DOCUMENT RESUME

ED 409 179 SE 060 332

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TITLE Environmental Attitude and Ecological Behavior.
PUB DATE Aug 96
NOTE 65p.; Paper presented at the Annual Meeting of the American Psychological Association (104th, Toronto, Ontario, Canada, August 9-13, 1996).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Attitudes; Cognitive Structures; Environment; *Environmental Education; Factor Analysis; Foreign Countries; Psychology; Quality of Life; Questionnaires; *Science and Society; Values
IDENTIFIERS Environmental Attitudes; *Environmental Psychology; Switzerland

ABSTRACT

This paper establishes environmental attitude, a construct in environmental psychology, as a powerful predictor of ecological behavior. Based on Ajzen's theory of planned behavior, this study uses a unified concept of attitude and a probabilistic measurement approach. Questionnaire data from members of two ideologically different Swiss transportation associations are used. The study confirms three measures of orthogonal dimensions by means of factor analysis: (1) environmental knowledge; (2) environmental values; and (3) ecological behavior intention. One other measure, general ecological behavior, is established as a Rasch-scale that assesses behavior by considering influences beyond a person's actual behavior control. A structural equation model was used to confirm the proposed model: environmental knowledge and environmental values explain 40% of the variance of ecological behavior intention which, in turn, predicts 75% of the variance of general ecological behavior. Contains 78 references. (Author/DDR)

# Environmental Attitude and Ecological Behavior

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Paper presented at the 104th Annual Convention of the American Psychological Association (APA), Toronto, Ontario, Canada, August 9-13, 1996

Abstract

This paper establishes environmental attitude -- the most often used construct in environmental psychology -- as a powerful predictor of ecological behavior. Past studies failed in this enterprise because they did not consider three shortcomings that limit the predictive power of environmental attitude concepts: (a) the lack of a unified concept of attitude, (b) the lack of measurement correspondence between attitude and behavior on a general level, and (c) the lack of consideration of behavior constraints beyond people's control. Based on Ajzen's theory of planned behavior, the present study uses a unified concept of attitude and a probabilistic measurement approach to overcome these shortcomings. Questionnaire data from members of two ideologically different Swiss transportation associations are used.

This study confirms three measures as orthogonal dimensions by means of factor analysis: (1) general Environmental Knowledge, (2) general Environmental Values, and (3) general Ecological Behavior Intention. One other measure, General Ecological Behavior, is established as a Rasch-scale that assesses behavior by considering the tendency to behave ecologically and the difficulties in carrying out the behaviors, both of which, in turn, depend on influences beyond people's actual behavior control. A structural equation model was used to confirm the proposed model: Environmental Knowledge and Environmental Values explain 40% of the variance of Ecological Behavior Intention which, in turn, predicts 75% of the variance of General Ecological Behavior.

# Environmental Attitude and Ecological Behavior[1]

Global environmental problems of shrinking natural resources, pollution, and population growth challenge the ways people live. As with many other disciplines, psychology attempts to develop human societies less exploitive in their use of earth's natural resources (cf. Stern, 1992a; Kruse, 1995). Because psychologists refer to individual behavior rather than to behavior of whole societies they ask questions such as, What determines an individual's ecological behavior (i.e., "actions which contribute towards environmental preservation and/or conservation," Axelrod & Lehman, 1993, p.153)? Or, How can behavior be changed in a more ecological direction? In answering these questions, environmental attitude is considered one of the most promising concepts (Newhouse, 1990). In fact, almost two thirds of all environmental psychological publications include environmental attitude in one way or another.[2] Not surprisingly, the relation between environmental attitude and ecological behavior is well-explored.[3] However, the relation appears to be at best moderate across different studies (e.g., Hines, Hungerford, & Tomera 1986/87). This lack of a stronger correlation occasionally results in rather pessimistic views of the usefulness of environmental attitude as a predictor of ecological behavior[4] (Stern, 1978; Lloyd, 1980).

The present paper proposes three reasons -- one theoretical and two methodological -- that affect the predictive power of environmental attitude concepts. From a theoretical point of view, there are at least three main research traditions that use quite different attitude concepts. The differences confuse

the comparison of research results in the ecological domain. The two methodological flaws that affect any attitude-behavior relation, also affect the environmental attitude and ecological behavior relation. These two flaws are the lack of measurement correspondence and the lack of consideration of situational influences on a given behavior. Measurement correspondence refers to measurement of attitude and behavior on the same level of specificity (see e.g., Ajzen & Fishbein, 1977). Because of the multitude of situational influences, the level of specificity should be rather general. Situational influences refer to constraints and facilities on behavior beyond people's control (see e.g., Ajzen & Madden, 1986). Inclusions of such behavior influences are seen as particularly important in the ecological domain (Hines et al., 1986/87; Granzin & Olsen, 1991; Vining & Ebreo, 1992; Stern, 1992b; Foppa, Tanner, Jaeggi, & Arnold, 1995; Guagnano et al., 1995). Such influences are usually considered either as moderator effects on the relation between environmental attitude and ecological behavior or as direct influences on ecological behavior. Both approaches require a rather arbitrary selection of possible influences.

The present paper promotes the theory of planned behavior (Ajzen, 1985, 1991; Schifter & Ajzen, 1985; Ajzen & Madden , 1986) as an overall theoretical framework in the ecological domain. Moreover, both of the methodological shortcomings can be overcome by using a probabilistic measurement approach for the assessment of ecological behavior.

## Three Environmental Attitude Approaches and Ecological Behavior

In essence, two types of environmental attitude[5] are used to predict ecological behavior: (a) attitudes toward the environment, and (b) attitudes toward ecological behavior (Hines et al., 1986/87; the same is proposed for energy conservation by Olsen, 1981). Either the object of one's attitude is the natural environment itself or some aspects of it (e.g., air quality) or the attitude object is ecological behavior (e.g., recycling, political activism). Environmental attitude toward ecological behavior refers to the Fishbein and Ajzen tradition of attitude research that will be described in more detail later. Only a minority of the studies (approx. 20% of the studies according to Hines et al., 1986/87) that relate environmental attitude with ecological behavior refer to the framework of the theory of reasoned action (e.g., Ajzen & Fishbein, 1972) and its developed version the theory of planned behavior (e.g., Ajzen & Madden, 1986). In contrast, attitude toward the environment commonly refers to environmental concern (Vining & Ebreo, 1992). Environmental concern is used either as a multiple or single component approach (Fuhrer, 1995) and covers either environment in general or some particular aspects of environment.

If attitude toward environment refers to a multiple component approach, the distinction between cognitive, affective, and intentional components of attitude (proposed by Rosenberg & Hovland, 1960) is usually made. This research tradition of environmental attitudes can be traced back to two studies by Maloney and colleagues (Maloney & Ward, 1973;

Maloney, Ward, & Braucht, 1975). An Affect scale measures the affective component, factual Knowledge about the environment measures the cognitive aspects, and Verbal Commitment measures the behavior intention component of environmental attitude (Smythe & Brook, 1980). A fourth scale measures Ecological Behavior.[6]

Originally, all three environmental attitude components -- affect, knowledge (i.e., cognition), and intention -- were used in parallel to predict ecological behavior. Recent versions of this approach vary: some propose the affect component as the single indicator of environmental attitude (Langheine & Lehmann, 1986; Newhouse, 1990), others abandon ecological behavior intention (Dispoto, 1977), while a third group uses the ecological behavior intention component as the single indicator of environmental attitude (Schahn & Holzer, 1990a, 1990b; Auhagen & Neuberger, 1994).

Moreover, instead of using these environmental attitude components in parallel, some approaches use the concepts (knowledge, affect, and intention) in a more sequential way to predict either environmental attitude or ecological behavior (Geller, 1981; Diekmann & Franzen, 1995; Grob, 1995). Consequently, environmental attitude is, occasionally, measured independently from its cognitive, affective, and intentional components. Hence, one's attitude toward the environment can become a single component measure (Arbuthnot, 1977; Van der Pligt, 1985; Oskamp et al., 1991; Lansana, 1992; Derksen & Gartell, 1993; Gamba & Oskamp, 1994). If attitude toward the environment refers to a single component approach, this attitude can be predicted by knowledge, affect, and

intention as already mentioned. Occasionally, however, environmental attitude is measured by knowledge, affect, and intention items (Sia, Hungerford, & Tomera, 1985/86; Axelrod & Lehman, 1993; Berger & Corbin, 1992).

The New Environmental Paradigm (NEP), which is the third and most recently developed tradition of environmental attitude research (e.g., Dunlap & Van Liere, 1978; Stern et al., 1993; Scott & Willits, 1994), is an alternative, single component measure of environmental attitude. Some question its unidimensionality and use it instead as a multiple component measure consisting of dimensions such as Balance of Nature, Limits of Growth, and Humans over Nature (cf. Vining & Ebreo, 1992). Because proponents of this tradition regard one's moral values as the core concept of environmental attitude (e.g., Stern et al., 1993) it may be argued that NEP represents a shift toward a more evaluative conception of attitude (see Schahn & Holzer, 1990a; or cf. Dunlap & Van Liere, 1978; such a shift can be seen in other attitude concepts as well: e.g., Verhallen & Van Raaij, 1981; Van Liere & Dunlap, 1981; Leonard-Barton, 1981; Axelrod & Lehman, 1993). This interpretation is additionally supported by the fact that NEP findings barely match those regarding the relation between environmental attitude and ecological behavior. In short, the strength of the relation between the NEP and ecological behavior ranges from non-existent (Smith et al., 1994) to weak (Dunlap & Van Liere, 1978; Scott & Willits, 1994). Conversely, environmental attitude and ecological behavior appear to be at least moderately related (Hines et al., 1986/87).

Because the empirical findings of the field will be presented in regard to a general theoretical framework, the following section introduces the theory of planned behavior as this frame. The proposed frame encompasses most aspects of the three formerly mentioned attitude concepts.

A General Framework: The Theory of Planned Behavior

In the theory of reasoned action (e.g., Ajzen & Fishbein, 1972) and its developed version, the theory of planned behavior (e.g., Ajzen, 1985), behavior intention to perform the behavior in question is the immediate antecedent of overt behavior. Intention, in turn, is seen as a function of one's attitude toward performing a particular act and one's subjective norms (i.e., the perception of the expectations of relevant others). Because attitude includes not just the evaluation of a certain outcome but also the estimation of the likelihood of this outcome, salient information or factual knowledge is a necessary precondition for any attitude (Stutzman & Green, 1982).[7] As subjective norms refer to the strength of normative beliefs and the motivation to comply with these beliefs, social and moral values (i.e., what one should do from a normative stance, social expectations as well as moral principles) can be considered as an approximation of one's subjective norms.

Insert Figure 1

In Figure 1, the theory of reasoned action is presented graphically. The theory of planned behavior extends the theory of reasoned action by its inclusion of influences on behavior beyond people's control. If these influences are measured by

means of the perception of one's control, two assumptions have to be made: (a) The predicted behavior must be, at least partially, beyond volitional control and (b) perception of control must reflect actual control upon behavior with some accuracy (Ajzen & Madden, 1986). While the latter assumption has to be seen as a possible flaw of the planned behavior approach, the former assumption is often claimed in the ecological domain.

Ecological behavior appears to be susceptible to a wide range of influences beyond one's control (Hines et al., 1986/87). Outside temperature (Olsen, 1981) and home characteristics (Verhallen & Van Raaij, 1981), for instance, affect energy consumption; cost of water affects water conservation (Moore et al., 1994); and the number of people in a given household (Gamba & Oskamp, 1994), house ownership (Lansana, 1992), storage space (Williams, 1991) and type of residence (Oskamp et al., 1991) affect recycling behavior. Examples of community or neigborhood-related influences, include political measures that support public transportation systems that provide an alternative to commuting by automobiles, or political measures that facilitate recycling, or force people to pay for garbage disposal, which further reduces waste generation and promotes recycling. In short, socio-cultural constraints determine, to some extent, which ecological behavior is easier to carry out and which is harder.

As a consequence, people appear to behave inconsistently, since even someone who claims to be ecologically oriented may behave ecologically in one domain, and unecologically in

another (cf. Oskamp et al., 1991; Vining & Ebreo, 1992; Pickett, Kangun, & Grove, 1993; Scott & Willits, 1994). Thus, not surprisingly, the theory of planned behavior, which includes behavior constraints beyond volitional control, has to be considered especially useful in predicting ecological behavior. Because the theory of reasoned action does not include such constraints, previous research may have been affected by neglecting socio-cultural constraints (cf. Stutzman & Green, 1982). However, selection of possible socio-cultural constraints remains a challenging problem; possible ways of meeting this challenge are discussed later.

Environmental Attitude, Factual Knowledge, Values, Intention and Ecological Behavior

To include all three attitude concepts (i.e., attitudes toward the environment, the New Environmental Paradigm, and attitudes toward ecological behavior) in one general framework (i.e., the theory of planned behavior), this framework has to consist of at least three components: factual knowledge about the environment, social and moral values regarding environment, and ecological behavior intention. The theory of planned behavior (see Figure 1) proposes that attitude influences behavior, mediated by intention. Factual knowledge can be seen as a precondition of any attitude and, thus, the relation between factual knowledge and behavior is mediated by intention as well. Moreover, subjective norms -- or at least one's values -- are also mediated by intention, and therefore predict behavior indirectly. Given these interrelations, research findings in the ecological domain fit together quite well.

Attitude effect. If environmental attitude is assessed by one single measure regardless of the type of environmental attitude, the usual findings reveal either a moderate relation between environmental attitude and ecological behavior (Weigel et al., 1974; Hines et al., 1986/87; Langeheine & Lehmann, 1986; Smith et al., 1994; Axelrod & Lehman, 1993) or a weak relation (McGuinness et al., 1977; Sia et al., 1985/86; Williams, 1991; Berger & Corbin, 1992; Moore et al., 1994; Barker, Fong, Grossman, Quin, & Reid, 1994; Diekmann & Franzen, 1995; Grob, 1995). However, at least five studies report no such relation at all (Arbuthnot, 1977; Van der Pligt, 1985; Oskamp et al., 1991; Lansana, 1992; Gamba & Oskamp, 1994) and one study yields a strong association between environmental attitude and ecological behavior (Lynne & Rola, 1988). If environmental attitude refers to components, as for instance, environmental knowledge, environmental values, and ecological behavior intention, the following findings are reported.

Knowledge effect. Given that factual knowledge about the environment is a precondition of one's environmental attitude,[8] this knowledge should not be related with ecological behavior strongly because its influence is mediated both by environmental attitude and ecological behavior intention. Hence, it is not surprising that several studies found either no relations between factual environmental knowledge and ecological behavior (Maloney & Ward, 1973; Maloney et al., 1975; Amelang et al., 1977; Schahn & Holzer, 1990a, 1990b) or at best moderate relations (Dispoto, 1977; Arbuthnot, 1977; Smythe & Brook, 1980; Stutzman & Green, 1982;

Hines et al., 1986/87; Oskamp et al., 1991). When this relation appears to be stronger, it is knowledge about an ecological behavior (i.e., knowledge about what and how something can be done) rather than factual knowledge about the environment that is related to ecological behavior (e.g., Levenson, 1974; Sia et al., 1985/86; Smith-Sebasto & Fortner, 1994).

Value effect. As proposed by the theory of planned behavior, one's subjective norms (Olsen, 1981; Midden & Ritsema, 1983; Kantola et al., 1983) and normative beliefs regarding environment (McGuinness et al., 1977; Stutzman & Green, 1982) affect his or her intention to behave ecologically. However, this effect ranges from rather weak (Midden & Ritsema, 1983) to fairly large (McGuinness et al., 1977). Furthermore, this relation decreases if ecological behavior instead of ecological behavior intention is considered (McGuinness et al., 1977; Vining & Ebreo, 1992), presumably indicating the mediating effect of ecological behavior intention. One's environmental values, proposed as an approximation of subjective norms regarding environment (cf. Olsen, 1981), parallel these findings: Environmental values are related to their ecological behavior intention (Dunlap & Van Liere, 1978; Van Liere & Dunlap, 1981; Axelrod, 1994); and if environmental values are related to ecological behavior (Dunlap & Van Liere, 1978; Van Liere & Dunlap, 1981; Verhallen & Van Raaij, 1981; Stern et al., 1993; Grob, 1995) they are presumably mediated by a third variable. This third variable could be inconvenience attitude (McCarty & Shrum, 1994), however,

according to the theory of planned behavior, it is ecological behavior intention.

Intention effect. The most striking effect usually found is between ecological behavior intention and ecological behavior. Ecological behavior intention is strongly related to ecological behavior (Maloney & Ward, 1973; Maloney et al., 1975; Schahn & Holzer, 1990a, 1990b; Lansana, 1992; Auhagen & Neuberger, 1994) or at worst moderately related (Smythe & Brook, 1980; Stutzman & Green, 1982; Hines et al., 1986/87; Moore et al., 1994; Diekmann & Franzen, 1995). Unfortunately, there are some types of ecological behavior with which no such relation is found (Auhagen & Neuberger, 1994; Fuhrer & Wölfing, in press) and at least two studies in which the relation between ecological behavior intention and ecological behavior appears to be small (McGuinness et al., 1977; Van Liere & Dunlap, 1981). Note that it is not uncommon in the ecological domain that one type of ecological behavior is affected by either environmental attitude, environmental knowledge, environmental values, or ecological behavior intention while others are not (e.g., Langeheine & Lehmann, 1986; Berger & Corbin, 1992). One recommendation for dealing with this sort of finding refers to measurement correspondence, which means measuring related concepts on the same level of specificity. Specific environmental attitude measures are better predictors of specific rather than general ecological behavior measures (Weigel et al., 1974; McGuinness et al., 1977; Van der Pligt, 1985; Smith et al., 1994). However, specific measures appear to be more strongly affected by situational influences than general ones, which, in turn,

makes findings from different domains hardly comparable. This has some important methodological implications and consequences for the ecological domain.

## Methodological Considerations

Two things have to be considered when dealing with the relation between environmental attitude and ecological behavior: Measurement correspondence and behavior influences beyond people's control.

### Measurement Correspondence: General Attitude and General Behavior

The possible lack of measurement correspondence between environmental attitude and ecological behavior is well recognized (e.g., Weigel et al., 1974; Newhouse, 1990; Vining & Ebreo, 1992; Stern, 1992b; Axelrod & Lehman, 1993) and does not need much further explication. It can be summarized as follows: If one's environmental attitude is assessed generally, "the behavioral criterion should be equally general or comprehensive" (Weigel et al., 1974, p.728). Note, however, that highly specific rather than general measures of ecological behavior -- even though corresponding with environmental attitude -- are occasionally refused as a solution because they are highly susceptible to situational influences beyond people's control (e.g., Granzin & Olsen, 1991; Pickett et al., 1993). As specific measures appear to be affected easier than general measures, general environmental attitude measures are proposed as better predictors of comprehensive ecological behavior criteria (Newhouse, 1990). Even though some data apparently confirm this notion by strong relations between general environmental attitude and general

ecological behavior measures (Lynne & Rola, 1988; Axelrod & Lehman, 1993) others do not (McGuinness et al., 1977; Van Liere & Dunlap, 1981; Berger & Corbin, 1992; Scott & Willits, 1994; Smith et al., 1994; Diekmann & Franzen, 1995; Grob, 1995). These puzzling findings concerning the relation between general environmental attitude and general ecological behavior may also be due to measurement problems related to general ecological behavior measures (for a discussion see Kaiser, in press). Occasionally, such a general measure is questioned in principle (cf. Lloyd, 1980; Oskamp et al., 1991). However, there is at least one general measurement approach that includes a broad range of different behaviors, which rules out situational influences beyond people's control (see Kaiser, in press). The next section discusses three different approaches to how situational influences can be considered including this general ecological behavior measure.

Consideration of Influences Beyond People's Control

As previously stated, the relation between environmental attitude and ecological behavior may be affected by influences beyond people's volitional control. Thus, situational factors "… such as economic constraints, social pressures and opportunities to choose different actions …" (Hines et al., 1986/87, p.7) may interfere with one's attitude. For instance, recycling opportunities affect the amount of recycling behavior (Williams, 1991; Vining & Ebreo, 1992; Guagnano et al., 1995). Such situational influences can be considered in at least three different ways. First, perceived control -- proposed by Ajzen and Madden (1986) as an indicator of actual control -- can be used as a predictor of ecological behavior.

Second, moderators of the relation between environmental attitude and ecological behavior may be scrutinized. Because moderators represent conditional aspects of a given relation, non-volitional behavior constraints that affect such a relation can be chosen as moderators (e.g., residential area, season). Third, an ecological behavior measure -- established as a Rasch-scale -- that quantifies ecological behavior difficulties can be used as the outcome measure.

Perceived control. In the ecological domain, different concepts of perceived control (Levenson, 1974; Berger & Corbin, 1992; Auhagen & Neuberger, 1994; Kals & Montada, 1994; Grob, 1995) are used, for instance, internal locus of control (Arbuthnot, 1977; Sherman et al., 1981; Huebner & Lipsey, 1981; Hines et al., 1986/87; Sia et al., 1985/86; Oskamp et al., 1991; Gamba & Oskamp, 1994; Smith-Sebasto & Fortner, 1994), self efficacy (Kantola et al., 1983; Axelrod & Lehman, 1993), and feelings of powerlessness (Busch-Rossnagel & Weigel, 1984). None of them, however, indicates people's actual control (as proposed by Ajzen & Madden, 1986). Rather, they represent different predictors of either ecological behavior (Levenson, 1974; Arbuthnot, 1977; Busch-Rossnagel & Weigel, 1984; Hines et al., 1986/87; Oskamp et al., 1991; Axelrod & Lehman, 1993; Smith-Sebasto & Fortner, 1994; Auhagen & Neuberger, 1994; Gamba & Oskamp, 1994; Sia et al., 1985/86; Grob, 1995) or ecological behavior intention (Sherman et al., 1981; Huebner & Lipsey, 1981; Kantola et al., 1983; Kals & Montada, 1994). Occasionally, perceived control concepts are used as moderators of the environmental attitude-ecological behavior relation (Berger & Corbin, 1992). Unfortunately, the

relation between perceived control and ecological behavior is inconsistent and ranges from slightly negative (Grob, 1995) to non-existent (Oskamp et al., 1991; Gamba & Oskamp, 1994) to very positive (Auhagen & Neuberger, 1994). Besides this inconsistency, the assumption that one's perceived control reflects actual control over a certain behavior appears, without any control of its accuracy, problematic.

Moderators. A selection of moderators used that affect the environmental attitude-ecological behavior relation includes gender (Schahn & Holzer, 1990a, 1990b), socio-economic status (Midden & Ritsema, 1983), mode of behavior assessment (Hines et al., 1986/87), group membership (environmentalists vs. non-environmentalists: Hines et al., 1986/87), income (Lynne & Rola, 1988), access to recycling programs (Derksen & Gartell, 1993), season (Becker et al., 1981), and nationality (Meseke, 1994). All these moderators represent different sorts of non-volitional behavior constraints. Usually, questions concerning their scope remain unanswered: Do they affect all or just a few ecological behaviors? Alternative moderators, for instance, knowledge (used as a moderator of the ecological behavior intention-ecological behavior relation in Schahn & Holzer, 1990a, 1990b), perceived control (Berger & Corbin, 1992), or environmental attitude strength (Smith et al., 1994), cannot be seen as mere situational constraints but rather represent modifications of the environmental attitude model.

Because moderator effects -- indicating situational influences -- are either difficult to explain or they demand further theoretical clarification, they raise usually more

questions than they answer and, hence, remain somewhat problematic. Moreover, the arbitrariness of their selection presumably affects empirical findings as well. For instance, each study uses some moderators while others are neglected.

A General Ecological Behavior measure. As a probability of a behavior considers influences beyond people's actual control, an accurate measure of ecological behavior is actually a probability that one carries out the specific behavior rather than anything else. Whether someone commutes on a given morning or not may depend on several factors beyond his or her control, for instance, weather, traffic, and availability of an automobile. Moreover, all sorts of influences beyond people's control affect different behaviors in a way that make them varyingly difficult to carry out. Hence, some behaviors seem to be easier to carry out than others. For example, recycling is easy to carry out when recycling bins are readily accessible. Therefore, influences beyond people's control have to be considered in two different ways by estimating the probability (i.e., one's tendency) of behaving ecologically, as well as the probability of anyone carrying out a certain behavior (i.e., behavior difficulty).

The General Ecological Behavior (GEB) scale assesses general ecological behavior by considering 38 different ecological behaviors, for example, using an oven-cleaning spray to clean an oven. Each of these behaviors has a given difficulty to be carried out, which, in turn, represents an estimate of all the constraints beyond people's control. The easier a behavior is to carry out the less constraints have to be assumed. This behavior difficulty is estimated for each behavior by

considering the number of people who behave correspondingly (i.e., the probability that anyone will behave that way regardless of his or her tendency to behave ecologically). One's tendency to behave ecologically is estimated by considering the number of ecological behaviors he or she carried out (i.e., the probability that somebody will behave ecologically given that behaviors differ in difficulties).

Because a measure of one's ecological behavior considers the tendency to behave ecologically as well as behavior difficulties, people are free -- to a certain extent -- to behave inconsistently across different ecological behaviors. Someone, for instance, who tends to behave ecologically on a very high level across different behaviors, may fail to recycle newspapers, even though this behavior is easy to carry out. In contrast, someone who usually behaves very unecologically may -- for whatever reason -- not drive an automobile, a behavior that is commonly difficult not to carry out. And as such inconsistencies result from -- may be individually -- different socio-cultural constraints beyond people's actual control, situational influences are represented in this behavior measure in two different ways. Because both probabilities -- behavior difficulty and behavior tendency -- allow for constraints beyond people's actual control, one's GEB score appears to represent a quite useful estimate of ecological behavior. Moreover, the GEB measure of ecological behavior is a general rather than a specific one (for more details see Kaiser, in press).

## Hypotheses

As explained in the previous sections, three shortcomings affect the predictive power of environmental attitude concepts regarding ecological behavior: (a) the lack of a unified attitude concept, (b) the lack of measurement correspondence between attitude and behavior on a general level, and (c) the lack of considerations of situational behavior constraints beyond people's control. The present paper proposes to use an abbreviated version of the theory of planned behavior by Ajzen as a unifying frame for environmental attitude concepts; it also uses a probabilistic measurement approach that may overcome the methodological shortcomings.

Environmental knowledge, environmental values, and ecological behavior intention are suggested as the conceptual skeleton of the theory of planned behavior that encompasses the three most commonly used attitude approaches in environmental psychology: attitude toward the environment, attitude toward ecological behavior, and the NEP, which appears to regard environmental values as its core concept. In addition, the relation between environmental attitude and ecological behavior should be considerably strengthened by adopting a general ecological behavior measure that assesses behavior by means of behavior difficulties and behavior tendencies. This relation between general attitude and general behavior should remain consistent even across very ideologically distinct groups of people. To test the latter, two known groups with different ecologically relevant ideologies are scrutinized. The present paper explores the following predictions in further detail:

1. Environmental knowledge and environmental values are significant preconditions of ecological behavior intention (see Figure 1).
2. Ecological behavior intention affects ecological behavior strongly if both of them are assessed rather generally and if the ecological behavior measure considers situational behavior constraints.
3. All relations among the three environmental attitude concepts (i.e., environmental knowledge, environmental values, and ecological behavior intention) and between ecological behavior intention and ecological behavior are not moderated by ideology; rather they can be generalized across ideologically heterogeneous groups.

## Method

### Participants and Procedures

The present sample was constituted from an initial pool of 3000 members of each of two Swiss transportation associations. The associations can be differentiated ideologically. One aims to promote a transportation system that has as little negative impact on humans and nature as possible. The other represents primarily automobile drivers' interests. To include as wide a range of diversity as possible, the two associations were further stratified by primary language (French, Italian, German) and type of residential area (city, suburb, village). Of all members of both associations, 27.4% (1643) were willing to participate. This pool was asked to complete three questionnaires: The first was sent out during December 1993, and 1371 (83.5%) completed it (Seiler, 1994; Fuhrer, Kaiser, Seiler, & Maggi, 1995). The targeted participants of the

second questionnaire were those who had completed the first questionnaire. The second questionnaire was mailed in May of 1994, and 1189 (86.7%) of those who completed the first questionnaire participated in this second study. The present, third study, was undertaken during November 1994, and targeted only the German speaking subgroup from the first study. Note that the German speaking subgroup of the first and second studies numbered 579 (42.2% of the total sample) and 438 (36.8%), respectively. After 36 people declined further participation, 543 (93.8%) of the German speaking participants in the first study remained to be surveyed in the third study. Of these, 445 (82.0%) returned completed questionnaires. Participants' (62.5% male) median age was 45.5 years (m: 46.6, range: 20 to 82).

The high participation rate within the pool can be seen as a result of self-selection process of more ecologically concerned participants. Members of the automobile drivers' association were less well-represented in the sample (25.8%) in contrast to members of the association promoting a more ecological transportation system (74.2%). For the purpose of the present study, it is sufficient that the participants reflect a wide range of diversity, as for instance, in ecological concern. Any sample bias is of minor importance because the generalizability of the proposed relations will be scrutinized by statistical means.

## Measures

The questionnaire consists of a Social Desirability scale, a General Ecological Behavior measure, and three scales that represent the environmental attitude related concepts.

The Social Desirability (S.D.) scale presented by Amelang and Bartussek (1970) consists of 32 items grouped in two subscales, Lying and Denying.[9] Fourteen items contribute to the Lying scale (e.g., "I never claim to know more than I actually do") and 18 items to the Denying scale (e.g., "I have taken advantage of people in the past"). To be consistent with the response options for the ecological behavior items, the original true/false format was changed to a yes/no format. To contribute to the Lying sum score, those items had to be answered yes. To contribute to the Denying sum score, denying items had to be answered no. Missing values (N = 109; 0.77%) were treated as no responses for the Lying scale and as yes responses for the Denying scale (assuming participants' tendency not to lie and to deny).

The General Ecological Behavior (GEB) measure consists of 38 items representing different types of ecological behavior (e.g., "Usually, I do not drive my automobile in the city"; "For shopping, I prefer paper bags to plastic ones") and some non-environmental prosocial behaviors (e.g., "Sometimes I give change to panhandlers") as well. A yes/no response format for these items was used. No responses to negatively formulated items were recoded as yes responses and vice versa. Missing values (N = 80; 0.45%) were handled as no responses in general (assuming participants' doubt - represented by missing values - as indicator of not behaving alike in general). The GEB measure has been calibrated as an unidimensional Rasch-scale (Kaiser, in press). All GEB items and the 32 S.D. items were distributed randomly throughout the questionnaire.

Twenty-eight items, which were used to establish the three environmental attitude related scales during the first study (cf. Seiler, 1994; Fuhrer et al., 1995; Fuhrer & Wölfing, in press), were reevaluated. These scales are Environmental Knowledge (EK), Environmental Values (EV), and Ecological Behavior Intention (EBI). Generally, the content of all 28 items is related to the topic of pollution (see Table 1). A 5-point Likert scale that ranged from agree totally (1) to disagree (5) was the response format used. All 10 knowledge items, which represent the EK scale, were distributed randomly throughout a total of 24 knowledge items. All 7 value items, which represent the EV scale, were distributed randomly throughout a total of 13 value items. All 11 intention items were grouped together in the questionnaire.

A principal-factor analysis (PFA) was performed to confirm the three-factor structure of the first study (Seiler, 1994; Fuhrer et al., 1995; Fuhrer & Wölfing, in press; see Table 1). 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. Three hundred and ninety-one participants remained in the analysis; fifty-four people were excluded because of missing values. Twenty-eight items with a total of 49.1% explainable variance remained in the analysis. The final three-factor solution accounted for 74.9% of this remaining 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 = 31.9%, EV = 24.4%, and EBI = 43.7%. The three factors either

correlated non-significantly ($p > .05$) or correlated only marginally ($R^2 = 1.2\%$), though significantly ($p < .05$): $\underline{r}$(EK-EV) = .11, $\underline{r}$(EK-EBI) = .08, $\underline{r}$(EV-EBI) = .09.

Insert Table 1

Internal consistency of the three factors in the solution was also estimated by using Cronbach's $\alpha$. Standardized Cronbach $\alpha$s for the remaining factors are $\alpha$(EK) = .84 ($\underline{N}$ = 418), $\alpha$(EV) = .73 ($\underline{N}$ = 425), and $\alpha$(EBI) = .85 ($\underline{N}$ = 423).

For subsequent analyses, scores for EK, EV, 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 the latter are useful approximations of the former: $\underline{r}$(EK) = .89, $\underline{r}$(EV) = .90, $\underline{r}$(EBI) = .95, $\underline{N}$ = 391. By using mean values instead of factor scores ($\underline{N}$ = 391), data for additional participants could be included in further analyses ($\underline{N}$(EK) = 441, $\underline{N}$(EV) = 440, $\underline{N}$(EBI) = 442).

According to the factor loadings of the PFA, each of the three environmental attitude related scales EK, EV, and EBI was divided into two subscales that were used as input variables for the following structural equation analyses. Ordered according to their loadings, the first, the third, two of three tied for fifth[10], and the ninth items were used to calculate the EK1 mean value ($\underline{N}$ = 441), whereas EK2 is constructed out of the remaining EK-items (items with the 2nd, 4th, the third tied for 5th, the 8th, and the 10th highest loading; $\underline{N}$ = 441). EV1 is a mean value based on the items with

the first, third, fifth, and the seventh highest loading on the EV-factor (N = 439), whereas EV2 is composed of the three remaining EV-items (items with the 2nd, 4th, and the 6th highest loading; N = 438). EBI1 is composed of six items based on the items with the first, third, fifth, seventh, one of two tied for eighth and the eleventh highest loading on the EBI-factor (N = 442). EBI2 is a mean value out of five items (items with the 2nd, 4th, 6th, the other tied for 8th, and the 10th highest loading; N = 442). Mean values of these subscales were calculated only when responses in at least half of the items of a given subscale were available.

## Statistics

### Technical Information

SAS release 6.08 was used for calculating all basic statistics. All structural equation models were assessed by means of LISREL8 (Jöreskog & Sörbom, 1993) using the Maximum Likelihood method. Unless otherwise indicated, covariance matrices were used as input-matrices (see Appendix for a correlation matrix, variable means (m), and their standard deviations (SD).

### Model Constraints

All subscales, which were used as measures of latent constructs, are -- if possible -- balanced according to the factor loadings of their underlying items (see section Measures). As a consequence, all subscales intended to measure the latent constructs, Environmental Knowledge (EK), Environmental Values (EV), or Ecological Behavior Intention (EBI), were planned to measure with equal reliability. Both knowledge subscales (EK1 and EK2), for instance, were planned

to measure EK equally well, which means that the parameters (β-coefficients -- the standardized multiple regression coefficient -- and measurement errors [ME]) are assumed to be equal. However, the adjustment to optimal model fit forces the negation of three of these six equality constraints as follows: ME(EK1) ≠ ME(EK2); ME(EV1) ≠ ME(EV2); β(EBI-EBI1) ≠ β(EBI-EBI2). The remaining equality constraints are: β(EK-EK1) = β(EK-EK2); β(EV-EV1) = β(EV-EV2); ME(EBI1) = ME(EBI2). Because GEB is measured by only a single indicator (GEB Scale) no measurement error (ME(GEB Scale) = 0) was proposed, initially (see Figure 2).

## Results

The present findings are reported in three sections. Firstly, constructs were checked for Social Desirability effects. Secondly, hypotheses 1 and 2 -- EBI is a function of EK, and EV, and, in turn, determines GEB -- were tested. Thirdly, hypothesis 3 -- can hypotheses 1 and 2 be generalized even across ideologically heterogeneous groups -- was scrutinized. The number of participants -- if not otherwise indicated -- for all statistical tests below is $N = 435$.

### Social Desirability Effects

All four measures of interest EK, EV, EBI, and GEB are -- as a preliminary testing for Social Desirability (S.D.) effects reveals -- just marginally influenced by S.D. All measures either correlated non-significantly ($p > .05$; $r$(S.D.-EV) = -.01; $N = 440$) or correlated only marginally -- indicated by the amount of explained variance ($R^2$) -- even though significantly ($p < .05$) with S.D.: $r$(S.D.-EK) = -.13, $R^2$ =

1.7%, N = 441; r(S.D.-EBI) = -.13, $R^2$ = 1.7%, N = 442; r(S.D.-GEB) = -.10, $R^2$ = 1.0%, N = 443.

Environmental Attitude and Ecological Behavior

Confirmatory testing of the two hypotheses -- EBI is a function of EK, and EV, and, in turn, determines GEB (see Figure 2) -- reveals that both can be accepted from an empirical point of view ($\chi^2$ = 23.51, df = 14, p = .052, Goodness-of-Fit-Index (GFI) = .99, Adjusted-Goodness-of-Fit-Index (AGFI) = .97, Root-Mean-Square-Residual (RMR) = .014, Standardized-Root-Mean-Square-Residual (SRMR) = .030). If all three above mentioned equality constraints are dropped the model fits slightly better ($\chi^2$ = 18.18, df = 11, p = .077, GFI = .99, AGFI = .97, RMR = .011, SRMR = .021). A comparison of all estimates between the two tested models reveals maximal fluctuations of corresponding coefficients as follows: the difference for $\beta$ is no more than $\pm$ .04, and for ME no more than $\pm$ .06. However, the comparison between the two models -- with and without equality constraints -- reveals that they do not differ significantly ($\Delta\chi^2$ = 5.33, $\Delta$df = 3, p > .05). The restricted model has three additional degrees of freedom; this increases the possibility for it to be rejected, and so makes it even more compelling from a methodological stance. Nevertheless, Figure 2 presents the unrestricted model. As $\beta$-coefficients indicate the strength of a given relation between constructs and as these relations are directed, arrows are used to indicate such relations in Figure 2. Pearson correlation coefficients are indicated by two-sided arrows in Figure 2.

Insert Figure 2

Forty percent of the variance of EBI can be explained by the two determinants EK ($\beta$ = .47; $\beta$ = .49 [restricted model]) and EV ($\beta$ = .23; $\beta$ = .20). These two indicators of EBI themselves correlate considerably with one another ($\underline{r}$ = .62; $\underline{r}$ = .61). Thirty-eight percent of the variance of GEB can be explained by one single indicator, EBI ($\beta$ = .61; $\beta$ = .62). However, this proportion of explained variance increases remarkably if the reliability of GEB is considered more accurately ($\beta$(GEB-GEB Scale) = .71; see Kaiser, in press). Accordingly, the error variance was to be assumed as ME(GEB Scale) = .50 instead of being zero. With such an attenuation for measurement error 75% of the variance of GEB can be explained by EBI ($\beta$ = .87).

To assess the stability of the present findings, the GEB reliability estimate was included by using a correlation instead of a covariance matrix as input-matrix. The number of participants for both models tested below is $\underline{N}$ = 436. Sixteen out of 20 coefficients of the final model remained identical to the ones reported in Figure 2 with one exception: $\beta$(EV-EBI) = .23 opposed to $\beta$(EV-EBI) = .22. The four coefficients that differed remarkably are: the two reliability indicators of GEB [$\beta$(GEB-GEB Scale) = .71 instead of $\beta$(GEB-GEB Scale) = 1.0 and ME(GEB Scale) = .50 instead of ME(GEB Scale) = 0], the estimate for $\beta$(EBI-GEB) [$\beta$(EBI-GEB) = .87 instead of $\beta$(EBI-GEB) = .61] and, consequently, the estimate for the Variance of GEB [Variance(GEB) = .25 instead of Variance(GEB) = .62]. Note that -- based on correlation matrices -- the difference between the two models -- with and without equality constraints -- is significant: $\Delta\chi^2$ = 16.95, $\Delta\underline{df}$ = 3, $\underline{p}$ < .05. With three equality constraints the model fits significantly

less well ($\chi^2$ = 34.81, df = 14, p = .002, GFI = .98, AGFI = .95, RMR = .051, SRMR = .051) than without equality constraints ($\chi^2$ = 17.86, df = 11, p = .085, GFI = .99, AGFI = .97, RMR = .021, SRMR = .021).

Transportation Association as a Moderator

Indicated by the different participation rates of the members of the two transportation associations, the present sample is biased toward more ecological concerned participants. This methodological shortcoming may affect the generalizability of our current conclusions (cf. Hines et al., 1986/87). Therefore, we compared members of the automobile drivers' association (N = 111) with members of the association promoting a more ecological transportation system (N = 322). This comparison supports, on the one side, the generalizability of the formerly mentioned model. On the other side, it points to two moderation effects caused by the association membership.

Insert Table 2

A model, in which the two association subsamples differed either in the reliability of their EBI measures or in both the variances of EK and EV and the strength of the relation between EK and EV, supports the proposed theoretical framework in principle although the model misfits -- strictly speaking -- significantly ($\chi^2$ = 61.45, df = 32, p = .001, GFI = .97, RMR = .02, SRMR = .062). Seven modifications of the model had to be included for an acceptable model fit -- although the Chi-Square statistic still remains significant. These seven

modifications are listed in Table 2. In both groups, however, EK and EV still predict EBI which, in turn, determines GEB.

Association membership appears to have two major impacts on the proposed model. First, four modifications in Table 2 -- three reliability indicators of EBI1 and EBI2 [$\beta$(EBI-EBI1); $\beta$(EBI-EBI2); ME(EBI2)] and the additional measurement error correlation {r[ME(EBI1)-ME(EBI2)} for members of the ecological transportation association -- suggest that for the automobile driver's interest association the assessment of EBI is much more accurate than for the ecological transportation association. Measurement of EBI in the latter group appears to be affected by influences beyond the scope of the present study. Second, the other three modifications in Table 2, free variances for EK and EV as well as the difference in the strength of the relation between these two constructs point to differences in the homogeneity of the two associations involved regarding EK and EV.

## Discussion

Three propositions were made to unify the three most commonly used environmental attitude approaches and to enhance the predictive power of environmental attitude in relation to ecological behavior. The propositions are: (a) an abbreviated version of the theory of planned behavior (e.g., Ajzen, 1985, 1991) should be used as the theoretical framework; (b) environmental attitude concepts as well as ecological behavior should be measured rather generally; and (c) any ecological behavior measurement approach should assess one's ecological behavior by means of behavior difficulties. Behavior difficulties should be estimated by considering all socio-

cultural, situational behavior constraints instead of testing only a few of them by means of -- more or less arbitrarily chosen -- moderator effects (cf. e.g., Hines et al., 1986/87). Claiming perceived control as an accurate estimate of people's actual control (e.g., Ajzen & Madden, 1986), which also represents situational behavior constraints, remains -- because such a claim is hardly provable -- problematic as well. The present results support all three propositions.

Three concepts, general Environmental Knowledge, general Environmental Values and general Ecological Behavior Intention, are suggested as the conceptual skeleton of the theory of planned behavior. Moreover, these concepts are the core of all commonly used attitude approaches -- attitudes toward the environment, the New Environmental Paradigm, and attitudes toward ecological behavior -- used to predict ecological behavior. The first substantive outcome refers to the notion that Environmental Knowledge and Environmental Values are significant preconditions of Ecological Behavior Intention: As 40% of the variance of Ecological Behavior Intention are explained by Environmental Knowledge and Environmental Values such a claim appears to be sufficiently supported. Surprisingly, the strength of both of these relations -- the one between Environmental Knowledge and Ecological Behavior Intention as well as the one between Environmental Values and Ecological Behavior Intention (see Figure 2) -- are quite comparable to the ones reported by Ajzen and Madden (1986). Although neither of the additional mediation processes -- the one in which Environmental Knowledge is mediated by attitude toward ecological behavior

nor the one in which Environmental Values are mediated by subjective norms (see Figure 1) -- is considered in the present model, Ecological Behavior Intention could be predicted rather well. This supports the proposition that Environmental Knowledge is a quite useful approximation of attitude, as well as the proposition that Environmental Values are a useful approximation of subjective norms. However, accurate measures of one's attitude toward ecological behavior and one's norms, presumably, would increase the amount of explained variance of Ecological Behavior Intention.

Moreover, alternative predictors of Ecological Behavior Intention might be worth including in a broader frame of environmental attitude than the one presented in this paper. One such predictor could be environmental affects, another could be responsibility toward environment. Environmental affects are crucial concepts in the environmental concern domain (e.g., Maloney and Ward, 1973; Maloney et al., 1975). Whereas responsibility toward the environment not only appears to affect different ecological behavior intentions considerably (e.g., Fridgen, 1994; Kals & Becker, 1994; Kals & Montada, 1994), but it also predicts General Ecological Behavior itself (mediated by one's responsibility judgment toward the environment, which in turn is most prominent an intentionality judgment too; see Kaiser & Shimoda, 1996).

The second substantive outcome refers to the proposition that ecological behavior intention predicts ecological behavior remarkably given that both of them are assessed generally and that the ecological behavior measure considers behavior constraints beyond people's control. As socio-

cultural, situational constraints determine to some extent which ecological behavior is easier to carry out and which is harder, two methodological claims are made. The first is that general measures -- in this case behavior intention and behavior -- are less susceptible to influences beyond people's control which should result in a considerably enhanced strength of the relation between ecological behavior intention and ecological behavior. Unfortunately, some studies still report less than strong relations between general ecological behavior intention and general ecological behavior (e.g., McGuinness et al., 1977; Diekman & Franzen, 1995). Such findings may be due to the general ecological behavior measurement approach used. The second methodological claim, thus, is that a measurement approach, which estimates ecological behavior difficulties to assess general ecological behavior, is better suited than alternative measurement approaches, which are based on classical testing theory (Kaiser, in press). Seventy-five percent explained variance of General Ecological Behavior by Ecological Behavior Intention supports the above proposition impressively.

A behavior measure, which considers behavior constraints beyond people's control, allows the disentangling of psychological and non-psychological[11] -- i.e., socio-cultural, situational influences -- determinants of ecological behavior. Such a measure has two major advantages.

The first is related to the fact that non-psychological influences affect ecological behaviors dominantly (cf. Stern, 1992b; Guagnano et al., 1995). As a consequence, socio-cultural influences might cover psychological ones (see e.g.,

Stutzman & Green, 1982; Derksen & Gartrell, 1993) or distort comparisons of different psychological concepts (see e.g., Oskamp et al., 1991; Lansana, 1992; Moore et al., 1994). If all non-psychological, situational influences are controlled, which can be done by using a probabilistic measurement approach, psychological concepts (e.g., environmental attitude) can be tested and compared as predictors of behavior unbiased from non-psychological influences. And as the present study suggests, they can become remarkable predictors of behavior. However, all other influences, as for instance, money, weather, public policy, and so forth have to be controlled and not just an arbitrary selection of them, which is usually the case when some non-psychological influences but not all of them are scrutinized (as moderators or as predictors).

The second advantage of the proposed General Ecological Behavior measure, which assesses behavior difficulties of different ecological behaviors, can be seen in its applicability as an assessment tool for measures of communities and societies to affect individual behavior (Kaiser, in press). As all non-psychological, situational influences together result in a given behavior difficulty for any single behavior, changes in behavior difficulties can point out effects of non-psychological measures that promoted these changes. For example, a community intends to change individual recycling behavior by means of a curbside recycling program. This political effort to reduce the amount of garbage in the community might, in fact, result in an alteration of behavior difficulties of different recycling behaviors, as for

instance, glass, paper, and can recycling. A comparison between the community and a second community without curbside recycling program or compared to itself before introducing the program can reveal the effectiveness of the recycling program by means of behavior difficulty changes.

Hence, as behavior difficulties can vary between communities or societies, the General Ecological Behavior scale points to behaviors that are sensitive to certain measures. Thus, it can be used as an assessment tool for environmental behavior measures of communities and societies. Moreover, the scale could be used as a detection tool for effective measures that might affect ecological behaviors as well. The latter suggests that measures that make it easier for people to behave ecologically in one community might be effective in another community as well. And measures that are already empirically established in one community or society as effective measures to enhance ecological behaviors can be adopted by other communities and societies too, which results in a less arbitrary and vague adoption process of political measures.

In contrast to findings by Hines and collaborates (1986/87), the third substantive outcome supports the notion that the relation between environmental attitude and ecological behavior remains comparable even for ideologically heterogeneous groups. Given that the participants are rather numerous, the model fit indicators are quite acceptable. Members of both transportation associations, one that promotes a transportation system as ecologically sound as possible and one primarily concerned with automobile driver's interests, yield similar relations among the three environmental attitude

related concepts and between Ecological Behavior Intention and General Ecological Behavior.

Besides all similarities, however, there are two differences between the two association groups worth noticing. Ecological Behavior Intention measures for members of the ecological transportation association are less reliable than for members of the automobile driver's interest group. As there are three times more environmentalists than other participants in the present study their greater heterogeneity is, however, not that surprising at all. However, the finding might indicate as well that there is a powerful predictor of Ecological Behavior Intention not considered yet. Such an additional predictor could be, as already pointed out, either environmental affects or responsibility experience toward the environment. The greater heterogeneity of the ecological transportation association is also indicated by variance differences for both associations in their Environmental Knowledge and Environmental Values as well as different interrelations between Environmental Knowledge and Environmental Values in both groups. Besides differences in numbers, the present research topic, which could not be hidden totally, might have resulted in a bias towards more ecologically concerned participants. And as, presumably, most of the ecological transportation association members already are somewhat ecologically concerned such a bias might have affected primarily members of the automobile driver's interest group. Thus, not surprisingly, this group appears more homogeneous since we might have got the more ecologically concerned subset of the automobile diver's interest group. The strong

correlation between Environmental Knowledge and Environmental Values for members of this group gives credit to this notion: Environmental knowledge and values are barely distinguishable in the automobile driver's interest group and the values are environmental ones.

Occasionally, questionnaires reveal the intent of a given study to participants. Hence, a participant's readiness to adopt the researcher's expectations -- although unintentionally expressed by the researcher -- has to be controlled. All measures of interest, Environmental Knowledge, Environmental Values, Ecological Behavior Intention, and General Ecological Behavior, are only marginally influenced by readiness to adopt the researchers expectations assessed by a Social Desirability scale. This finding supports the notion that all presented analyses are at most marginally biased by readiness to answer in ways they thought we wanted them to answer, which in turn gives credit to the validity of the reported results.

The present findings remarkably support the idea of using the theory of planned behavior (Ajzen, 1985, 1991) as a unifying frame for the environmental attitude research. Moreover, they support a behavior measurement approach that considers actual behavior control more accurately than by measures of one's perceived control (cf. Ajzen & Madden, 1986). The proposed measurement approach allows the disentangling of psychological and non-psychological influences on individual behavior. And as behavior, ecological or non-ecological, is in general affected by psychological and influences beyond people's control, psychological and non-

psychological influences have to be disentangled to be tested effectively. To scrutinize the predictive power of psychological concepts, as for instance, attitude, the proposed behavior measurement approach appears promising -- presumably regardless of the domain.

Footnotes

[1] Environmental and ecological are technical terms. The former is the psychological index term related to attitude while the latter is the one related to behavior. It is not our intent to distinguish them beyond this common use.

[2] A literature review in the PsychInfo database (1/1/67 through 8/31/95) reveals a field of 1361 publications that deals with environmental problems in one way or another. The psychological index terms used are: environmental attitudes (N = 847), conservation (ecological behavior) (N = 422), pollution (N = 273), and environmental education (N = 32). The total number of publications (N = 1574) is reduced because of multiple use of index terms to N = 1361. Of these, the majority (62.2%) refers to environmental attitude.

[3] One third of all publications of the field deals with ecological behavior (31%; N = 422). Of these, more than one third (36.3%; N = 153) relates environmental attitude to ecological behavior. Note that the present study is not a comprehensive review of this literature. Therefore, not all of these publications are referred to. However, the present selection, we assume, fairly well represents the principle findings of the environmental attitude and ecological behavior literature.

[4] Ecological behavior in this paper includes specific behaviors as well as general behavior indices. Specific behaviors include recycling (e.g., McCarty & Shrum, 1994; Smith, Haugtvedt, & Petty, 1994; Guagnano, Stern, & Dietz, 1995), spatial mobility (e.g., Sherman, Perez, & Sherman, 1981; Fuhrer & Wölfing, in press), energy conservation (e.g.,

Geller, 1981; Midden & Ritsema, 1983; Van der Pligt, 1985), political action (e.g., Huebner & Lipsey, 1981; Stern, Dietz, & Kalof, 1993), consumerism (e.g., Scott & Willits, 1994), regulatory support behavior (e.g., Berger & Corbin, 1992; Axelrod, 1994), ecological house keeping (e.g., Auhagen & Neuberger, 1994), commitment to environmental organizations (e.g., Weigel, Vernon, & Tognacci, 1974), ecological farming (e.g., Lynne & Rola, 1988; Axelrod, 1994), water conservation (e.g., Kantola, Syme, & Nesdale, 1983; Moore, Murphy, & Watson, 1994). General behavior indices are used, for instance, in Maloney and Ward (1973), Axelrod and Lehman (1993), Smith-Sebasto and Fortner (1994), Diekmann and Franzen (1995), and Grob (1995).

[5] Alternative attitude concepts not covered in the present paper refer to one's perception of the inconvenience caused by a given ecological behavior (Becker, Seligman, Faszio, & Darley, 1981; McCarty & Shrum, 1994) or to one's judgment of the importance of a given ecological behavior (Karns & Khera, 1983; Oskamp, Harrington, Edwards, Sherwood, Okuda, & Swanson, 1991; McCarty & Shrum, 1994).

[6] Unfortunately, confirmatory tests of the proposed instrument (Maloney & Ward, 1973; Maloney et al., 1975) failed to replicate its dimensionality (Amelang, Tepe, Vagt, & Wendt, 1977; Smythe & Brook, 1980).

[7] Factual knowledge about the environment is needed to built up attitudes toward the environment as well as attitudes toward ecological behavior (see McGuinness, Jones, & Cole, 1977; Diekmann & Franzen, 1995; Grob, 1995).

[8] Surprisingly, the reported strength of the relation between knowledge and attitude ranges from non-existing (Stutzman & Green, 1982) to weak (Langheine & Lehmann, 1986; Diekman & Franzen, 1995; Grob, 1995).

[9] A translated version of the Social Desirability scale of Amelang and Bartussek (1970) is available on request.

[10] Items with identical factor loadings are given identical ranks. Items with factor loadings next to items with identical factor loadings are ranked as if no duplicates of ranks exist.

[11] The term non-psychological refers to social, financial, material, and so forth determinants of ecological behavior.

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# Appendix

Insert Table 1A

Table 1

Twenty-eight items and their factor loadings grouped into three factors: Environmental Knowledge (EK), Environmental Values (EV), and Ecological Behavior Intention (EBI)

| ITEM | Original | Replication |
|---|---|---|
| Knowledge (EK): I agree that … | | |
| 1. … melting of the polar ice caps may result in a flooding of shores and islands. | .46 | .70 |
| 2. … fossil fuels (e.g., gas, oil) produce $CO_2$ in the atmosphere when burned. | .42 | .67 |
| 3. … all living beings (micro-organisms, plants, animals, and humans) are interdependent with one another. | .37 | .62 |
| 4. … poisonous metals are introduced into the food chain, for instance, via ground water. | .37 | .50 |
| 5. … ozone near the ground may cause respiration problems. | .37 | .47 |
| 6. … a change in climate caused by increased levels of $CO_2$ in the atmosphere is called the greenhouse effect. | .46 | .47 |
| 7. … poisonous metals remain in the human body. | .35 | .47 |
| 8. … world climate will probably massively change if $CO_2$ continues to be emitted into the atmosphere in as huge amounts as it is now. | .56 | .45* |
| 9. … a reduced number of species may interrupt the food chain, affecting some subsequent species in the chain. | .45 | .40 |

continued

| ITEM | Original | Replication |
|---|---|---|
| 10.- … the greenhouse effect does not result in the melting of glaciers in central Europe. | .34 | .39 |
| Values (EV): I agree that (meaning: I admit that) … | | |
| 1. … all things, whether humans, animals, plants, or stones have the right to exist. | .58 | .72 |
| 2. … animals should have legal rights. | .51 | .59 |
| 3. … all organisms' lives are precious and worth preserving. | .52 | .57 |
| 4. … nature must be preserved because God or another supernatural force is part of it, even in its non-living aspects. | .55 | .47 |
| 5. … in general, raising animals in cages should be forbidden. | .39 | .41 |
| 6. … for everything that I do, including deeds affecting the environment, I am responsible to a supernatural force, for instance God. | .39 | .36 |
| 7. … the earth's value does not depend on people; it is valuable in itself. | .37 | .34 |
| Intention (EBI): I agree that (meaning: I admit that) … | | |
| 1. … I support raising parking fees in cities. | .60 | .74 |
| 2. … I am ready to pay environmental taxes (e.g., raising fuel or automobile taxes). | .59 | .71 |
| 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). | .61 | .69 |

continued

| | ITEM | Original | Replication |
|---|---|---|---|
| 4. | … I support efforts to create automobile free inner cities. | .59 | .65 |
| 5. | … I would prefer to drive only if absolutely necessary (i.e., no other mode of transportation is available). | .59 | .53 |
| 6. | … I would prefer not to drive to work any longer. | .56 | .52 |
| 7. | … I would prefer to be able to go shopping without my automobile. | .56 | .48 |
| 8. | … I will stop the engine at red lights in the future. | .47 | .43 |
| 9.- | … I will still need my automobile in the future. | .43 | .43 |
| 10. | … my next automobile will be small and as ecologically sound as possible. | .46 | .41 |
| 11.- | … I will travel by automobile or by airplane during my vacations. | .42 | .40 |

Note. Analyses are based on 28 items: 10 knowledge-, 7 value-, and 11 intention-items.

(-) indicate items inversed in their meaning. Their response format was recoded that it ranged from disagree (1) to agree totally (5) opposed to all other items.

Original: N = 922; the three-factor solution accounted for 72.6% of the explainable variance (i.e., 40%) among 28 items. After rotation, the three factors explained EK = 29.8%, EV = 25.3%, and

EBI = 44.9% of this variance. The three factors correlated marginally with one another ($R^2$ < 2%): $\underline{r}$(EK-EV) = .08, $\underline{r}$(EK-EBI) = .14, $\underline{r}$(EV-EBI) = .06 (Seiler, 1994).

Replication: $\underline{N}$ = 391: all of them participated in the original study as well.

* indicates an item that loads mainly (i.e., .48) on the EBI instead of the proposed EK.

Table 2

Seven differences for members of the ecological transportation and members of the automobile driver's interest association.

| | association | |
|---|---|---|
| | automobile driver's interest (N = 111) | ecological transportation (N = 322) |
| β(EBI-EBI1): | .85 | .58 |
| β(EBI-EBI2): | .93 | .43 |
| ME(EBI2): | .14 | .82 |
| r[ME(EBI1)-ME(EBI2)]: | - | .27 |
| Variance(EV): | free | free |
| Variance(EK): | free | free |
| r(EK-EV): | .63 | .39 |

Table 1A

Correlation matrix, variable means (m), and standard deviations (SD) of all variables used in the LISREL analyses

| Subscale | N | m | SD | correlation matrix | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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 | | | |
| EBI1 | 442 | 3.53 | .84 | .456 | .388 | .293 | .195 | | |
| EBI2 | 442 | 4.17 | .76 | .501 | .430 | .366 | .231 | .736 | |
| GEB_Sc. | 443 | 1.58 | .88 | .360 | .290 | .298 | .165 | .549 | .498 |

# Figures

Figure 1: The theory of reasoned action

Figure 2: General Ecological Behavior (GEB) predicted by Ecological Behavior Intention (EBI), which, in turn, is a function of Environmental Knowledge (EK), and Environmental Values (EV).

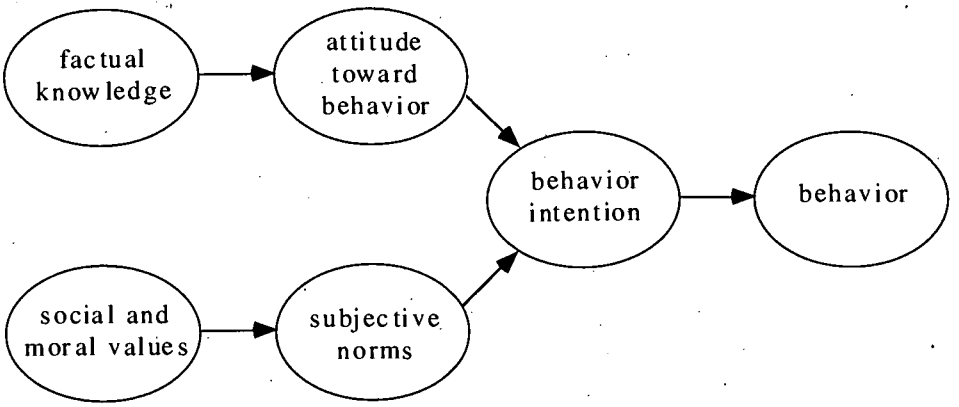
factual knowledge
attitude toward behavior
behavior intention
behavior
social and moral values
subjective norms

Figure 1:

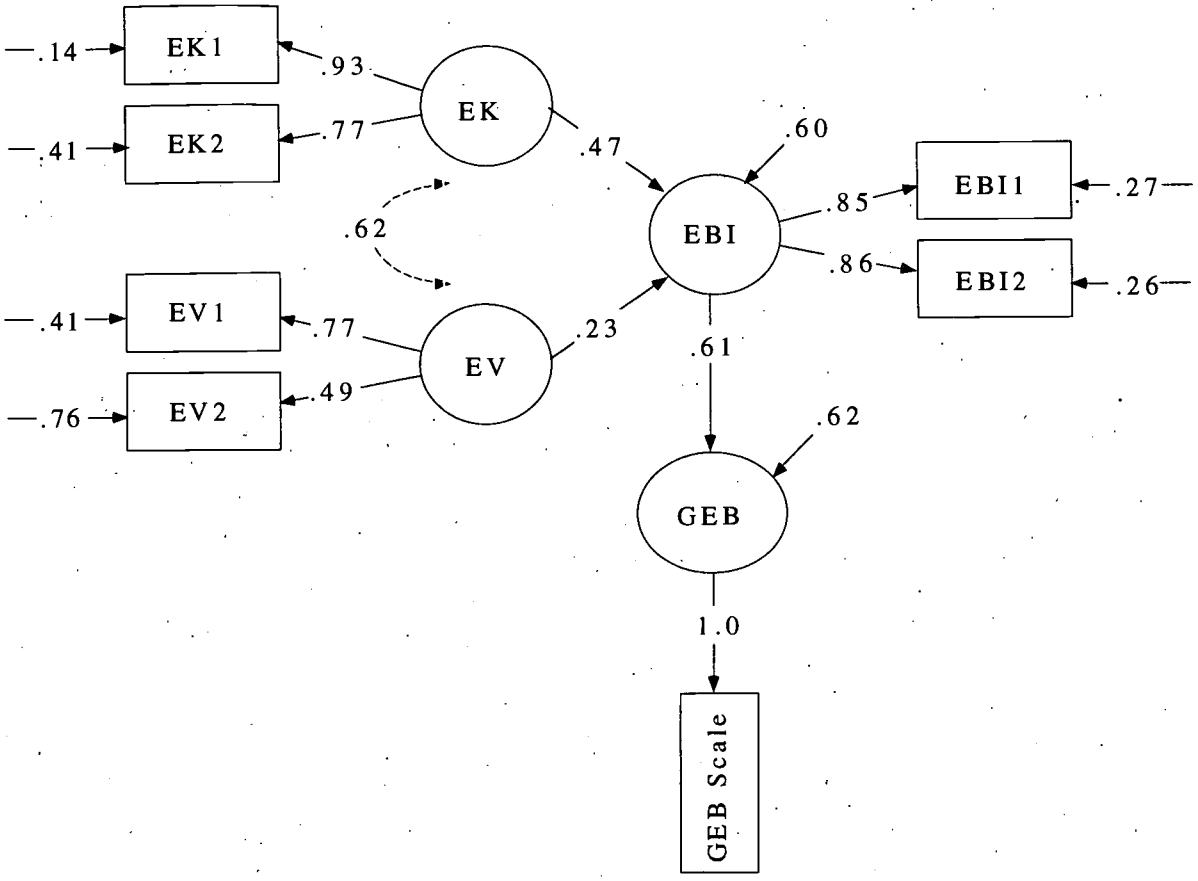
.14
EK1
.93
EK
.41
EK2
.77
.47
.60
.62
EBI
.85
EBI1
.27
.86
EBI2
.26
.41
EV1
.77
EV
.23
.61
.76
EV2
.49
.62
GEB
1.0
GEB Scale

Figure 2:

## Authors' Note

The present research was supported by Grant #5001-35271 and Fellowship #8210-040207 from the Swiss National Science Foundation.

We wish to thank the following colleagues for their helpful comments on earlier drafts of this paper: Kenneth Craik, Birgit Fahrer, Samuel Gossling, Michael Ranney, Jeanne Wildner, Mark Wilson, and Charles Woodson. We are especially grateful to Christopher Brandon White and Todd Shimoda for their language support. We are also grateful to Sibylle Steinmann and Esther Walter for their assistance in collecting and preparing data and to Machteld Hoskens, Terry Hartig, and David Ragland for access to their computing facilities.

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