

# Ecological Behavior, Environmental Attitude, and Feelings of Responsibility for the Environment

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*Given their definition of subjective norms, rational-choice theories must be located within the realm of social conventionality. However, subjective norms can be grounded in moral as well as conventional considerations. Not surprisingly, then, rational-choice theories insufficiently explain behaviors that are at least partially moral, such as ecological behavior. The present paper establishes an expanded rational-choice model of environmental attitude that extends into the moral domain by using feelings of personal obligation toward the environment (i. e., feelings of responsibility) as an additional predictor of intentions to behave ecologically. Findings from two studies are presented. In Study 1 a sample of Swiss adults (N = 436) was used to test the proposed model. Study 2 replicates the*

*findings of Study 1 with a sample of California college students (N = 488). Assessments were carried out in a structural equation modeling framework. Environmental knowledge, environmental values, and responsibility feelings together explained 45% (50% in Study 2) of the variance of ecological behavior intention which, in turn, predicted 76% (94%) of the explainable variance of general ecological behavior. As the inclusion of responsibility feelings increased the proportion of explained variance of ecological behavior intention by 5% (10%) above and beyond a more basic attitude model, the moral extension of the proposed attitude model is largely supported.*

*Keywords: Ecological behavior, environmental attitude, responsibility.*

Shrinking natural resources, overwhelmed landfill sites, pollution, the depletion of the ozone layer, and the greenhouse effect challenge human existence. Not surprisingly, some surveys show that people's attitudes reveal quite a bit of environmental concern, suggesting that a general environmentalist attitude is becoming more and more prevalent (e. g., Kempton, Boster, & Hartley, 1995). Unfortunately, the relation between environmental attitude and ecological behavior<sup>1</sup> appears to be, at best, moderate across different studies (e. g., Hines, Hungerford, & Tomera, 1986/87; Schultz, Oskamp, & Mainieri, 1995). Strictly speaking, a person's ecological behavior often does not match his or her attitudinal intentions (see Maloney & Ward, 1973). Despite the fact that a considerable amount of the environmental psychology literature deals with the attitude-behavior issue (Smythe & Brook, 1980), explaining the gap between environmental attitude and ecological behavior remains a challenge. Supplementary concepts have become prom-

ising, especially concepts derived from the realm of morality (see Fuhrer, 1995; Heberlein, 1972; Hunecke, 1996; Thøgersen, 1996).

Because the environment is a common property that is available to all people, one individual's consumption of natural resources also affects other people. Abstinence from consumption is often at one's own expense, but betters the situation of others (e. g., Biel & Gärling, 1995; Mosler, 1993). Not surprisingly, ecological behav-

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ior is seen more and more as a prosocial (Granzin & Olsen, 1991; Van Liere & Dunlap, 1978) or an altruistic behavior (Hallin, 1995; Hopper & Nielsen, 1991; Stern et al., 1993; Vining & Ebreo, 1992). This view puts ecological behavior at least partially into the moral domain (Howe, Kahn, & Friedman, 1996; Kahn, 1997; Kahn & Friedman, 1995). Because most environmental attitude approaches presuppose people who act deliberately, egoistically, and rationally (i. e., people who maximize utility), these approaches often fail to include altruistic considerations, considerations that better the situation of others at one's own expense. Such considerations are essential for decision making in the moral domain (see Thøgersen, 1996). In this paper, we propose an account that extends environmental attitude models into the moral realm.

## Environmental Attitude From a Rational-Choice Perspective

In spite of the large body of environmental psychology literature on the attitude-behavior relation (see Hines et al., 1986/87; Kaiser, Wölfing, & Fuhrer, in press), understandings of environmental attitude are hardly consistent across studies. Besides more or less ad hoc conceptions of environmental attitude (e. g., Becker, Seligman, Fazio, & Darley, 1981; Derksen & Gartrell, 1993; Gamba & Oskamp, 1994; Grob, 1995; McCarty & Shrum, 1994; Oskamp, Harrington, Edwards, Sherwood, Okuda, & Swanson, 1991; Sia et al., 1985/86; Van der Pligt, 1985; Van Liere & Dunlap, 1981; Verhallen & Van Raaij, 1981), three main traditions can be distinguished: Attitudes toward the environment (e. g., Amelang, Tepe, Vagt, & Wendt, 1977; Arbuthnot, 1977; Dispoto, 1977; Maloney & Ward, 1973; Maloney, Ward, & Braucht, 1975; McGuinness et al., 1977; Schahn & Holzer, 1990; Shean & Shei, 1995; Smythe & Brook, 1980), attitudes toward ecological behavior (e. g., Hamid & Cheng, 1995; Kantola et al., 1983; Lynne & Rola, 1988; Midden & Ritsema, 1983; Moore et al., 1994; Stutzman & Green, 1982; Taylor & Todd, 1995), and the New Environmental Paradigm (e. g., Dunlap & Van Liere, 1978; Larsen, 1995; Schultz & Oskamp, 1996; Scott & Willits, 1994; Vining & Ebreo, 1992). Some have promoted the theory of reasoned action (e. g., Ajzen & Fishbein, 1980) as the unifying framework of these different approaches (Gamba & Oskamp, 1994; Olsen, 1981). Consistent with such a view, Kaiser and colleagues (in press) have proposed the trioka of environmental knowledge, environmental values, and

ecological behavior intentions as the least common denominator of most environmental attitude approaches. Their proposal is for a general attitude model grounded in a rational-choice perspective.

Kaiser and colleagues' (in press) model is different from the original theory of reasoned action, and is not a rational-choice model in a strict sense because the theory's rational-choice constructs, attitude and subjective norms, are substituted by the two more comprehensive concepts of knowledge and values. However, their proposed common denominator does represent the theory's basic structure. Originally, behavior intentions were seen as a function of knowledge about the likelihood that performing a particular behavior would lead to a specific outcome. Both normative knowledge (i. e., values) and behavioral knowledge (i. e., factual knowledge) affect intentions and subsequent behavior, either through attitudes and/or through subjective norms (e. g., Madden, Ellen, & Ajzen, 1992). The abbreviated version of the theory of reasoned action uses factual environmental knowledge as an approximation of attitude toward ecological behavior and environmental values as an approximation of subjective (social) norms. With this model Kaiser and colleagues could predict 75% of their respondents' ecological behavior; however, as only about 40% of ecological behavior intentions could be predicted, room for improvement remained.<sup>2</sup>

Like other rational-choice theories, the theory of reasoned action fails to sufficiently predict morally related behaviors, such as ecological behavior (e. g., Kantola et al., 1983; Thøgersen, 1996), either because moral behavior goes beyond sheer egoistic prudence or because the interests of others are not an apparent issue in most rational decisions. Furthermore, although Ajzen and Fishbein (1980) discount the inclusion of moral norms in their model, there are at least two reasons why moral norms should be included. The first is a pragmatic reason. Besides rational-choice theories, moral norm-activation theories are the second most popular theoretical approach in environmental psychology, suggesting a need for an extension (Fuhrer, 1995; Kals & Montada, 1994). Both theoretical lines (i. e., rational-choice and norm-activation theory) are used either independently or in parallel, while little effort has been expended to empirically integrate the approaches.

There is also a second, philosophical, reason for inclusion of moral norms. In moral philosophy, two types of social norms are distinguished: Social conventional and moral norms (Tugendhat, 1994). This distinction parallels a differentiation of two social cognition domains, the moral and the conventional (see Turiel, 1985),

which, in turn, matches the differentiation of two corresponding types of social emotions: Embarrassment-shame for violated conventions and guilt for violated moral standards (Keltner & Buswell, 1996).

Moral norms derive from moral concepts, for instance, another's welfare, another's rights, and fairness or justice considerations. In contrast, one's conventional norms are grounded in social customs or traditions, appeals to authorities, and one's need for social appreciation. Thus, if ecological behavior at least partially falls into the moral domain (e. g., Shean & Shei, 1995; Van Liere & Dunlap, 1978; Vining & Ebreo, 1992) and is determined by moral rather than conventional thinking (Howe et al., 1996; Kahn & Friedman, 1995), the predictive power of the theory of reasoned action should be adversely affected because subjective norms in this approach are basically conventional social norms. As Midden and Ritsema (1983) wrote, subjective norms are "... the sum of the products of normative beliefs [defined as cognitions about what other people think they should or should not do] and motivations to comply with these separate normative beliefs for different referent persons and groups." (p. 44)

Some empirical evidence supports the notion that environmental decision making is affected by different domains of social thinking (e. g., Leonard-Barton, 1981; Stern et al., 1993), which is all the more reason to extend the explanatory part of rational-choice theories by adding moral concepts. Feelings of a personal obligation (i. e., feelings of responsibility) appear to be promising in this regard.

## **Norm-Activation and Feeling Responsible**

Schwartz's (e. g., 1977) norm-activation model deals with the issue of personal obligation and is being used increasingly in environmental psychology (e. g., Fuhrer, 1995; Guagnano et al., 1995; Hallin, 1995; Heberlein, 1972; Hopper & Nielsen, 1991; Stern et al., 1993; Van Liere & Dunlap, 1978; Vining & Ebreo, 1992). The model holds that a person's personal obligation to act in favor of others depends on at least two things: The ascription of personal responsibility and awareness of the consequences of a given behavior (Vining & Ebreo, 1992). Thus, the norm-activation model, at least implicitly, assumes that people tend to feel obligated for the welfare of others beyond the prudential interest in favor of one's own well-being (see Stern et al., 1993). A sense of person-

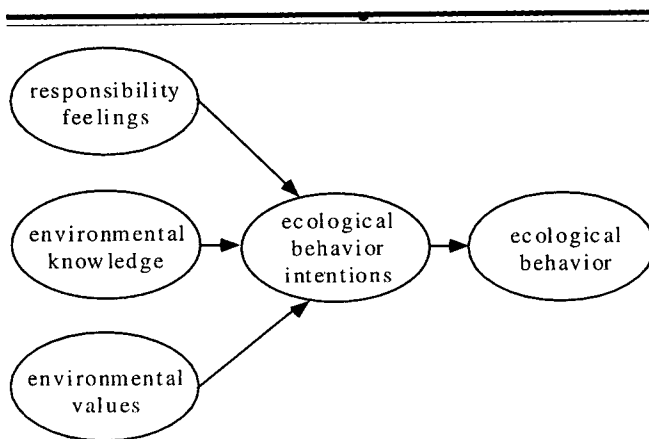
al obligation for the welfare of others implies that people feel a responsibility to act for the benefit of others, so the model promotes feelings of responsibility as a personal moral obligation.

Unfortunately, the findings from the norm-activation approach are mixed. Some data suggest that the ascription of responsibility (i. e., responsibility judgment; see Kaiser & Shimoda, in press) is the most relevant concept (Guagnano et al., 1995; Hallin, 1995; Van Liere & Dunlap, 1978), while others have found the personal sense of obligation (i. e., feeling of responsibility; e. g., Kaiser & Shimoda, in press) to be crucial (Hopper & Nielsen, 1991; Vining & Ebreo, 1992). Beyond the norm-activation model, several others also attest to the significance of responsibility feelings as a predictor of ecological behaviors (e. g., Arbuthnot, 1977; Fridgen, 1994; Granzin & Olsen, 1991; Heberlein & Black, 1976; Hines et al., 1986/87; Kals & Montada, 1994; Kantola et al., 1983).

## **Research Goals**

On the one hand, while rational-choice theories, given their definition of subjective norms, have to be located within the realm of social conformity (i. e., conventionality), they fail to include moral norms. Not surprisingly, as social norms can be grounded in both conventional as well as moral considerations (Tugendhat, 1994), rational-choice theories insufficiently explain behavior with a moral aspect (e. g., ecological behavior). Schwartz' norm-activation theory, on the other hand, belongs more fully in the moral domain. Unfortunately—given the heterogeneity of the findings—this model is not fully conclusive. Hence, based on an attitudinal approach, which is suggested to be the least common denominator of most environmental attitude models (see Kaiser et al., in press), an extension of this general model is proposed (see Figure 1).

In this model, feelings of personal responsibility toward the environment are used to bridge the gap between rational-choice and norm-activation theories. Environmental knowledge, environmental values, and responsibility feelings predict ecological behavior intentions, which in turn predict ecological behavior (see Figure 1). Ecological behavior intentions should be predicted more accurately by including the morally related concept of one's personal obligation (i. e., responsibility feelings). The present paper yields results from two studies that explore the proposed extension.



**Figure 1**  
Ecological behavior as a function of environmental attitude extended by responsibility feelings.

## Study 1

Study 1 explores the utility of the extended attitude model with a sample of Swiss adults. The same sample was previously used to develop the unextended attitude model that can be seen as the least common denominator of most environmental attitude approaches, which involves environmental knowledge, environmental values, and ecological behavior intentions. Thus, the findings can be directly compared. If the inclusion of responsibility feelings increases the explained variance of participants' ecological behavior intentions above 40% (see Kaiser et al., in press), the proposed model is empirically supported.

### Method

#### *Participants and Procedures*

The sample involved 445 members from two ideologically differentiated Swiss transportation associations. One association aims to promote a transportation system that has as little negative impact on humans and nature as possible. The other primarily represents automobile drivers' interests. German was the primary language used by all participants. Participants' median age was 45.5 years ( $M$  46.6, range 20–82), and 62.5% were male. Questionnaires were mailed during November 1994, and participants could fill them out at their convenience.

The response rate was 82.0% (for more details see Kaiser et al., in press). Members of the automobile driv-

ers' association were less well-represented in the sample (25.8%), compared to members of the association promoting a more ecological transportation system (74.2%). Hence, the sample seems to be biased toward more ecologically concerned participants. However, for the purpose of the present study, it is sufficient that the participants reflect a wide diversity, for instance, in ecological behavior. Sample bias is of less concern because the generalizability of the proposed relations will be scrutinized in Study 2.

### *Measures*

The questionnaire consisted of a social desirability scale, a general ecological behavior measure, three scales that represent concepts related to environmental attitude, and a measure for responsibility feelings regarding the environment.

The Social Desirability (S.D.) scale presented by Amelang and Bartussek (1970) consists of 32 items (an English translation of Amelang and Bartussek's S.D. scale is available on request). Fourteen of the items must be answered "Yes" to contribute to the S.D. sum score (e. g., "I never claim to know more than I actually do"). Eighteen of the items must be answered "No" to contribute to the S.D. sum score (e. g., "I have taken advantage of people in the past"). Missing values (0.77% of all S.D. item responses) were treated as if participants answered in a non-socially desired way.

The General Ecological Behavior (GEB) measure has been calibrated as a unidimensional Rasch scale based on a dichotomous model within item response theory (e. g., Wright & Masters, 1982). It consists of 38 items that assess different types of ecological behavior (e. g., "Usually I do not drive my automobile in the city;" "I put dead batteries in the garbage" [negatively formulated item]) and some non-environmental prosocial behaviors (e. g., "Sometimes I give change to panhandlers"). A yes/no response format for these items was used in this study. "No" responses to negatively formulated items were recoded as "Yes" responses and vice versa. Missing values (0.45% of all GEB item responses) were treated as "No" responses, assuming that participants' doubt—represented by missing values—was indicative of not behaving ecologically (for more details see Kaiser, 1998).

In measuring environmental attitude, a principal-factor analysis (PFA) was performed with 391 participants to confirm the orthogonal three-factor attitudinal structure of a prior study (Fuhrer & Wölfling, 1997; see also Kaiser et al., in press). Twenty-eight items adequate-

**Table 1**

Environmental Knowledge (EK), Environmental Values (EV), Ecological Behavior Intention (EBI), and Responsibility Feelings (RF) Items.

Item	Factor Loadings	
	Study 1	Study 2
<b>Knowledge (EK): I agree that . . .</b>		
1. . . . melting of the polar ice caps may result in a flooding of shores and islands.	.70	.52
2. . . . fossil fuels (e. g., gas, oil) produce CO <sub>2</sub> in the atmosphere when burned.	.67	.62
3. . . . all living beings (micro-organisms, plants, animals, and humans) are interdependent with one another.	.62	(excl.)
4. . . . poisonous metals are introduced into the food chain, for instance, via ground water.	.50	.49
5. . . . ozone near the ground may cause respiration problems.	.47	.53
6. . . . a change in climate caused by increased levels of CO <sub>2</sub> in the atmosphere is called the greenhouse effect.	.47	.48
7. . . . poisonous metals remain in the human body.	.47	.50
8. . . . world climate will probably massively change if CO <sub>2</sub> continues to be emitted into the atmosphere in as huge amounts as it is now.	.45*	.61
9. . . . a reduced number of species may interrupt the food chain, affecting some subsequent species in the chain.	.40	.40
10.– . . . the greenhouse effect does not result in the melting of glaciers in central Europe.	.39	(excl.)
<b>Values (EV): I agree that . . .</b>		
1. . . . all things, whether humans, animals, plants, or stones have the right to exist.	.72	.61
2. . . . animals should have legal rights.	.59	.62
3. . . . all organisms' lives are precious and worth preserving.	.57	.67
4. . . . nature must be preserved because God or another supernatural force is part of it, even in its non-living aspects.	.47	(excl.)
5. . . . in general, raising animals in cages should be forbidden.	.41	.48
6. . . . for everything that I do, including deeds affecting the environment, I am responsible to a supernatural force, for instance God.	.36	(excl.)
7. . . . the earth's value does not depend on people; it is valuable in itself.	.34	(excl.)
<b>Intention (EBI): I agree that . . .</b>		
1. . . . I support raising parking fees in cities.	.74	.56
2. . . . I am ready to pay environmental taxes (e. g., raising fuel or automobile taxes).	.71	.40
3. . . . I support speed limits on freeways (100 kph [i. e., 62.5 mph] and 80 kph [i. e., 45 mph] where freeways cross residential areas).	.69	(excl.)
4. . . . I support efforts to create automobile free inner cities.	.65	.51
5. . . . I would prefer to drive only if absolutely necessary (i. e., no other mode of transportation is available).	.53	.56
6. . . . I would prefer not to drive to work any longer.	.52	.60
7. . . . I would prefer to be able to go shopping without my automobile.	.48	.66
8. . . . I will stop the engine at red lights in the future.	.43	(excl.)
9.– . . . I will still need my automobile in the future.	.43	.38
10. . . . my next automobile will be small and as ecologically sound as possible.	.41	.41
11.– . . . I will travel by automobile or by airplane during my vacations.	.40	(excl.)
<b>Responsibility Feelings (RF): I agree that . . .</b>		
1.– . . . because my personal contribution is very small I do not feel responsible for air pollution.	N/A	N/A
2.– . . . I do not feel responsible for the greenhouse effect.	N/A	N/A
3. . . . I feel responsible for the condition of the air.	N/A	N/A
4. . . . I feel at least co-responsible for the presently occurring environmental problems.	N/A	N/A
5. . . . because I drive an automobile—as rare as that may be—I contribute to, and am responsible for air pollution.	N/A	N/A

Note: – indicates items that are inverted in their meaning; \* one item that loads mainly (i. e., .48) on the EBI instead of the proposed EK; excl. indicates excluded items in Study 2.

ly represented the three proposed environmental attitude-related scales (see Table 1, which includes factor loadings of the varimax rotated final solution). The proposed scales are Environmental Knowledge (EK; 10 items), Environmental Values (EV; 7 items), and Ecological Behavior Intention (EBI; 11 items). The response format was a 5-point Likert scale (1 = agree totally; 5 = disagree). Negatively formulated items were reversed in coding.

Responsibility Feelings (RF) regarding the environment were assessed as in another study (Kaiser & Shimoda, in press). Five items were used (see Table 1). The response format was a 5-point Likert scale (1 = confirm totally; 5 = reject totally). Negatively formulated items were reversed in coding.

Generally, the content of all 33 responsibility and attitude items is related to the topic of pollution (see Table 1). The internal consistencies of all four factors, EK, EV, EBI, and RF, were estimated by using standardized Cronbach's  $\alpha$ :  $\alpha_{EK} = .84$  ( $N = 418$ ),  $\alpha_{EV} = .73$  ( $N = 425$ ),  $\alpha_{EBI} = .85$  ( $N = 423$ ), and  $\alpha_{RF} = .82$  ( $N = 412$ ). For subsequent analyses, scores for EK, EV, RF, and EBI were obtained by taking the mean of the constituent items. Mean

values were calculated only if participants had answered at least half of the items for each factor. The correlations between factor scores and mean values of factors indicate that the latter are useful approximations of the former:  $r_{EK} = .89$ ,  $r_{EV} = .90$ ,  $r_{RF} = .87$ ,  $r_{EBI} = .95$ . By using mean values ( $N_{EK} = 441$ ;  $N_{EV} = 440$ ;  $N_{EBI} = 442$ ;  $N_{RF} = 444$ ) instead of factor scores ( $N_{EK, EV, EBI} = 391$ ;  $N_{RF} = 412$ ), data for additional participants could be included in further analyses.

### Analysis

According to the factor loadings, each of the three environmental attitude-related scales as well as the responsibility scale (for factor loadings see Kaiser & Shimoda, in press) was divided into two balanced subscales (EK1, EK2, EV1, EV2, EBI1, EBI2, RF1, and RF2) that were used as input variables for the structural equation analyses. All structural equation models were assessed by means of LISREL8 (Jöreskog & Sörbom, 1993), using the maximum likelihood method. The correlation matrix was the input matrix. The correlation matrix, variable means ( $M$ ), and their standard deviations ( $SD$ ) are given in Table 2.

**Table 2**

Correlation matrix, variable means ( $M$ ), and standard deviations ( $SD$ ) of all variables used in the LISREL analyses: Members of two Swiss transportation associations (Study 1) and University of California, Irvine students (Study 2).

Scale	N	M	SD	Correlation matrix										
<i>Swiss sample</i>														
EK1	441	4.72	.43											
EK2	441	4.65	.46	.712										
EV1	439	4.45	.59	.447	.334									
EV2	438	3.74	1.01	.275	.263	.379								
RF1	444	3.65	.86	.509	.481	.271	.228							
RF2	444	3.87	.85	.417	.364	.296	.215	.676						
EBI1	442	3.53	.84	.456	.388	.293	.195	.429	.280					
EBI2	442	4.17	.76	.501	.430	.366	.231	.461	.336	.736				
GEB	443	1.58	.88	.360	.290	.298	.165	.336	.230	.549	.498			
<i>US sample</i>														
EK1	313	4.11	.66											
EK2	313	4.38	.57	.611										
EV1	313	3.98	.80	.250	.270									
EV2	313	4.25	.79	.198	.189	.515								
RF1	313	3.47	.79	.230	.221	.260	.251							
RF2	313	3.66	.83	.316	.300	.302	.253	.609						
EBI1	313	3.05	.89	.310	.268	.271	.204	.424	.425					
EBI2	313	2.75	.84	.200	.141	.281	.188	.441	.374	.618				
GEB	313	.05	.25	.216	.253	.277	.264	.417	.368	.536	.553			

Note: The possible range of scale means lies between 1 and 5 with one exception: GEB ranges potentially between  $\pm \infty$  (see Wright & Masters, 1982). EK1 = Environmental Knowledge scale 1, EK2 = Environmental Knowledge scale 2, EV1 = Environmental Values scale 1, EV2 = Environmental Values scale 2, RF1 = Responsibility Feelings scale 1, RF2 = Responsibility Feelings scale 2, EBI1 = Ecological Behavior Intention scale 1, EBI2 = Ecological Behavior Intention scale 2, GEB = General Ecological Behavior scale.

Results

The present findings are reported in two sections. First, constructs were checked for S.D. effects. Second, a model was tested in which EBI is a function of RF, EK, and EV, and, in turn, determines GEB.

- $r_{S.D.-EK} = -.13, R^2 = 1.7\%, N = 441$
- $r_{S.D.-RF} = -.12, R^2 = 1.4\%, N = 444$
- $r_{S.D.-EBI} = -.13, R^2 = 1.7\%, N = 442$
- $r_{S.D.-GEB} = -.10, R^2 = 1.0\%, N = 443$

Social Desirability Effects

All five measures of interest—EK, EV, EBI, RF, and GEB—were marginally influenced by S.D. With respect to S.D., all measures either correlated nonsignificantly ( $p > .05; r_{S.D.-EV} = -.01, N = 440$ ) or only slightly, albeit significantly ( $p < .05$ ):

Environmental Attitude, Responsibility Feelings, and Ecological Behavior

Figure 2 presents the tested model: General Ecological Behavior (GEB) predicted by Ecological Behavior Intention (EBI), which, in turn, is a function of Environmental Knowledge (EK), Environmental Values (EV), and Responsibility Feelings regarding the environment (RF).

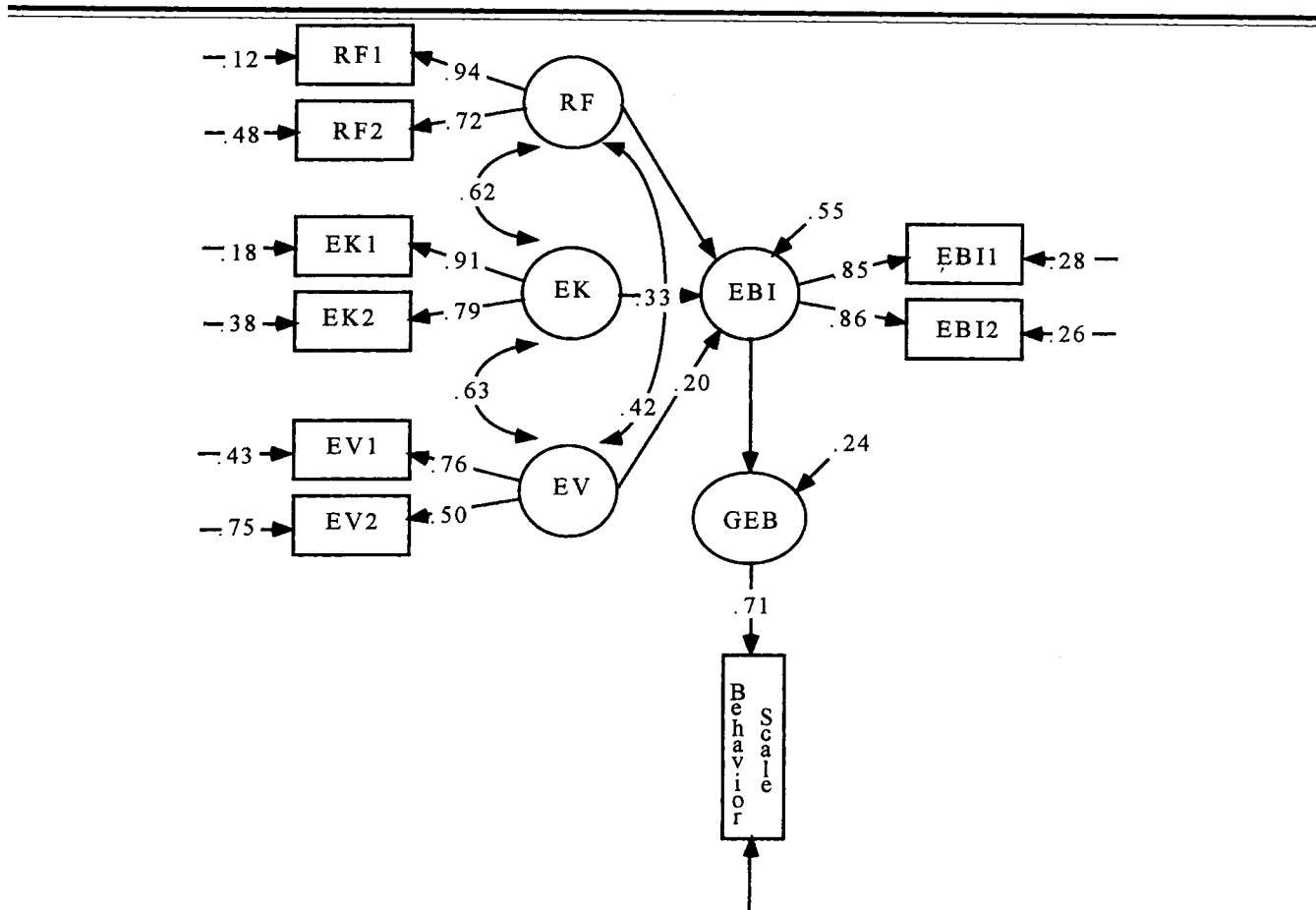


Figure 2

General Ecological Behavior (GEB) predicted by environmental attitude (EK, EV, EBI) extended by responsibility feelings (RF); Swiss adult sample  $N = 436$ .

Note: Since the relations between constructs are directed, arrows indicate such relations.  $\beta$ -coefficients (i. e., the standardized multiple regression coefficients) represent their strength. Two-sided arrows indicate Pearson correlation coefficients. Measurement errors (ME) and unexplained proportions of variances are indicated with arrows without origins. The item response theory-based reliability (for formulas see Wright & Masters, 1982) of GEB [ $\beta_{GEB-Behavior\ Scale} = .71$ ] and accordingly, the error variance [ $ME_{Behavior\ Scale} = .50$ ] is not estimated by the LISREL approach; rather, it is provided by the proposed GEB measure (see Kaiser, 1998).

The fit statistics of the proposed model turned out to be quite acceptable ( $\chi^2 = 35.27$ ,  $df = 21$ ,  $p = .026$ , non-normed fit index (NNFI) = .98, root-mean-square error of approximation (RMSEA) = .040). The number of participants for this model's test was  $N = 436$ .

Forty-five percent of the variance of EBI could be explained by the three determinants EK ( $\beta = .33$ ), EV ( $\beta = .20$ ), and RF ( $\beta = .26$ ). These three indicators of EBI themselves correlated considerably with one another ( $r_{EK-EV} = .63$ ;  $r_{EK-RF} = .62$ ;  $r_{EV-RF} = .42$ ). Seventy-six percent of the variance of GEB could be explained by one single indicator, EBI ( $\beta = .87$ ). This proportion of explained variance dropped to 38% without correction for measurement error attenuation, as  $\beta_{GEB\text{-}Behavior\ Scale} = 1.0$ .

## Discussion

We proposed an environmental attitude model that extends into the moral domain by using feelings of responsibility toward the environment as an additional predictor of ecological behavior intentions. The present results support this extension in two substantial ways.

First, Ecological Behavior Intention could be predicted more accurately by including Responsibility Feelings into the sort of conceptual structure that unifies most extant environmental attitude approaches (see Kaiser et al., in press). Although Environmental Knowledge and Environmental Values were already significant preconditions of Ecological Behavior Intention, together explaining 40% of the variance of Ecological Behavior Intention, an additional 5% of the variance could be explained by including participants' Responsibility Feelings regarding the environment. Note that this inclusion required not a single model modification. Furthermore, all correlations between the three predictors of Ecological Behavior Intention (i. e., Environmental Knowledge, Environmental Values, and Responsibility Feelings) were remarkably high ( $.42 \leq r \leq .63$ ). This finding occasionally results in researchers collapsing various sets of these attitude measures into a single scale (e. g., Berger & Corbin, 1992; Werner, Turner, Shipman, Twitchell, Dickson, Brusck, & von Bismarck, 1995). More importantly, given their strength, these intercorrelations point to influential mediated effects that usually appear to be neglected if interrelations are used only to find the most powerful predictors of ecological behavior (e. g., Gamba & Oskamp, 1994; Sia et al., 1985/86). Because Environmental Knowledge, Environmental Values, and Responsibility Feelings affect Ecological Behavior Intention directly as well as indirectly through each other, studies that test only for direct statistical effects, as in hierarchical multiple regressions, un-

derestimate the influence of at least two of the three determinants of intention. Given that direct effects are only part of the story, indirect, mediated effects need to be considered as well. Not surprisingly, studies that use different statistical techniques vary considerably in their assessment of the effectiveness of different concepts (regarding environmental knowledge: see Grob, 1995; Maloney & Ward, 1973; Oskamp et al., 1991).

The second substantial outcome relates to the possibility that questionnaires occasionally reveal the intentions of a given study to its participants. As participants might be inclined to adopt researchers' expectations, social desirability effects have to be assessed and controlled. All measures of interest, Environmental Knowledge, Environmental Values, Responsibility Feelings, Ecological Behavior Intention, and General Ecological Behavior, were at most quite diminutively ( $R^2 = 1.7\%$ ) influenced by Social Desirability. Thus, all presented analyses are only diminutively biased towards social desirability, which enhances the validity of the reported results.

Our findings are limited by the fact that the same sample was used twice: Once to successfully develop the basic, rather general, environmental attitude model (Kaiser et al., in press) that unifies different environmental attitude approaches, and then again to further extend this attitude model into the moral domain by employing responsibility feelings regarding the environment. Thus, the generalizability of the proposed model must be examined.

## Study 2

To tackle the generalizability issue, the proposed model requires replication with other samples. Study 2 addresses the question of whether the extended attitude model can be generalized beyond the particular Swiss adult sample.

### Method

#### *Participants and Procedures*

The sample consisted of 488 students who were either biology or social ecology majors at the University of California, Irvine. Sampling was accomplished from December 1995 through March 1996. All participants filled out their questionnaires during a single class period. Participants' median age was 21.0 years ( $M 21.4$ , range 17–50), and 44.4% were male.



### Measures

The questionnaire used in this study consisted of a social desirability scale, a general ecological behavior measure, three scales that represent the environmental attitude-related concepts, and a measure for responsibility feelings regarding the environment.

We used a different Social Desirability (S.D.) scale in this study because of the change in native language. However, the S.D. scale used in Study 1 (Amelang & Bartussek, 1970) is based on the Crowne and Marlowe scale used in this study. Thus, the shift should be of minor importance. The S.D. scale presented by Crowne and Marlowe (1960) consists of 33 items. Eighteen of the items must be answered "Yes" to contribute to the S.D. sum score (e. g., "I have never intensely disliked anyone"). Fifteen of the items must be answered "No" to contribute to the S.D. sum score (e. g., "I like to gossip at times"). To be consistent with the response options for the ecological behavior items, the original true/false format was changed to a Likert scale (1 = strongly disagree; 5 = strongly agree). Missing values (0.16% of all S.D. item responses) were treated as if participants tend to answer in a neutral way (i. e., they were coded to the middle category indicating neither agreement nor disagreement). Negatively formulated items were reversed in coding.

The General Ecological Behavior (GEB) measure has been calibrated as a unidimensional Rasch scale based on a partial credit model within item response theory (see Wright & Masters, 1982). Such a shift from a dichotomous to a partial credit model became necessary due to the change in the response format of the GEB items between studies, a change that was supposed to enhance the reliability of the GEB scale (see Kaiser & Wilson, in press): The original yes/no response format was changed to a Likert scale (1 = strongly disagree; 5 = strongly agree). This study's GEB measure consists of the 38 items from Study 1 and 13 new items (e. g., "I take my own coffee cup to work or school;" "I like ordering take-out from restaurants" [negatively formulated item]). The items represent different types of ecological behavior and some non-environmental prosocial behaviors (for examples, see Study 1). Missing values (0.33% of all GEB item responses) were treated as neutral responses (i. e., they were coded to the middle category indicating neither agreement nor disagreement). Negatively formulated items were reversed in coding.

Both the change in item response format and the inclusion of new items were used to demonstrate the flexibility of the GEB scale. A comparison of the two

different GEB measures used in Studies 1 and 2 revealed quite acceptable and comparable item response theory-based reliabilities (i. e.,  $r = .71$ ,  $r = .73$ , respectively; for formulas see Wright & Masters, 1982) and validity indicators (e. g., behavior difficulty estimates in California and in Switzerland correlated significantly [ $r = .51$ ]; see Kaiser & Wilson, in press).

Poor estimates of participants' GEB measures for about one third of the sample ( $N = 175$ ) required our attention. A given person's fit statistic is based on the average of all weighted, standardized, and squared behavior item residuals (see Wright & Masters, 1982). The corresponding  $t$  value is used to assess the suitability of a person's behavior estimate;  $t$  values beyond  $\pm 1.96$  indicate poor behavior estimates. Three reasons may account for these somewhat problematic GEB scores (see Kaiser & Wilson, in press):

1. Some participants' lack of conscientiousness in completing the questionnaire.
2. The overly differential response format.
3. The "restricted range" of the GEB measure.

Both the lack of conscientiousness due to low motivation and the overly differential response format, unfortunately, made answers more arbitrary and thus decreased the predictability of some GEB measures. The restricted range of the GEB measure reflects the narrow distribution of the GEB scores: The Swiss participants' GEB scores in Study 1 ranged from  $-1.50$  through  $4.36$  logits, which are the basic units of item response theory-based scales (see Wright & Masters, 1982). The California students' GEB scores in Study 2 ranged from  $-0.61$  through  $0.92$  logits. Thus, Swiss adults had an almost 4 times wider distribution than California students. As our student sample represents a homogeneous group of young adults (e. g., 94.9% of all participants are single), it appears possible that the uniform circumstances of students' lives restricted the GEB range. Such a restriction of range, in addition to the undifferentiated and unsettled behavior patterns of some of these young adults, made the GEB estimation procedure a more difficult task because even small random differences could affect a solution, resulting in some rather poor estimates. As poor GEB estimates might affect potential findings, for all analyses that include the GEB measure we restricted our sample to the 313 (488-175) participants for whom the GEB estimate appears adequate and for whom the GEB scale works reliably. Please note that this exclusion was a preliminary precautionary measure and the model test was replicated using the whole sample.

In measuring environmental attitude, a principal-factor analysis (PFA) was performed to reassess Study 1's three-factor structure of Environmental Knowledge (EK), Environmental Values (EV), and Ecological Behavior Intention (EBI). Communality estimates were iteratively derived using the highest correlation of each variable with any other variable as a starting value. The final solution was varimax rotated. Four hundred and fifty-four participants remained in the analysis, as 34 were excluded because of missing values. Twenty items from the 28 used in Study 1—with a total of 41.0% explainable variance—remained in the analysis. Eight items had to be excluded after translation from German (e.g., Tabachnick & Fidell, 1989): Five items that represented outliers with respect to the other variables (i.e., factor loadings in the unrotated matrix that were  $< .30$ ), and three items that yielded poor loadings on factors (i.e., factor loadings in the rotated matrix that were  $< .35$ ). The final three-factor solution accounted for 80.8% of the explainable variance. Factor loadings of the varimax rotated final solution can be seen in Table 1. After rotation, the explained variance is attributable to each of the three factors as follows: EK = 38.0%, EV = 26.1%, and EBI = 35.9%. The three factors either correlated non-significantly ( $p .05$ ) or correlated only marginally ( $R^2 = 1.2\%$ ), though significantly ( $p < .05$ ):  $r_{EK-EV} = .11$ ,  $r_{EK-EBI} = .06$ ,  $r_{EV-EBI} = .08$ .

Responsibility Feelings (RF) were assessed by the same 5 items used in Study 1 (see Table 1). A 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) was the response format used for all attitude-related (i.e., EK, EV, and EBI) and RF items. Negatively formulated items were reversed in coding.

The internal consistencies of all four factors, EK, EV, EBI, and RF, were estimated by standardized Cronbach's  $\alpha$ :  $\alpha_{EK} = .76$  ( $N = 470$ ),  $\alpha_{EV} = .72$  ( $N = 483$ ),  $\alpha_{EBI} = .75$  ( $N = 470$ ), and  $\alpha_{RF} = .75$  ( $N = 479$ ). For subsequent analyses, scores for EK, EV, RF, and EBI were obtained by taking the mean of the constituent items. Mean values were calculated only if participants had answered at least half of the items for each factor. The correlations between factor scores and mean values of factors indicate that the latter are useful approximations of the former:  $r_{EK} = .97$ ,  $r_{EV} = .95$ ,  $r_{RF} = .94$ ,  $r_{EBI} = .94$ . By using mean values ( $N = 488$ ) instead of factor scores ( $N = 446$ ), data for additional participants could be included in further analyses.

### Analysis

According to the factor loadings, each of the three environmental attitude-related scales as well as the RF scale was divided into two balanced subscales (EK1, EK2, EV1,

EV2, EBI1, EBI2, RF1, and RF2) that were used as input variables for the structural equation analyses. All structural equation models were assessed by means of LISREL8 (Jöreskog & Sörbom, 1993), using the maximum likelihood method. The correlation matrix was the input matrix. The correlation matrix, variable means ( $M$ ), and their standard deviations (SD) are given in Table 2.

## Results

### Social Desirability Effects

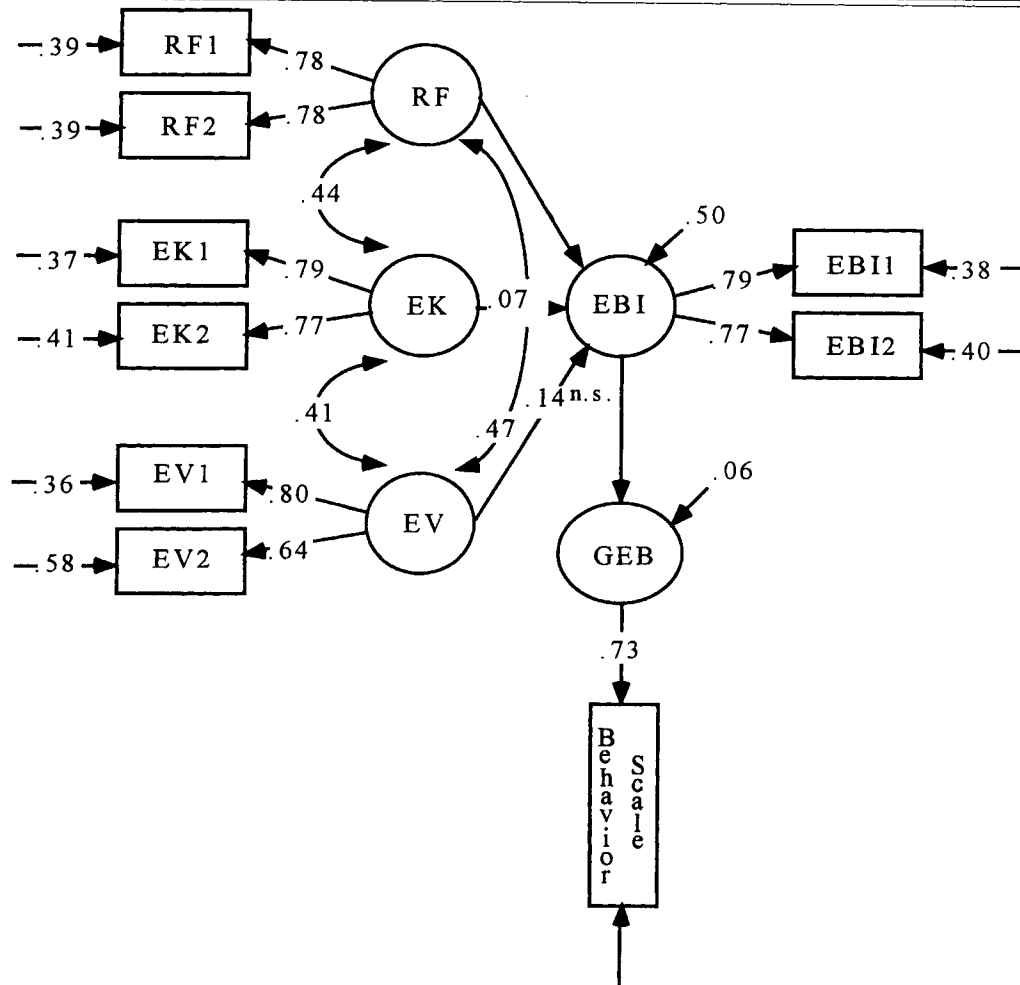
All five measures of interest—EK, EV, EBI, RF, and GEB—were statistically significantly affected by S.D. The amount of explained variance ( $R^2$ ) was in each case small to moderate:

- $r_{S.D.-EK} = .13$ ,  $p < .01$ ,  $R^2 = 1.7\%$ ,  $N = 488$
- $r_{S.D.-EV} = .19$ ,  $p < .01$ ,  $R^2 = 3.6\%$ ,  $N = 488$
- $r_{S.D.-RF} = .15$ ,  $p < .01$ ,  $R^2 = 2.3\%$ ,  $N = 488$
- $r_{S.D.-EBI} = .24$ ,  $p < .01$ ,  $R^2 = 5.8\%$ ,  $N = 488$
- $r_{S.D.-GEB} = .29$ ,  $p < .01$ ,  $R^2 = 8.4\%$ ,  $N = 488$

### Environmental Attitude, Responsibility Feelings, and Ecological Behavior

Figure 3 presents the tested model: General Ecological Behavior (GEB) predicted by Ecological Behavior Intention (EBI), which, in turn, is a function of Environmental Knowledge (EK), Environmental Values (EV), and Responsibility Feelings regarding the environment (RF). The fit statistics of the proposed model turned out to again be quite acceptable and very much comparable to the fit statistics in Study 1 ( $\chi^2 = 28.03$ ,  $df = 21$ ,  $p = .14$ , NNFI = .99, RMSEA = .033). The number of participants for this model's test was  $N = 313$ .

Fifty percent of the variance of EBI could be explained by three determinants: EK ( $\beta = .07$ ), EV ( $\beta = .14$ ), and RF ( $\beta = .59$ ). However, only RF affected EBI directly in a significant way. As these three indicators of EBI themselves correlated considerably with one another ( $r_{EK-EV} = .41$ ;  $r_{EK-RF} = .44$ ;  $r_{EV-RF} = .47$ ), at least indirect knowledge (EK) and value (EV) effects have to be assumed. Ninety-four percent of the reliable variance of GEB could be explained by one single indicator, EBI ( $\beta = .97$ ). Although this effect appears to be quite impressive, it was not statistically significant, given the large standard error due to measurement error. Note that the proportion of explained variance dropped to a statistically significant 50% without correction for measurement error attenuation, as  $\beta_{GEB\text{-}Behavior\text{ Scale}} = 1.0$ .



**Figure 3**

General Ecological Behavior (GEB) predicted by environmental attitude (EK, EV, EBI) extended by responsibility feelings (RF); California student sample  $N = 313$ .

Note: The item response theory-based reliability (see Wright & Masters, 1982) of GEB [ $\beta_{\text{GEB-Behavior Scale}} = .73$ ] and accordingly the error variance [ $ME_{\text{Behavior Scale}} = .47$ ] is not estimated by the LISREL approach; rather, it is provided by the proposed GEB measure (see Kaiser & Wilson, in press).

Discussion

The present findings both confirm and modify various aspects of the findings from Study 1. The relational structure of the proposed model was confirmed; not a single model modification had to be made. While the extended attitude model held true even for a California student sample, some differential effects (i. e., quantitative differences between relational estimates) were also found. Our findings lend even more credit to the notion that environmental attitude theories grounded in a rational-choice perspective should be extended further into the moral domain (Thøgersen, 1996).

The first major finding is that Ecological Behavior Intention could be predicted more accurately by adding Responsibility Feelings into the rather general environmental attitude approach. This study explained 50% of the variance of Ecological Behavior Intention with the three concepts of Environmental Knowledge, Environmental Values, and Responsibility Feelings. Once again, all three predictors of Ecological Behavior Intention were interrelated ( $.41 \leq r \leq .47$ ). This finding continues to highlight the importance of mediation within attitudinal approaches.

The distributions of both Environmental Knowledge ( $M = 4.2$ ;  $SD = .56$ ;  $N = 488$ ) and Environmental

Values ( $M = 4.1$ ;  $SD = .74$ ;  $N = 488$ ) were concentrated toward the knowledgeable and environmentally oriented anchors on the 5-point Likert scale. This result suggests that, like the Swiss adults, the students already knew a good deal about the environment and held the same rather environmentally oriented values. Contrary to the Swiss sample, however, neither knowledge nor values made a real difference regarding their behavior intentions. Nevertheless, if knowledge and values are already in place, and if moral inclinations become the overarching determinant of intentions, both knowledge and values remain indirectly influential. Hence, they are important prerequisites of one's behavioral intentions (see Newhouse, 1990, regarding environmental knowledge). In other words, although one's responsibility feelings regarding the environment can become the main predictor ( $\beta = .59$ ), others, such as knowledge and values, remain necessary prerequisites of intentions.

A second major finding emphasizes the differential influences on Ecological Behavior Intention. On the one side, Environmental Knowledge, Environmental Values, and Responsibility Feelings were confirmed as determinants of Ecological Behavior Intention. On the other side, the relative influence of each of these concepts did vary across different groups of people. This finding is congruent with that of a recent international comparison of differential attitudinal influences on ecological behaviors (Lévy-Leboyer, Bonnes, Chase, Ferreira-Marques, & Pawlik, 1996). Within Study 1's more mature adult Swiss sample, which presumably represents the heterogeneity of the whole Swiss adult population (e. g., Kaiser et al., in press), all predictors appeared to be directly as well as indirectly effective. Within this study's more homogeneous student sample, however, the direct influences of Environmental Knowledge ( $\beta = .07$ ) and Environmental Values ( $\beta = .14$ ) dropped to insignificance.

A third major finding refers to the sole determination of General Ecological Behavior by Ecological Behavior Intention. Behavioral intentions predicted up to 94% of the reliable variance of behavior. However, it is worth noting that this estimate ( $\beta = .97$ ) was non-significant due to the amount of unreliable variance. Obviously, students' behavior remained, regardless of their intentions, to some extent unpredictable. This finding is presumably related to difficulties in estimating students' GEB scores (see below). Note, however, that it is not related to the GEB measure's scale qualities and, thus, its usefulness (e. g., Kaiser & Wilson, in press).

Two limitations of Study 2 deserve mention. The first relates to the influence of the California students' readiness to adopt social expectations. Because ques-

tionnaire data are sensitive to social desirability effects, such effects have to be controlled. All measures of interest (i. e., Environmental Knowledge, Environmental Values, Responsibility Feelings, Ecological Behavior Intention, but most of all, General Ecological Behavior) were significantly affected by Social Desirability ( $R^2$  max. = 8.4%). These findings suggest that California students were more inclined than more mature Swiss' adults to provide data that they expected they should produce. Although relevant, these results do not throw into question the validity of the reported findings, given that 94% (50% without correction for measurement error attenuation) of the variance of General Ecological Behavior could be explained by Ecological Behavior Intention. However, they reveal another source that contributed to the error variance, such that even an apparently impressive relation like the one between Ecological Behavior Intention and General Ecological Behavior ( $\beta = .97$ ) was statistically non-significant. The second limitation of the present study involves the poor General Ecological Behavior estimates for a considerable proportion ( $N = 175$ ) of the original student sample ( $N = 488$ ) and the resulting preliminary exclusion of these participants from the study.

As inaccurate General Ecological Behavior estimates could be related to the unsettled life circumstances of these fairly young participants, one might expect the knowledge, values, intentions, and responsibility feelings of these students to also be unsettled. This claim refers to a general increase in unpredictability (i. e., an increase in error) with the inclusion of the other 175, a proposition that can be tested. The fit statistics for the whole model (see, e. g., Figure 3) got worse when the whole sample was included:  $N = 488$ ;  $\chi^2 = 56.27$ ,  $df = 21$ ,  $p < .001$ , NNFI = .96, RMSEA = .059. Hence, this decrease in fit supports the proposition that approximately one third of our student sample appeared to be unsettled regarding the interrelationship between knowledge, values, responsibility feelings, behavior intentions, and ecological behavior. This finding provides a rationale for the exclusion of the 175 unsettled participants. However, note that the  $\chi^2$  statistic is affected by sample size, which increases from  $N = 313$  to  $N = 488$ , a fact that can be held at least partially accountable for the decrease in the model fit. Note also that the model fit indicator, which is independent of sample size (i. e., NNFI), decreased by only 3%, suggesting that the model still fits quite well (i. e., 96%). Thus, this additional finding supports, on the one hand, our precautionary measure of excluding the 175 unsettled participants. On the other hand, the model fit for the whole sample ( $N = 488$ ) largely credits the

findings yielded by the smaller sample ( $N = 313$ ) of California students.

## General Discussion

Environmental attitude theories grounded in a rational-choice perspective must be located within the realm of conventionality, and so do not consider moral norms. Not surprisingly, such theories do not sufficiently explain both ecological behavioral intentions and behavior if at least some people perceive ecological behavior as a moral behavior. This is not to say that conventional social influences are not effective in the ecological domain (e. g., Hornik, Cherian, Madansky, & Narayana, 1995; Schultz et al., 1995), but rather that conventional social norms are only part of the story. Based on an attitude approach proposed as the least common denominator of most environmental attitude models (Kaiser et al., in press), an expanded rational-choice model was proposed (Figure 1), in which feelings of personal responsibility toward the environment were used to extend the theory's explanatory part into the moral domain. Contrary to an international comparison study which found solely culturally specific results (Lévy-Leboyer et al., 1996), the two studies presented here support the generalizability of the proposed attitude model across different countries.

Although improved (by including Responsibility Feelings) to 45%–50%, the proportion of explained variance of Ecological Behavior Intention was not yet fully satisfactory. Two additional types of measures appear worth considering. One involves including alternative predictors into an even more extended attitude model. For example, environmental affect is a concept, widely used in the environmental attitude domain (e. g., Maloney & Ward, 1973), that we have not yet included. Perceived control, which transforms the theory of reasoned action into the theory of planned behavior (Madden et al., 1992), would be another candidate. A second type of extension would involve using the appropriate measures suggested by the theory of reasoned action (Ajzen & Fishbein, 1980). Given that neither attitude toward ecological behavior nor subjective norms regarding ecological behavior are used as predictors of ecological behavior intentions, the amount of explained variance of ecological behavior intentions could well increase if these more behavior-proximal measures were considered. They represent the theory of reasoned action and its rational-choice scope more accurately than environ-

mental knowledge and values as assessed in the present studies.

Room for improvement regarding the presented findings might also be seen in the variations of the measures used in both studies. Although all but one (i. e., Responsibility Feelings) of the measures used vary between the two studies, they remain fairly stable (Table 1). Of course, one can insist that since these measures were not identical, they did not measure exactly the same thing. Yet measurement variation can also be regarded as an advantage. Given that ideas (e. g., intelligence) rather than measurement procedures (e. g., IQ tests) define concepts, then measurement variations (a) allow us to generalize concepts beyond measurement procedures and across different groups of people and, thus (b) leave concepts open for differential operational definitions. Note, for example, some of the items excluded from Study 2 for having insufficient factor loadings (see Table 1): Item 3, on the interdependence of living things, loaded on the Environmental Knowledge scale for the Swiss sample, but not for the US college students; this may be due to the universal quantifier "all," which American students are often taught to view with suspicion in objective testing situations. Even more striking are items excluded from the Ecological Behavior Intention scale for the US participants (Items 3, 8, and 11 in Table 1). Swiss drivers quite often turn off their engines at red lights (see Item 8) to reduce pollutants; in the US, turning off one's engine is both a rarity and seems to be done more for fuel-consumption purposes and/or if one is in a traffic jam on the freeway. Items 3 and 11 refer to lifestyle differences among Swiss adults and American college students: As Americans face huge distances and poorly developed train service, it becomes much more difficult for them to travel without airplanes (see Item 11). It may not only be a matter of nationality; for example, speeding on freeways may be more tempting for younger than for older adults (see Item 3).

In sum, the extended environmental attitude framework proposed here appears promising, given that it held for both Swiss adults and California college students. Forty-five to 50% of the ecological behavior intentions, which, in turn, predicted 76%–94% of one's ecological behavior, could be explained by environmental knowledge, environmental values, and feelings of responsibility toward the environment. Although the model was of general utility, it is also understandable that some differential effects could be found by looking across different groups of people. While for some people conventional social norms and considerations may readily manifest themselves in ecological behavior

(Hornik et al., 1995; Schultz et al., 1995), moral social norms and reasons may drive the behavior of others (Howe et al., 1996; Kahn & Friedman, 1995). Such differential effects need to be considered if we are to effectively modify ecological behavior.

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### References

- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From cognition to behavior* (pp. 11–39). Berlin, Germany: Springer.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Amelang, M., & Bartussek, D. (1970). Untersuchungen zur Validität einer neuen Lügen-Skala [Validity studies of a new lying scale]. *Diagnostica*, 16, 103–122.
- Amelang, M., Tepe, K., Vagt, G., & Wendt, W. (1977). Mitteilung über einige Schritte der Entwicklung einer Skala zum Umweltbewusstsein [Report about some developmental steps of an environmental concern scale]. *Diagnostica*, 23, 86–88.
- Arbuthnot, J. (1977). The roles of attitudinal and personality variables in the prediction of environmental behavior and knowledge. *Environment and Behavior*, 9, 217–232.
- Axelrod, L.J., & Lehman, D.R. (1993). Responding to environmental concern: What factors guide individual action? *Journal of Environmental Psychology*, 13, 149–159.
- Becker, L.J., Seligman, C., Fazio, R.H., & Darley, J.M. (1981). Relating attitudes to residential energy use. *Environment and Behavior*, 13, 590–609.
- Berger, I.E., & Corbin, R.M. (1992). Perceived consumer effectiveness and faith in others as moderators of environmentally responsible behaviors. *Journal of Public Policy & Marketing*, 11, 79–89.
- Biel, A., & Gärling, T. (1995). The role of uncertainty in resource dilemmas. *Journal of Environmental Psychology*, 15, 221–233.
- Crowne, D.P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology*, 24, 349–354.
- Derksen, L., & Gartrell, J. (1993). The social context of recycling. *American Sociological Review*, 58, 434–442.
- Dispoto, R.G. (1977). Interrelationships among measures of environmental activity, emotionality, and knowledge. *Educational and Psychological Measurement*, 37, 451–459.
- Dunlap, R.E., & Van Liere, K.D. (1978). The “new environmental paradigm”: A proposed instrument and preliminary results. *Journal of Environmental Education*, 9, 10–19.
- Fridgen, C. (1994). Human disposition toward hazards: Testing the environmental appraisal inventory. *Journal of Environmental Psychology*, 14, 101–111.
- Fuhrer, U. (1995). Sozialpsychologisch fundierter Theorierahmen für eine Umweltbewusstseinsforschung [Social psychological framework for research on environmental concern]. *Psychologische Rundschau*, 46, 93–103.
- Fuhrer, U., & Wölfling, S. (1997). *Von den sozialen Grundlagen des Umweltbewusstseins zum verantwortlichen Umwelthandeln: Die sozialpsychologische Dimension globaler Umweltproblematik* [From the social basis of environmental concern to responsible ecological action: The social-psychological dimension of global environmental problems]. Bern, Switzerland: Huber.
- Gamba, R.J., & Oskamp, S. (1994). Factors influencing community residents' participation in commingled curbside recycling programs. *Environment and Behavior*, 26, 587–612.
- Granzin, K.L., & Olsen, J.E. (1991). Characterizing participants in activities protecting the environment: A focus on donating, recycling, and conservation behaviors. *Journal of Public Policy & Marketing*, 10, 1–27.
- Grob, A. (1995). A structural model of environmental attitudes and behaviour. *Journal of Environmental Psychology*, 15, 209–220.
- Guagnano, G.A., Stern, P.C., & Dietz, T. (1995). Influences on attitude-behavior relationships: A natural experiment with curbside recycling. *Environment and Behavior*, 27, 699–718.
- Hallin, P.D. (1995). Environmental concern and environmental behavior in Foley, a small town in Minnesota. *Environment and Behavior*, 27, 558–578.
- Hamid, P.N., & Cheng, S.-T. (1995). Predicting antipollution behavior: The role of molar behavioral intentions, past behavior, and locus of control. *Environment and Behavior*, 27, 679–698.
- Heberlein, T.A. (1972). The land ethic realized: Some social psychological explanations for changing environmental attitudes. *Journal of Social Issues*, 28, 79–87.
- Heberlein, T.A., & Black, J.S. (1976). Attitudinal specificity and the prediction of behavior in a field setting. *Journal of Personality and Social Psychology*, 33, 474–479.
- Hines, J.M., Hungerford, H.R., & Tomera, A.N. (1986/87). Analysis and synthesis of research on responsible environmental

- behavior: A meta-analysis. *Journal of Environmental Education*, 18, 1–8.
- Hopper, J.R., & Nielsen, J.M. (1991). Recycling as altruistic behavior: Normative and behavioral strategies to expand participation in a community program. *Environment and Behavior*, 23, 195–220.
- Hornik, J., Cherian, J., Madansky, M., & Narayana, C. (1995). Determinants of recycling behavior: A synthesis of research results. *Journal of Socio-Economics*, 24, 105–127.
- Howe, D.C., Kahn, P.H., & Friedman, B. (1996). Along the Rio Negro: Brazilian children's environmental views and values. *Developmental Psychology*, 32, 979–987.
- Hunecke, M. (1996). Ökologische Verantwortung: Ein Auslaufmodell in einer Kosten-Nutzen-Welt? [Ecological responsibility: An expired concept in a rational-choice world?]. *IPU Rundbrief*, 5 (1), 38–47.
- Jöreskog, K., & Sörbom, D. (1993). *LISREL8: Structural equation modeling with the SIMPLIS command language*. Hillsdale, NJ: Erlbaum.
- Kahn, P.H. (1997). Developmental psychology and the biophilia hypothesis: Children's affiliation with nature. *Developmental Review*, 17, 1–61.
- Kahn, P.H., & Friedman, B. (1995). Environmental views and values of children in an inner-city black community. *Child Development*, 66, 1403–1417.
- Kaiser, F.G. (1998). A general measure of ecological behavior. *Journal of Applied Social Psychology*, 28, 395–422.
- Kaiser, F.G., & Shimoda, T.A. (in press). Responsibility as a predictor of ecological behavior. *Journal of Environmental Psychology*.
- Kaiser, F.G., & Wilson, M. (in press). Assessing people's general ecological behavior: A cross-cultural measure. *Journal of Applied Social Psychology*.
- Kaiser, F.G., Wöfling, S., & Fuhrer, U. (in press). Environmental attitude and ecological behavior. *Journal of Environmental Psychology*.
- Kals, E., & Montada, L. (1994). Umweltschutz und die Verantwortung der Bürger [Pollution control and the responsibility of the citizens]. *Zeitschrift für Sozialpsychologie*, 25, 326–337.
- Kantola, S.J., Syme, G.J., & Nesdale, A.R. (1983). The effects of appraised severity and efficacy in promoting water conservation: An informational analysis. *Journal of Applied Social Psychology*, 13, 164–182.
- Keltner, D., & Buswell, B.N. (1996). Evidence for the distinctness of embarrassment, shame, and guilt: A study of recalled antecedents and facial expressions of emotion. *Cognition and Emotion*, 10, 155–171.
- Kempton, W., Boster, J.S., & Hartley, J.A. (1995). *Environmental values in American culture*. Cambridge, MA: MIT Press.
- Larsen, K.S. (1995). Environmental waste: Recycling attitudes and correlates. *Journal of Social Psychology*, 135, 83–88.
- Leonard-Barton, D. (1981). Voluntary simplicity lifestyles and energy conservation. *Journal of Consumer Research*, 8, 243–252.
- Lévy-Leboyer, C., Bonnes, M., Chase, J., Ferreira-Marques, J., & Pawlik, K. (1996). Determinants of pro-environmental behaviors: A five countries comparison. *European Psychologist*, 1, 123–129.
- Lynne, G.D., & Rola, L.R. (1988). Improving attitude-behavior prediction models with economic variables: Farmer actions toward soil conservation. *Journal of Social Psychology*, 128, 19–28.
- Madden, T.J., Ellen, P.S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin*, 18, 3–9.
- Maloney, M.P., & Ward, M.P. (1973). Ecology: Let's hear from the people. An objective scale for the measurement of ecological attitudes and knowledge. *American Psychologist*, 28, 583–586.
- Maloney, M.P., Ward, M.P., & Braucht, G.N. (1975). Psychology in action: A revised scale for the measurement of ecological attitudes and knowledge. *American Psychologist*, 30, 787–790.
- McCarty, J.A., & Shrum, L.J. (1994). The recycling of solid wastes: Personal values, value orientations, and attitudes about recycling as antecedents of recycling behavior. *Journal of Business Research*, 30, 53–62.
- McGuinness, J., Jones, A.P., & Cole, S.G. (1977). Attitudinal correlates of recycling behavior. *Journal of Applied Psychology*, 62, 376–384.
- Midden, C.J.H., & Ritsema, B.S.M. (1983). The meaning of normative processes for energy conservation. *Journal of Economic Psychology*, 4, 37–55.
- Moore, S., Murphy, M., & Watson, R. (1994). A longitudinal study of domestic water conservation behavior. *Population and Environment: A Journal of Interdisciplinary Studies*, 16, 175–189.
- Mosler, J. (1993). Self-dissemination of environmentally-responsible behavior: The influence of trust in a commons dilemma game. *Journal of Environmental Psychology*, 13, 111–123.
- Newhouse, N. (1990). Implications of attitude and behavior research for environmental conservation. *Journal of Environmental Education*, 22, 26–32.
- Olsen, M.E. (1981). Consumers' attitudes toward energy conservation. *Journal of Social Issues*, 37, 108–131.
- Oskamp, S., Harrington, M.J., Edwards, T.C., Sherwood, D.L., Okuda, S.M., & Swanson, D.C. (1991). Factors influencing household recycling behavior. *Environment and Behavior*, 23, 494–519.
- Schahn, J., & Holzer, E. (1990). Studies of individual environmental concern. The role of knowledge, gender, and background variables. *Environment and Behavior*, 22, 767–786.
- Schultz, P.W., & Oskamp, S. (1996). Effort as a moderator of the attitude-behavior relationship: General environmental concern and recycling. *Social Psychology Quarterly*, 59, 375–383.
- Schultz, P.W., Oskamp, S., & Mainieri, T. (1995). Who recycles and when? A review of personal and situational factors. *Journal of Environmental Psychology*, 15, 105–121.
- Schwartz, S.H. (1977). Normative influences on altruism. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 10, pp. 221–271). New York: Academic Press.
- Scott, D., & Willits, F.K. (1994). Environmental attitudes and behavior: A Pennsylvania survey. *Environment and Behavior*, 26, 239–260.

- Shean, G.D., & Shei, T. (1995). The values of student environmentalists. *Journal of Psychology, 129*, 559–564.
- Sia, A.P., Hungerford, H.R., & Tomera, A.N. (1985/86). Selected predictors of responsible environmental behavior: An analysis. *Journal of Environmental Education, 17*, 31–40.
- Smythe, P.C., & Brook, R.C. (1980). Environmental concerns and actions: A social-psychological investigation. *Canadian Journal of Behavioural Science, 12*, 175–186.
- Stern, P.C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior, 25*, 322–348.
- Stutzman, T.M., & Green, S.B. (1982). Factors affecting energy consumption: Two field tests of the Fishbein-Ajzen model. *Journal of Social Psychology, 117*, 183–201.
- Tabachnick, B.G., & Fidell, L.S. (1989). *Using multivariate statistics* (2nd ed.). New York: Harper.
- Taylor, S., & Todd, P. (1995). An integrated model of waste management behavior: A test of household recycling and composting intentions. *Environment and Behavior, 27*, 603–630.
- Thøgersen, J. (1996). Recycling and morality: A critical review of the literature. *Environment and Behavior, 28*, 536–558.
- Tugendhat, E. (1994). *Vorlesungen über Ethik* [Lectures on ethics] (2nd ed.). Frankfurt a.M., Germany: Suhrkamp.
- Turiel, E. (1985). *The development of social knowledge. Morality and convention* (2nd ed.). Cambridge, MA: University Press.
- Van der Pligt, J. (1985). Energy conservation: Two easy ways out. *Journal of Applied Social Psychology, 15*, 3–15.
- Van Liere, K.D., & Dunlap, R.E. (1978). Moral norms and environmental behavior: An application of Schwartz's norm-activation model to yard burning. *Journal of Applied Social Psychology, 8*, 174–188.
- Van Liere, K.D., & Dunlap, R.E. (1981). Environmental concern: Does it make a difference how it's measured? *Environment and Behavior, 13*, 651–676.
- Verhallen, T.M.M., & Van Raaij, W.F. (1981). Household behavior and the use of natural gas for home heating. *Journal of Consumer Research, 8*, 253–257.
- Vining, J., & Ebreo, A. (1992). Predicting recycling behavior from global and specific environmental attitudes and changes in recycling opportunities. *Journal of Applied Social Psychology, 22*, 1580–1607.
- Werner, C.M., Turner, J., Shipman, K., Twitchell, F.S., Dickson, B.R., Brusckke, G.V., & von Bismarck, W.B. (1995). Commitment, behavior, and attitude change: An analysis of voluntary recycling. *Journal of Environmental Psychology, 15*, 197–208.
- Wright, B., & Masters, G.N. (1982). *Rating scale analysis: Rasch measurement*. Chicago: MESA.

## Notes

<sup>1</sup> "Environmental" and "ecological" are technical terms as they are used in the PsychInfo database. The former is the psychological index term related to attitude, while the latter is the one related to behavior. It is not our intention to distinguish them beyond this common usage. Ecological behavior means "actions which contribute towards environmental preservation and/or conservation" (Axelrod & Lehman, 1993, p. 153). As ecological behaviors from different domains represent a unidimensional concept (Kaiser, 1998), the term ecological behavior used in this paper refers to specific behaviors as well as to general behavior measures. Specific behaviors include recycling (e. g., Guagnano, Stern, & Dietz, 1995; McCarty & Shrum, 1994), composting (e. g., Taylor & Todd, 1995), energy conservation (e. g., Midden & Ritsema, 1983; Van der Pligt, 1985), political activism (e. g., Hamid & Cheng, 1995; Stern, Dietz, & Kalof, 1993), consumerism (e. g., Scott & Willits, 1994), commitment to environmental organizations (e. g., Shean & Shei, 1995), ecological farming (e. g., Lynne & Rola, 1988), water conservation (e. g., Kantola, Syme, & Nesdale, 1983; Moore, Murphy, & Watson, 1994), and so forth. General behavior indices are used, for instance, in Dunlap and Van Liere (1978), Grob (1995), Maloney and Ward (1973), McGuinness, Jones, and Cole (1977), and Sia, Hungerford, and Tomera (1985/86).

<sup>2</sup> Although the theory of planned behavior (e. g., Ajzen, 1985) is an empirically successful extension of the theory of reasoned action (see Madden et al., 1992), its flaw derives from the assumption that perceived control reflects actual control upon a certain behavior with some accuracy (see Kaiser et al., in press).