision-makers. Thus, according to Heberlein, Schwartz's (1968a) norm-activation model is applicable to environmental issues. If this is so, then people's awareness of the consequences of environmental degradation and their acceptance of personal responsibility for those consequences should affect behaviour.

Heberlein (1972) cited some of his earlier work (Heberlein, 1971) on littering which tested this extension of Schwartz's (1968a) model to research on environmental behaviour. Flyers encouraging people to register for voting were distributed to pedestrians walking down a street. They were then observed to see if they littered with the flyers and subsequently interviewed to measure their awareness of consequences of littering and ascription of responsibility for those consequences to themselves.

Awareness of consequences had a significant, moderately strong negative correlation with littering, $r(75) = -.43$, $p < .001$, while ascription of responsibility and littering were weakly correlated, $r(75) = -.31$, $p < .05$. There was a significant, moderately strong multiple correlation obtained when awareness and responsibility were used as predictors of littering. Schwartz's model was supported, but again the correlational design of this study did not allow conclusions to be drawn about the direction of causality.

Another study on moral norms concerned people's garbage-burning in their backyards (Van Liere & Dunlap, 1978). The researchers found that people who were more aware of the social consequences of burning and scored higher on the level of responsibility they ascribed to themselves for controlling those consequences reported less frequent burning. Again moral norms were activated only when awareness of consequences and ascription of responsibility were relatively high, consistent with the norm-activation model (Schwartz, 1968a).

Black et al. (1985) conducted a study to examine causal models of the impact of personal and 'contextual' variables on household energy conservation behaviour. They performed path analysis for each of four categories of conservation behaviour: 1) capital investment in energy efficiency, such as installing insulation, 2) low-cost energy efficiency improvements, for example, sealing cracks around windows and doors, 3) ambient temperature changes using the thermostat, and 4) minor curtailments, such as turning off the heat in vacant rooms. Several of the independent variables entered into the analysis were designed to measure concepts in Schwartz's (1968a) norm-activation model, for example, awareness of the social consequences of energy efficiency and

curtailment, ascription of responsibility to people like oneself, and social and personal norms about energy efficiency and energy curtailment.

Capital investment behaviours were not significantly affected by any of the variables relating to Schwartz's (1968a) model. The only psychological variable that capital investment was directly associated with was beliefs about the personal benefits of energy efficiency, $\underline{R}(476)=.13$, $p<.05$.

In contrast to predictions based on the norm-activation model but consistent with Schwartz's (1968a) own results, none of the four conservation behaviours were significantly influenced by social norms. However, personal norms about energy efficiency had a direct effect on low-cost energy improvements, $\underline{R}(476)=.20$, $p<.05$. Also, personal norms for energy efficiency and energy curtailment were both very weakly related to minor curtailments of energy consumption, $\underline{R}(476)=.12$, $p<.05$, and $\underline{R}(476)=.18$, $p<.05$, respectively. There was a significant relationship of personal norms with ambient temperature changes, $\underline{R}(476)= -.31$, $p<.05$, but it was negative and therefore inconsistent with the norm-activation model.

The path analysis for low-cost efficiency improvements showed a weak influence of awareness of the social consequences of energy efficiency and ascription of responsibility to people like oneself on personal norms. Interestingly, for the low-cost efficiency improvement variable, both personal norms and awareness were strongly influenced by perceived personal benefits. For both temperature changes and minor curtailment, awareness and responsibility showed moderate levels of influence on personal norms. These results conformed with Schwartz's (1968a) model in which these factors are prerequisites for the activation of norms.

Overall, Black et al.'s (1985) results indicated that contextual variables such as home ownership and number of members in the household are more influential than Schwartz's (1968a) psychological variables for behaviours that require more initial financial outlay but less long-term effort. However, minor changes that require less outlay and continual repetition are more strongly related to psychological variables. The relationships between personal norms, awareness, and responsibility were partly consistent with the norm-activation model (Schwartz), although some did not support it. This suggests that Schwartz's model may be applicable to resource conservation issues like energy conservation.

One acknowledged limitation of the above study (Black et al., 1985) was its cross-sectional design which did not allow claims of causality. However, the researchers demonstrated that the proportion of variance explained by the independent variables was greater using an attitude-behaviour model than using a behaviour-attitude model, so causality from attitude to behaviour was more likely though not assured (see Black et al., p.10 for details). Either way, the key variables in the model and their structural relationships fitted moderately well with Schwartz's (1968a) norm-activation model.

In a two-year quasi-experimental field study that also tested Schwartz's (1968a) model, Hopper and Nielson (1991) compared the effects of three interventions on recycling behaviour. The first was an informational intervention using pamphlets about a recycling program, the collection dates, and what materials could be recycled. These were distributed just twice during the seven month intervention period. Second was a prompting intervention that involved flyers being delivered approximately three days prior to each month's collection during the seven months. The group receiving this

intervention also received the information pamphlets. Third was an intervention using the block leader approach. This involved one volunteer from each of the study's residential blocks requesting all other residents on the same block to recycle, providing them with the information pamphlets, and paying pre-collection visits with the prompt flyers. There was a fourth group which did not receive any intervention and served as a control group. To test Schwartz's model in this context, social and personal norms about recycling, people's awareness of the consequences of (not) recycling, and observed recycling were measured.

An analysis of the relationship between awareness of consequences, personal norms, and behaviour in Hopper and Nielson's (1991) study showed that, inconsistent with Schwartz's (1968a) model, personal norms and behaviour were not significantly correlated when awareness was high, $r(39)=.26$, $p=.18$, nor when awareness was low, $r(27)=.11$, $p=.50$. This inconsistency perhaps occurred because recycling is more subject to external constraints such as the availability of storage space, similar to Black et al.'s (1985) capital investment and low-cost improvements for energy conservation. However, the trend for the correlation to be stronger when awareness was high was consistent with Schwartz's findings.

Thus, there is some evidence that Schwartz's (1968a) norm-activation model of moral behaviour can also explain environmental behaviours such as littering (Heberlein, 1971 as cited in Heberlein, 1972), yard burning (Van Liere & Dunlap, 1978), and to a lesser degree energy conservation (Black et al., 1985). There was a trend in the direction of support for the model for recycling behaviour but this was not found to be statistically significant (Hopper & Nielson, 1991). It appears, then, that awareness of

the consequences of behaviour may activate the influence of personal norms on environmental behaviour, although this relationship does not hold for social norms nor perhaps for behaviour that is more subject to external constraints.

Environmental education assumes that knowledge or awareness is fundamental to environmentally responsible behaviour (Siero, Boon, Kok, & Siero, 1989; Simmons & Widmar, 1993). This assumption is consistent with Schwartz's (1968a) model and the majority of empirical findings described above. It is also generally assumed in environmental education that providing educational information leads to greater or more accurate knowledge, and then to corresponding behaviour changes. On face value, this is a logical assumption, particularly in light of the evidence cited above. However, the assumption does not necessarily hold. All the studies that found a relationship used correlational analyses in their assessment of the effects of awareness of consequences, so causality cannot be inferred. While Hopper and Nielson (1991) provided information and then measured knowledge, they focused on different content in each. Thus their analysis was correlational, also, and could not provide any evidence that exposure to information causes an increase in knowledge.

The studies reviewed above suggest that awareness of consequences may be important, but because causality cannot be inferred they do not necessarily suggest that awareness can be improved using educational information. However, other research that has used non-correlational analyses suggests that information can have some effect on knowledge (awareness). Field research has also been conducted to investigate the relationships between information, knowledge, and attitude; and information, knowledge, and behaviour.

Information and Knowledge

Usually, research in environmental education does one of two things. Either it relates existing knowledge to other variables, thereby giving no consideration to the role of educational information, or it employs information as an intervention strategy and assumes resultant increases in knowledge if there is behaviour change in the desired direction. This is not an ideal situation. The former approach provides no indication about the impact environmental awareness campaigns are likely to have because it does not examine how well environmental information is remembered. The latter approach, however, does not confirm that knowledge is the mediating variable between information and behaviour. Nor does it examine the nature of this relationship; whether the information is essentially a prompt, or it is summarised in people's minds in favour of details, or which types are most easily forgotten. Answers to these questions are essential to the design of effective campaigns. Hence, the relationship between information and knowledge warrants attention.

One result in the Hopper and Nielson (1991) study appeared to contradict the notion that environmental education is useful for encouraging environmental behaviours. They found that none of the interventions changed participants' awareness of consequences. However, this was probably a function of the type of information given in the pamphlets, which was simply information about the nature of the program and how to participate in it. In other words, the information did not address the *consequences* of recycling or not recycling, so predictably there was no subsequent change in participants' awareness of those consequences. Hopper and Nielson did not make it clear whether a change in awareness of consequences was expected or not.

The effect of information on knowledge was explicitly addressed in a quasi-experimental five-month study on recycling in a college dormitory setting by Goldenhar and Connell (1992). They compared the effectiveness of educational posters, feedback posters, and educational plus feedback posters on knowledge and self-reported newspaper recycling behaviour. There were also dormitories constituting the control group that had posters unrelated to recycling displayed during the five months of the study. Educational posters provided information on the solid waste crisis in general, and environmental consequences of paper recycling, product packaging, and energy savings. Feedback posters were altered regularly to provide intra- and inter-dormitory data on the amount of material recycled during the previous month. Memory for the educational information was assessed by five multiple choice memory items, and the mean post-intervention score was 2.3 (out of 5). The results showed no significant increase in knowledge from a pre-intervention baseline for any of the groups, indicating that the educational information did not translate into knowledge. The groups who had received only the educational information did not change their recycling habits any more than did the control group. However, the groups receiving either feedback or feedback plus education reported themselves as recycling more newspaper after the intervention period. The feedback poster was remembered by more people than was the education poster, even for the group that had been exposed to both.

This was possibly due to the fact that the feedback poster had a visual display, a bar graph showing the amount of monthly recycled paper, which may have made it more vivid than the educational poster, and therefore more likely to attract attention to the essential information (Costanzo et al., 1986). This may have prompted greater

newspaper recycling in the feedback poster conditions, in contrast to the educational poster conditions where participants had difficulty recalling that they had even seen the posters.

Another study by Young and Witter (1994) investigated the effectiveness of several brochures in increasing environmental knowledge. The brochures were about the biology and management of an infestatious moth which damages trees in the Michigan area of the USA. The researchers developed seven educational brochures of either 2,000 (long) or 700 (short) words, and high, medium, or low communication effectiveness. The manipulation of communication effectiveness was obtained by altering four interest characteristics (story line, mystery, vividness, and motivating reasons for behaviour) and three characteristics for making the brochures more understandable (chunking, legibility, and explicitness, p.28). Most of the resultant six experimental conditions consisted of just one brochure, although there were two long brochures with medium levels of communication effectiveness. The seven brochures were randomly distributed to a stratified sample of residents in three Michigan suburbs. A week later, questionnaires were sent to the same residents to gain a measure of knowledge levels using ten multiple-choice items, five on biology and five on management.

No differences were found in the effectiveness of the different brochure designs. However, participants in the experimental groups displayed significantly greater knowledge compared to the control group which had received no information (Young & Witter, 1994). This result was true for knowledge about both biology and management, supporting the notion that information leads to greater knowledge. However, in spite of

the significant increases in knowledge, scores were still relatively low with mean scores out of 10 of 1.8 and 1.5, respectively. Also, the response rate for the questionnaires was only 22%, so these results cannot be considered conclusive (Young & Witter, 1994).

In summary, there is evidence both for (Young & Witter, 1994) and against (Goldenhar & Connell, 1992) an increase in knowledge as a result of educational information. Researchers have proposed several reasons why an effect on knowledge may not be realised, including the attention of participants (Costanzo et al., 1986) and characteristics of the information.

Research on the effects of information has indicated that characteristics of its presentation may mediate its effects. The following five factors are arguably the most influential: 1) the medium used (e.g., written, audio, audio-visual), 2) the level of personalisation, 3) the vividness of presentation, 4) the credibility attributed to the source, and 5) the concreteness and understandability of the message (Costanzo et al., 1986). A pertinent point for the area of water conservation is that the perceived credibility of utility companies is often very low (Costanzo et al., 1986, p.524), which may hamper the effectiveness of their awareness campaigns. Winett and Kagel (1984) have suggested that an additional influence may be whether or not the design of the study ensures that participants actually read the brochures. Possibly, studies that have failed to find a relationship between information and knowledge (e.g., Goldenhar & Connell, 1992) have done so because the characteristics of the information were less likely to capture participants' attention and involvement.

Characteristics of information such as those described by Costanzo et al. (1986) may confound research into the effects of environmental information on knowledge,

particularly if the information provided has unfavourable characteristics. Although it cannot provide a direct indication of the influence of educational information, one way to avoid the confounding effects of information characteristics is to measure people's existing knowledge instead. If relationships between knowledge and attitudes and behaviour are found to be significant, it would seem to indicate that the main problem with educational information lies in its translation to knowledge.

Knowledge and Attitude

In research into environmental education, interest is often focused on attitudes, as attitudes are usually more easily measured than behaviours and are held to be antecedents to sets of behaviours, such as environmentally responsible behaviour (Eagly & Chaiken, 1993). In these environmental attitude studies researchers usually adhere to a correlational design, and do not use educational information as an intervention. Rather, they measure their participants' existing knowledge.

A study on high-school students (Ramsey & Rickson, 1976) was conducted in an attempt to determine the relationship between knowledge and attitudes toward pollution control. Both ecological and trade-off knowledge (being knowledge about the community costs of pollution control) were measured, each with five questions. In contrast to other research, the scores for both types of knowledge tended to be high. The results showed that, as expected, greater ecological knowledge was significantly related to greater support for both pollution abatement and unqualified pollution control. Also as expected, knowledge of the community costs of abatement and control was positively and significantly associated with resignation to pollution. Thus, knowledge was related

to attitudes, with the direction of the relationship depending on the kind of knowledge possessed. However, whether knowledge actually influenced attitudes, attitudes influenced knowledge, or there was a third variable involved could not be determined from this study.

In another correlational study of knowledge and attitude (Arcury, 1990), measures of general, energy, and State (Kentucky, USA) environmental knowledge were developed, and attitude was measured using Dunlap and Van Liere's (1978) New Environmental Paradigm questionnaire. A regression analysis indicated that knowledge was significantly although weakly related to attitudes even when age, gender, education, income, and metropolitan residence were controlled for. There was a significant relationship with attitude for all three types of knowledge, although the relationship was strongest with general environmental knowledge. This is congruous with the notion that the more similar in subject matter are measures, the stronger the relationship will be between those measures (e.g., Ajzen & Fishbein, 1980). This notion suggests that measures of general knowledge will relate to measures of general attitudes more strongly than they will relate to measures of specific attitudes. Likewise, measures of specific knowledge and attitude on a particular topic can be expected to relate to each other more strongly than measures mixed in specificity and topic. Arcury suggested that the weakness of the relationship observed in his study may have been due to either the generally low level of knowledge that was found, or to possible problems with the measures of knowledge. He suggested that the level of detail in the measures or the inclusion of questions about current events may have been inappropriate. Knowledge

about current events may relate to environmental attitudes differently than do other types of knowledge.

The relationship between knowledge and attitude was examined in another study by Borden and Schettino (1979) using a sample of 530 psychology undergraduate students. Embedded in other personality and attitude measures that the participants completed was the revised Maloney, Ward, and Braucht (1975) test including scales for environmental knowledge, verbal commitment, and actual commitment (based on a self-report measure of recycling, purchasing, and other behaviours). Knowledge was scored out of 14, and the observed mean was 7.48. Scores for verbal commitment (attitude) and actual commitment (behaviour) were out of ten, and their observed means were 6.12 and 2.88, respectively. The sample was split according to high and low knowledge, and analyses were performed to determine the relationship of knowledge with verbal commitment and actual commitment. There was a slight trend which approached significance for people high in knowledge to have greater verbal commitment scores. Furthermore, t-tests showed that level of knowledge was strongly and significantly associated with scores on actual commitment, with the group of participants high in knowledge undertaking more recycling behaviours than those low in knowledge. The discrepancy in the influence of knowledge on attitude and behaviour may be due to the pervasiveness of positive environmental attitudes and the relative paucity of environmental behaviours. That is, attitudes may currently be governed by social norms, so knowledge may only be somewhat important in determining them. This is supported by the weak nature of relationship also found by Arcury (1990). In contrast, there may as yet be only relatively weak or possibly no social norms for environmental

behaviours. This may explain the stronger relationship between knowledge and behaviour, because in this case social norms do not suggest that environmentally responsible behaviours are expected or even desirable, and thus people's individual beliefs must determine the desirability of certain actions.

The studies cited above suggest that knowledge is related to attitudes, but only weakly. While attitudes are often measured under the assumption that they are a determinant of behaviour, this relationship is usually weak (Greenwald, 1989; Hines, Hungerford, & Tomera, 1986). The measurement of behaviour is important in the area of environmental education because environmentally responsible behaviour is the ultimate goal. Also, attitude and behaviour may or may not be influenced by the same factors as each other. Indeed, Borden and Schettino's (1979) study indicated that behaviour may be more influenced by knowledge than is attitude. Therefore, it is necessary at this point to address the relationships between information and knowledge, and behaviour.

Information, Knowledge, and Behaviour

In Hopper and Nielson's (1991) quasi-experimental field study on recycling, described earlier, all groups that received information recycled more than did the control group. As hypothesised, the 'social intervention' using block leaders resulted in more recycling than did prompts and information pamphlets, and prompts and pamphlets together resulted in more recycling than did information pamphlets alone. The block leader intervention actually changed social and personal norms, attesting to this intervention's effectiveness in encouraging real change in people's intrinsic motivation.

These results indicate that recycling behaviour is influenced by information. Information has been found to influence behaviour and behavioural intentions in other conservation areas in addition to that of recycling.

A study by Hass, Bagley, and Rogers (1975) on the effects of information on intentions to conserve fuel in an energy shortage used a 2 x 2 factorial experimental design. Undergraduate business students were given short-essay style information on differentially noxious (severe and innocuous) consequences of energy shortages and their probability of occurrence (highly likely and unlikely). In the high-noxiousness condition, consequences were that: petrol prices would increase greatly, waiting lines at service stations would be longer, and popular consumer items would greatly increase in cost (p.755). Low-noxiousness was achieved by arguing that there would be only minor consequences if there was an energy shortage. The researchers found that probability of occurrence had no effect on intentions to conserve energy, but those who were given information on highly noxious, or severe, consequences indicated greater intentions to conserve. Contrary to expectations, no interaction was found between the two independent variables. Thus, educational information on noxious consequences of an energy shortage had a significant effect on intentions to conserve fuel, independent of the stated probability of occurrence of those consequences.

A similar study on water conservation in Perth manipulated perceived severity of the effects of water shortage, and perceived efficacy of individuals in moderating those effects through conservation (Kantola, Syme & Campbell, 1983). The researchers used films to convey their educational messages in the four combinations of high and low severity and efficacy during a period of drought. There was also a control group that did

not watch a film. In contrast to the Hass et al. (1975) study, perceived severity (similar to noxiousness) did not influence behavioural intention, and neither did perceived efficacy. Interestingly, though, the severity manipulation did have an effect on beliefs about two of the four informational items in the films. People in the high-severity group agreed more with the two environment-oriented statements ("If water consumption continues at its present rate water birds will be killed", and, "Unless we use less water there will be water pollution in Perth") than did people in both the low-severity and control groups. The groups did not differ on their agreement with the non-environment-oriented statements that "Our consumption of water is increasing at too fast a rate", and, "Our current reservoir system is not capable of keeping up with the demand for water" (Kantola et al., 1983).

Although it did not affect behavioural intention, perceived severity was found to have a significant negative effect on attitudes toward water conservation. Participants who viewed the high severity film had less favourable attitudes than those who viewed the low severity film (Kantola et al., 1983, p.174). This result contrasted with those expected which had been based on Rogers'(1975 cited in Rogers & Mewborn, 1976) protection motivation theory that the greater the threat of harm, the greater will be the likelihood of acting to prevent that harm.

Both the Hass et al. (1975) and Kantola et al. (1983) studies indicated that information can influence people's disposition toward conservation issues. However, the Kantola et al. results suggest that information may negatively affect attitudes if the problem is portrayed as severe. Here, the research suggests that the environment-oriented information may have been responsible for the negative effect. The authors do

not specifically discuss this issue, but they indicate that while the manipulations of severity and efficacy were statistically significant, they were small (Kantola et al., 1983, p.179). Thus, the results may have been spurious. It is possible that educational interventions relying on just one exposure to the stimulus materials are particularly prone to the problem of spurious or ambiguous effects. Interventions of longer durations, such as school programs, may result in less ambiguous differences.

Few studies on the behavioural outcomes of comprehensive, long-term educational programs exist, although two Canadian researchers (Asch & Shore, 1978) undertook such an evaluation. After an entire school year of studying several environmental problems, twelve inner-city boys from fifth-grade were taken to a mountain nature centre for four days. Twelve boys from another school in the same vicinity as that of the intervention group were randomly selected when their class visited the same mountain nature centre, and constituted a control group for the study. Raters spent three of the four days recording the destructiveness or otherwise of each boy's behaviours during small-group activities around the grounds of the nature centre. There were two observers for each group on each task, and the pairs of observers agreed 93.5 percent of the time on the number and type (destructive or conservational) of the behaviours that the boys displayed, yielding very high inter-rater reliability. The boys' conservation of forests, soils, water, and fish were rated and results were then analysed using a chi-square analysis for each type of conservation task. In accordance with the stated hypotheses, boys within the experimental group exhibited more conservational than destructive behaviours. They also exhibited more conservational behaviours and less destructive behaviours than the control group. Within the control group, in comparison,

participants exhibited more destructive than conservational behaviours, although it had been hypothesised that there would be no difference in the types of behaviour they displayed. Thus, the year-long school program with specific information on methods of conservation appeared to have a significant influence on relevant behaviours. However, in spite of the use of a control group, the quasi-experimental design did not permit a causal conclusion.

A field experiment on residential electricity conservation (Winett, Kagel, Battalio, & Winkler, 1978) compared the effectiveness of several popular interventions in reducing observed consumption. There were five experimental conditions including: a control group; a group receiving information only; another with information and weekly feedback on their consumption; a fourth receiving these plus a small rebate; and a final group receiving information, feedback, and a large rebate. Winett et al. hypothesised that rebates and feedback would affect consumption, but that information by itself would not. The information provided consisted of two booklets detailing household energy tips, that is, information on how to conserve. As expected, those people who were promised rebates decreased their energy use over the four-week experimental period, and this was maintained to a lesser degree over the following four weeks. Unexpectedly, though, both the feedback and information groups actually *increased* energy use over the experimental period. This result remained unexplained by the researchers. However, it is possible that a reactance situation was created when participants were informed prior to the study that there would be several conditions, some of which would include rebates. Participants may have cooperated simply on the chance that they would be in one of the rebate groups, or they may have unintentionally

developed an expectation that they would receive a rebate. If this occurred, reactance could have taken place because people were annoyed about not receiving a rebate and produced the unexpected result in the information and feedback conditions. As the authors noted, feedback is usually an effective way of promoting conservation.

Another field experiment, by Geller, Erickson, and Buttram (1983), utilised water meter readings to assess the relative effectiveness of education, feedback, and low cost conservation devices on domestic water consumption. The only effects were for phase, that is, baseline versus intervention, and an interaction between phase and the reception of a device. Those who received devices consumed significantly less water in the intervention condition than those who did not receive devices. However, the effects of the conservation devices were smaller than expected, with only about four litres per day being conserved. The authors cited the inexpensiveness of water in that region as the probable cause of the ineffectiveness of education and feedback. Another reason for the lack of effects in Geller et al.'s (1983) study is that, as shown by questionnaire responses, only one person in every household read the educational brochures.

The weak effect for conservation devices was partly due to the fact that less than a third of those who received the free devices actually installed them. It was also suggested that participants receiving the conservation devices may have tended to compensate for the anticipated savings (p.108, see also Gonzales, Aronson, & Costanzo, 1988). For example, when shower heads restricting the flow were installed, people may have taken longer showers, and justified this by the fact that they were not actually losing any money, or that they were still using no more than their 'fair share' of water. The perception that money is being saved, that is gained, does not mean as much to

people as when money is perceived as being lost, even when there is no real difference between the two (Kahneman, Slovic, & Tversky, 1982). Thus, in an article on energy conservation (Gonzales, Aronson, & Costanzo, 1988, p.1053) it was suggested that, "The typical energy conservation campaign strategy with its greater emphasis on savings may inadvertently be discouraging people from changing their energy-related behaviours". Water conservation campaigns and research such as that by Geller et al. (1983) may also suffer from this problem.

In a field experiment where the aim was to save fuel through the modification of driving behaviour in a postal service company (Siero et al., 1989), the provision of educational information was included as one of three components of an intervention program. As well as providing information on the advantages and disadvantages of certain driving techniques, participants were given a goal (5% reduction in fuel use) and daily feedback, and were also requested by those in authority to adhere to the suggested driving techniques. The two dependent variables were attitude, for which measurements were based on the Ajzen-Fishbein (1980) model and included beliefs about the consequences of the driving behaviours and the evaluation of those consequences, and the amount of fuel saved. Both one-month and six-month posttests showed significantly different attitudes compared to the baseline established before the intervention period. The change in attitudes was found to be largely due to a change in the perception of the consequences of targeted driving techniques rather than in the evaluation of the consequences. The intervention, which included education, resulted not only in attitude changes but also in lasting behaviour changes. The decrease in fuel usage from the baseline consumption level was more than 7% at the one-month follow-up, compared to

the original explicitly stated goal of 5%. At the six-month follow-up fuel consumption was 5.5% less than when the baseline measurements were obtained. The changes in beliefs about consequences and also in fuel consumption suggest that knowledge may have been related to behaviour, although the effect may have been due to the other interventions used in conjunction with education. The major drawback of this field experiment was that three intervention strategies were combined to ensure an outcome for the company. This makes it impossible to know which particular strategies produced the effects.

A study by Ellen (1994) focused on people's knowledge of what and how to precycle and recycle. (Precycling refers to buying products that use minimal packaging.) A questionnaire containing items to measure perceived knowledge, actual knowledge, and self-reported precycling, recycling, and political activism was mailed to a sample of households, and a 72% response rate yielded 397 participants. The mean score on actual knowledge, measured by multiple-choice questions, was relatively low at 4.0 out of 9. Only 16% of the participants answered five or more knowledge questions correctly. Notably, scores for actual and perceived knowledge were unrelated, indicating that people were not able to accurately assess their own knowledge levels. Perceived knowledge was found to be more related than actual knowledge to all three types of self-reported behaviour. Actual knowledge was found to be related only to self-reported recycling.

Research conducted by Finger (1995), to investigate the usefulness of his life-world approach to predicting environmental behaviour, used a sample of 1004 participants from Switzerland. He used regression analyses to assess the relative predictive power of

several variables, including knowledge, for the dependent variables: self-reported standard environmental behaviour, limited activism, and protest behaviour. Contrary to the above study by Ellen the results showed no relationship between knowledge and standard behaviour (including recycling and using public transport), although there were significant albeit weak associations with limited activism (voting, signing petitions, local activism), and protest behaviour (greater local activism and participation in demonstrations). Despite the discrepancies between Ellen's and Finger's results in the details of which types of conservation behaviours were influenced by knowledge, both found significant relationships. Other researchers have obtained similar results.

A useful meta-analysis of 128 empirically based studies conducted since 1971 on environmental behaviour was provided by Hines et al. (1986). Of the predictive variables included in their analysis, knowledge ranked fifth in strength of association with environmentally responsible behaviour (r=.30). Further analysis indicated that knowledge was more strongly related to observed behaviour (r=.37) than to self-reported behaviour (r=.29). This discrepancy between observed and self-reported behaviour is similar to findings from water conservation measures. In a study by Hamilton (1985) on the relationship between self-reported and observed water conservation, participants were generally unable to accurately report the amount of water they had saved by using conservational devices and changing their behaviour.

Hines et al. (1986) also found that knowledge was very strongly related to behaviour among people belonging to environmental organisations (r=.69) compared to the weak relationship within the general population (r=.27) and for children (r=.19). A similar pattern was found for the effects of the population sampled on the relationship between

attitude and behaviour, however, Hines et al. provided no explanation for these patterns. Perhaps people who are members of environmental organisations have more of an opportunity to learn from their involvement in activities, and so the more they do, the more they learn. Or, they may be involved in both learning and 'doing' activities through the organisation, so that their level of involvement with the organisation determines both. Alternatively, the pattern may reflect a mediatory role of self-efficacy on the influence of other psychological variables on behaviour. Those people who are involved with environmental organisations may be involved because they have greater self-efficacy regarding environmental problems than do the general population. Also, adults may generally have greater self-efficacy than children. Thus, it is possible that self-efficacy enhances the influence of knowledge and attitude on behaviour.

In summary, three of the studies reviewed found a correlation between knowledge and behaviour. Ellen (1994) found that actual knowledge was related to recycling, but not to source reduction or political activism. In constrast, Finger (1995) found knowledge to be unrelated to standard behaviours such as recycling, but to be weakly related to limited activism and protest behaviour. Hines et al. (1986) conducted a meta-analysis and found a weak relationship between knowledge and both self-reported and observable behaviour, the relationship being stronger for the latter. Two quasi-experimental studies (Geller et al., 1983; Winett et al., 1978) found little or no relationship between the provision of information and subsequent behaviour. However, both of these studies suffered from problems, making it difficult to interpret the results as disproving the notion that information affects behaviour. Geller et al discovered that only one person in each household read their brochure, and less than a third who

received free water-saving devices actually installed them. Those who did may have then over-compensated for the savings. Winett et al employed techniques that may well have induced psychological reactance.

Three of the studies reviewed found a relationship between information and behaviour. Of these, one (Hass et al., 1975) measured only the participants' intention to conserve energy, another (Asch & Shore, 1978) assessed the effectiveness of a long-term, relatively intensive school-based program, which limits the ability to generalise the findings to less comprehensive environmental education, and the third (Siero et al., 1989) was designed in such a way that the effects of the educational intervention could not be distinguished from the effects of the two parallel interventions.

The design problems of several of these studies indicate that more experimental and quasi-experimental studies on the effects of information on environmental behaviour need to be conducted. However, the results overall suggest that knowledge is weakly related to behaviour, and if there is a relationship between information and behaviour then it is also weak. The question arises, then, as to whether people are aware of environmental problems but are unconcerned about them and therefore do not act, or they are concerned but do not translate this concern into action.

Attitude-Behaviour Inconsistency

Dunlap and Scarce (1991) recently reviewed the history of public opinion on environmental issues. According to their analysis, pro-environmental attitudes developed during the late sixties, reaching a peak about the time of the first Earth Day in 1970. Attitudes became less pro-environmental over the following decade, although

they did not return to the low levels of the early sixties, but again became more pro-environmental during the eighties with the emergence of new and steadily worsening environmental problems, and the media attention resulting from these problems. By 1990, attitudes toward the environment were more positive than they had ever been before (Dunlap & Scarce, 1991).

Dunlap (1991) summarised the results of many polls and surveys, leading him to conclude that, "The results of these many polls clearly indicate that public concern over environmental degradation has risen substantially in recent years and that public support for environmental protection has become a truly consensual issue" (p.15). Although attitudes about the environment in general are very positive, judgements about which environmental issues are the most important vary from country to country. Australians have cited pollution, conservation of flora and fauna, and deforestation as the most important environmental issues to them (Tolba & El-Kholy, 1992). Although water conservation is absent from the issues ranked as the most important, attitudes toward water conservation in Australia are generally positive (Water Authority of Western Australia, 1995b; Moore, et al., 1994; Murphy et al., 1991; Syme & Salerian, 1987).

While Dunlap (1991) speculated that the public was probably not so concerned about the environment in 1970 as it is now, Gigliotti (1993) has demonstrated that people are now willing to give up *less* for the environment than 25 years ago when the environmental movement was relatively young. He compared the attitudes of undergraduate students at Cornell University in 1990 with those of students at the same university in 1981 and 1971. The same survey was administered to each of the three groups. Participants were asked for ratings on five-point Likert-type scales of how

willing they were to give up 35 specific items to help protect the environment. The list included items such as: the telephone, formal dress, air travel, canned soft drinks, and hiking. The 1990 and 1981 groups were similar in their overall 'willingness-to-give-up scores'. However, the 1990 group was significantly less willing than the 1971 group to give up 21 items. The five items that were most discrepant were: formal dress, canned soft drinks, current fashion, home air conditioning, and jewelery. They were significantly more willing to give up only 6 of the 35 items. These items were having an oven in the home, prewrapping of fresh foods, frozen foods (although they were less willing to give up instant foods), motorcycles, hiking, and beef steaks.

Hence, despite the consistently positive attitudes that are obtained by people's verbal reports, there has been little success in having these attitudes translate into a willingness to give up personal benefits. There has, however, been some behaviour change for the better.

Dunlap and Scarce (1991), in their review of previous opinion polls in the USA, stated that "growing majorities" report having taken actions to protect the environment (p.657). These behaviours include contributing money, joining an environmental organisation, writing a letter to an editor or politician, boycotting companies or avoiding particular products, not littering, recycling, and doing volunteer work for an environmental conservation or protection group. Predictably, the least effortful and costly actions have been taken by the most people. Some of the most popular actions included not littering, talking about environmental issues with friends, and recycling. However, far fewer people (18%) reported taking more effortful actions such as doing volunteer work for an environmental group (Gallup Organisation, as cited in Dunlap &

Scarce). The authors pointed out that all figures are likely to be biased toward having engaged in environmentally responsible behaviour because they are based solely on self-report measures. A problem they failed to note was that most of the questions that these figures represent were based on either no retrospective time frame or a very vague one, for example, "Over the past several years..." or "...in recent years..." (p.670, p.671). Thus, respondents may have donated money or recycled just once in the past "several years" and still be counted as taking action. So, while there is a consensus of pro-environmental attitudes and most people, in the USA and presumably in Australia, have taken some kind of environmental action, "few have made the substantial changes in life-style that many environmentalists see as necessary" (Roper Organisation, 1990 cited in Dunlap & Scarce, 1991, p.657).

These results are contrary to the intuitive relation between attitude and behaviour, and are certainly contrary to the desired results of the awareness campaigns of the environmental movement. In part, this lack of consistency may be due to general attitudes having been used to predict specific behaviours (Eagly & Chaiken, 1993; Heberlein & Black, 1976). However, this does not explain the relative absence of environmental activity compared to the highly positive attitudes pervasive in today's societies. A further explanation may lie in the type of information about which people are made aware, as some types of information may be more motivating than others. It may be the generality or the abstract nature of much environmental education and knowledge that has led to their weak relationships with behaviour. It may be that, congruent with Schwartz's (1968a) norm-activation model, information about the consequences of behaviour would provide a rationale and thus be more motivational.

Currently, much environmental education does not provide information about the consequences of actions, but rather abstract facts that may aid in understanding the problem, topic, or object of interest. For example, education about issues that relate to animals or plants often focuses on their biology or other scientific facts, rather than how the issue affects those animals or plants (Hills, 1991). Also, education about water conservation often focuses on scientific facts about the water cycle, rather than how our use of water affects us and the environment (Murphy et al., 1991).

In the absence of information about consequences of environmental problems for valued objects, people may not perceive any particularly meaningful reason to act. They may be more motivated if information appealed to their concern for valued objects such as self, others, and the environment (Stern et al., 1993). The relationship of values to belief systems and environmental behaviour is a burgeoning area of research that is currently attempting to determine which types of concern have the most influence over environmental behaviour.

In his seminal work on human values, Rokeach (1973, p.18) stated that values are one of the more central components in individuals' belief systems, certainly more so than are attitudes. Rokeach defines a value as "an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence" (p.5). Rokeach argues that attitudes and behaviour are influenced by the priority individuals ascribe to particular values. As such, they are proposed to be a fundamental influence on behaviour, and may be useful for determining underlying concerns or motivations for particular kinds of behaviour. Research into value orientations that motivate environmental attitudes and

behaviours has been developing since the early 1970s and is currently receiving substantial attention.

The Value Bases of Environmental Behaviour

Although people currently have positive attitudes toward the environment, there may be different value bases underlying these attitudes (Pierce, 1979; Stern et al., 1993; Thompson & Barton, 1994). Investigating specific values and general value orientations as motivations for environmentally responsible behaviour may be important for finding which are most likely to lead to appropriate individual action or to restrain inappropriate individual action. Possibly, appeals to those that are the most motivational may then be used to encourage behaviour.

In the psychological literature, much of the thinking about different value orientations toward the environment has stemmed from the seminal work by Dunlap and Van Liere (1978) discussing the emergence of a new social paradigm, or collective worldview, which they termed the New Environmental Paradigm (NEP). Dunlap and Van Liere claimed that the emerging NEP emphasised a natural limit to growth and that the "balance of nature" needs to be preserved (p.10). They contrasted this to the dominant social paradigm which included our

> belief in abundance and progress, our devotion to growth and prosperity, our faith in science and technology, and our commitment to a laissez-faire economy, limited governmental planning and private property rights...[our] anthropocentric notion that nature exists solely for human use. (p.10)

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Accompanying Dunlap and Van Liere's (1978) argument that a new social paradigm was emerging was an instrument they developed to measure the degree to which individuals subscribed to the dominant social paradigm or to the NEP. Their instrument measured on a five-point Likert-type scale beliefs that were seen to relate to each of the two social paradigms. People were asked how much they agreed or disagreed with twelve statements about how power in the relationship between humans and nature rightfully ought to be weighted, about the balance of nature, and about limits to growth. Statements in the questionnaire included, for example, "Humans have the right to modify the natural environment to suit their needs", "The balance of nature is very delicate and easily upset", and "There are limits to growth beyond which our industrialised society cannot expand". In their study, a systematic probability sample of 806 householders and a sample of 407 members of an environmental group completed the NEP questionnaire. Results showed that the environmental group agreed much more strongly with NEP items than did the general public sample and disagreed more strongly with statements corresponding to the dominant social paradigm. However, contrary to expectations, the majority of the general public sample also agreed with the NEP statements and disagreed with the statements measuring adherence to the dominant social paradigm. It was concluded that the level of agreement with these beliefs could distinguish those who were environmentally active from the general public, but also that the NEP had become rapidly accepted within Washington, USA, while not yet necessarily replacing the dominant social paradigm.

Although this instrument for the measurement of environmental attitudes has been widely used in research (e.g., Arcury, 1990; Gigliotti, 1994; Noe & Snow, 1990;

Shetzer, Stackman, & Moore, 1991), "the idea that environmentalism represents a new way of thinking has not been linked to a social-psychological model" (Stern et al., 1993). Indeed, it has been argued that this lack of theoretical development may be one reason why psychological research into environmental attitudes to date has been largely disjointed (Arcury & Christianson, 1990; Stern & Oskamp, 1987). To help remedy this problem, Stern et al. (1993) have proposed a model of environmental concern that integrates some of the previous psychological literature. The self-interest motivation implied or explicit in some writings on environmental issues (e.g., Hardin, 1968; Black et al., 1985) is integrated with Schwartz's (1968a) norm-activation model of moral behaviour and the work of Dunlap and Van Liere (1978) to suggest that there are three broad value orientations which may underlie environmental attitudes. The first value orientation was that of self-interest, which Stern et al. (1993) termed "*egoistic*". Conservation stemming from this value orientation may be motivated by the desire to achieve self-interested end-states such as the maximisation of personal gains or minimisation of personal losses. The well-known NIMBY ("Not In My Back Yard") effect is the result of egoistic values guiding behaviour (Stern et al., p.326).

The second value identified as a motivation for environmental concern has been termed "*social-altruistic*" (Stern et al., 1993) and is most closely related to that type of moral behaviour discussed by Schwartz (1968a, b). Social-altruistic values motivate attitudes and behaviour that reflect a genuine concern for the welfare of other people. Stern et al. suggested that people with this value orientation would be likely to possess strong attitudes toward issues involving environmental health threats, and that these

same people would probably be concerned and active around other social issues such as human rights, poverty, blood donation, and other community work (p.327).

Instrumental values, which have been discussed at length in the field of philosophy (e.g., Calicott, 1986; Katz, 1960), are related to the above egoistic and social-altruistic value orientations. Arguments based on instrumental values are termed 'utilitarian' because they assume that the value of the object in question lies in its utility for another object. When it is oneself or other humans for which the valued object has utility, the value is said to be an 'anthropocentric' utilitarian value. Most utilitarian arguments for environmental protection are anthropocentric and do not afford non-human individuals, species, or nature as a whole any intrinsic value in and for themselves. Rather, their worth derives from their potential for satisfying humans' personal or societal goals and needs (Hills, 1991). Even arguments based on aesthetics are utilitarian. For environmental issues, the egoistic and social-altruistic value orientations lead to pro-environmental attitudes which are held in order to achieve some environmentally unrelated outcome, such as monetary gain or human welfare. That is, these orientations are both based on anthropocentric utilitarian justifications for advocating environmental protection.

The third value orientation proposed by Stern et al. (1993) is the "*biospheric*" orientation, which consists of concerns about the natural environment in and for itself, or for its intrinsic worth. In the typology of worth or ascribed value, intrinsic value is antagonistic to utilitarian value (Callicot, 1986; Stokols, 1990). People who hold a biospheric value are more likely than others to act when the welfare of non-human

species or the integrity of a natural setting are in jeopardy (Stern et al., 1993), even when there is no threat to human welfare.

The three value orientations described above, then, are: 1) the egoistic orientation based exclusively on self-interest which ascribes the environment utilitarian worth; 2) the social-altruistic orientation which also ascribes the environment utilitarian worth although based on genuine concern for other people; and 3) the biospheric orientation which ascribes the environment intrinsic value. It is interesting to note that Merchant (1992) independently arrived at virtually the same tripartite model at the same time as did Stern et al. (1993) (see Stern & Dietz, 1994).

Stern et al. (1993) anticipated the need to determine whether their value orientations could really predict the different attitudinal and behavioural outcomes that the model suggested should follow from each orientation, and conducted their own preliminary research. Three-item subscales for beliefs based on each of the value orientations were developed for a questionnaire (p.333). Perceived consequences for oneself of environmental protection included limitations to jobs, personal freedom, and recreation opportunities. Consequences for others of environmental degradation included the effects of pollution on public health, and the necessity for dealing with environmental problems for the benefit of future generations. Consequences for the biosphere included the effects of pollution on the earth's climate (although this clearly has implications for people, also), the rate of the extinction of species, and the ease with which the balance of nature could be upset. In addition were four items to measure willingness to take political action, including participation in demonstrations, contributing money to environmental organisations, signing petitions for tougher environmental laws, and not

taking a job with a company known to be harming the environment. Furthermore, two items were used to assess willingness to pay for environmental protection through income and fuel taxes.

A systematic random sample of 349 undergraduate students at a university responded to the questionnaire. Results indicated that scores for each of the three value orientations were able to independently predict willingness to take political action when the effects of the other two were statistically controlled, with the regression coefficients from the analysis decreasing from egocentric through social-altruistic to biospheric. The influence of all three orientations on self-reported behaviour was therefore supported by these results. Stern et al. pointed out that, "this finding is consistent with the Schwartz (1968a) model, but implies that beliefs about consequences for oneself or for the biosphere, and not only about consequences for others, can motivate action on environmental issues" (p.336). However, only egoistic beliefs were reliable predictors for willingness to pay for environmental quality through taxes. Egoistic beliefs attained significant regression coefficients of .42 with willingness to pay through income tax and .20 with willingness to pay through a tax on leaded fuel. Social-altruistic beliefs were not significantly related to either of the willingness-to-pay measures. Biospheric beliefs were significantly related to willingness to pay through income tax, with a regression coefficient of .28, but were not significantly related to willingness to pay through a tax on leaded fuel. Such contradictory results between willingness to take political action and willingness to pay through taxes were not anticipated and require explanation. Stern et al. (1993) hypothesised that they may have been due to different demand characteristics of the questions:

> in a survey, questions about intended political action draw respondents' attention to whatever values spur them to political action on the issue in question - and in environmental politics, the public debate suggests that each of the three value orientations may be involved. Questions about willingness to pay draw repondents' attention to the things on which they spend money, and these things are more likely to pertain to their well-being than to social-altruistic or biospheric values. If this argument is correct, a willingness-to-pay question has the effect of focusing attention on the egoistic value orientation. (p.336)

Thompson and Barton (1994) further examined the usefulness of the distinction between attitudes based on ecocentric and anthropocentric values (in this case both egoistic and social-altruistic) by developing a questionnaire with two corresponding subscales and questions on apathy toward environmental issues. People's self-reported (retrospective) conservation behaviours and membership in environmental organisations were also measured. The results showed that those people who reported themselves as agreeing more strongly with anthropocentric statements such as, "The most important reason for conservation is human survival" (p.152), were more apathetic and reported less conservation behaviours compared to those who were more ecocentric. An example of an ecocentric statement is, "I prefer wildlife reserves to zoos" (p.152). In a regression analysis, both scales could uniquely predict apathy and reported conservation behaviour. However, people who were more ecocentric and people who were more

anthropocentric in their attitudes did not differ on the number of environmental organisations to which they belonged. While this study had the advantage of sampling a more general (although probably fairly affluent) population rather than a student population, the researchers acknowledged that self-report measures have limited validity and that the internal reliabilities of the scales they had developed required improvement.

Thompson and Barton (1994) performed a second study using observable behaviours and revised scales, although in this case they used university students as participants. The observable behaviour was students' signing up to express interest in being contacted by the student environmental organisation. Both the anthropocentric and ecocentric scales were included in regression analyses with apathy toward the environment, and behaviour as the dependent variables. The variation explainable by a traditional measure of environmental attitudes (Weigel & Weigel, 1978) was partialled out of the regression coefficients to discover whether the anthropocentric and ecocentric scales measured anything over and above the traditional attitude measure. The results indicated that only ecocentrism had a significant regression coefficient with signing up when the traditional attitude measure was partialled out. The fact that anthropocentrism was not related to signing up and neither value orientation was associated with level of apathy when the traditional attitude scale was controlled for was important in its difference from the first study.

Due to the age differences between the two samples, Thompson and Barton analysed the results for age effects. The results showed that this could not explain the difference between the two results and the researchers suggested that perhaps the attendance of the participants in their second study at a "small private liberal arts

college"_may have biased the results (p.155). Exactly how this might bias the results was not stated. However, it is possible that this group's self-reports were more prone to social desirability and, due to the relatively high level of education of this group, the demand characteristics also may have caused some participants to overestimate their ecocentrism and underestimate their anthropocentrism. Also, it is possible that the results of their first study were artifacts of the low internal reliabilities of the scales.

However, anthropocentrism may have been unrelated to observed behaviour because of characteristics of the task. The conservation behaviours that participants were asked about in study one (e.g., recycling, reusing, using public transport) involve effort and convenience costs to the individual. However, signing up to *express interest* in being *contacted* by the *student* environmental organisation as in study two involves minimal effort and cost. Perhaps this explains why anthropocentrism was unrelated to behaviour in this second study. Even so, it must be noted that this does not explain the contrasting results for studies one and two in regard to apathy toward the environment, in which the measures employed were the same for both studies. As stated above, the differences in internal reliability may account for that result.

Taken together, the studies by Stern et al. (1993) and Thompson and Barton (1994) provide support for the independent influences of the egoistic, social-altruistic, and biospheric values, although this appears to fluctuate depending on the context. Stern et al. do not suggest that individuals have only one orientation, however, they do state that people are likely to have a dominant value orientation which has most influence over their attitudes and behaviour. In trade-off situations where one of these three values is

in conflict with another, the dominant orientation will theoretically prevail and guide behaviour.

In 1994, a study by Axelrod provided empirical evidence for the dominance of particular values for individuals, supporting the notion that people do indeed have personal value orientations. Six hundred undergraduate students at the University of British Columbia, Canada, were asked to rate eight sets of three goals. For each set of three, they rated the importance of each goal for their lives in general. The goals related to each of Axelrod's three value orientations: economic, social, and universal. His economic orientation was similar to Stern et al.'s (1993) egoistic orientation, as it primarily concerned the attainment of personal financial and material security, comfort, and wealth. His social orientation included a slightly wider domain than that of Stern et al. in that it referred to needs for belongingness and conformity as well as social altruism. The universal orientation included in Axelrod's typology was based on Schwartz's (1992) "universalism" domain, and referred to "the pursuit of self-respect garnered from making a contribution to the betterment of the world, particularly as it pertains to pursuing and attaining outcomes that correspond with universalistic-type goals (e.g., equality, environmental preservation)" (p.88). On the basis of responses to Axelrod's questionnaire, approximately half of the respondents could be assigned a dominant value orientation in that they chose responses in the questionnaire that predominantly corresponded to one orientation. Of these, 144 students were included in the second phase of the study, where participants representing the three value orientations were presented with three independent hypothetical conflict situations involving the environment.

The first of the three dilemmas was based on the "Commons" dilemma as described by Hardin (1968). The commons dilemma involves the management of a resource, a common cattle grazing ground in Axelrod's scenario, where overuse benefits the individual through personal gain but diminishes the overall resource belonging to a community or group. The second scenario was a version of the "Harvest" dilemma, where the choice is between economic gain and environmental preservation; logging in native forests was the scenario used in Axelrod's study. Finally, the "Waste" scenario dealt with the choice between disposing of solid waste for free in an area previously designated to be a new suburban park, or paying to have a new recycling program developed.

Half the participants in the study were presented with high-conflict situations and half with low-conflict situations for each of the scenarios. This was accomplished by maximising personal losses pursuant to an environmentally protective course of action and maximising personal benefits pursuant to an environmentally destructive course of action in the high-conflict situations, and vice versa in the low-conflict. Participants were required to choose which of two opposing behavioural options they thought they would take in that situation, describe in free-response format the factors that influenced their decision, and rate on five-point scales the importance of twelve reasons (representing the three value domains) in each of their decisions.

Value orientation had an effect in the Commons and Harvest dilemmas but not in the Waste dilemma. This last concerned recycling, for which there is generally great support (Dunlap & Scarce, 1991). In the Commons dilemma, the economically-oriented participants chose the environmentally protective option significantly less than the other

participants. In the Harvest dilemma, only about half of the economically- and socially-oriented participants chose the environmental option compared to 85% of the universally-oriented participants. There was also an interaction effect. In the high-conflict Harvest dilemma, economically-oriented participants tended to choose the environmentally protective course of action less (29.2%) than in the low-conflict situation (70.8%). Conflict had no effect on those with social (56.5% versus 54.2%) or universal (87.0% versus 84.0%) orientations. The free-responses regarding factors influencing the participants' decisions and their rankings of importance for twelve prompted reasons were consistent with their assigned value orientations.

Axelrod's (1994) study demonstrated the usefulness in the environmental domain of the concept of value orientations similar to those of Stern et al. (1993). Although people may not have a dominant value orientation, this study suggests that when they do, that domain will have the most effect on behaviour. A limitation of this study was its reliance on self-reports in response to hypothetical scenarios, as self-reports are of questionable validity. Another limitation was that, while the scenarios were designed to capture the complexities of real-life situations, factors such as social pressures and economic realities are far easier to resist in hypothetical dilemmas than in dilemmas that are directly experienced.

With regard to water conservation, considerations for each of the three value orientations should all suggest that conserving is desirable. For example, people can save money (egoistic), ensure that water will be available for the future (social-altruistic), and also limit the need for more environmentally destructive dams (biospheric). So, water conservation does not involve the same dilemma as present in

Axelrod's scenarios. It would, however, be useful to know what type of values to appeal to in persuasive communications about water conservation. Indeed, there is already evidence to suggest that personal values *are* important in people's thinking about fresh water (Pierce, 1979).

Pierce (1979) concisely summed up the interface between Schwartz's (1968a) norm-activation model and the role of values in environmental decisions by positing that, "It is rational for people who see preservation as relevant to their values to employ values in their evaluation of preservation policy" (p.148). Thus values are activated when they are deemed relevant to a situation, similar to Schwartz's model. Two of Rokeach's (1973) values that Pierce expected to be particularly associated with support for preservation were "A World of Beauty" and "A Comfortable Life". From a sample of 687 heads of household in Washington, USA, support for allocating water to preservation compared to six other uses was obtained using a ranking method. Allocation to preservation might mean, for example, keeping flowing river sections that are downstream from dams, or supplying metropolitan wetlands with water, despite the fact that this water is then unavailable for human use. Also obtained were respondents' rankings of Rokeach's 36 values, and two measures of their self-interest in water policy: whether they owned waterfront property, and their level of water use (low, medium, or high). For each category for both of the self-interest measures, multiple regression analyses were performed using the rankings of Rokeach's values as predictors of support for the allocation of water for preservation.

Consistent with the hypothesis, a larger amount of the variance (30% for property owners, 18% for high consumers) in preservation rankings was explained for those who

were high on self-interest, than for those who were low on self-interest (15% for property non-owners, 5% for low consumers). That is, self-interest activated values, similar to the activation of norms by awareness of consequences and ascription of responsibility in Schwartz's (1968a) model. The two values that Pierce was concerned with both had significant independent effects on participants' support for preservation. The rankings of the value "A World of Beauty" had the greatest effect and was positively related to support for preservation, whereas "A Comfortable Life" had a significant negative relationship with support for preservation only for those who were categorised as high in self-interest. Interestingly, Rokeach's value, "Responsible", was also negatively related to support for preservation for those who owned waterfront property. This concurs with Rokeach's (1973, pp.376-377) finding that the ranking of this value increases with income level. Pierce suggests that people for whom this value is important may see the use of water for preservation as irresponsible because it "lock[s] up needed resources" (p.155). In any event, this study indicated that values are relevant to the issue of water resources.

Pierce (1979) provided support for the conception that level of self-interest, or the relevance of the situation to objects of personal value, is a mediator of support for preservation. The perception of relevance to personal values is similar to Schwartz's (1968a) theory that awareness of the consequences of behaviour for others is a necessary precondition of moral behaviour. As yet, however, no evidence for Schwartz's theory in terms of awareness about environmental consequences has been presented.

So far, all reviewed studies that have tested the theory of norm-activation (Schwartz, 1968a) have been concerned with the consequences of behaviour for people

as opposed to consequences for the environment, despite their environmental contexts. Heberlein (1971, as cited in Heberlein, 1972) tested participants' awareness of the "negative *interpersonal* consequences" (p.79, italics added) of littering (cf. Dunlap & Van Liere, 1977), and Van Liere and Dunlap (1978) measured knowledge of effects on *neighbours* of backyard burning. Black et al. (1985) operationalised awareness of consequences as the awareness of the *social* consequences of energy efficiency. Also, Hopper and Nielson (1991) targeted mostly societal consequences in their awareness items measuring how important four reasons were for recycling. These reasons were: recycling helps conserve natural resources (for human consumption); recycling helps reduce litter (aesthetically unappealing to humans); recycling helps save energy (for continued human use), and; recycling helps reduce use of landfills/dumps (which is becoming more and more inconvenient and expensive; p.205).

Thus, these studies were concerned with social altruism, not altruism for the environment. However, Schwartz's (1968a) model may also be able to contribute to our understanding of environmental behaviour by considering the latter. That is, it can tell us whether an awareness of *environmental consequences* increases the likelihood or degree of environmentally responsible behaviour.

A recent study conducted by Guagnano, Dietz, and Stern (1994) tested the influence of awareness of environmental consequences on people's verbally ascertained willingness to pay for environmental quality. A random sample of 367 residents of Virginia, USA, were interviewed by telephone, and asked about species extinction, public health, and climate change to measure their awareness of general consequences of human activity. Two additional items measured the perceived personal costs of

environmental protection, and two measured perceived personal responsibility for environmental protection. Six brief scenarios were also presented and respondents were then asked to state how much they would be willing to pay personally to help rectify the environmental problem in the scenario. Regression analysis found that participants' willingness to pay was significantly and directly related to their scores on awareness and responsibility, except in the two scenarios where payment for environmental protection was by taxes. Thus, except for payment by taxes, these results were in agreement with the norm-activation model (Schwartz, 1968a). The norm-activation model can, then, be extended to the effects of the awareness of environmental consequences on environmental behaviour, at least as indicated by willingness to pay. However, it must be noted that public health has consequences for people, and climate change may have been interpreted this way by participants, too.

Another important contribution of the study by Guagnano et al. (1994) was to provide empirical support for the direction of causality in the norm-activation model (Schwartz, 1968a). Path analysis supported a model where awareness and responsibility directly affect willingness-to-pay. This direction of causality was also supported by Black et al.'s (1985) path analyses, reported earlier, of variables involved in energy conservation, although relationships found in the analyses in that study were weak. So, it can be argued that when people believe there are negative environmental consequences of human activity, they are more likely to report a willingness to act. This suggests that the provision of information about those consequences may influence self-reported and observable environmental behaviour.

An Australian study (Aitken, McMahon, Wearing, & Finlayson, 1994) suggested that some types of information can affect domestic water consumption. In the study values, attitudes, and habits were used as psychological predictors of inhouse domestic water consumption in Melbourne (Australia), and contextual predictors such as household size were also used. Two hundred and seventy-three household residents were asked to rate how strongly they agreed or disagreed with the statements, for example, that "saving water takes more effort than it is worth" (p.140) to measure attitude, and that, "It is my duty as a responsible citizen to conserve water" (p.148) to measure perceived responsibility. The residents were also asked to rate on a five-point scale how frequently they performed particular conservation behaviours in order to gain a measure of habits. Scores for these psychological variables were then summed for each, so that each respondent was given a single score for each. Finally, residents were asked to rank a complete list of Rokeach's values, and scores for the values variable were calculated as the summed rankings of four values which Aitken et al. (1994) argued were particularly relevant to water conservation. These values were: "A World of Beauty", "A Comfortable Life", "Pleasure", and "Family Security".

A regression analysis showed that neither values, attitudes, nor habits were predictive of household consumption. In contrast, nearly half of the variance in consumption was explained by the number of people living in the household. Therefore, to determine whether the low correlations between psychological variables and consumption in the whole sample had been caused by the responses of just one household member on the one hand and total household consumption on the other, a correlation analysis on attitude and consumption was performed for the 25 single-

member households in the sample. This yielded a non-significant ***negative*** coefficient, indicating that those with more positive attitudes had a slight tendency to consume more water than those with negative attitudes. Hence the measurement of individual psychological variables but household consumption could not have caused the attitude-behaviour discrepancy.

Aitken et al. (1994) used this discrepancy to their advantage in a second study and used weekly informational interventions ("postcards") to arouse dissonance and provide feedback about consumption. The cognitive dissonance card reminded participants of their agreement with the responsibility statement in the first study, and then gave feedback on their water consumption in the previous week along with the average winter consumption for Melbourne households of the same size as the participant's. The feedback postcards were the same as those used for the dissonance condition, but without the dissonance-inducing reminder at the beginning. The feedback and control conditions did not display any significant differences in consumption levels. However, there was an interaction of prior consumption level with intervention and experimental period, where high-consumers who received the dissonance information showed significantly lower levels of consumption in both the treatment and recovery periods compared to the baseline period. The average reduction for this group was 4.3%. For the low-consumers, who were already consuming less than the average amount, there was a significant difference showing an *increase* in consumption between the baseline and recovery periods for those receiving feedback only. It was proposed that this group may have reacted to feedback data by 'normalising' their consumption in the absence of

potentially 'rewarding' information (for them) that was used to arouse cognitive dissonance in the high-consuming group.

Aitken et al. (1994) claimed that the inability of values, attitudes, and habits to predict consumption meant that the public education campaign that had been conducted by the local water utility company for some years before the study had had little effect, and that "Behaviour change requires stronger inducements and better targeted information, as demonstrated by the minor success of the dissonance and feedback treatments employed in this project" (p.156). Yet, no regression analysis of the psychological and contextual predictors of consumption was conducted after the cognitive dissonance intervention. Aitken (personal communication, November 7, 1995) suggested that, had one been conducted, the psychological variables would most likely have still not been significant predictors of consumption. So, while the researchers did not use educational information, they *did* show that some information, cognitive dissonance information combined with feedback, can achieve reductions in the residential water use of high consumers. They also suggested that there would have been greater reductions had the study been conducted in summer as there is more scope for changes in garden and recreational water use over that period.

The above study (Aitken et al.) sets a background for research on the effects of information on water consumption by showing a sizeable decrease in response to one particular type of information. Some studies have examined the effects on behaviour of educational (versus cognitive dissonance) information that is related to environmental values. Their quasi-experimental designs aided the reliability of the studies. One of

these, by De Young et al. (1993), measured the effects of economically based and environmentally based information on precycling or source reduction behaviour.

While interventions used in research cannot usually claim to change people's values, appeals to some values may motivate action more than appeals to other values. In this study, shoppers were provided with educational pamphlets advocating source reduction, including buying non-toxic products and products with less packaging. The three experimental groups received rationales for source reduction; one group was given economic rationales, the second was given environmental rationales, and the third was given both rationales. These rationales were seen as giving different motivations for source reduction and can be related to egoistic and ecocentric (or biospheric) values, respectively. The fourth group was a control group.

All intervention conditions reported that they had undertaken more source reduction over the ten-week treatment period than during the three-week baseline period, with the group receiving both rationales reporting significantly greater reduction than the other two groups. It was concluded that people have both self-interested and environmentally oriented values for conservation behaviour, and that educational programs should appeal to both.

An acknowledged weakness of the study was that only volunteers participated. If this caused a bias in the results, one could expect that its influence would have been to increase the effects of the environmental rationale on behaviour, as source reduction is likely to be perceived as an environmental issue. A similar bias may have resulted from the use of a self-report measure.

Another study on domestic water conservation by Thompson and Stoutemeyer (1991) did not examine ecocentric motivations, but distinguished between egoistic and social-altruistic motivations. One-hundred and seventy-one households were distributed with educational information about either economic (egoistic) consequences of water use and conservation, long-term community (social-altruistic) consequences, or just prompts to conserve. Participants in these three conditions received a list of 25 tips on how to conserve. This last condition served as a control group for demand characteristics, but not for possible 'Hawthorne' effects, as these participants knew their water consumption was being monitored. To control for knowledge of participation in the study and also for self-selection, the consumption of an extra 36 households constituting a fourth group was monitored without the residents' awareness. For this study, observable behaviour was measured, that is, actual water consumption over a two-month billing period.

It was found that the group receiving information on long-term community consequences conserved more water than all other groups during the intervention period, but that the economic information group did not differ significantly from the two control groups. However, in the follow-up period the two experimental groups consumed significantly less water than those in the control groups. The long-term effects of this information on observed behaviour supported the findings of De Young et al. (1993) discussed above.

The research that has been reviewed above indicates that people's values affect their environmental attitudes (Stern et al., 1993), including those toward water allocation for preservation (Pierce, 1979). Their values also affect their environmental decisions

(Axelrod, 1994) and environmental behaviours (Thompson & Barton, 1994). In addition, awareness of the consequences of behaviour has been shown to influence people's willingness to pay for environmental quality (Guagnano et al., 1994).

Field experiments using educational information based on the consequences of behaviour for valued objects have shown effects on behaviour change over and above information that merely describes how to conserve (De Young et al., 1993; Thompson & Stoutemeyer, 1991). One of these field experiments (Thompson & Stoutemeyer) was on domestic water conservation, and the results indicated that both egoistic and social-altruistic information encouraged water conservation, although the effects of the former were slightly delayed in appearing. The other (De Young et al , 1993) was not in the area of water conservation, but was important in that it compared the effects of egoistic and ecocentric rationales for conservation. No study of experimental design has examined the effects of all three value orientations - egoistic, social-altruistic, and ecocentric - on observed or self-reported behaviour. Few studies have manipulated the information to appeal to different values. Those that have, have used measures of behavioural willingness and intention rather than allowing time for changes in actual behaviour to occur.

The purpose of the present study was thus to extend the research on water conservation to that which presents information that provides both anthropocentric (egoistic and social-altruistic) and ecocentric rationales, and to examine effects on knowledge and self-reported behaviour.

The Present Study

The aim of the present study was to investigate the way in which information affects behaviour by considering the association between perceived importance, memory of information, and behaviour change. It was considered useful to know which types of information people perceive to be important, and whether this is the only information they remember. This could have a large impact on the design of materials for environmental education.

Thus, the present study, sought to explicitly examine the information-knowledge-behaviour model that is assumed in environmental education, but has not been clearly addressed in research to date. For example, studies have assessed the relationships between information and knowledge, information and behaviour, and knowledge and behaviour, but none appear to have examined the three variables together. However, consistent with the environmental education model and the weak effects of information and knowledge on behaviour found in previous research, it was predicted that there would be effects of information on both memory for the information and behaviour.

Prior research (Water Authority of Western Australia, 1994) has also found that income level is a major determinant of water consumption, in that households with higher income consume more water. In Perth, 'very high water user' households, those who use more than 700kL of water per year, are significantly more likely to have an annual income of more than $80,000 than those households who do not use that much water. In addition, households with relatively high income levels have been found to be less responsive to conservation campaigns in their behaviour change (Thompsen & Stoutemeyer, 1991). To strengthen this finding, the present experiment also examined

levels of income: upper-middle and lower-middle. No predictions were made concerning perceived importance and memory of the information. However, for behaviour it was hypothesised that the lower income group would show significantly more change in their behaviour than would the higher income group, consistent with Thompson and Stoutemeyer's findings, because financial savings would be more meaningful for them than for the latter group.

The focus of the study was on the relative effects of consequential information appealing to different value orientations in a water conservation context, and non-consequential information that did not appeal to values. Because Thompson and Stoutemeyer (1991) have already found economic (egoistic) and social-altruistic rationales to encourage domestic water conservation, the present study combined these two types of information (egoistic and social-altruistic) and classed them as 'anthropocentric' information, because they are based on the consequences of conserving and of not conserving water for humans. The effects of anthropocentric information were compared with the effects of the third type of value relevant information, 'ecocentric' information, which relates to the consequences of conserving and of not conserving water for the environment. This dual categorisation is the same as that used by Thompson and Barton (1994), who found that both were related to self-reported behaviour and that ecocentric information was related to observed behaviour. Thus, the present study extended the types of information used in research on water conservation to include ecocentric information, which was the third environmentally related value-orientation in Stern et al.'s (1993) tripartite model.

An additional comparison was made between these two types of consequential information and nonconsequential or 'abstract' information that provides facts and statistics about domestic water sources and their use, but provides no rationale for conservation in the form of awareness of consequences for valued objects. Some abstract information is based on the consequences of actions in terms of how much water would be saved by taking those actions, but it is not based on consequences for valued objects. Abstract information is typical of the information that the local water utility company generally disseminates to the public to encourage conservation. However, Schwartz's (1968a) model of norm-activation, which bases behaviour on the awareness of the consequences of actions, would predict its inefficacy, especially since it demonstrates no obvious pertinence to a person's values or valued objects.

Ecocentric, anthropocentric, and abstract information were all presented in conjunction with tips for conserving water (i.e., 'action' information) to control for differences in knowledge about which actions to take. A control group received action information only.

The research hypotheses were as follows:

1. Because the perceived importance of the information ought to reflect its motivational relevance, it was expected that ecocentric and anthropocentric information would be rated as more important than abstract information.
2. Motivational relevance was also expected to enhance memory for the information, so that ecocentric and anthropocentric information would be remembered better than would abstract information.

3. It was hypothesised that the effects of information on behaviour would follow the same trend as its effects on memory, so that again ecocentric and anthropocentric information would result in greater behaviour change than would abstract information. (Given the conflicting nature of previous research in this area, the relative effects of ecocentric and anthropocentric information compared to each other were not predicted.)
4. The lower-middle income group was expected to show significantly greater behaviour change than the higher-middle income group. However, work on the relationship between income and memory for the information was considered exploratory, so no hypothesis was proposed.

CHAPTER THREE

PILOT STUDY

Developing the Information Brochures

Information on fresh water and its conservation was collected from several sources including the National Geographic special edition on fresh water (Graves, 1993); local and interstate water utility companies; Greenpeace; and a groundwater expert who works both with a university and the Conservation Council of Western Australia, a non-governmental organisation. One hundred and two relevant items of information were collected from these sources and given to nine independent judges. The judges were provided with definitions of ecocentric, anthropocentric, abstract, and action information and asked to categorise each of the 102 items as one of these types of information. No specifications about the number of items in each category were given, to avoid judges basing their decisions on having to fill a 'quota' for each type of information. The items were also mixed in their ordering to dissuade pattern-type responses by the judges.

Items were discarded if two or more of the nine judges disagreed with the majority about the proper categorisation of the item. The remaining 72 items were collated into brochures for each type of information. Two versions for each type of brochure were used to minimise the likelihood of effects being caused by particular items.

For ecocentric information, items focused on the effects on the environment of conserving or not conserving water, for example, "When we use less water, it reduces

the need for more dams. Dams can upset the delicate balance of nutrients needed by organisms at the start of the food chain". Anthropocentric items either described effects on individuals, such as, "By using less hot water and using dishwashers and washing machines more efficiently, you can make large savings on your energy bill", or described effects on sociey, for example, "Conserving water will help keep increases in the price of water to a reasonable level". Abstract information included statistics like, "If all the earth's water were put in a 4 litre jug, easily accessible fresh water would equal about a teaspoon (or .03%)". Useful action strategies for conserving water constituted the action information. An example of this type of information was, "Leave the basin tap off while brushing your teeth and use a single cup of water to rinse afterwards".

In the final versions (see Appendix C), there were 10 items in each brochure, although 3 items were the same in both versions of the ecocentric information and also in both versions of the anthropocentric information. This was due to the lack of categorised items of these types in the information sources. Every effort was made to ensure similar amounts of information in terms of the number of words and the number of concepts expressed across brochures so that differences in these could not influence the results. At the end of each brochure was a statement informing participants that it had been compiled by Edith Cowan University. This was intended to make it more likely that the information would be perceived as coming from a credible source, which is another influence on the translation of information to behaviour (Costanzo et al., 1986).

Developing the Memory Measures

It was intended in the main study to gain a measure of knowledge or memory for the information three weeks after participants had read the brochures, so that knowledge could be related to behaviour change. However, there was to be no pretest of participants' knowledge in the main experiment, so the memory measures had to be checked for systematic differences in pre-existing knowledge that may have confounded the results. A pilot study was used to determine mean levels of pre-existing knowledge of the ecocentric, anthropocentric, and abstract information.

Participants

Study 1. Ten people from a sport club and and 25 staff from a local hospital responded to requests for participants. Thus, participants were volunteers and non-randomly selected. There were 21 females and 13 males, and one person whose sex was not specified. The mean age was 36.4yrs.

Study 2. A sample (N=27) of undergraduate and postgraduate psychology students from Edith Cowan University were used in the second study. Information on age and gender were not collected from this sample, however, there were more females than males and because night classes and postgraduates were used, there was a reasonable range of ages. Again, all participants were volunteers.

Materials

Questions in the tests of knowledge were specific to the information contained in the brochures. Hence, for each of the six non-action brochures (two for each version) there was a corresponding knowledge test to measure how much of the brochure information the participants knew. In each test there were 3 recognition items (multiple

choice) and 7 recall (free response) items. Each answer scored 0 if it was incorrect, .5 if it was partially correct, and 1 if it was correct. Thus, the range of possible scores was 0 to 10.

Procedures, Results, and Discussion

Study 1. The knowledge test for ecocentric knowledge for water conservation was completed by 10 respondents from the sport club and hospital, anthropocentric by 14 respondents, and abstract by 11. Respondents were randomly assigned, and did not receive information in brochures or in any other form before completing the test. Action knowledge was not assessed as all groups in the main experiment were to receive it, so differences across experimental conditions were not an issue.

Knowledge was found to be significantly related to question type when a one-way ANOVA was performed, $F(2,32)=3.90$, $p=.03$. A Tukey's Honestly Significant Difference post hoc test indicated that people already knew more of the ecocentric consequences of water use, or could guess more on the test for ecocentric knowledge ($M=4.45$, $SD=1.34$) than for abstract knowledge ($M=3.05$, $SD=1.23$). Anthropocentric knowledge had a mean of 3.25 ($SD=1.19$). Therefore, changes to the ecocentric knowledge tests were made in order to make the test for ecocentric knowledge as difficult as the others, and all six non-action knowledge tests were tested again in a second study.

Study 2. The student sample from Edith Cowan University was asked to complete two of the memory tests each without receiving any educational information beforehand. Tests were compiled in pseudo-random order to minimise order effects. Again, action knowledge was not included.

Scores for each of the three conditions were comparable, as indicated by a one-way analysis of variance (ANOVA), $F(50,2)=.11$, $p=.89$. The grand mean was 3.22 correct responses out of a possible 10. Thus a baseline level of knowledge was obtained that did not differ across groups, and thus could not systematically influence memory scores in the main experiment.

CHAPTER FOUR

METHOD

Participants

Participants were selected from the general public using a cluster sampling technique. Two lower-middle and two upper-middle income suburbs in Perth, Australia, were chosen so that they clustered into two geographic areas, with one suburb from each income category in each (see Table 1). A low income household is deemed to be one that earns less than $25,000 per annum (Australian Bureau of Statistics, 1993). The two lower-middle income suburbs chosen for the present study had median annual incomes of $26,300 and $30,400. The two upper-middle income suburbs had median annual incomes of $35,600 and $57,300 (Australian Bureau of Statistics, 1993, provided by their information service). The clusters were approximately 15km apart, but within clusters the lower and upper income suburbs were adjacent to one another to control for effects due to differences in location, such as one or the other being in a newly developed area. Within the chosen suburbs, the streets on which houses were approached and the order in which they were completed were randomised. All the streets in each suburb were listed and numbered. Then, for each suburb, a random number generator was used to choose 20 streets on which the data would be collected. The order in which the numbers were generated also determined the order in which the streets were used for data collection, because it was unknown how many streets would have to be used to obtain 40 participants from each suburb.

Table 1

Sampling Design Based on Income Group and Geographical Location (Cluster).

	Income Group	
	Lower-Middle	Upper-Middle
Cluster 1	Suburb A (Bayswater)	Suburb C (Mt. Lawley)
Cluster 2	Suburb B (Mirrabooka)	Suburb D (Noranda)

The total sample size was 160, with more females (N=98) than males (M=62). Participants' ages ranged from 18 to 75 with a mean of 37.4. Only four participants were over 60 years of age, and only one was over 65. Mostly participants were exluded if they were over 60 because their performance in the memory portion of the study may have been confounded by age-related memory deficits. Of the 393 residents who were approached for the study, 51 (13%) were excluded because they were over 60. However, the four who were sampled and were over 60 were mistakenly included by interviewers in phase one. During the follow-up telephone interview in phase two, these participants did not appear to have any difficulties compared to the majority of the sample. Seventy nine percent of participants owned their house or had a mortage (N=126) and the remaining 21% were renting (N=33). Fifty eight percent were using a bore (well) on their property (N=92) while all except two of the remaining 41% were not (N=65). (Two people were unsure whether they used a bore.)

Because approximately 40% of household water is used on the garden where one exists, only houses and duplexes were approached for the study. While many of the water conservation actions suggested in the brochures focused on saving inside the house, a number were also suggestions for savings outside in the garden. Households without a garden may have been disadvantaged in the number of possible behaviour changes they could have made during the study.

Of the 342 eligible people approached, 182 declined, leaving a response rate of 47%. Most people who refused cited being busy at the time as their reason for non-participation (N=68). A further 64 refused outright, either giving no reason or citing lack of interest. The remaining 50 explanations provided for non-participation were lack of English language skills (approximately half), and miscellaneous other reasons.

Participants were treated ethically at all times, being made aware that their participation was completely voluntary and could be withdrawn at any time.

Materials

Brochures

Information of all types was presented as a small, single page brochure. All brochures (see Appendix A) appeared exactly the same on the front, except that the action information brochures were green, while nonaction brochures were blue to make it easier for the data collectors to distinguish them. "Water Conservation in Perth" was the title on the front, and underneath appeared a paraphrasing of a statement by Edmund Burke, "Nobody makes a greater mistake than the person who does nothing because he or she can do only a little" (adapted from Thompson & Stoutemeyer, 1991, p.322). This

statement was used to enhance interest in the brochures on initial contact and also to increase self-efficacy, which has been related to conservation behaviours in the past (Hines et al., 1986). Another statement immediately inside the front page of all brochures was designed both to make the issue salient despite the fact that it was the middle of a wet winter, and again to enhance self-efficacy. It read:

> Fresh water is one of our most precious resources and requires careful management all year round. Currently, our dar. are only 30% full. *You* can make a *significant* contribution to the conservation of our water resources.

The following sentence read differently depending on the information type. Ecocentric information was introduced as "Here are 10 ways that our use of fresh water impacts upon the natural environment". Anthropocentric information was introduced by, "Here are 10 ways that our level of use affects us", and abstract information by, "Here are 10 facts you may not know about fresh water and our u se of it". Action information was introduced with the statement, "Here are 10 ways that you can help year-round with the best type of management: conservation".

Importance Rating Scale

A ten-point Likert-type scale (Appendix B) was u sed to ascertain the importance attached to each item of information. Five written labels were used - one for every two numeric points on the scale - and they ranged from *neutral* through *somewhat, quite,* and *very important* to *extremely important.* Data collectors filled the scale out, although participant s were free to view the scale. Scores for the complete rating could range from 0 through to 100 for each brochure.

Consent Form

A consent form (Appendix C) was used to obtain permission for the follow-up telephone interview 3 weeks after initial contact. Participants were asked to write their telephone numbers and the most convenient times to contact them. Confidentiality and anonymity were assured.

Memory Tests

There were eight memory tests (Appendix D); one for each brochure. Each participant was administered the one or two tests appropriate to the particular brochures they had read. All non-action tests consisted of 7 free response questions and 3 multiple choice questions, and had comparable numbers of guessable or previously known items (3.22 out of a possible 10). The tests for action information had 7 free response but only 2 multiple choice items, to give a possible range of 0 to 9 for memory scores.[1]

One free-response question asked in relation to the ecocentric information was: "Name two negative effects that dams have on native birds and animals" (scored by giving half a point for each correct answer). A multiple choice anthropocentric item was: "About how much money could a household save each year by installing a low-flow shower nozzle - a) $70 or b) $100?". An example of a question posed to those who had read the abstract information was: "If all the earth's water were put in a 4 litre jug, how much (in measurement or percentage) would easily accessible fresh water equal?". Finally, an action strategy for conserving water that participants were questioned about was: "Besides mulch, what can you put on your existing lawn to help it use water more efficiently?". The questions were developed to be as comparable

[1] Errors in the third multiple choice items originally in each of the action brochures were found after the commencement of testing. Thus, these items could not be included in the results.

across brochures as possible. For the multiple choice questions, each brochure had two items with two choices, and the non-action brochures also had one item with three choices. For both the anthropocentric and the abstract information, multiple choice items were mostly based on statistics. However, this was impracticable for ecocentric and action information, as they were not based on statistics. An example of an ecocentric multiple choice item was: "Do dams affect micro-organisms in the water by: a) changing the levels of the waterway (river or stream), or b) being so deep that oxygen cannot circulate properly?". Refer to Appendix D for the complete sets of questions.

Self-Reported Behaviour Measures

Two structured interviews (Appendix E) were developed to measure self-reported water conservation behaviour. Both related directly to the corresponding action brochures. As mentioned previously, problems with self-reporting of water conservation have been documented. Hamilton (1985) found only a weak correlation between reported savings and actual savings. The specificity of the questions in the present experiment and their direct relation to suggestions in the brochures were intended to make self-reports more reliable in this study.

Participants were asked if, since reading the brochures, they had initiated each of the behaviour changes suggested in the particular action brochure they received.[2] An example of a question was: "Have you applied slow-release fertiliser to lawns and gardens?". Participants were also asked to indicate if they had been taking that action before participation in the present study or if they intended to initiate the change during

[2] Due to the errors mentioned earlier for the memory tests, it was necessary to also exclude one item from each version of the self-report behaviour measure, which meant there were measurements out of a maximum of nine behaviours.

approximately the next three months after the telephone interview. A record was also kept if particular behaviours were inapplicable, for example if the person did not own a dishwasher or could not replace plants with natives because they were renting.

Scores were computed for the number of changes participants could make, the number they did make, and the number of changes they intended to make after the study. However, it was noted that most people were already undertaking some conservation behaviours and also that most had at least one change which was inapplicable to them. This influenced the possible number of changes they could make or could intend to make. In order to control for this, behaviour change was computed as *the number of changes made as a proportion of total possible changes*. The same approach was taken for intention which was computed as a proportion of possible changes at the outset minus the number of changes made since reading the brochures.

Demographic Data

Demographic data included age in years, gender, total household income (seven categories ranging from under $10,000p.a. to over $60,000p.a.), whether there was a bore in use on the property, and whether the house or duplex was owned or rented (mortages were classified as ownership).

Procedure

Phase One

Upon initial contact, householders were asked to help evaluate water conservation brochures being trialled by Edith Cowan University. The source was clearly mentioned here (as well as in written form at the end of each brochure) to ensure that participants

perceived the source as credible before undertaking importance ratings. Those who agreed to participate read the brochures immediately, with the interviewer ensuring that they read the self-efficacy statements first. Ratings of importance were primarily gained to ensure that each item of information was read, as it has previously been found that people do not always do so, and this has the potential to affect research results (Costanzo et al., 1986; Geller et al., 1983). Participants were instructed to read through the information items one at a time and to indicate on ten-point Likert-type scales how personally important they found the concept expressed in each item. In the case of action information, participants were instructed to rate the information regardless of whether or not they thought they would initiate the behaviour. Always the non-action brochure was rated first and the action brochure last. After instructions on how to rate importance, a number of participants were still under the impression that they were required to indicate whether they agreed or disagreed with the information. If this was the case, the interviewer clarified that this was not being asked of the participants. Any questions about the correctness of the information were addressed by the interviewer citing some of the sources of the information and suggesting that it could reasonably be assumed that all the information was correct or true. Most participants appeared to accept this, at least as a necessary condition for completing the ratings.

The consent form was signed at the end of the interview. This was not only to confirm that the participant's data for the first phase could be used for the research, but also to gain consent for the follow-up telephone interview and solicit their telephone number for that purpose. In explaining the purpose of the follow-up interview to gain informed consent, participants were simply told that it was to find out how useful they

had found the brochures. Any further questions from participants were addressed as clearly as possible without indicating that their memory and behaviour would be assessed. In some cases, participants were informed that their questions could not be fully answered until the end of the second phase, because otherwise their knowledge might affect the results. All were satisfied to wait until then. Participants were instructed to read the consent form thoroughly before signing. If they inquired about declining to sign, it was explained that they were at liberty to do so, but that they could no longer be included in the study if they chose that option.

It was explained to participants that anonymity and confidentiality would be maintained by storing consent forms separately from their interview results and ensuring that both the consent forms and the results were stored in locked cabinets. Their results would not bear their names or telephone numbers.

The relevant brochures were left with participants with no indication that they would be required for the follow-up interview. This was intended to reflect natural information-reception situations where some people dispose of brochures while others re-read them.

Phase Two

Three weeks after phase one, participants were interviewed by telephone to obtain measures of their memory of the brochure information and of the conservation behaviours they had initiated in the intervening period. The memory tests were conducted first, this time with action knowledge tested before non-action because the non-action tests gave answers to some of the action questions. Self-reported behaviour measures were then obtained and demographic data were collected. Participants were

then thanked for their time and their cooperation, and any further questions were answered. Participants were informed that final results would be available from the university, and that it was intended to try and make the results more accessible by having them published in the environment liftout section of the main local newspaper.

CHAPTER FIVE

RESULTS

Income Manipulation Check

A manipulation check was conducted to ensure that participants' total household incomes were in fact lower in the lower-middle income areas than in the upper-middle income areas. Demographic data collected on participants' total household incomes, measured by seven categories, were used as the dependent variable in the manipulation check. Results of a one-tailed Mann-Whitney U-test showed that there was a significant difference between household incomes for the two groups, $z(149) = -2.24$, $p = .01$. The median category for the lower-middle income group was \$30-\$40,000 per annum, whereas it was \$40-\$50,000 per annum for the upper-middle income group. The modes fell in the \$20-30,000 and \$60,000 and over categories, respectively.

Data Screening

All variables were tested for normality and only two were found to be non-normal in distribution. These were the two behaviour measures: behaviours initiated since

receiving the brochures and behaviours that participants were intending to initiate after the telephone interview in phase two of the study. Both of these variables were positively skewed.

The data were checked for univariate outliers on importance ratings, memory scores,and the behaviour change variable by transforming scores into z-scores for each information group. Two outliers were found for behaviour change as indicated by z-scores greater than 3.00. Only one of these was deemed a genuine outlier coming from outside the target population, and was not included in any further analyses. This participant understood English barely well enough to complete the interviews, although effort was made to ensure that he did understand. He stated that he had not previously known how to save water or indeed that it was possible to do so. It appeared that he and his family were recent immigrants. He wished to use less water because his household had been receiving large excess water bills. The bills had been a concern for him given the limited income his household was earning and he had implemented 4 out of 6 of the suggested behaviour changes available to him in the 3-week measurement period. He was also intending to ask the landlord to make minor structural changes.

The second outlier, in contrast, was considered to be part of the target population, as he appeared not to be greatly different in any respect from the majority of participants. His score was therefore changed to be just one unit greater than the next most extreme

score as recommended by Tabachnick and Fidell (1989, p.70). A calculation of Mahalanobis' distances revealed that there were no multivariate outliers.

All analyses were two-tailed and performed using an alpha level of .05, unless otherwise stated.

Importance Ratings

A 3 x 2 ANOVA was conducted on importance ratings using information condition (Ecocentric, Anthropocentric, and Abstract information conditions) and income group (lower-middle and upper-middle) as independent variables. There were no main effects for information condition, $F(2,113)=0.16$, $p=.86$, nor for income group, $F(1,113)=3.49$, $p=.06$. However, there was a significant interaction, $F(2,114)=4.08$, $p=.02$. A Tukey's Honestly Significant Difference (HSD) post hoc analysis indicated that participants in the lower-middle income group rated the ecocentric information as more important than did participants in the upper-middle income group (see Table 2 and Figure 1).

There were no significant differences observed for ratings of the importance of action information (see Table 3 and Figure 2).

Importance ratings for non-action and action information were moderately strongly correlated, $r(117)=.49$, $p<.001$, indicating that those who rated the information as highly important for one brochure tended to rate the information in the other brochure as highly important, and vice versa.

Table 2–

Importance Ratings for Non-Action Information as a Function of Information Condition and Income Group.

	Income Group					
	Lower-Middle		Upper-Middle		TOTAL	
Information Type	M	SD	M	SD	M	SD
Ecocentric	78.10	12.53	62.90	16.78	70.50	16.52
Anthropocentric	67.58	13.90	69.90	13.97	68.77	13.80
Abstract	70.25	14.06	68.45	14.08	69.35	13.92
TOTAL	69.55	14.70	67.08	15.06	69.55	14.70

Possible range for importance ratings was 0 to 100.

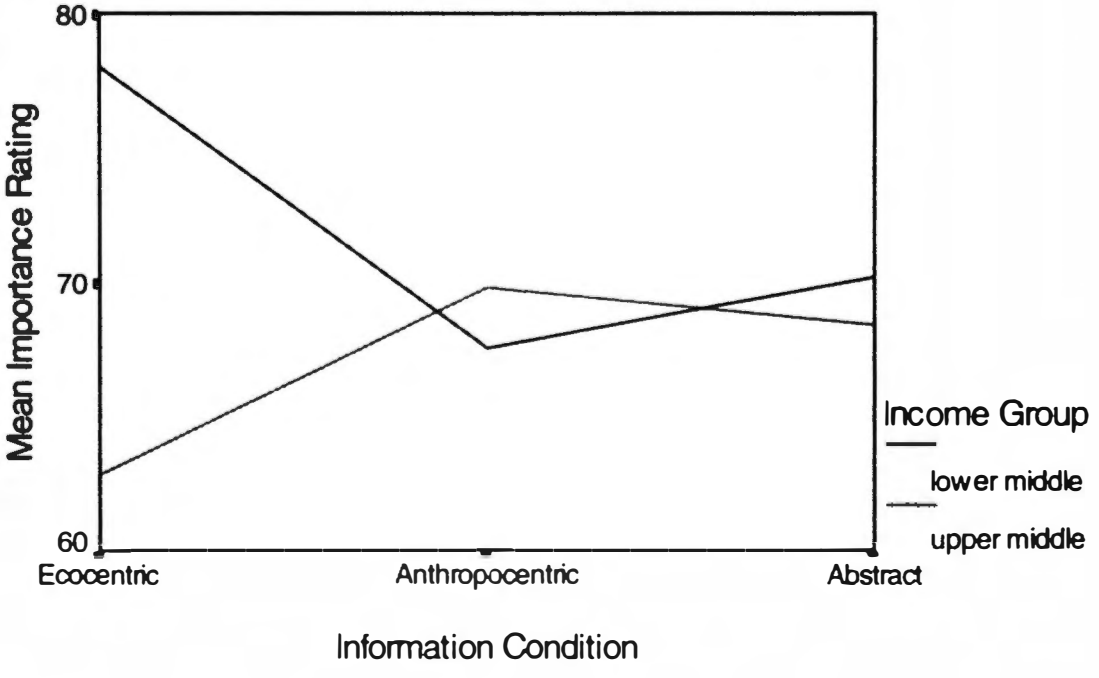

Figure 1 Importance Ratings for Non-Action Information as a Function of Information Condition and Income Group.

Table 3 –

Importance Ratings for Action Information as a Function of Information Condition and Income Group.

	Income Group					
	Lower-Middle		Upper-Middle		TOTAL	
Information Type	M	SD	M	SD	M	SD
Ecocentric	77.35	15.63	72.65	17.30	75.00	16.44
Anthropocentric	73.58	12.44	71.20	15.09	72.36	13.74
Abstract	73.60	14.38	72.15	14.65	72.88	14.35
Action Only	74.25	16.57	77.30	17.70	75.78	16.99
TOTAL	74.71	14.66	73.32	16.10	74.01	15.37

Possible range for importance ratings was 0 to 100.

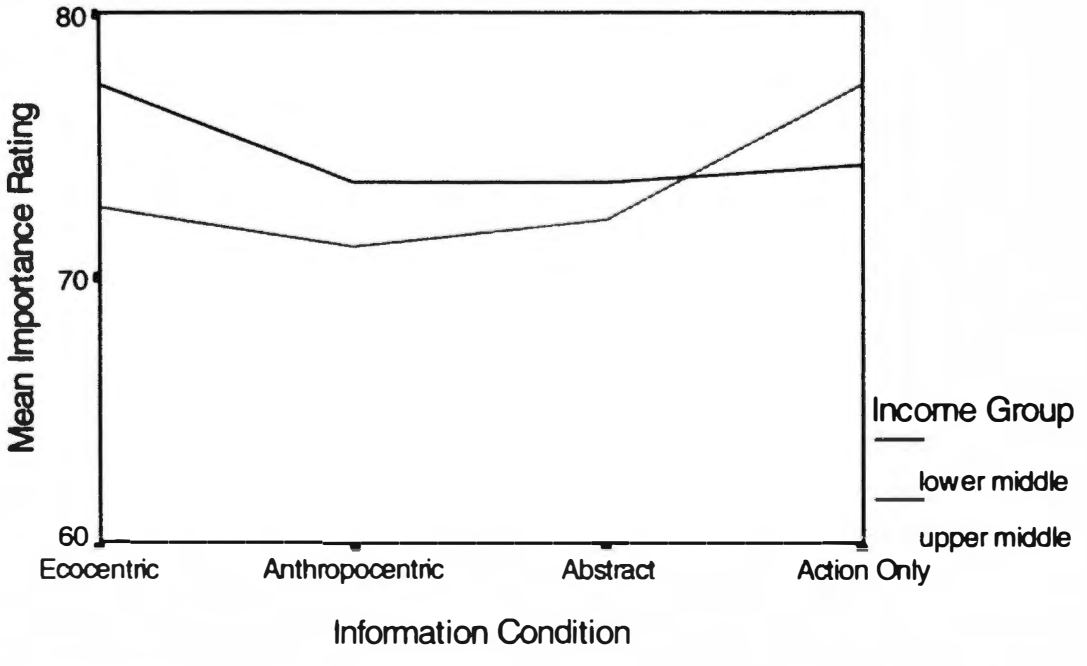

Figure 2 Importance Ratings for Action Information as a Function of Information Condition and Income Group.

Memory

A 3 x 2 ANOVA on memory of non-action information using information condition (Ecocentric, Anthropocentric, and Abstract information conditions) and income group (lower-middle and upper-middle) as independent variables showed no main effect for income group, $F(1,113)=1.86$, $p=.18$. However, there was a main effect for information condition, $F(2,113)=3.89$, $p=.02$ (see descriptive statistics in Table 4). A Tukey's HSD post hoc analysis revealed that abstract information ($M=3.92$) was remembered significantly better than anthropocentric information ($M=2.90$). There was no interaction of information condition with income group for memory, $F(2,113)=.09$, $p=.91$.

Table 4

Memory for Non-Action Information as a Function of Information Condition and Income Group.

	Income Group					
	Lower-Middle		Upper-Middle		TOTAL	
Information Type	M	SD	M	SD	M	SD
Ecocentric	3.52	1.50	2.92	1.70	3.22	1.61
Anthropocentric	3.05	1.35	2.75	1.51	2.90	1.42
Abstract	4.10	1.96	3.75	1.90	3.92	1.91
TOTAL	3.55	1.64	3.14	1.74	3.35	1.70

Possible range for memory scores was 0 to 10.

Memory for action information was analysed in a 4 x 2 ANOVA with information condition (Ecocentric, Anthropocentric, Abstract, and Action Only) and income group (lower-middle and upper-middle) as the independent variables. There were no main effects, neither for information condition, $F(3,151)=1.14$, $p=.34$, nor for income group, $F(1,151)=1.42$, $p=.23$. Also, there was no interaction, $F(3,151)=1.03$, $p=.38$ (see descriptive statistics in Table 5).

Correlation analysis showed that people who remembered action information well generally also remembered non-action information well, $r(117)=.21$, $p=.02$. However, the scores for memory of action information were generally much higher, $M=6.17$, $SD=1.58$, than those for non-action information, $M=3.35$, $SD=1.70$.

Table 5

Memory for Action Information as a Function of Information Condition and Income Group.

	Income Group					
	Lower-Middle		Upper-Middle		TOTAL	
Information Type	M	SD	M	SD	M	SD
Ecocentric	5.98	1.43	5.58	1.60	5.78	1.51
Anthropocentric	6.18	1.63	6.52	1.19	6.36	1.41
Abstract	5.88	1.81	6.68	1.57	6.28	1.72
Action Only	6.04	1.56	6.50	1.73	6.28	1.64
TOTAL	6.02	1.58	6.32	1.57	6.17	1.58

Possible range for memory scores was 0 to 9.

Self-Reported Behaviour Change

A two-way chi-square analysis was performed on the number of participants who initiated at least one behaviour in the three weeks between the first and second phases of the study, comparing across information conditions. A significant relationship was found between information condition and whether or not participants initiated a conservation behaviour, $X^2(3, N=159)=8.95$, $p=.03$. Similar proportions of participants initiated behaviours in the Anthropocentric and Action conditions (28.2% and 30.0%, respectively). However, fewer did so in the Ecocentric group (12.5%) and more did so in the Abstract group (42.5%). (See Table 6, below.)

Table 6

Frequencies of Participants Initiating No Versus at Least One Behaviour Change in Each of Four Information Conditions.

	Behaviour Initiation				
Information Condition	Did Nothing n	%	Did Something n	%	Total
Ecocentric	35	(87.5)	5	(12.5)	40
Anthropocentric	28	(71.8)	11	(28.2)	39
Abstract	23	(57.5)	17	(42.5)	40
Action Only	28	(70.0)	12	(30.0)	40
Total	114	(71.7)	45	(28.3)	159

Some participants had initiated more than one behaviour in the 3-week period between receiving the information and being interviewed over the telephone. However,one restriction on the number of behaviours initiated was that some people were already using water conservation strategies and could therefore make few additional adjustments to conserve more water. That is, a simple measure of how many people initiated conservation behaviours was not entirely accurate, because it could not take this influence on behaviour change into account. Therefore, as indicated previously, a new variable was computed by calculating the number of behaviours initiated as a *percentage* of the number of possible behaviours. This then became the measure of behaviour change used as the main dependent variable.

The new variable was entered into another 4 x 2 ANOVA with information condition (Ecocentric, Anthropocentric, Abstract, and Action Only) and income group (low-middle and upper-middle) as the independent variables. Consistent with the findings of the chi-square analysis, there was a significant main effect for information condition, $F(3,151)=3.05$, $p=.03$. The means again revealed that the greatest difference was between ecocentric and abstract information, and this was confirmed as statistically significant using a Tukey's HSD analysis. This was the only significant difference, with the means for the Anthropocentric and Action conditions falling in between those for the Ecocentric and Abstract conditions. There was also a strong main effect for income group, $F(1,151)=8.07$, $p=.005$. Lower-middle income participants made more conservation changes than those in the upper-middle income areas. There was no significant interaction, $F(3,151)=.64$, $p=.59$. Table 7 below provides the descriptive statistics for behaviour change.

Table 7_

Behaviour Change as a Percentage of Possible Changes According to Information Type and Income Group.

	Income Group					
	Lower-Middle		Upper-Middle		TOTAL	
Information Type	M	SD	M	SD	M	SD
Ecocentric	4.75	9.80	1.67	7.45	3.21	8.73
Anthropocentric	14.71	19.14	3.33	8.29	8.88	15.53
Abstract	15.36	18.87	9.71	13.29	12.54	16.36
Action Only	11.01	17.71	6.00	11.37	8.50	14.91
TOTAL	11.42	17.07	5.18	10.62	8.28	14.46

Due to the non-normal distribution of the behaviour change variable, two Kruskal-Wallis one-way ANOVAs were conducted to ensure that the outcome of the two-way ANOVA was valid. These results also attained significance at a similar probability level, confirming the validity of the two-way ANOVA.

The use of a proportionate score for behaviour change, as described above, was intended to control for the effects of the number of behaviours that it was possible for participants to initiate. To ensure that there were no systematic differences in behaviours that were possible that could have biased the results, an ANOVA was conducted on the number of behaviours that were reported as possible for each participant.

The total number of possible behaviours attained a moderately strong correlation with the number of changes that were actually initiated, $r(157)=.46$, $p<.001$, and also with behaviour change as a proportion, $r(157)=.30$, $p<.001$. This indicated that the latter was less influenced by the number of behaviours that were possible, as was intended. There were no significant differences for possible behaviours in a 3 x 2 ANOVA with information condition (Ecocentric, Anthropocentric, and Abstract information) and income group (lower-middle income and upper-middle) as the independent variables. Thus, the observed differences for behaviour change were not attributable to systematic differences in the number of behaviours available to participants at the start of the study.

There were no differences across information conditions in the number of behaviours that participants reportedly intended to initiate after the study, as a proportion of the number possible to initiate, $F(3,151)=1.42$, $p=.24$, nor was there an effect for income group, $F(1,151)=.44$, $p=.73$, nor an interaction. However, the total number of conservation behaviours reported as possible to initiate after phase two had a moderately strong correlation with the number intended to be taken up at that time, $r(157)=.43$, $p<.001$.

Age, Sex, Home Ownership and Bore Use

Due to the number and post hoc nature of analyses on age, gender, home ownership, and bore use, the results can only be regarded as exploratory. Familywise error was taken into account, with a Boferroni test indicating that alpha levels should be set at .006 for all analyses.

A median split was performed on age (Md=36.00) and age, sex, home ownership, and bore use were entered into t-tests with the eight dependent variables: importance ratings of both action and non-action information, memory scores for both action and non-action information, the number of behaviours that could have been initiated, behaviour change, the number of behaviours that would have been possible after the study, and the number of behaviours the participant was intending to initiate after the study.

The relationship of age with behaviour change was not significant when taking familywise error into account. However, the t-test indicated that there was a non-significant trend, $t(130.3)=2.04$, $p=.04$. The means revealed that younger participants tended to undertake a greater percentage of their possible behaviour changes ($M=10.78\%$, $SD=16.8\%$) than did older participants ($M=6.05\%$, $SD=11.7\%$).

There were no significant effects for age. However, the analyses indicated effects of sex on importance ratings of both non-action information, $t(117)= -2.91$, $p=.004$, and action information, $t(97.6)= -3.02$, $p=.003$. Females ($M=72.68$ and $M=77.06$, respectively) tended to rate the information as more important than did males ($M=64.92$ and $M=69.11$, respectively). No differences were found for either bore use or home ownership.

Assessment of Individual Items

The frequency of each self-reported behaviour was calculated. This allowed the behaviours that were the most commonly initiated for each experimental condition to be ascertained. Some behaviours were the most commonly initiated in three or more

of the experimental conditions. The behaviour that was initiated by the greatest number of participants across all conditions was the reduction of showering time. In total, 17 participants reported that they had reduced their showering time by up to 15 minutes (M=5.03, SD=3.50). Other behaviours that were the most commonly initiated included turning the basin tap off while brushing teeth, and having leaks in watering equipment fixed. Tables 8 and 9 below show the frequencies for each behaviour of how many participants reported having initiated that behaviour over the three week measurement period ("Behaviour Initiated"). Also listed in those tables are frequencies indicating for how many participants the behaviour was possible to initiate during that period ("Behaviour Possible to Initiate").

The item about the reduction of showering time, which was by far the most commonly reported change, was only in one version of the action information. However, this could not have caused the differences found for behaviour change because the versions were systematically randomised to ensure similar numbers of each version across experimental conditions.

Individual importance items and memory items were also examined to suggest which, if any, may have primarily caused the observed effects. Items that scored the highest can be found in Appendices F and G.

Table 8_

Frequencies of Behaviours Initiated (BI) and Behaviours Possible to Initiate (BPI) for Behaviour Measure One for Four Types of Information.

Behaviour	Eco centric	Anthrop ocentric	Abstract	Action Only	**Total**
	BI (BPI)	BI (BPI)	BI (BPI)	BI (BPI)	**BI (BPI)**
Behaviour Measure 1	(N=20)	(N=20)	(N=19)	(N=20)	**(N=79)**
Replaced (with natives) or moved plants in the garden.	0 (14)	2 (11)	1 (17)	0 (16)	**3 (58)**
Installed a tap timer on the garden hose.	0 (10)	0 (10)	0 (9)	0 (12)	**0 (41)**
Put mulch on the garden.	0 (4)	2 (8)	0 (2)	2 (9)	**4 (23)**
Checked for leaks in watering equipment and had any fixed.	1 (8)	1 (8)	4 (7)	2 (9)	**8 (32)**
Made sure that no sprinklers were spraying onto the road or other paving.	1 (4)	1 (4)	2 (4)	0 (2)	**4 (14)**
Figured out time taken to water garden to 10mm and taken up that watering time.	0 (14)	0 (9)	0 (14)	0 (13)	**0 (50)**
Replaced toilet with a dual-flush, or otherwise reduced the size of the flush.	1 (9)	0 (5)	1 (6)	1 (8)	**3 (28)**
Made sure the dishwasher was always full before use.	0 (1)	0 (1)	0 (0)	0 (0)	**0 (2)**
Had dishwasher or washing machine serviced.	0 (8)	0 (13)	0 (4)	0 (6)	**0 (31)**
TOTAL	3 (72)	6 (69)	8 (63)	5 (75)	**22(279)**

Table 9_

Frequencies of Behaviours Initiated (BI) and Behaviours Possible to Initiate (BPI) as Measured by Behaviour Measure Two for Four Types of Information.

Behaviour	Eco centric	Anthrop ocentric	Abstract	Action Only	**Total**
	BI (BPI)	**BI (BPI)**	**BI (BPI)**	**BI (BPI)**	**BI (BPI)**
Behaviour Measure 2	(N=20)	(N=19)	(N=21)	(N=20)	**(N=80)**
Picked up a free *Waterwise* gardening information kit from the local plant nursery.	0 (19)	0 (17)	0 (20)	0 (18)	**0 (74)**
Changed sprinklers if the ones previously owned produced a fine spray or mist.	0 (7)	0 (4)	0 (9)	0 (4)	**0 (24)**
Applied slow-release fertiliser to lawns and gardens.	0 (3)	0 (7)	2 (6)	2 (8)	**4 (24)**
Reduced showering time, if more than 5 minutes.	3 (8)	4 (6)	7 (12)	4 (10)	**18 (36)**
Now leave basin tap off while brushing teeth.	1 (2)	1 (3)	3 (10)	3 (4)	**8 (19)**
Checked toilet for leaks using dye and had it fixed if.	0 (15)	0 (14)	1 (18)	0 (17)	**1 (64)**
Now match load setting on w[illegible]e with amount of laundry to be washed.	0 (0)	1 (1)	2 (2)	1 (2)	**4 (5)**
Checked house for large leaks using the water meter.	0 (14)	3 (14)	1 (13)	1 (15)	**4 (56)**
Stopped cleaning driveways and other outdoor paving with a hose.	0 (8)	0 (5)	0 (8)	1 (4)	**1 (25)**
TOTAL	4 (76)	9 (71)	16 (98)	12 (82)	**41(327)**

CHAPTER SIX

DISCUSSION

The present study investigated the effects of consequential versus nonconsequential information on domestic water conservation. It was hypothesised that ecocentric and anthropocentric information would be more motivational than both abstract information and action information by itself, because both encompassed rationales for water conservation based on consequences for valued objects. Consequently, it was predicted that ecocentric and anthropocentric information would be rated as more important, and would be remembered better than abstract information, and would effect greater behaviour change than both abstract and action information. However, results were largely contrary to these expectations.

There were no main effects for type of information on importance ratings. However, there was a significant interaction of type of information with income group, where the lower-middle income group rated ecocentric information as relatively important, while the upper-middle income group rated it as relatively unimportant. The independent variables had no effects on ratings of the importance of action information, and there were no interactions.

For memory, there was a main effect for type of information. However, the only significant difference was between anthropocentric and abstract information, and the direction was opposite to that hypothesised. Abstract information was remembered significantly better than anthropocentric information. There were no effects of income

group, nor an interaction. There were no effects of type of information, or income group, nor any interaction for memory of action information.

There was a main effect of type of information on behaviour change. However, contrary to expectations post hoc tests revealed that abstract information encouraged significantly more behaviour change than did ecocentric information. No type of information affected behaviour change significantly differently from action information by itself, although there was a trend showing that ecocentric information tended to encourage less behaviour change than action information.

Importance

The high ratings of the importance of all types of information supported previous literature which found that people in Perth generally state that it is "very important" for Western Australians to use water efficiently (Water Authority of Western Australia, 1995b). Also, the results confirm the research of Syme and Salerian (1987) demonstrating that Perth residents already use water conservation methods in the home.

The high importance ascribed to ecocentric information along with the other types of information is consistent with the literature on environmental attitudes and the concern that people express about environmental problems (e.g., Dunlap, 1991; Dunlap & Scarce, 1991). Yet, the interaction of type of information with income group showing that lower-middle income participants rated the ecocentric information as more important than did upper-middle income participants was different from the findings of previous research. Arcury (1990), for example, found that income was significantly and positively correlated with each of the four environmental attitude scales that he used.

That is, the higher people's income, the more positive were their attitudes. However, it is possible for essential resources such as water that upper-middle income earners view the ascription of primary importance to the environment, as may have been implied by the ecocentric information, as irresponsible (c.f. Pierce, 1979). Previously, Rokeach (pp.376-377) has found that the instrumental value "Responsible" is more important to upper-middle income earners than to lower-middle income earners. Thus, the former may view environmental considerations as secondary to anthropocentric considerations.

The main aim of obtaining importance ratings from the participants was to ensure that they read the information. Previous research (Geller et al., 1983) has found that participants may not attend to information presented to them, unless they are 'forced' to by a task that requires comprehension of the information. Although group differences in attention to information that is used in research may influence results (Costanzo et al., 1986), the likelihood of this confounding the results of the present experiment was minimised by the use of the importance rating task.

Memory

Contrary to expectations, abstract information was found to be remembered significantly better than anthropocentric information. This was not the expected difference because abstract information provided no rationale for water conservation, whereas ecocentric and anthropocentric information were about consequences for valued objects. It is possible that the simple and novel nature of the abstract items caused this difference. For example, the abstract items with the highest memory scores were: 1) "Top loading washing machines generally use about 30% more water than

front loading machines and are also less energy efficient", and 2) "The average Perth household currently uses 324kL of scheme water per year, or 900 litres a day. A household that is called a 'high user' consumes 500kL or more of water per year, or 1400 litres a day". Both of these items had multiple choice memory questions, with the first being a choice out of just two answers, and this may have inflated their memory scores. However, the scores for both items were well above chance. Abstract items that did not have multiple choice memory questions yet were remembered well were: 1) "Perth uses more water per person than any other Australian city", 2) "Mulch decreases evaporation from the soil surface by up to 70%", and 3) "People can generally use as little as half the amount of water they use on the garden without any detriment to it". The first of these items was also rated as one of the most important.

As stated, a possible explanation for why these items were remembered better than ecocentric or anthropocentric items is that they may have been perceived as more simple and novel. All abstract items were simple in that neither complex social issues nor competing interests appeared to be involved. Also, many of them were novel in that people had most likely not been previously aware of those facts. Both the simplicity and the novelty may have made the information seem more vivid, 'concrete', and understandable to participants. That is, abstract information may be more conducive to clear internal conceptualisations. Vividness, concreteness, and understandability are characteristics of information that Costanzo et al. (1986) have proposed may mediate the influence of information. Vividness encourages attention to the message (Maio & Olson, 1995; Petty & Cacioppo, 1990) and has been found to be remembered better in the medium term than similar non-vivid information (Baesler & Burgoon, 1994).

Concreteness and understandability may make the information easier to process, and hence easier to encode into memory. Thus, these three characteristics may explain the greater memorability of abstract information. Another notable characteristic of the best remembered (non-multiple choice) items above is that they described in factual detail how much water is used in Perth and how this could be substantially reduced with little personal cost. Perhaps this leads people to conserve because they perceive that their community is using more than their 'fair share' of fresh water, particularly if the latter information implies that large amounts are essentially being wasted (i.e., used for no greater benefit than a smaller amount would yield).

Self-Reported Behaviour Change

The unexpected result for behaviour change was the direction of the difference between consequential and nonconsequential information. Schwartz's (1968a) norm-activation model and supporting evidence have indicated that people are more likely to act morally if they are aware of the consequences of their behaviour for other people. Previous research has found this to apply to information about both ecocentric and anthropocentric consequences (De Young et al., 1993; Guagnano et al., 1994; Thompson & Stoutemeyer, 1991). The results of the present experiment contrasted with this, because consequential information about people affected self-reported conservation no differently than did information that was not about consequences. Furthermore, consequential information about the environment resulted in significantly *less* behaviour change than did nonconsequential information. These results may be attributed to the fact that participants remembered nonconsequential abstract information better than

consequential information, although the only significant memory difference was between abstract and anthropocentric information and the only significant behaviour difference was with ecocentric information. Nevertheless, the results for behaviour were contrary to previous quasi-experiments by Thompson and Stoutemeyer (1991) and De Young et al. (1993), who found that both ecocentric and anthropocentric information significantly changed behaviour over and above information that was only about action strategies.

It is possible that the main cause of the differences between the present and previous studies was the explicit request for people to conserve that accompanied the information in both Thompson and Stoutemeyer's (1991) and De Young et al.'s (1993) studies. In Thompson and Stoutemeyer's study, participants received not only information, but also a pledge sheet which they signed to commit themselves to conserving water, because undertaking a 'public' commitment has previously been found to be a useful method of motivating behaviour change (Costanzo et al., 1986). However, neither Thompson and Stoutemeyer's participation control nor their true control groups signed a pledge sheet. Thus, it may have been the pledged commitment to conserve that caused the effects of both the egoistic and social-altruistic information, rather than the information itself.

In the study by De Young et al. (1993), participants received a cover letter encouraging them to adopt the source reduction strategies suggested in the information. This information provided either economic, ecocentric, or both rationales for source reduction. However, participants in the control group did not receive a cover letter, nor even the pamphlets defining source reduction and describing how to go about it. All

conditions that had received a cover letter and pamphlet changed their behaviour significantly more than the control, with those receiving both rationales changing their behaviour the most. The individual rationales used in this study may not have influenced behaviour any more than would have an encouraging letter without a rationale and a pamphlet on how to go about source reduction, without any rationale. However, the effect of the information with two rationales would still have been greater.

The present study, in contrast, did not explicitly request participants to conserve water. This was primarily intended to avoid participants guessing that their behaviour would be measured, which would have allowed demand characteristics to bias the results. Additionally, the pseudo-control group in the present experiment was given the same information as the other groups on how to conserve, because this type of information has previously been found to significantly influence behaviour on its own (see Hines et al., 1986). These differences between the designs of previous studies and the present study may explain why consequential information apparently motivated behaviour in the former but not the latter.

Based on previous findings (Thompson & Stoutemeyer, 1991), it was hypothesised in the present study that the lower-middle income group would report greater behaviour change than the upper-middle income group. This hypothesis was supported, with a main effect showing that the lower-middle income group reported more than twice as much behaviour change as the upper-middle income group. People's income level, then, has a bearing on how much water they will conserve. This effect may be directly related to the amount of money available to the two groups for expenditure, and thus how easy it is to pay for the water bill. This would support Geller et al.'s (1983)

findings that suggested when the cost of water is negligible, then information and other 'stronger' interventions have little effect on consumption. While the price of water is reasonably high in Perth, having been recently restructured to encourage conservation, the price is obviously relatively less for those who are financially better off.

General Discussion

Overall, information about water, its use, and its conservation were rated as very important. This was unsurprising, given the current water shortage in Perth, the recent and upcoming restrictions on the use of scheme water in summer, and the previous and current water conservation campaigns conducted by the local water utility company, including price restructuring. The high importance ratings were also consistent with the positive attitudes to water conservation found in other Australian centres such as Melbourne (Moore et al., 1994; Murphy et al., 1991).

In contrast to the high importance ratings of the information, the information was not remembered well. Indeed, memory scores were generally very similar to those in the pilot study, suggesting that what was mostly being measured in the tests was participants' prior knowledge. Although the different populations sampled in the pilot and the main study cannot be directly compared, this nevertheless implies that people are unlikely to remember non-action water conservation information when it is in brochure form. However, abstract information was remembered significantly better than was anthropocentric information, indicating that participants receiving this information had gained new knowledge. A possible explanation for this is that abstract information

is more simple and novel than anthropocentric information, which may make it easier to process on the one hand, and more vivid and involving on the other.

The simple nature of abstract information can be attributed to the fact that it is essentially based on indisputable statistics, for example, "Perth uses more water per person than any other city". However, anthropocentric information may be perceived to be influenced by politics or other individual judgement criteria. Indeed, several participants in the present study spontaneously stated that in their opinion arguments about price increases resulting if people did not conserve were purely political on the part of the water utility company and were therefore not valid reasons for conserving. This reflects the low perceived credibility of utility companies that was noted by Costanzo et al. (1986, p.524) and which they state affects the influence of information on attitudes and behaviour. Also, anthropocentric information may be perceived as conceptually complex. Items about dams and groundwater may be perceived as complex because they portray these as undesirable, whereas people's existing evaluation of dams and groundwater use is probably favourable because they satisfy the human need for clean fresh water. Thus, the conflicting evaluations may render the information too complex to process quickly and immediately, as participants in the present study were required to do, or participants may have avoided processing this information altogether.

There is additional support for the notion that the simple and 'hard statistical' nature of the abstract information may have been the cause of its effect on memory. Costanzo et al (1986) state that, "Basic principles of learning theory and communication theory predict that clear, specific, concrete information is remembered

best" (p.525). Also, a recent study measured the differential effects of story and statistical type messages in textual information about juvenile delinquency (Baesler & Burgoon, 1994). The results showed that statistical information was remembered better at a 3-week follow-up. This applied particularly to vivid statistical information. While the ecocentric and anthropocentric information used in the present study were not story type messages, they included little statistical information compared with the abstract information. The better recall and recognition of the abstract information in the present study therefore is consistent with the results of Baesler and Burgoon's study.

The novelty of abstract information lies mainly in vivid analogies used to convey information such as the amount of easily accessible fresh water available in the world (i.e., "If all the earth's water were put in a 4 litre jug, easily accessible fresh water would equal about a teaspoon (or .03%)", and in facts that are largely unknown by the general public. An example of such a fact is that Australia uses the world's third greatest amount of water per capita after the USA and Canada. As well as items like these being vivid, other abstract information may make people feel more efficacious by aiding them to conceptualise how much water they use, exactly how much particular activities use, and how much is unnecessary usage. That is, the gap between self-reported and observed water consumption identified by Hamilton (1985) may be made smaller by providing information which helps people to better judge their consumption and to decide which conservation activities are likely to be effective and which are not. If this were the case, it could help explain the greater reported behaviour change in the condition with abstract information.

The effectiveness of abstract information for both memory and behaviour provides some tentative support for the environmental education model which assumes that information leads to knowledge, and knowledge to behaviour (Black et al., 1985; Hungerford & Volk, 1990; Ramsey & Rickson, 1976). While the present results indicate that information may not always lead to knowledge, they demonstrate that abstract information can do so, and that furthermore greater behaviour change is associated with the greater knowledge. However, it is still not known whether this association, if not spurious, was due to the influence of knowledge on behaviour, or whether both knowledge and behaviour were independently influenced by the simple and novel characteristics of abstract information.

While abstract information resulted in the most behaviour change, ecocentric information resulted in significantly less. This result was not so surprising for the upper-middle income group, who had rated the ecocentric as the least important. However, the lower-middle income group had rated ecocentric as the most important type of information. For this group, then, there was an incongruence between perceived importance and behaviour for ecocentric information. This incongruity was consistent with previous research showing that while environmental attitudes, similar to perceived importance, are very strong, environmental behaviour is relatively lacking (e.g., Dunlap & Scarce, 1991; see Murphy et al., 1991, for research relating to water conservation). The results of the present study support the notion that certain types of information may be better able than others to reduce the attitude-behaviour incongruity. However, contrary to expectations, ecocentric information appears not to be one of the types of information to achieve this for water conservation. There are at least two reasons for the

incongruity between perceived importance and behaviour for the lower-middle income group: a) environmental consequences are important to this group, but they feel helpless to prevent or rectify environmental problems, or b) environmental consequences are important, but attitudes toward the environment are symbolic and relate more to an idealistic vision of the world than to actual reality.

Information about environmental consequences may be genuinely important to the lower-middle income group, but environmental problems may be perceived as insurmountable and therefore engender feelings of helplessness. People may consider that their individual actions will be powerless to prevent or rectify environmental problems, and thus they may not undertake any action. The systemic nature of environmental problems, where problems in one part of the system affect other parts of the system, could conceivably appear too far-reaching and complex for people to consider them rectifiable. This may be particularly true for problems based around an object so fundamental to the ecosystem as water.

Alternatively, attitudes toward the environment may be largely symbolic in nature. Research by Hills (1991) suggests that attitudes toward animals may be based on a worldview in which animals, particularly wildlife, are an essential "backdrop against which we live our lives; things that set the scene for our quality of life, and make the earth an attractive and interesting place to live" (p.188). That is, it is very important to people that animals exist, but they are not one of the salient everyday concerns of people. This line of reasoning may arguably be extended to include all of nature. Attitudes toward the environment may be symbolic in that it is very important to people that nature exists and that it is clean and healthy. This symbolic attitude may be what is

expressed in environmental attitude measures obtained around the globe, where attitudes are consistently very positive (Tolba & El-Kholy, 1992). However, thinking about the environment may remain on this symbolic level, with notions about the ideal 'backdrop', and not easily influence behaviour in the 'foreground' of people's lives, where self-interests are more likely to take precedence.

Despite the significant difference found for behaviour change, it is important to note that there were few behaviours initiated during the three week measurement period. Only about a quarter of the sample initiated new water conservation behaviours, and the vast majority of these initiated only one. Part of the reason for this may have been that only behaviours that were partly or wholly prompted by the brochures were counted as having been initiated. Furthermore, the study was conducted during winter, when behaviours were likely to be seen as not so urgent. Indeed, several participants claimed that they intended to undertake some conservation behaviours "when summer comes". These were mostly those behaviours related to garden maintenance.

It is also important to note that participants reported there were relatively few behaviours that were possible for them to initiate. Many behaviours were already being undertaken, others were irrelevant, and for those who were renting, some behaviours were the responsibility of the rental agency. While the proportionate behaviour score was meant to control for this, it still could possibly have influenced the overall frequency of behaviour initiation. This implies that there may be limited scope for further changes in water conservation behaviour in Perth homes. However, strongly encouraging those behaviours that show the most opportunity for change may yet result in substantial savings across the population. The ecocentric condition in the present

study was the condition in which the least behaviour change occurred. Still, 12% of this group initiated at least one water conservation behaviour. If information can indeed motivate even this amount of change, then considerable amounts of water would be conserved. Furthermore, the present research indicates that approximately 42% of the population could possibly be motivated to initiate at least one additional behaviour by providing them with abstract information.

The above discussion is predicated on the assumption that the differences found to be statistically significant are real differences. However, it is important to note that there were no significant differences between any of the experimental groups and the action only group which was being used as a control. Thus, it is possible that the differences between anthropocentric and abstract information for memory, and ecocentric and abstract information for self-reported behaviour were spurious findings based on chance differences from the control.

Mitigating against this interpretation was the fact that for both memory and self-reported behaviour the differences were in the same direction for both income groups. This is an important consideration as these were two independent samples taken from separate suburbs. In essence, they acted as a reliability check, and the fact that they showed the same results suggests that there was a real effect present. For memory and self-reported behaviour, the only condition for which the two income groups showed different trends was for self-reported behaviour in the anthropocentric condition. This difference was expected, though, in line with the hypothesis that personal financial savings would be more motivating for lower-middle than for upper-middle income participants.

Limitations of the Present Study

The reliance on self-report measures of behaviour limits the validity of the measure as one reflecting real behaviour changes. Hamilton (1985) has demonstrated that there is only a small relationship between self-reported and actual water consumption. The specificity of the questions in the self-report behaviour measures used in the present study was intended to minimise the scope for participants to over-estimate their conservation. The absence of an effect indicating social desirability (i.e., for the ecocentric information) may indicate that this measure was reasonably valid.

Another limitation of the present study was the lack of significant differences in behaviour from the group that received only action information. This made it difficult to draw firm conclusions, although the significant difference between ecocentric and abstract information and the consistency of the effect of abstract information indicated that there was a real effect present. Future research should use stronger interventions to test the reliability of the non-significant trends that were found in the present study. Possibly, this could be achieved simply by conducting water conservation research in summer when consumption is higher (mainly because of garden watering) and when consequently there is greater opportunity for behaviour change.

The absence of a real control group meant that the overall level of behaviour change could not be attributed for certain to the information per se. It could be that changes were occurring in the general population's consumption levels anyway as a result of the ongoing water conservation campaign. However, this does not explain the differences found between groups, and also participants were asked to report behaviours that were prompted by the brochures, not those that they were going to undertake anyway.

Although the lack of a control group is not an issue for differences across information conditions in the present study, it limits the reliability of the overall effect of information on behaviour change. Yet, attempts were made to minimise demand characteristics that might have biased participants toward making behaviour changes. Instructions in phase one focused on perceptions of the information rather than on behaviour to avoid participants guessing that their behaviour change would be tested, while in real conservation campaigns behaviour change is clearly implied as the desirable outcome. Considering this, the short period of time in which participants had to initiate behaviours, and the one-off nature of the information presentation, these results appear to support the notion in environmental education that information can encourage conservation behaviour. However, the lack of a control group makes this interpretation uncertain.

A factor that limits the generalisability of the present experiment is the use of volunteers. The 47% response rate probably means that residents who were not interested in the issue refused to participate, and this may have led scores on all dependent variables to be higher than they would be for the general population. That is, those who participated may have viewed the information as more important, remembered it better, and changed their behaviour more than would a more representative sample.

Many 'refusals' for participation were because residents had English skills too poor to complete the tasks. Therefore, the present results may not be applicable to the non-English speaking population of Perth, particularly recent immigrants. This is suggested as an area of practical importance for water conservation campaigns, given that Perth's

population growth is mostly due to immigration. Migrants' knowledge about water conservation and their perception of information about water conservation deserves further research within the community. Possibly, information in different languages should be introduced into the current campaign. The case of the outlier that was excluded because he initiated many behaviours indicates that this course of action may be quite useful because it would provide new information to an audience that may not yet have been reached by the campaigns.

The personal delivery of the brochures may have motivated greater behaviour change than would otherwise have been reported, as described earlier. Participants may have paid particular attention to the information used in the study because of the personal delivery of the brochures, or because they knew that someone would be calling them back about the brochures at a later date. In particular, rating the perceived importance of the information in front of an interviewer may have set up a dissonance situation. After 'publicly' rating information in the non-action brochure as important and continuing to rate the action information as important, people may have been forced when rating the action information to attend to the fact that there were simple conservation behaviours which they were aware of but had not undertaken. The difference between ascribed importance and behaviour may have become salient and aroused dissonance, possibly contributing to the motivational influence of the information. As described earlier, dissonance can be a motivator of water conservation in its own right (Aitken et al., 1994). However, while this may have influenced the overall results for behaviour, it cannot explain the difference found across information conditions.

The study was conducted soon after a summer during which restrictions had been imposed due to a shortage of fresh water. Perceived importance and behaviour change may be less when there is no shortage. However, a factor that may have limited the number of behaviours that the participants reported having initiated was the short time frame of the study. Some of the behaviours required time, for example, checking watering equipment for leaks. Participants may have been intending to undertake some behaviours but may not have found the time to do so in the three week measurement period.

Directions for Future Research

It is suggested for future research on environmental education which uses an informational intervention, that pretest-posttest designs be used to determine changes in knowledge. Any such changes can then be analysed to ascertain which types of information are best remembered, and whether they relate to behaviour change.

Future studies should also further investigate abstract information. It is possible that only some kinds of abstract information motivate water conservation as observed in the present study. As suggested earlier, it may be information regarding the enormous amounts of water used and the relative scarcity of clean, fresh water available that is the most effective. On the other hand, information about how much water people use and in which parts of the house they use it may be the most effective, as discussed in regard to Hamilton's (1985) findings.

Research should also attempt to endow ecocentric and anthropocentric information with those characteristics of abstract information that are proposed to have caused the

effects observed in the present experiment (e.g., simplicity and novelty). This would enable determination of whether content or structural characteristics of the information caused the present effects for abstract information. If ecocentric or anthropocentric information were novel, simple and included statistics, it may be that they would be as memorable and motivating as abstract information. One method to overcome this problem would be to manipulate the value base of rationales used in conjunction with abstract information. This method was used by De Young et al. (1993). In order to more fully apply Stern et al's (1993) tripartite model of environmental value-bases, future studies should examine each of the three bases - egoistic, social-altruistic and ecocentric - rather than studying two at a time or combining them as has been done in the area of informational intervention in the past and also in the present study.

In the present study, the lack of an effect for anthropocentric information may be explained by the fact that previous water conservation campaigns have been based on anthropocentric rationales, so that people have already been influenced as much as possible by these. In addition, the recent price rises and tariff restructuring that were aimed at discouraging excessive use have possibly made people aware of the financial consequences for themselves of not conserving. A comparison between a location such as Perth where water conservation campaigns have already emphasised anthropocentric rationales, and a location in which there has been no such campaign would be useful to examine the effects of anthropocentric and nonconsequential information. This would determine whether previous campaigns were the cause of the lack of an effect of anthropocentric information on behaviour in the present study.

It appeared that ecocentric information may have reduced environmental behaviour. Previous research has produced results consistent with this finding (e.g. Kantola et al., 1983). Because such an effect would have major implications for environmental education, this is an area that deserves more attention. Research should now test in a more controlled environment the behavioural effects of ecocentric information against true control groups that are given no information or unrelated information. It was proposed for the present study that if the effect were a true effect, then it may have been caused by high conflict between environmental- and self-interests. If laboratory studies reveal the effect to be true, then this hypothesis is also worthy of attention. Further research on environmental issues involving high self-interest needs to be conducted to confirm the negative impact of ecocentric information upon behaviour found in the present study. Possibly, people could be given either ecocentric or no rationale for two types of conservation behaviour, one of low and the other of high conflict. If behaviour change was less for the ecocentric rationale compared to no rationale for the high conflict issue, then this would indicate that people indeed react against ecocentric rationales when self-interest is high, even when those interests are compatible. Differences may be highlighted if all information was combined with abstract information, and if information was provided on more than one occasion to increase attention and salience.

Another area of study that may aid the interpretation of the present results is an investigation of whether or not people realise that the environment largely remains a concern that they talk about but rarely act upon. If people do realise this, then they may be able to describe the main reasons why they do not act on their concern. If people do

not realise the incongruity between their concern and behaviour, then it should be determined whether their concern does not translate into future behavioural intention, or future behavioural intention does not translate into behaviour. Determining which of these is the case will aid the discovery of why environmental concern generally does not cause environmentally responsible behaviour.

Conclusion

The present study tended to show a consistent effect for information that was about 'abstract' facts and statistics. Although differences were significant only between the abstract condition and groups other than the control, it was suggested that the consistency of the differences across independent groups indicated a real effect. This effect demonstrated that, when attitudes are positive, abstract information is remembered better and motivates conservation more than information about environmental, or personal and societal consequences of conserving and of not conserving water.

Consistent with the environmental education model, the effect of abstract information on behaviour change may have been attributable to the increase in knowledge it engendered. That is, information appears to have an effect on behaviour only when it is available in memory. However, it remains to be discovered whether this is because the new knowledge allows an individual to decide that certain behaviours are relevant to an existing attitude, or whether the new knowledge simply makes the topic salient and acts as a reminder to conserve. If the latter is the case, then it would be useful for designing information campaigns to find out exactly how recently new

information must have been acquired for it to act as a reminder. Possibly, information that has been known for a moderate length of time becomes 'background' knowledge, losing its salience and consequently its ability to act as a reminder.

A re-evaluation of the assumption that environmental information leads to environmentally responsible behaviour may be needed. An unexpected finding of the present study was an almost detrimental effect of information about environmental consequences on self-reported water conservation, although it was only significantly different from the condition with abstract information. Further research is required to establish whether this effect is replicable and what it was caused by. If the effect can be replicated, an assessment is needed to determine for which other environmental issues ecocentric information discourages behaviour. Also of importance is how the effect observed in the present experiment fits with the positive (though weak) association generally found between ecocentric environmental attitudes and behaviour. Clearly, the results of the present investigation indicate that there are aspects to the motivational forces behind environmentally responsible behaviour which cannot be explained by our current understanding of the topic.

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APPENDIX A

IMPORTANCE RATING SCALE

INTERVIEWER: Please ask the respondent to indicate on the scale below how ***personally*** **important** each item is to him or her for water conservation. **Circle** the response for the blue brochure; **cross** it for the green Action Strategies brochure.

ITEM ONE

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM TWO

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM THREE

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM FOUR

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM FIVE

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM SIX

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM SEVEN

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM EIGHT

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM NINE

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

ITEM TEN

Neutral Somewhat Quite Very Extremely

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

APPENDIX B

CONSENT FORM

WATER CONSERVATION IN PERTH

Dear Participant,

We are investigating how useful people find information about water conservation. Thank you for your help in evaluating the brochure we have just shown you. To assist us in completing the evaluation, we would like to contact you by telephone in about three weeks' time to find out how useful you have found the information.

Please be assured that any information we obtain from you will be treated in the strictest confidence, and will remain anonymous (we will not keep a record of the source of any information).

Please feel free to ask any questions during the follow-up telephone call.

If you are agreeable to being contacted, please sign the consent form below:
I have read the information above and any questions I have asked have been answered to my satisfaction. I agree to be contacted by telephone in approximately three weeks' time, realising I may withdraw my consent at any time.

_____
Participant's name

_____
Signature Date

Telephone Number: _____

Most convenient times to contact: _____ _____ _____

Project Manager:
Brigit Cosgrove
Tel: 400 5863

Project Supervisor:
Dr. Adele Hills
Tel: 400 5536

APPENDIX C

ECOCENTRIC INFORMATION BROCHURES

VERSIONS ONE AND TWO

Fresh water is one of our most precious resources and requires careful management all year round. Currently, our dams are only 30% full. *You* can make a *significant* contribution to the conservation of our water resources. Here are 10 ways that our use of fresh water impacts upon the natural environment:

① When we use less water, it reduces the need for more dams. Dams can upset the delicate balance of nutrients needed for organisms at the start of the food chain.

② Not damming means the preservation of native birds' and animals' habitats and feeding grounds that would otherwise have been flooded.

③ Damming can destroy marsh plants and erode shorelines because reduced flow downstream of the dam can allow seawater to flow upstream.

④ If a waterway's course is slowed down significantly by damming, then coastal wetlands and beaches can miss out on replenishing silt which is rich in minerals and organic matter.

⑤ When a watercourse is altered, the plant species in an area can change, which in turn may mean that some animals cannot live there any more.

⑥ Groundwater levels drop a lot in summer because of evaporation and the high use of bore water for lawns and gardens.

⑦ Lowering the water table by using too much groundwater can make wetlands dry up. Wetlands are important because they help purify groundwater and provide specialised habitats for many animals.

⑧ Taking too much water from bores within about 100m of the Swan Estuary and 200m of the coast (and 'Cottesloe Peninsula') can lead to salt water intrusion. This causes trees to die and wetlands to become less inhabitable for plants and animals.

⑨ Being waterwise by watering the garden less often helps hold nutritious topsoil in place by encouraging the growth of deep root systems.

⑩ Over-watering washes fertilisers and pesticides past plant roots and into groundwater, which often flows into streams and rivers causing algal blooms.

Compiled by Edith Cowan University

Fresh water is one of our most precious resources and requires careful management all year round. Currently, our dams are only 30% full. *You* can make a *significant* contribution to the conservation of our water resources. Here are 10 ways that our use of fresh water impacts upon the natural environment:

① Dams can kill off aquatic life. There is so little movement of water at the bottom that micro-organisms at the start of the food chain may not get enough oxygen to stay alive.

② If a waterway is dammed, then fish populations downstream suffer from reductions in food supply.

③ Damming often lets seawater into a waterway by slowing the downstream flow of water. The increased salt levels can kill fish.

④ In some areas, the breeding patterns of those fish that migrate from downstream to lay eggs upstream can be greatly disturbed.

⑤ When a watercourse is altered, the plant species in an area can change, which in turn may mean that some animals cannot live there any more.

⑥ Taking too much water from bores within about 100m of the Swan Estuary and 200m of the coast (and 'Cottesloe Peninsula') can lead to salt water intrusion. This causes trees to die and wetlands to become less inhabitable for plants and animals.

⑦ Using more than natural amounts of water in cities increases the number of plant and animal pests because most pests thrive on water.

⑧ High use of groundwater, making the water table too low, can make trees with shallow root systems such as banksias die because they can no longer reach groundwater.

⑨ Being waterwise by watering the lawn and garden less often encourages deep root systems, helping plants resist disease, and survive during periods of heat, drought and strong winds.

⑩ Over-watering washes fertilisers and pesticides past plant roots and into groundwater, which often flows into streams and rivers and causing algal blooms.

Compiled by Edith Cowan University

APPENDIX C (Continued)

ANTHROPOCENTRIC INFORMATION BROCHURES

VERSIONS ONE AND TWO

Fresh water is one of our most precious resources and requires careful management all year round. Currently, our dams are only 30% full. *You* can make a *significant* contribution to the conservation of our water resources. Here are 10 ways that our level of use affects us:

① When we use less water, it reduces the need for more expensive dams and reservoirs, which are starting to cost more than their benefits warrant because the best sites are already taken.

② If you use less water, your water bill will be less than it would otherwise be. You could easily save $100 a year by installing a low-flow shower nozzle.

③ By using less hot water and using dishwashers and washing machines more efficiently, you can make large savings on your energy bill.

④ Dual-flush toilets pay themselves off in water bill savings about 8 years after they are installed. After that time, the owners start making extra savings.

⑤ Taking too much water from bores within about 100m of the Swan Estuary and 200m of the coast (and 'Cottesloe Peninsula') can lead to salt water intruding into our bore supplies.

⑥ There may be less chances for recreational stream or river fishing if water is not conserved. When waterways are altered by constructing dams, fish supplies can decrease.

⑦ Over-watering may lead to less opportunities for fishing because fertilisers and pesticides are washed past garden plant roots (making it necessary to buy large amounts of these products) and thus pollute groundwater and waterways.

⑧ In 25 years there will not be enough fresh water to go around at a price that most can afford if we do not conserve well now. Perth has run out of fresh water rivers to dam in the Darling Range and some of our major rivers are suffering from salinity.

⑨ If we do not conserve and manage our fresh water with care, we are likely to face restrictions more often.

⑩ If we conserve water, then any excess savings are stored in our reservoirs for times when we need it the most.

Compiled by Edith Cowan University

Fresh water is one of our most precious resources and requires careful management all year round. Currently, our dams are only 30% full. *You* can make a *significant* contribution to the conservation of our water resources. Here are 10 ways that our level of use affects us:

① Conserving water will help keep increases in the price of water to a reasonable level.

② A household with a dripping tap or leaking pipe typically wastes about $70 per year.

③ Constructing dams often means the destruction of areas valued by people for their beauty.

④ When a dam is built, surrounding areas are sometimes restricted to industrial use, with little or no recreation allowed around that part of the waterway.

⑤ Using less water per person is now considered one of the least expensive ways of providing fresh water for rapidly growing populations, including Perth's.

⑥ Taking too much water from bores within about 100m of the Swan Estuary and 200m of the coast (and 'Cottesloe Peninsula') can lead to salt water intruding into our bore supplies.

⑦ If we do not conserve and manage our fresh water with care, we are likely to face harsher restrictions in the future.

⑧ By saving hot water and using dishwashers and washing machines efficiently, you can make large savings on your energy bill.

⑨ The extremely high demand for fresh is starting to cause tension between those who use the water for different things such as agriculture, recreation, power generation and the environment.

⑩ In 25 years there will not be enough fresh water to go around at a price that most can afford if we do not conserve well now. Perth has run out of fresh water rivers to dam in the Darling Range and some of our major rivers are suffering from salinity.

Compiled by Edith Cowan University

APPENDIX C (Continued)

ABSTRACT INFORMATION BROCHURES

VERSIONS ONE AND TWO

Fresh water is our most precious resource and requires careful management all year round. *Each individual can make a significant contribution* to the conservation of our water resources. Here are 10 facts you may not know about fresh water and our use of it:

① Non-native gardens reduce local rainfall because introduced plant species are not as adapted to helping with cloud formation in our local environment.

② If all the Earth's water were put in a 4 litre jug, easily accessible fresh water would equal about a teaspoon (or .03%).

③ Perth uses more water per person than any other Australian city.

④ Domestic use of Perth's scheme water is still growing at 1-2% per person every year, while the commercial/ industrial sector has maintained a steady level of usage per head of population over the past 15 years by improving efficiency. Overall water use is doubling every 12 years.

⑤ People could easily save about 250L a day in winter by conserving inside the home.

⑥ Water consumption by washing machines that are suitable for a family range from 80L to 160L per load.

⑦ Slow-release, organic fertiliser helps water stay in the soil longer, as do wetting agents, giving plants more time to use the water. A lightly fertilised lawn can use 30% less water than an unfertilised one.

⑧ Mulch decreases evaporation from the soil surface by up to 70%.

⑨ The 10% of households using the most water use about a quarter of the total domestic water consumption.

⑩ A 5 minute reduction in showering can save up to 100L of water. Installing a low-flow shower nozzle saves up to 65L every 5 minutes of showering. Doing both could save up to 165L out of 200L on a shower that was originally 10 minutes long.

Compiled by Edith Cowan University

Fresh water is our most precious resource and requires careful management all year round. *Each individual can make a significant contribution* to the conservation of our water resources. Here are 10 facts you may not know about fresh water and our use of it:

① The problems in water management are not occurring due to a lack of water, but because of fast population growth and a steady increase in the amount of water used per person.

② For Perth scheme water, most surface water is stored at, in order of capacity: Serpentine Dam (Jarrahdale), Canning Dam (Roleystone), Mundaring Weir (Mundaring), Wungong Dam (Bedfordale), South Dandalup Dam (Dwellingup) and the North Dandalup Pipehead.

③ Australia uses the third largest amount of fresh water per person after the USA and Canada.

④ People can use as little as half the amount of water they use on the garden without any detriment to it.

⑤ The domestic (household) sector is the single biggest user of water in the Perth region, accounting for 45% of total water use.

⑥ The average Perth household currently uses about 900L of scheme water a day. A household that is called a "high user" consumes 1, 400L or more a day.

⑦ Sixty percent of household water is used inside the home, of which 39% is used in the bathroom, 32% in the toilet, 22% in the laundry and 7% in the kitchen.

⑧ Non-dual flush toilets use half again the amount of fresh water that a dual-flush uses.

⑨ Watering after 8am or in windy conditions allows up to 50% of water to evaporate before it has had time to benefit the garden.

⑩ Top loading washing machines generally use about 30% more water than front loading machines and are also less energy efficient.

Compiled by Edith Cowan University

APPENDIX C (Continued)

ACTION INFORMATION BROCHURES

VERSIONS ONE AND TWO

Fresh water is on of our most precious resources and requires careful management all year round. Currently, our dams are only 30% full. *You* can make a *significant* contribution to the conservation of our water resources. Here are 10 ways that you can help year-round with the best type of management: conservation.

① Keep all high water-use plants in the same section of the garden. The best time to transplant is winter.

② Install a tap timer to make sure that forgetting to turn sprinklers off (a major cause of wastage) is not a problem.

③ Use mulch on gardens. Decomposable organic matter at least 75mm thick is the best, but keep it away from trunks and stems to avoid fungal problems.

④ Check for and repair any leaks in your watering equipment.

⑤ Put a mark at the 10mm point on several empty ice-cream containers and place them under the main throws of the sprinklers, recording the time it takes for the water to reach the mark on each. Take the average of the times. You should only ever water your garden for this amount of time. Then,, vary *how often* you water to suit: Generally, every second morning in summer, every third to fifth morning in the *warmer* months of spring and autumn, and not at all in winter.

⑥ Replace your toilet with a dual-flush or bend *brass* ball valve arms downwards to slightly reduce the size of the flush.

⑦ Only flush the toilet after passing solid waste or after every second urination.

⑧ Install a low-flow nozzle for your shower. (They are available at the same places as other nozzles, or 'roses'.)

⑨ Always make sure the dishwasher is full before use.

⑩ Keep dishwashers and washing machines serviced and make a point of inquiring about waterwise models when buying new ones.

Compiled by Edith Cowan University

Fresh water is on of our most precious resources and requires careful management all year round. Currently, our dams are only 30% full. *You* can make a *significant* contribution to the conservation of our water resources. Here are 10 ways that you can help year-round with the best type of management: conservation.

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⑨ Always make sure the dishwasher is full before use.

⑩ Keep dishwashers and washing machines serviced and make a point of inquiring about waterwise models when buying new ones.

Compiled by Edith Cowan University

APPENDIX D

MEMORY TESTS

APPENDIX D
Ecocentric Memory Test, Version One

1. Do dams affect micro-organisms in the water by: a) changing the water levels of the waterway (river or stream), or b) being so deep that oxygen cannot circulate properly?

2. In what three ways could damming affect fish populations?
   1.
   2.
   3.

3. Besides flooding, why might animals die or have to go elsewhere when a waterway is dammed?

4. Besides lowering the water table, in what two ways does the use of too much groundwater negatively affect the environment?
   1.
   2.

5. Is it best to water plants as infrequently as possible because it encourages: a) healthier, b) stronger, or c) deeper root systems in plants?

6. How does high water consumption in the garden affect plant and animal pests?

7. Does watering the garden a lot mainly cause: a) algal blooms in nearby rivers, or b) nearby plants to be unable to use sunlight for energy as well as usual?

APPENDIX D (Continued)
Ecocentric Memory Test, Version Two

1. Do dams affect organisms at the start of the food chain by: a) changing the water levels of the waterway, or b) changing the balance of nutrients in the waterway (river or stream)?

2. Name two negative effects that dams have on native birds and animals.

3. Besides flooding, in what way does damming change the surrounding natural habitat?

4. What parts of a waterway can be damaged when dams reduce downstream flow and let salty seawater move upstream (inland)?

5. Are coastal wetlands and beaches negatively affected by dams mainly because: a) less fresh water flows down to them, or b) because they receive less silt?

6. Please give two reasons, besides there being less rainfall, why there is less groundwater in summer.

7. Besides lowering the water table, in what two ways is the environment negatively affected when too much groundwater is used?
   1.
   2.

8. Is it best to water plants as infrequently as possible because it encourages: a) deeper, b) stronger, or c) healthier root systems in plants?

9. What negative effect does overwatering gardens have on waterways?

APPENDIX D (Continued)
Anthropocentric Memory Test, Version One

1. What are two disadvantages to society and individuals of building more dams?
   1.
   2.

2. About how much money could a household save each year by installing a low-flow shower nozzle?
   A. $70 B. $100

3. Besides conserving water and having a smaller water bill, what is the main advantage for the individual household in using less water for showers, washing machines and dishwashers?

4. About how many years does it take for a dual-flush toilet to pay itself off by reducing the water bill?
   A. 3 B. 10

5. What can happen if too much groundwater is used near the sea or an estuary?

6. What type of recreation may be affected by over-watering lawns and gardens?

7. There may be too little easily accessible fresh water to provide it at a price that most can afford in about how many years?
   A. 10 B. 25 C. 60

8. If we do not conserve our fresh water, what may be introduced in order to stop people using excessive amounts?

9. Why should we not use too much of the water available to us in any one year?

APPENDIX D (Continued)
Anthropocentric Memory Test, Version Two

1. What are three disadvantages to society and individuals of building more dams to store fresh water?
   1.
   2.
   3.

2. About how much money a year would a household typically save by fixing a dripping tap or leaking pipe?
   A. $70 B. $100

3. Besides its environmental benefits, why is conservation now thought of as one of the best ways of providing fresh water for rapidly growing populations?

4. What can cause salt water to get into groundwater supplies - taking too much bore water from near: a) the river and sea, or b) from near wetlands?

5. If we do not conserve our fresh water, what may be introduced in order to stop people using excessive amounts?

6. Besides conserving water and having a smaller water bill, what advantage is there for the **individual household** in using less water for showers, washing machines and dishwashers?

7. Besides using it in the home, what other things do we use water for?

8. There may be too little easily accessible fresh water to provide it at a price that most can afford in about how many years?
   A. 25 B. 60 C. 10

APPENDIX D (Continued)
Abstract Memory Test, Version One

1. How do non-native plants affect rainfall by: a) using more water than natives, or b) not being as good as natives at helping with cloud formation?

2. If all the earth's water were put in a 4 litre jug, how much (in measurement or percentage) would easily accessible fresh water equal?

3. Compared with other Australian cities, at what position does Perth rank in the amount of water used per person?

4. Has Perth's industrial sector maintained a steady level of usage over the last 15 years by: a) using water more efficiently, or b) finding alternatives?

5. About how many litres can a household easily save per day by conserving water inside the home (as opposed to outside in the garden)?

6. What is the range of water-use per load (in litres) for family sized washing machines?
   A. 20-80 B. 160-250 C. 80-160

7. How does slow-release, organic fertiliser help conserve water in the garden?

8. How does mulch decrease a garden's water consumption?

9. About what percentage of the total domestic water is used by the highest consuming 10% of households?

10. Up to about what proportion of shower water could be saved by reducing showering length by half as well as using a low-flow nozzle?

APPENDIX D (Continued)
Abstract Memory Test, Version Two

1. What are the world's current problems in water management mostly due to?

2. Please name three of the six main locations for surface water storage for Perth scheme water.

3. Compared to the rest of the world, where does Australia rank in the use of fresh water per person?

4. Can people generally use up to (a) 50% or (b) 80% less water on their garden without any detriment to it?

5. About what percentage of the total water use in the Perth region is used by the domestic sector ?

6. Households that are "High Consumers" of scheme water use at least how many kilolitres per year?
   A. 500 B. 100 C. 300

7. Of the water that is used inside the home, what percentage does the water used in the kitchen account for?

8. Compared to normal toilets, how much less water do dual-flush toilets use?

9. Watering after 8am or in windy conditions allows about what percentage of the water to evaporate before it has had time to benefit the garden?

10. Do top-loading washing machines use (a) more or (b) less water than front-loading washing machines?

APPENDIX D (Continued)
Action Memory Test, Version One

1. Should you: a) keep all high water use plants in the same section of the garden, or b) disperse them in amongst the other plants?

2. What device can make sure that forgetting to turn sprinklers off is not a problem?

3. What can you put **on** the garden to help conserve water?

4. What should you check and correct your irrigation system for?

5. Generally should you vary: a) the amount of water you give your garden at one time, or b) how often you water it?

6. Besides fixing leaks, what two ways are there to save water in the toilet?
   1.
   2.

7. In what two ways can people make sure their dishwashers and/or washing machines are not wasting too much water?
   1.
   2.

APPENDIX D (Continued)
Action Memory Test, Version Two

1. Is it best to replace plants in the garden with natives in: a) summer, or b) winter?

2. Which should you avoid because it has a high loss of water by evaporation: a) fine-spray irrigation, or b) micro-irrigation?

3. Besides mulch, what can you put on your existing lawn to help it use water more efficiently?

4. What type of kit can guide you on how to save water in the garden?

5. In what way can people conserve water in the shower?

6. Besides turning the tap off during brushing, how can people use water wisely while brushing their teeth?

7. What procedure can you use to check whether there is a leak in a toilet?

8. Besides servicing, how can the use of washing machines be made more water efficient?

9. What is one way you yourself can check for large leaks in a home's whole water system?

APPENDIX E

SELF-REPORT BEHAVIOUR MEASURES

APPENDIX E
Self-Report Behaviour Measure, Version One

Now I would like to ask you some questions about any changes you may have made or intend to make since reading the brochures 3 weeks ago. If you did any of the things listed below before receiving the brochures, please indicate that as I go through the following questions.

(D/A = Did already)

1. Have you replaced or moved any plants in your garden?

   YES NO D/A INTEND TO N/A

2. Have you installed a tap timer?

   YES NO D/A INTEND TO N/A

3. Have you put any mulch on your garden?

   YES NO D/A INTEND TO N/A

4. Have you checked for leaks in your watering equipment and had any that were found fixed?

   YES NO D/A INTEND TO N/A

5. Have you made sure that none of your sprinklers are spraying onto the road or other paving, and changed them if they were?

   YES NO D/A INTEND TO N/A

6. Have you figured out the time it takes to water your garden to 10mm and changed your watering habits accordingly?

   YES NO D/A INTEND TO N/A

7. Have you replaced your toilet with a dual-flush, bent the valve arms downwards (if they are brass), or otherwise reduced the size of the flush?

YES NO D/A INTEND TO N/A

8. Do you now make sure the dishwasher is full before use?

YES NO D/A INTEND TO N/A

9. Have you had your dishwasher or washing machine serviced?

YES NO D/A INTEND TO N/A

Finally, could I ask you to give me a few demographic details?:

What is your age in years?:_____

What is your total household income for one year?:

Up to $10,000 ☐
$10,000-$20,000 ☐
$20,000-$30,000 ☐
$30,000-$40,000 ☐
$40,000-$50,000 ☐
$50,000-$60,000 ☐
More than $60,000 ☐

Do you have a bore?: Yes ☐ No ☐

Do you own or rent the place you are living in?: Own ☐ Rent ☐

Sex: Female ☐ Male ☐

APPENDIX E (Continued)
Self-Report Behaviour Measure, Version Two

Now I would like to ask you some questions about any changes you may have made or intend to make since reading the brochures 3 weeks ago. If you did any of the things listed below before receiving the brochures, please indicate that as I go through the following questions.

(D/A = Did already)

1. Have you picked up a free *Waterwise* gardening kit from your local nursery?

   YES NO D/A INTEND TO N/A

2. Have you changed or do you intend to change your sprinklers if you owned ones that produced a fine spray or mist?

   YES NO D/A INTEND TO N/A

3. Have you applied slow-release fertiliser to lawns and gardens?

   YES NO D/A INTEND TO N/A

4. Have you reduced your showering time, or was it quite short to begin with?

   YES (by _ mins.) NO D/A (_ mins.) INTEND TO

5. Do you now leave the basin tap off while brushing your teeth?

   YES NO D/A INTEND TO

6. Have you checked your toilet for leaks using dye?

   YES NO D/A INTEND TO N/A

7. Do you now make sure that you match the load setting on the washing machine with the amount of laundry to be washed?

YES NO D/A INTEND TO N/A

8. Have you checked your house for large leaks using the water meter?

YES NO D/A INTEND TO N/A

9. Do you clean driveways and other outdoor paving using a hose?

NO YES D/A INTEND NOT TO

Finally, could I ask you to give me a few demographic details?:

What is your age in years?:_____

What is your total household income for one year?:

Up to $10,000 ☐
$10,000-$20,000 ☐
$20,000-$30,000 ☐
$30,000-$40,000 ☐
$40,000-$50,000 ☐
$50,000-$60,000 ☐
More than $60,000 ☐

Do you have a bore?: Yes ☐ No ☐

Do you own or rent the place you are living in?: Own ☐ Rent ☐

Sex: Female ☐ Male ☐

APPENDIX F

INDIVIDUAL ITEMS RATED AS MOST IMPORTANT

Items Rated as the Most Important for Four Types of Water Conservation Information

Information Item	M	SD
Ecocentric:		
Overwatering washes fertilisers and pesticides past plant roots and into groundwater, which often flows into streams and rivers and causes algal blooms.	8.35	2.06
Being waterwise by watering the lawn and garden less often encourages deep root systems, helping plants resist disease and survive during periods of heat, drought and strong winds.	7.90	2.59
Being waterwise by watering the garden less often helps hold nutritious topsoil in place by encouraging the growth of deep root systems.	7.80	1.58
Anthropocentric:		
If we do not conserve and manage our fresh water with care, we are likely to face harsher restrictions in the future.	8.35	2.06
By saving hot water and using dishwashers and washing machines efficiently, you can make large savings on your energy bill.	8.10	1.86
If we do not conserve and manage our fresh water with care, we are likely to face restrictions more often.	8.05	2.09
Abstract:		
Watering after 8am or in windy conditions allow up to 50% of the water to evaporate before it has had time to benefit the garden.	9.10	1.02
Non-dual flush toilets use half again the amount of fresh water that a dual-flush uses. The toilet uses about 30% of all water used inside a household.	8.05	2.26
Mulch decreases evaporation from the soil surface by up to 70%.	8.00	2.15
Action:		
Always make sure the dishwasher is full before use.	8.49	2.47
Make sure none of your sprinklers are spraying onto the road or other paving.	8.47	1.86
Check for and repair any leaks in your watering equipment.	8.46	1.77

Possible range = 0 to 10

APPENDIX G

INDIVIDUAL ITEMS WITH GREATEST MEMORY SCORES

Items With the Greatest Mean Memory Scores for Four Types of Water Conservation Information.

Memory Question	M	SD
Ecocentric:		
Is it best to water plants as infrequently as possible because it encourages: a) healthier, b) stronger, or c) deeper root systems in plants?	.80	.41
Is it best to water plants as infrequently as possible because it encourages: a) deeper, b) stronger, or c) healthier root systems in plants?	.75	.44
Do dams affect organisms at the start of the food chain by: a) changing the water levels of the waterway, or b) changing the balance of nutrients in the waterway (river or stream)?	.65	.49
Anthropocentric:		
If we do not conserve our fresh water, what may be introduced in order to stop people using excessive amounts?	.75	.44
What can happen if too much groundwater is used near the sea or an estuary?	.63	.48
There may be too little easily accessible fresh water to provide it at a price that most can afford in about how many years? A. 25 B. 60 C. 10	.60	.50
Abstract:		
Do top-loading washing machines use (a) more or (b) less water than front-loading washing machines?	.95	.22
Households that are "High Consumers" of scheme water use at least how many kilolitres per year? A. 500 B. 100 C. 300	.85	.37
Action:		
Generally should you vary: a) the amount of water you give your garden at one time, or b) how often you water it?	.97	.16
What device can make sure that forgetting to turn sprinklers off is not a problem?	.94	.25
What should you check and correct your irrigation system for?	.91	.26

Possible range = 0 to 1