VALUES, ENVIRONMENTAL CONCERN, AND ENVIRONMENTAL BEHAVIOR
A Study Into Household Energy Use

WOUTER POORTINGA *is senior research associate at the Centre for Environmental Risk, University of East Anglia, United Kingdom. Currently, he is working on the Understanding Risk program funded by the Leverhulme Trust. His research interests are in people's responses to environmental risks, modeling of environmentally significant behavior, and social dilemma research.*

LINDA STEG, *Ph.D., is lecturer in environmental psychology, University of Groningen, the Netherlands. Her main research interest is in individual and corporate behavior related to sustainable development from a multidisciplinary perspective. Her research projects focus on environmentally significant behavior, energy use, car use, social dilemmas, and corporate responsibility.*

CHARLES VLEK, *Ph.D., is professor of environmental psychology and decision research at the University of Groningen, the Netherlands. He has extensively studied individual and social decision making and risk judgment. His recent work is devoted to human behavior patterns (in households, transport, and business) in relation to environmental quality, quality of life, and sustainable development.*

ABSTRACT: In this study, the role of values in the field of household energy use is investigated by using the concept of quality of life (QOL). Importance judgments on 22 QOL aspects could be summarized into seven clearly interpretable value dimensions. The seven value dimensions and general and specific environmental concern contributed significantly to the explanation of policy support for government regulation and for market strategies aimed at managing environmental problems as well as to the explanation of the acceptability of specific home and transport energy-saving measures. In line with earlier research, home and transport energy use were especially related to sociodemographic variables like income and household size. These results show that it is relevant to distinguish between different measures of environmental impact and different types of environmental intent. Moreover, the results suggest that using only attitudinal variables, such as values, may be too limited to explain all types of environmental behavior.

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VALUES AND ENVIRONMENTAL BEHAVIOR

It is often suggested that environmental attitudes and environmental behavior are related to people's values (see Dunlap, Grieneeks, & Rokeach, 1983; Karp, 1996; Schultz & Zelezny, 1999; Stern, 2000). Values are typically conceptualized as important life goals or standards that serve as guiding principles in life (e.g., Rokeach, 1973). As such, they may provide a basis for the formation of attitudes and act as guidelines for behavior. That is, people consider implications of behavioral choices for the things they value. In relation to environmental problems, which often arise from a conflict between individual and collective interests, values may play an important role (Axelrod, 1994; Karp, 1996). Pro-environmental behavior may well arise from values that transcend self-interest.

Several studies have shown that values contribute to the explanation of various environmental attitudes and behaviors. The value scales of Rokeach (1973) and Schwartz (1994) have been successfully used for explaining general environmental concern (Schultz & Zelezny, 1999) as well as more specific environmental attitudes and beliefs (Stern & Dietz, 1994; Stern, Dietz, & Guagnano, 1995). Karp (1996) demonstrated that Schwarz's values were significantly correlated to various self-reported behaviors, such as recycling behavior, consumer behavior, and political behaviors to protect the environment. Other studies showed that values are related to recycling behavior (Dunlap, Grieneeks, & Rokeach, 1983) and to people's willingness to take action to protect the environment (Stern & Dietz, 1994). In a recent study, Stern, Dietz, Abel, Guagnano, and Kalof (1999) demonstrated that values significantly contributed to the explanation of activist as well as various nonactivist environmental behaviors, such as consumer behavior, policy acceptance, and environmental citizenship.

An area where global environmental problems are clearly linked to individual behavior is household energy consumption (Brandon & Lewis, 1999; Noorman & Schoot Uiterkamp, 1998). One would expect that in this area, where individual and collective interests are so evidently in conflict, values could play an important role. However, to our knowledge, the relationships between values and household energy use have not yet been examined.

The aim of this article is to explore the value basis of environmental behavior in the field of household energy use. More specifically, it examines

whether values, general environmental concern, and specific environmental beliefs are related to household energy use, the acceptability of specific energy-saving measures, and support for environmental policies. This article is organized as follows. First, we outline the hierarchical model for environmental behavior of Stern et al. (1995), which is used as a general framework for the present study. This model links values to environmental behavior via a number of mediating variables. Second, the concept of quality of life (QOL) is discussed, which is used as a measure of basic human values. Third, we argue that various types of environmental behavior should be distinguished, for these might be related to different factors. Finally, results of a study on factors influencing household energy use will be presented.

A HIERARCHICAL MODEL FOR EXPLAINING ENVIRONMENTAL BEHAVIOR

Stern et al. (1995) have proposed a general framework to examine the relationship between values and environmental behavior. In this model, environmental behavior is linked to values through a causal chain of intermediate variables. The model has a hierarchical character. That is, values are seen as causally antecedent to worldviews, more specific beliefs and attitudes, and, ultimately, behavior. It is argued that values and worldviews act as filters for new information so that congruent attitudes and beliefs (i.e., concern about specific environmental problems or attitudes toward certain behaviors) are more likely to emerge. In turn, these specific attitudes and beliefs determine environmental behavior. Values and worldviews differ in the sense that values are situation-transcending beliefs about what is important in life, whereas worldviews are general beliefs related to a specific domain of life. Stern et al. (1995) proposed their model with the specific aim of incorporating the New Environmental Paradigm Scale (Dunlap & Van Liere, 1978) into a broad social-psychological framework. The New Environmental Paradigm Scale (NEP) is aimed at measuring people's views on the human-environment relationship. As such, NEP can be considered as a worldview on the vulnerability of the environment to human interference (Poortinga, Steg, & Vlek, 2002). In the environmental psychology literature, NEP is commonly taken to measure general environmental concern. Also, we will use the label "general environmental concern" in this article.

QUALITY OF LIFE AND HUMAN VALUES

In most studies in which the predictive power of values for environmental behavior is examined, the value scales of Rokeach (1973) or Schwartz (1994) are used. These value scales were not developed to explain environmental behavior, and consequently environmental values are underrepresented (cf. Stern et al., 1995). In this study, a list of subjective QOL indicators is used to measure values (see Table 1). The list of QOL aspects was initially developed to identify possible social and psychological barriers for developing sustainable household consumption patterns. This list was based on an extensive literature review on needs, values, and human well-being in relation to sustainable development (see Gatersleben, 2000; Vlek, Rooijers, & Steg, 1999; Vlek, Skolnik, & Gatersleben, 1998) and is believed to represent a wide range of aspects that are important to consumers. In contrast to the Schwartz and Rokeach value scales, the list of QOL aspects also comprises environmental values.

The various QOL indicators have been used in a number of studies to evaluate the impacts of changes in societal and environmental conditions and consumption (Gatersleben, 2000; Poortinga et al., 2001; Vlek et al., 1998). A multi-attribute evaluation measure can be constructed by adding up expected changes in the various QOL variables as a consequence of such changes, multiplied by importance weights assigned beforehand. For example, Vlek et al. (1998) examined which expected impacts future scenarios with differing economic and environmental conditions had on overall QOL. Gatersleben (2000) studied, among other things, the QOL changes people expected when they would develop a (imaginary) sustainable household consumption pattern. Poortinga et al. (2001) asked respondents to evaluate future household energy use scenarios that were systematically varied in focus of energy saving (home versus transport), the way of energy saving (via technical innovations, behavior changes, or a combination of both), and in the amount of energy saving (small versus large).

Because values are usually conceptualized as important life goals or as normative standards that serve as a guiding principle in life (Rokeach, 1973), importance judgments given to the various QOL aspects may also be taken to reflect basic human values. Consequently, they may be used to examine whether a set of QOL indicators can help to explain environmental attitudes and environmental behaviors.

TABLE 1
Twenty-Two Quality-of-Life Aspects and Their Description

Aspect	*Description*
Aesthetic beauty:	Being able to enjoy the beauty of nature and culture.
Challenge/excitement:	Having challenges and experiencing pleasant and exciting things.
Change/variation:	Having a varied life. Experiencing as many things as possible.
Comfort:	Having a comfortable and easy daily life.
Education:	Having the opportunity to get a good education and to develop one's general knowledge.
Environmental quality:	Having access to clean air, water, and soil. Having and maintaining a good environmental quality.
Freedom:	Freedom and control over the course of one's life, to be able to decide for yourself, what you do, when, and how.
Health:	Being in good health. Having access to adequate health care.
Identity/self-respect:	Having sufficient self-respect and being able to develop one's own identity.
Leisure time:	Having enough time after work and household work and being able to spend this time satisfactorily.
Material beauty:	Having nice possessions in and around the house.
Money/income:	Having enough money to buy and to do the things that are necessary and pleasing.
Nature/biodiversity:	Being able to enjoy natural landscapes, parks, and forests. Assurance of the continued existence of plants and animals and maintaining biodiversity.
Partner and family:	Having an intimate relation. Having a stable family life and having good family relationships.
Privacy:	Having the opportunity to be yourself, to do your own things, and to have a place of your own.
Safety:	Being safe at home and in the streets. Being able to avoid accidents and being protected against criminality.
Security:	Feeling attended to and cared for by others.
Social justice:	Having equal opportunities and having the same possibilities and rights as others. Being treated in a righteous way.
Social relations:	Having good relationships with friends, colleagues, and neighbors. Being able to maintain contacts and to make new ones.
Spirituality/religion:	Being able to live a life with an emphasis on spirituality and/or with your own religious persuasion.
Status/recognition:	Being appreciated and respected by others.
Work:	Having or being able to find a job and being able to fulfill it as pleasantly as possible.

ENVIRONMENTAL BEHAVIOR

Many studies on environmental behavior have been conducted without carefully defining environmental behavior. Often environmental behavior is assumed to be an undifferentiated class of behaviors (Stern, 2000). By doing so, it is implicitly assumed that various types of environmental behavior are dependent on similar factors, which is not always the case (Stern, Dietz, Ruttan, Socolow, & Sweeney, 1997). Moreover, many psychological studies focus on behaviors that are not very interesting from an environmental perspective. That is, the focus is on individual behaviors that have only little effect on environmental qualities (Stern, 2000; Stern et al., 1997). These include behaviors such as refusing plastic bags in stores or purchasing recycled paper (Gatersleben, Steg, & Vlek, 2002).

Stern (2000) proposed that environmentally significant behavior may be classified from an *intent-oriented* or an *impact-oriented* perspective, respectively. Classifying environmentally significant behavior from an *intent-oriented* perspective means that environmentally significant behavior is defined by the motivation of the actor. That is, the classification of behavior is based on whether a particular behavior is undertaken by the actor with the intention to benefit the environment. Although some behaviors are performed because they are perceived to be environmentally beneficial, they do not necessarily result in a reduction of the actual impact on the environment. On the other hand, an *impact-oriented* perspective does not focus on the motivation of the actor to perform certain behavior but defines behavior by its actual impact on the environment. Examples for (measures of) impact-defined behavior are energy use, water use, or waste production (Gatersleben et al., 2002). The distinction between an intent-oriented and impact-oriented definition of behavior is relevant because behavior that is classified by the actors' (environmental) intent and behavior that is defined by its actual impact on the environment may be influenced by different factors. For example, Gatersleben et al. (2002) demonstrated that deliberate (intent-oriented) pro-environmental behaviors are mainly determined by attitudinal variables, whereas actual household energy use (an impact-oriented measure) was especially related to sociodemographic variables, such as household size and income, that influence individual abilities to perform specific behaviors (see also Steg, 1999).

Next to a distinction between an impact-oriented and intent-oriented classification of behaviors, one can discriminate between behavior that *directly*, and behavior that *indirectly* influences environmental qualities (Stern, 2000). Behaviors (either intent-oriented or impact-oriented) that are performed in the private sphere of households can be considered as direct behaviors. These

are behaviors that have direct environmental consequences (Stern, 2000). In the case of behaviors that indirectly influence environmental qualities, one tries to influence the (political) context in which environmental relevant choices are made. Although behaviors with direct environmental impacts have gained the most attention from psychologists and other consumer researchers, behaviors with indirect impacts, such as environmental activism and policy support, may eventually also have large environmental impacts. For example, environmental activism and policy support can contribute to the successful implementation of (new) environmental policies. Environmental activism is the most committed type and involves actively influencing the policy system and public opinion to take and support environmental measures (Stern et al., 1999). Policy support can be defined as the tacit endorsement of or willingness to accept environmental measures and regulations.

In this study, we focus on household energy use. The use of (fossil) energy is directly related to the exploitation of natural resources and is also a major cause of air pollution and global warming (Dürr, 1994). In households, energy is used for a wide variety of activities. Two broad domains can be distinguished: *home* and *transport* energy use. Van Diepen (2000) describes this as a distinction between "sojourning in space" (home) and "bridging of space" (transport). Home energy use is related to activities such as home heating, lighting, and the use of household appliances. Transport energy use is related to transportation by any means (e.g., for commuting, shopping, leisure activities, or holidays). It may be worthwhile to distinguish between home and transport energy use because they seem to depend on different motivational variables (cf. Poortinga, Steg, Vlek, & Wiersma, 2003). In a recent study, Gatersleben (2000) examined how various household goods contributed to people's quality of life. It appeared that the car contributed more to other QOL aspects than did the possession of household appliances such as a TV set, washing machine, and refrigerator. So, various values may be differently related to home and transport behavior.

In this study, we examine how values are associated with two impact-defined measures for environmental behavior with a direct environmental impact (i.e., home and transport energy use). We also examine whether values are related to measures of intent-defined behaviors that directly influence environmental qualities: that is, the acceptability of specific measures aimed at changing respondents' home and transport behavior to save energy. In addition, the impact of values on behaviors that indirectly influence environmental qualities is studied. In this case, a distinction is made between support for government regulation and support for market strategies aimed at managing environmental problems. As such, both can be characterized as measures of pro-environmental intent.[1]

METHOD

PROCEDURE AND RESPONDENTS

Data for this study were collected during October and November 1999. A carefully designed questionnaire was sent to 2,000 randomly selected addresses in the Netherlands. In an accompanying letter, household representatives were invited to participate in the study. After 3 weeks, a reminder was sent to the selected households. In total, 455 respondents returned a completed questionnaire, a response rate of 22.8%. The responsive sample was not completely representative of the Dutch population (Centraal Bureau voor de Statistiek, 1999). Male respondents were slightly overrepresented (58%). All respondents in the sample were 20 years or older, 28.5% were between 20 and 39 years old, 55.3% were between 40 and 64 years old, and 16.2% were 65 years or older. High-income groups were somewhat overrepresented: 17.7% of the respondents had an net income of less than 2500 Dutch guilders (Dfl) per month (*low*), 43.1% had an monthly net income between Dfl 2500 and Dfl 4500 (*average*), and 39.2% had a net income of more than Dfl 4500 per month (*high*).[2] People with a high level of education were somewhat overrepresented: 14.6% had a low level of education (i.e., primary school, low vocational), 28.9% had an intermediate level of education (i.e., secondary school, intermediate technical or vocational), and 54.5% had a high level of education (i.e., pre-university education, high vocational, university). In the sample, 24.9% had a one-person household, 39.4% were living in a two-person household, and 35.7% were living in a household of three persons or more.

MEASURES

Values

Quality-of-life indicators. The respondents were asked to indicate on a 5-point, Likert-type scale how important they found 22 QOL aspects for their own lives (see Table 1). This list of QOL aspects resulted from extensive reviews of relevant literature (see Gatersleben, 2000; Vlek et al., 1999). The judgment scale ranged from 1 (*unimportant*) to 5 (*very important*). A principal component analysis on the importance ratings was conducted to condense the 22 QOL aspects into a limited number of value dimensions (see Value Dimensions in the Results section). Scores on each value dimension were constructed by calculating the mean scores of the variables showing

factor loadings higher than 0.50 on the specific factor. Because mean scores were used, individual scores on the QOL factors had the same 5-point scale as the original QOL variables.

Worldviews

New Environmental Paradigm (NEP). The New Environmental Paradigm Scale (NEP) was used for measuring general environmental concern (Dunlap & Van Liere, 1978). This scale is composed of 12 items. The respondents could point out to what degree they agreed with each statement. The answers could be given on a 5-point, Likert-type scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The environmental-concern variable was calculated by adding up subjects' scores on the 12 items, after four items of the NEP scale had been recoded. The resulting measure could range from 12 (*low environmental concern*) to 60 (*high environmental concern*), with 36 as the midpoint value. The reliability of the scale appeared to be sufficient (Cronbach's alpha = .76).

Specific Beliefs

Concern about global warming (CGW). Concern about global warming (i.e., a specific environmental belief) was measured by the item "We do not need to worry about global warming." Answers could be given on a 5-point, Likert-type scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The item scale was inverted so as to make scores range from 1 (*low concern about global warming*) to 5 (*high concern about global warming*).

Behaviors

Policy support. Respondents were asked how they thought environmental problems should be addressed. First, the extent to which respondents supported government regulation for controlling environmental problems was measured by the item "To solve environmental problems, the government should give clear rules about what is and what is not allowed." Second, the item "The free market is the best way to solve environmental problems" was used as a measure of the extent to which respondents supported market strategies for controlling environmental problems. Answers on both items could vary from 1 (*totally disagree*) to 5 (*totally agree*). Policy support for government regulation and support for market strategies are considered as intent-

TABLE 2
Eighteen Home Energy-Saving Measures and 10 Transport Energy-Saving Measures

Home Energy-Saving Measures	*Transport Energy-Saving Measures*
Appliances not on stand-by	Carpooling
Rinsing the dishes with cold water	Using public transport
Smaller refrigerator	Walking or cycling up to 2.5 km
Switching lights off in unused rooms	Walking or cycling up to 5 km
Turning off heating pump in summer	Energy-efficient car
Thermostat maximally 18° Celsius	Holiday by train
Line drying of laundry	Holiday not by plane
Showering shorter	Econometer in car
Doing dishes by hand (disposing of dishwasher)	Driving maximally 100 km/h on highways
Applying radiator insulation	Speed limiter
Cooking on gas	
Double glazing	
Energy-efficient refrigerator	
Energy-efficient washing machine	
Energy-saving light bulbs	
Insulation of heating pipes	
House insulation	
Energy-efficient heating system	

defined measures for behavior that indirectly influences environmental qualities.

Acceptability of energy-saving measures. Respondents were asked to indicate on a 5-point scale to what extent they found it acceptable to take 28 specific measures in their own household to save energy. These included 18 home energy-saving measures and 10 transport energy-saving measures (see Table 2). Two acceptability scales were constructed by calculating the average acceptability of the home energy-saving measures and the average acceptability of the transport energy-saving measures. The reliability-scores (Cronbach's alpha) of both scales were satisfactory (.78, and .80, respectively). The acceptability of home and transport energy-saving measures are measures for intent-defined behavior that directly affect environmental qualities. These are behaviors that people are willing to adopt to save energy themselves.

Energy use. Fourteen questions about subjects' actual possession and use of household goods were used to calculate home and transport energy use of

households. The questions were selected from an interview-model designed for measuring household energy consumption (Kramer, Wiersma, Gatersleben, Noorman, & Biesiot, 1998). The Appendix gives estimations of direct and indirect energy use related to the possession and use of various household goods (in Giga Joules).[3] These figures represent the average annual energy use related to the possession or use of a specific household good. Home energy use was estimated by questions about type of dwelling, heating, and the possession of various household appliances. Note that people were only asked about the possession of a small number of household appliances. The possession of widely used appliances, such as the refrigerator and the washing machine, would not provide information about differences in energy use between households, and were therefore excluded. Transport energy use was estimated via questions on car possession, car use, and transportation for holidays. Both home and transport energy use are impact-defined measures of environmental behavior that directly influence environmental qualities.

ANALYSIS

To test the model of Stern et al. (1995), several regression analyses were conducted. Model variables were regressed with all preceding model variables as predictors. The first multiple regression model was constructed with general environmental concern (as measured by the NEP scale) as the dependent variable and the value dimensions as independent variables. In the second multiple regression model, a specific environmental belief, concern about global warming, was regressed on the value dimensions and environmental concern. Third, the seven value dimensions, environmental concern, and concern about global warming were used to predict various types of environmental behavior (i.e., support for government and market solutions, acceptability of home and transport energy-saving measures, and home and transport energy use).

RESULTS

VALUE DIMENSIONS

Respondents were asked to indicate how important 22 QOL aspects were for their own lives. By means of a principal component analysis on the

importance ratings, the possibility of summarizing the 22 QOL aspects into a smaller number of value dimensions was examined. To facilitate the interpretability of the factors, a varimax rotation was conducted. This type of rotation rearranges the variables in such a way that the original variables load high on only one of the factors and low on the other factors. A seven-factor solution yielded clearly interpretable results. The seven resulting factors accounted for an acceptable 60.4% of the original variance in subjects' importance ratings.

Table 3 shows the factor loadings of the original QOL variables on the seven factors after rotation. Because the variable social justice had no high loading on any of the seven factors (i.e., all its factor loadings were lower than 0.50), this variable was omitted from further analyses. The QOL variables money/income, comfort, status/recognition, and material beauty correlated highly with the first factor. This factor is labeled as Self-Enhancement. It may be closely related to what Schwartz and Bilsky (1990) call enjoyment and what Schwartz (1994) calls power and hedonism. The second factor summarizes the QOL variables nature/biodiversity, aesthetic beauty, and environmental quality. This can be interpreted as an Environmental Quality factor. This factor is often referred to as reflecting a biospheric value dimension (Stern & Dietz, 1994; Stern, Dietz, Kalof, et al., 1995; Vlek et al., 1998). The QOL variables that loaded highly on the third factor were privacy, freedom, and leisure time. Like the first factor, this is a self-centered dimension. However, whereas the first dimension could be characterized as materialistic, this dimension is more about autonomy and independence. This factor is labeled as Self-Direction (cf. Schwartz, 1994; Schwartz & Bilsky, 1990). The fourth factor comprises the QOL variables challenge/excitement, change/variation, and social relations. This factor, which has been found in many other studies (Karp, 1996; Schwartz, 1994; Stern, Dietz, & Guagnano, 1998), refers to Openness to Change and is labeled likewise in this study. The fifth factor is more difficult to interpret. The factor correlates with the QOL variables spirituality/religion, identity/self-respect, and security. This factor resembles to a large extent the Maturity domain of Schwartz and Bilsky (1990). They described this domain as the appreciation, understanding, and acceptance of oneself, others, and the surrounding world. The factor is labeled likewise in this study. Partner and family, health, and safety loaded highly on the sixth factor. This factor has been found in various other studies and is often referred to as traditional values (cf. Braithwaite & Law, 1985; Schwarz, 1994; Stern et al., 1998) or as security (Schwarz, 1994). In this study, this factor is labeled Family, Health, and Safety. The seventh factor covers the QOL variables work and education. This dimension is labeled Achievement (cf. Schwartz, 1994).

TABLE 3
Factor Loadings After Varimax Rotation

	Factor						
	1	*2*	*3*	*4*	*5*	*6*	*7*
Comfort	0.75						
Money/income	0.71						
Status/recognition	0.57						
Material beauty	0.79						
Nature/biodiversity		0.77					
Aesthetic beauty		0.69					
Environmental quality		0.79					
Privacy			0.69				
Freedom			0.78				
Leisure time			0.55				
Challenge/excitement				0.75			
Change/variation				0.82			
Social relations				0.55			
Spirituality/religion					0.69		
Identity/self-respect					0.52		
Security					0.72		
Partner and family						0.54	
Safety						0.65	
Health						0.76	
Work							0.71
Education							0.78
Social justice							
Eigenvalue	2.46	2.18	2.16	1.86	1.67	1.54	1.41
Explained variance	11.2	9.9	9.8	8.5	7.6	7.0	6.4
Average importance[a]	3.20	3.93	4.35	3.57	3.77	4.69	4.22

NOTE: Only the factor loadings higher than 0.50 are presented; Factor interpretations: 1 = Self-Enhancement; 2 = Environmental Quality; 3 = Self-Direction; 4 = Openness to Change; 5 = Maturity; 6 = Family, Health, and Safety; 7 = Achievement.
a. Scores ranged from 1 (*unimportant*) to 5 (*very important*).

A HIERARCHICAL MODEL TO EXPLAIN ENVIRONMENTAL BEHAVIOR.

Table 4 shows the results of a series of multiple regression analyses to test the hierarchical model, as proposed by Stern et al. (1995). The first column shows the results of the model in which environmental concern, interpreted as a general worldview, was regressed on the seven value dimensions. It appeared that these could explain 18% of the original variance in environmental concern. The Self-Enhancement and Environmental Quality value dimensions were the strongest predictors, followed by the Achievement value dimension. Obviously, environmental concern is positively related to

Environmental Quality value dimension and negatively with the Self-Enhancement value dimension. The Achievement value dimension was positively related to environmental concern. That is, respondents who think that educational and work-related issues (achievement) are important have a higher environmental concern than the respondents who think those issues are less important.

The second model regressed concern about global warming (CGW) (i.e., a specific environmental belief) against the seven value dimensions and general environmental concern. In total, 15% of the total variance of CGW could be explained by these variables. CGW was only significantly related to environmental concern and not to the seven value dimensions. People with a higher NEP were also more concerned about global warming.

The third and fourth columns of Table 4 show the results of regression analyses conducted to examine to what extent the seven value dimensions, environmental concern, and CGW could predict policy support. Twenty-one percent of support for government regulation could be explained by these variables. General environmental concern was the strongest predictor of support for government regulation, followed by the Environmental Quality value dimension. Both were positively related to support for government regulation. To a lesser extent, CGW was positively related to support for government regulation. Likewise, 21% of support for market strategies was explained. In this case, CGW was the strongest predictor, followed by general environmental concern. However, these relationships were both negative. Lower scores on CGW and general environmental concern were positively related to higher support for market strategies. Moreover, support for market strategies was positively related to the Self-Enhancement value dimension.

The acceptability of home and transport energy-saving measures was examined by means of two separate multiple regression models, each comprising the seven value dimensions, general environmental concern, and CGW as predictor variables. It appeared that the model could explain 17% of the variance in the acceptability of home energy-saving measures. Environmental concern was the strongest predictor, followed by CGW and the Self-Enhancement value dimension. Higher environmental concern, higher CGW, and a lower importance of the Self-Enhancement value dimension meant a higher acceptability of home energy-saving measures. Moreover, the Maturity and the Achievement value dimensions were positively related to the acceptability of home energy-saving measures. Table 4 shows that 18% of the acceptability of transport energy-saving measures could be explained. General environmental concern and the Environmental Quality value dimension were the strongest predictors (i.e., higher general environmental

TABLE 4
Standardized Regression Coefficients

Independent Variables	*Worldview*	*Specific Beliefs*	*Policy Support*		*Acceptability of Energy-Saving Measures*		*Energy Use*	
	NEP	*CGW*	*Government Regulation*	*Market Strategies*	*Home*	*Transport*	*Home*	*Transport*
Self-Enhancement	–.31 (–6.50)***	–.09 (–1.82)	.06 (1.12)	.12 (2.50)*	–.13 (–2.60)**	–.10 (–1.94)	.02 (.415)	.01 (.25)
Environmental Quality	.32 (6.34)***	.08 (1.51)	.14 (2.67)**	.02 (.39)	.05 (.917)	.17 (3.28)***	–.01 (–.16)	–.07 (–1.18)
Self-Direction	.09 (1.79)	.02 (.31)	–.04 (–.85)	–.02 (–.39)	–.02 (–.35)	–.07 (–1.30)	–.09 (–1.73)	–.08 (–1.57)
Openness to Change	.05 (1.07)	.02 (.49)	–.01 (–.23)	.02 (.35)	.05 (1.14)	–.09 (–2.03)*	–.01 (–.14)	.23 (4.72)***
Maturity	.00 (.03)	–.05 (–1.08)	.03 (.52)	.01 (.30)	.11 (2.18)*	.13 (2.70)**	–.06 (–1.16)	–.09 (–1.67)
Family, Health, and Safety	–.08 (–1.64)	.05 (1.08)	–.05 (–1.12)	.04 (.90)	–.09 (–1.88)	–.04 (–.88)	.16 (3.05)**	.05 (1.01)
Achievement	.16 (3.37)**	.02 (.41)	.08 (1.71)	–.03 (–.54)	.10 (2.17)*	.05 (.99)	–.05 (–.95)	–.06 (–1.20)
NEP	—	.35 (6.99)***	.35 (7.20)***	–.16 (–3.22)**	.26 (5.21)***	.28 (5.57)***	–.02 (–.27)	–.09 (–1.61)
CGW	—	—	.09 (1.97)*	–.35 (–7.58)***	.14 (2.87)**	.06 (1.34)	–.07 (–1.29)	.12 (2.35)*
R^2	.19	.16	.22	.22	.18	.20	.04	.08
Adj. R^2	.18	.15	.21	.21	.17	.18	.02	.06

NOTE: *t*-values are shown in parentheses. NEP = new environmental paradigm; CGW = concern about global warming.
*$p < .05$. **$p < .01$. ***$p < .001$.

concern and greater importance of values related to environmental quality go along with greater acceptance of transport energy-saving measures). Moreover, respondents who assigned greater importance to Openness-to-Change values found measures aimed at reducing transport energy use less acceptable, whereas respondents who assigned greater importance to Maturity evaluated these energy-saving measures as more acceptable.

Finally, home and transport energy use were regressed on the seven value dimensions, environmental concern, and CGW. Only 2% of the variation of home energy use could be explained. It appeared that this regression model was not significant, $F(9, 438) = 1.83$, $p = .060$. Moreover, it appeared that the model could (only) explain 6% of the variance in transport energy use. Transport energy use was mainly related to the Openness-to-Change value dimension. That is, a greater importance of Openness to Change corresponded to a higher level of transport energy use. Moreover, transport energy use was related to CGW. Surprisingly, a higher CGW corresponded to a higher transport energy use.

These results correspond to the findings of a recent study by Gatersleben et al. (2002). In this study, it was shown that household energy use was primarily related to sociodemographic variables, which influence people's ability to act in an environmentally (un)conscious way (i.e., household size and income) but hardly so to attitudinal variables. To compare the importance of attitudinal and sociodemographic variables for explaining home and transport energy use, two additional regression analyses were conducted.

EXPLAINING HOME AND TRANSPORT ENERGY USE FROM ATTITUDINAL AND SOCIODEMOGRAPHIC VARIABLES

Table 5 shows the results of two regression analyses in which home and transport energy use were regressed on the variables of the first model (seven value dimensions, general environmental concern, and CGW), supplemented with several sociodemographic variables (i.e., age, household income, level of education, and household size). These variables could explain 15% of home energy use and 35% of transport energy use, respectively (compared to 2% and 6% when the sociodemographic variables are excluded). It appeared that home energy use was especially related to income and household size. These results correspond to those reported by Gatersleben et al. (2002). Obviously, higher income groups and household size went along with a higher home energy use. Also, level of education and the Family, Health, and Safety dimension were significantly related to home energy use. A higher level of education was related to lower home energy

TABLE 5
Standardized Regression Coefficients

	Energy Use	
Independent Variables	*Home*	*Transport*
Age	.043 (.88)	–.13 (–2.95)**
Income	.27 (4.91)***	.34 (7.06)***
Level of education	–.11 (–2.16)*	.17 (3.68)***
Household size	.22 (4.29)***	.17 (3.73)***
Self-Enhancement	.01 (.16)	.07 (1.46)
Environmental Quality	.00 (.06)	–.04 (–.75)
Self-Direction	–.04 (–.71)	–.01 (–.13)
Openness to Change	–.03 (–.51)	.16 (3.66)***
Maturity	–.03 (–.57)	.07 (–1.52)
Family, Health, and Safety	.11 (2.17)*	.03 (.56)
Achievement	–.04 (–.71)	–.10 (–2.17)*
NEP	–.01 (–.16)	–.06 (–1.29)
CGW	–.09 (–1.77)	.04 (.98)
R^2	.17	.37
Adj. R^2	.15	.35

NOTE: *t*-values are shown in parentheses. NEP = new environmental paradigm; CGW = concern about global warming.
*$p < .05$. **$p < .01$. ***$p < .001$.

use, although a higher importance of the Family, Health and Safety value dimension was related to a higher home energy use.

All four sociodemographic variables (age, income, level of education, and household size) were significantly associated to transport energy use. Age was negatively related to transport energy use, whereas income, level of education, and household size were positively related with transport energy use. Please note that, even after incorporating the sociodemographic variables, the Openness-to-Change and Achievement value dimensions are still significantly associated to transport energy use. As in the former model (without the sociodemographic variables), a higher importance of Openness to Change corresponded to a higher level of transport energy use. A higher importance of Achievement was related to lower transport energy use. On the other hand, the significant relationship between concern about global warming and transport energy use appears to be spurious: It has disappeared in the regression model including the sociodemographic variables. This relationship was probably an artifact of a shared correlation with income and education.

DISCUSSION

The aim of this article was to investigate the role of values in the explanation of different types of measures of environmental impact and different types of measures of environmental intent in the field of household energy use. The results of this study show that the model of Stern et al. (1995) is a useful framework for examining the motivational determinants of environmental behavior. In general, the results appeared to be consistent with the assumption that variables especially have a direct relationship with ensuing variables in the model but may also be related to variables more than one level downstream. This article also showed that it is relevant to differentiate between several types of environmental behavior—namely, impact-oriented measures that directly influence environmental qualities (home and transport energy use), intent-oriented measures with a direct environmental impact (acceptability of home and transport energy-saving measures), and intent-oriented measures that indirectly affect the environment (support for governmental and market policies) were related to different types of variables. It was also shown that different aspects of environmental impact (i.e., energy use in different domains) are related to a different set of variables. These results show that measures of different aspects of environmental impact as well as different types of environmental intent are influenced by distinct variables.

Importance judgments on 22 QOL aspects were used for identifying value dimensions, which represent various domains of what people may find important in life. It appeared that the original 22 QOL aspects could be reduced to seven clearly interpretable factors. The seven factors were identified as Self-Enhancement; Environmental Quality; Self-Direction; Openness to Change; Maturity; Family, Health, and Safety; and Achievement and were taken to reflect different value dimensions. Although a different set of items was used, the seven dimensions showed a remarkable resemblance to the value domains identified by Schwarz and Bilsky (1990). A major difference was that in the present study a separate environmental quality value dimension was found. However, this is not unexpected, as Schwartz and Bilsky (1990) did not include environmental items in their study.

Consistent with earlier research, environmental concern as well as different types of environmental behavior were clearly related to basic human values (Corraliza & Berenguer, 2000; Karp, 1996; Schulz & Zelezny, 1999; Stern, Dietz, Kalof, et al., 1995; Stern et al., 1995). Not surprisingly, people who valued environmental quality more had a higher environmental concern.

The Self-Enhancement value dimension was (negatively) related to environmental concern. Unexpectedly, environmental concern was also related to the Achievement value dimension, indicating a broad value-basis of environmental concern. That is, concern for the environment is not only related to the extent one values this public good per se but also is negatively influenced by the extent one thinks that personal prosperity is important. The relationship with the Achievement value dimension is less straightforward. As could be expected, specific environmental concern, such as CGW, was mainly related to general environmental concern. This shows that, consistent with the model (Stern et al., 1995), specific environmental concerns are embedded in a more general view on the vulnerability of the environment to human interference (cf., Poortinga et al., 2002).

It appeared that the values and general and specific environmental concern were especially able to explain variance in intent-oriented measures of environmental behavior that directly or indirectly influence environmental qualities (i.e., policy support and the acceptability of specific energy-saving measures). As expected, both support for government regulation and support for market strategies were related to general environmental concern and CGW. However, support for government regulation was positively related to the Environmental Quality dimension, whereas support for market strategies was positively related to the Self-Enhancement value dimension. These results indicate that the relationships between values, environmental concern, and environmental behavior might be more complex than is often assumed (Poortinga et al., 2002). Possibly, people with a low environmental concern think that market-oriented policies are less strict. By preferring free-market solutions, as opposed to government regulation, people shift the responsibility for solving environmental problems to others. Support for market strategies may also reflect an attitude that doing nothing is the best option. In contrast, persons with a high environmental concern may perceive free-market solutions to be weak alternatives to direct governmental actions and (therefore) less effective than government regulation.

The proposed model proved to be less effective in explaining impact-defined measures for environmental behavior that directly influences environmental qualities. Although the various (indirect and direct) measures of pro-environmental intent were significantly related to the value dimensions and especially to environmental concern, these variables could only explain a very small amount of the variance in home and transport energy use. This is in line with the findings of a recent Dutch study (Gatersleben et al., 2002). In this study, it was found that whereas environmental behaviors defined from an intent-oriented perspective are related to attitudinal variables, such as environmental awareness, environmental behaviors defined from an impact-

oriented perspective were not. Household energy use appeared to be especially related to sociodemographic variables, which influence individual abilities to perform specific behaviors, such as household size and income. Likewise, the present study showed that home and transport energy use were more strongly related to sociodemographic variables.

However, it is important to note that the attitudinal variables could explain a significant, if little, amount of the variance of transport energy use. One value dimension may be of special interest to psychologists studying travel behavior: it appeared that the Openness-to-Change value dimension contributed significantly to the explanation of transport energy use as well as to the acceptability of transport energy-saving measures. Even after sociodemographic variables were included, Openness to Change was still significantly related to transport energy use. An explanation may be that transport is being used for various ends, such as going to work, maintaining social relations, and recreation. It may be argued that for having a varied life, to be able to maintain social relationships, and to commute to work, (motorized) transport is perceived as indispensable.

This study shows that the method of measuring households' home and transport energy use can be a useful instrument for examining factors influencing impact-oriented definitions of environmental behavior (cf. Gatersleben et al., 2002). However, our measures were based on a limited number of questions and therefore could only grasp a limited amount of the actual home and transport energy use of households. Moreover, average energy-use figures were used to calculate home and transport energy use. A meticulous assessment of household energy use would require a large number of detailed questions about the possession and use of various household goods (see Kramer et al., 1998), which could become a burden for respondents. The questions in this article were specifically selected to provide information on differences in energy use between households, which serves the purpose of examining which factors lead to higher environmental impacts of households.

In conclusion, the results of this study suggest that a purely attitudinal motivational model to explain environmental behavior may be too limited. In general, the attitudinal variables included in this study could explain a significant but modest amount of variance in the various types of environmental behavior. Clearly, environmental behavior is not only dependent on motivational factors but is also determined by contextual factors, such as individual opportunities and abilities. Some behaviors may be more difficult to perform (for some people) and therefore less likely to be completely dependent on motivational factors (Black, Stern, & Elworth, 1985; Poortinga et al., 2003; Stern, 2000). Although this conclusion has been around in the energy field

for a long time and has been corroborated in this study from a different perspective, contextual factors are still largely ignored within the field of environmental psychology. Future research on environmental behavior should take a broader perspective and should also focus on the role of contextual factors that may influence individual abilities and opportunities. This study also showed that it could be especially worthwhile to examine the influence of motivational and contextual variables on measures of environmental impact in specific domains of household consumption.

APPENDIX
Estimations of Home and Transport Energy Use (in Giga Joules)

	Energy use
Home energy use	
Type of dwelling (average energy use for heating)	
Detached	84.8
Semi-detached	61.6
Terraced house	48.5
Apartment or flat	36.5
Other	61.6
Heating	
Temperature: Every degree more or less than 20° C	3.3
Possession of household appliances	
Freezer	3.8
Microwave oven	1.0
Electric kettle	0.5
Tumble dryer	5.3
Dishwasher	3.6
Computer	0.5
Waterbed	7.2
Electric stove	4.7
Transport energy use	
Car use	
Number of cars owned	8.3 GJ per car
Car use (annual mileage)	2.9 per 1000 km
Holidays	
Average energy use for transport	2.3 per holiday per person
Flying	20.4 per flight per person

NOTES

1. Please note that the acceptability of specific home and transport energy-saving measures and support for government regulation and support for market strategies do not reflect individual behaviors or self-reported behaviors. Rather, they can be characterized as the willingness to perform behaviors and to support measures to improve environmental quality.

2. In December 1999, Dfl100 was about 45, €27, or $45.

3. Households use energy directly as well as indirectly. Direct energy use has attracted most attention and includes the use of gas, electricity, and car fuel. However, more than half of households' energy use is consumed in an indirect way. Indirect energy is the energy needed for the manufacturing, transportation, and disposal of goods and services, which are consumed by households (see also Gatersleben et al., 2002; Noorman & Schoot Uiterkamp, 1998; Poortinga et al., 2001; Vringer & Blok, 1995).

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