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ENVIRONMENTAL ATTITUDE AND ECOLOGICAL BEHAVIOUR

FLORIAN G. KAISER[1], SYBILLE WÖLFING[2] AND URS FUHRER[3]

[1] *ETH Zürich, Zürich, Switzerland;* [2] *Universität Bern, Bern, Switzerland;*
[3] *Otto-von-Guericke-Universität, Magdeburg, Germany*

Abstract

This paper establishes environmental attitude as a powerful predictor of ecological behaviour. Past studies have failed in this enterprise because they did not consider three shortcomings that limit the predictive power of environmental attitude concepts: (1) the lack of a unified concept of attitude, (2) the lack of measurement correspondence between attitude and behaviour on a general level, and (3) the lack of consideration of behaviour constraints beyond people's control. Based on Ajzen's theory of planned behaviour, 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 confirmed three measures as orthogonal dimensions by means of factor analysis: (1) environmental knowledge, (2) environmental values, and (3) ecological behaviour intention. One other measure, general ecological behaviour, is established as a Rasch-scale that assesses behaviour by considering the tendency to behave ecologically and the difficulties in carrying out the behaviours, which depend on influences beyond people's actual behaviour control. A structural equation model was used to confirm the proposed model: environmental knowledge and environmental values explained 40 per cent of the variance of ecological behaviour intension which, in turn, predicted 75 per cent of the variance of general ecological behaviour.

Introduction[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 the earth's natural resources (*cf.* Stern, 1992*a*; Kruse, 1995). Because psychologists refer to individual behaviour rather than to behaviour of whole societies they ask questions such as what determines an individual's ecological behaviour [i.e. 'actions which contribute towards environmental preservation and/or conservation.' (Axelrod & Lehman, 1993: p. 153.)] or how can behaviour 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 relationship between environmental attitude and ecological behaviour is well-explored.[3] However, the relationship appears to be at best moderate across different studies (Hines *et al.*, 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 behaviour[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–behaviour relationship also affect the environmental attitude and ecological behaviour relationship. These two flaws are the lack of measurement correspondence and the lack of consideration of situational influences on a given behaviour. Measurement correspondence refers to measurement of attitude and behaviour on the same level of specificity (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 behaviour beyond people's control (Ajzen & Madden, 1986). Inclusions of such behaviour influences are seen as particularly important in the ecological domain (Hines *et al.*, 1986/87; Granzin & Olsen, 1991; Stern, 1992*b*; Vining & Ebreo, 1992; Foppa *et al.*, 1995; Guagnano *et al.*, 1995). Such influences are usually considered either as moderator effects on the relationship between environmental attitude and ecological behaviour or as direct influences on ecological behaviour. Both approaches require a rather arbitrary selection of possible influences.

The present paper promotes the *theory of planned behaviour* (Ajzen, 1985) 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 behaviour.

Three environmental attitude approaches and ecological behaviour

In essence, two types of environmental attitude[5] are used to predict ecological behaviour: (1) attitudes toward the environment, and (2) attitudes toward ecological behaviour (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 behaviour (e.g. recycling or political activism). Environmental attitude towards ecological behaviour refers to the Fishbein and Ajzen tradition of attitude research that will be described in more detail later. Only a minority of the studies (approximately 20%, according to Hines *et al.*, 1986/87) that relate environmental attitude with ecological behaviour refer to the framework of the theory of reasoned action (Ajzen & Fishbein, 1980) and its developed version, the theory of planned behaviour (Ajzen, 1985). In contrast, attitude towards the environment commonly refers to *environmental concern* (Vining & Ebreo, 1992). Environmental concern is used either as a multiple or a single component approach (Fuhrer, 1995) and covers either environment in general or some particular aspects of environment.

If attitude towards 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 *et al.*, 1975). An affect scale measures the affective component, factual knowledge about the environmental measures the cognitive aspects, and verbal commitment measures the behaviour intention component of environmental attitude (Smythe & Brook, 1980). A fourth scale measures ecological behaviour.[6]

Originally, all three environmental attitude components—affect, knowledge (i.e. cognition), and intention—were used in parallel to predict ecological behaviour. Recent versions of this approach vary: some propose the affect component as the single indicator of environmental attitude (Langheine & Lahmann, 1986; Newhouse, 1990), others abandon ecological behaviour intention (Dispoto, 1977), while a third group uses the ecological behaviour intention component as the single indicator of environmental attitude (Schahn & Holzer, 1990*a*, 1990*b*; 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 behaviour (Geller, 1981; Diekmann & Preisendörfer, 1992; Grob, 1995). Consequently, environmental attitude is, occasionally, measured independently from its cognitive, affective and intentional components. Hence, one's attitude towards the environment can become a single component measure (Arbuthnot, 1977; Van der Pligt, 1985; Oskamp *et al.*, 1991; Lansana, 1992; Derksen & Gartrell, 1993; Gamba & Oskamp, 1994). If attitude towards 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 *et al.*, 1985/86; Berger & Corbin, 1992; Axelrod & Lehman, 1993).

The new environmental paradigm (NEP), which is the third and most recently developed tradition of environmental attitude research (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

(Stern *et al*., 1993) it may be argued that the NEP represents a shift towards a more evaluative conception of attitude (Schahn & Holzer, 1990*a*; or *cf*. Dunlap & Van Liere, 1978; such a shift can be seen in other attitude concepts as well: Leonard-Barton, 1981; Van Liere & Dunlap, 1981; Verhallen & Van Raaij, 1981; Axelrod & Lehman, 1993). This interpretation is additionally supported by the fact that NEP findings barely match those regarding the relationship between environmental attitude and ecological behaviour. In short, the strength of the relationship between the NEP and ecological behaviour ranges from nonexistent (Smith *et al*., 1994) to weak (Dunlap & Van Liere, 1978; Scott & Willits, 1994). Conversely, environmental attitude and ecological behaviour 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 behaviour as this frame. The proposed frame encompasses most aspects of the three formerly mentioned attitude concepts.

A general framework: the theory of planned behaviour

In the theory of reasoned action (Ajzen & Fishbein, 1980) and its developed version, the theory of planned behaviour (Ajzen, 1985), behaviour *intention* to perform the behaviour in question is the immediate antecedent of overt behaviour. Intention, in turn, is seen as a function of one's attitude towards 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.

In Figure 1, the theory of reasoned action is presented graphically. The theory of planned behaviour extends the theory of reasoned action by its inclusion of *influences on behaviour beyond people's control*. If these influences are measured by means of the perception of one's control, two assumptions

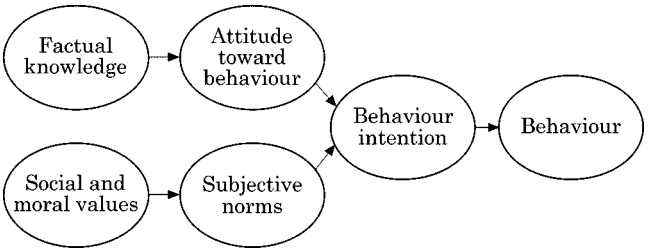

FIGURE 1. The theory of reasoned action.

have to be made: (1) the predicted behaviour must be, at least partially, beyond volitional control, and (2) perception of control must reflect actual control upon behaviour with some accuracy (Ajzen & Madden, 1986). While the latter assumption has to be seen as a possible flaw of the planned behaviour approach, the former assumption is often claimed in the ecological domain.

Ecological behaviour 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 behaviour. Examples of community or neighbourhood-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 behaviour 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 *et al*., 1993; Scott & Willits, 1994). Thus, not surprisingly, the theory of planned behaviour, which includes behaviour constraints beyond volitional control, has to be considered especially useful in predicting ecological behaviour. 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 behaviour

To include all three attitude concepts (i.e. attitudes toward the environment, the new environmental paradigm and attitudes toward ecological behaviour) in one general framework (i.e. the theory of planned behaviour), this framework has to consist of at least three components: factual knowledge about the environment, social and moral values regarding environment, social and moral values regarding environment and ecological behaviour intention. The theory of reasoned action, as well as the theory of planned behaviour, proposes that attitude influences behaviour, mediated by intention (see Figure 1). Factual knowledge can be seen as a precondition of any attitude and, thus, the relationship between factual knowledge and behaviour is mediated by intention as well. Moveover, subjective norms, or at least one's values, are also mediated by intention and therefore predict behaviour 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 relationship between environmental attitude and ecological behaviour (Weigel *et al.*, 1974; Langeheine & Lehmann, 1986; Hines *et al.*, 1986/87; Axelrod & Lehman, 1993; Smith *et al.*, 1994) or a weak relationship (McGuinness *et al.*, 1977; Sia *et al.*, 1985/86; Williams, 1991; Berger & Corbin, 1992; Diekmann & Preisendörfer, 1992; Barker *et al.*, 1994; Moore *et al.*, 1994; Grob, 1995). However, at least five studies report no such relationship 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 behaviour (Lynne & Rola, 1988). If environmental attitude refers to components, for instance, environmental knowledge, environmental values and ecological behaviour 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 behaviour strongly because its influence is attenuated both by environmental attitude and ecological behaviour intention. Hence, it is not surprising that several studies found either no relationship between factual environmental knowledge and ecological behaviour (Maloney & Ward, 1973; Maloney *et al.*, 1975; Amelang *et al.*, 1977; Schahn & Holzer, 1990*a*, 1990*b*) or at best a moderate relationship (Arbuthnot, 1977; Dispoto, 1977; Smythe & Brook, 1980; Stutzman & Green, 1982; Hines *et al.*, 1986/87; Oskamp *et al.*, 1991). When this relationship appears to be stronger, it is knowledge about an ecological behaviour (i.e. knowledge about what and how something can be done) rather than factual knowledge about the environment that is related to ecological behaviour (e.g. Levenson, 1974; Sia *et al.*, 1985/86; Smith-Sebasto & Fortner, 1994).

Value effect

As proposed by the theory of planned behaviour, one's subjective norms (Olsen, 1981; Kantola *et al.*, 1983; Midden & Ritsema, 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 relationship decreases if ecological behaviour instead of ecological behaviour intention is considered (McGuinness *et al.*, 1977; Vining & Ebreo, 1992), presumably indicating the mediating effect of ecological behaviour intention. One's environmental values parallel these findings: environmental values are related to ecological behaviour intention (Dunlap & Van Liere, 1978; Van Liere & Dunlap, 1981; Axelrod, 1994); and if environmental values are related to ecological behaviour (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. According to the theory of planned behaviour, this mediator is ecological behaviour intention.

Intention effect

The most striking effect usually found is between ecological behaviour intention and ecological be-

haviour. Ecological behaviour intention is strongly related to ecological behaviour (Maloney & Ward, 1973; Maloney *et al*., 1975; Schahn & Holzer, 1990*a*, 1990*b*; 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 behaviour with which no such relationship is found (Auhagen & Neuberger, 1994; Fuhrer & Wölfing, 1997) and at least two studies in which the relationship between ecological behaviour intention and ecological behaviour 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 behaviour is affected by either environmental attitude, environmental knowledge, environmental values or ecological behaviour intention while others are not (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 behaviour 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 relationship between environmental attitude and ecological behaviour: measurement correspondence and behaviour influences beyond people's control.

Measurement correspondence: general attitude and general behaviour

The possible lack of measurement correspondence between environmental attitude and ecological behaviour is well recognized (Weigel *et al*., 1974; Newhouse, 1990; Stern, 1992*b*; Vining & Ebreo, 1992; Axelrod & Lehman, 1993) and does not need much further explanation. It can be summarized as follows: if one's environmental attitude is assessed generally, 'the behavioural criterion should be equally general or comprehensive' (Weigel *et al*., 1974: p. 728). Note, however, that highly specific rather than general measures of ecological behaviour, even though corresponding with environmental attitude, are occasionally refused as a solution because they are highly susceptible to situational influences beyond people's control (Granzin & Olsen, 1991; Pickett *et al*., 1993). As specific measures appear to be affected more easily than general measures, general environmental attitude measures are proposed as better predictors of comprehensive ecological behaviour criteria (Newhouse, 1990). Even though some data apparently confirm this notion by strong relationships between general environmental attitude and general ecological behaviour measures (Lynne & Rola, 1988; Axelrod & Lehman, 1993) others do not (McGuinness *et al*., 1977; Van Liere & Dunlap, 1981; Berger & Corbin, 1992; Diekmann & Preisendörfer, 1992; Scott & Willits, 1994; Smith *et al*., 1994; Grob, 1995). These puzzling findings concerning the relationship between general environmental attitude and general ecological behaviour may also be due to measurement problems related to general ecological behaviour measures (for a discussion see Kaiser, 1998). Occasionally, such a general measure is questioned in principle (Lloyd, 1980; Oskamp *et al*., 1991). However, there is at least one general measurement approach that includes a broad range of different behaviours, which rules out situational influences beyond people's control (see Kaiser, 1998).

Consideration of influences beyond people's control

As previously stated, the relationship between environmental attitude and ecological behaviour 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 behaviour (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 behaviour. Second, moderators of the relationship between environmental attitude and ecological behaviour may be scrutinized. Because moderators represent conditional aspects of a given relationship, nonvolitional behaviour constraints

that affect such a relationship can be chosen as moderators (e.g. residential area or season). Third, an ecological behaviour measure, established as a Rasch-scale, that quantifies ecological behaviour 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; Huebner & Lipsey, 1981; Sherman *et al.*, 1981; Sia *et al.*, 1985/86; Hines *et al.*, 1986/87; 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, indicate people's actual control (as proposed by Ajzen & Madden, 1986). Rather, they represent different predictors of either ecological behaviour (Levenson, 1974; Arbuthnot, 1977; Busch-Rossnagel & Weigel, 1984; Sia *et al.*, 1985/86; Hines *et al.*, 1986/87; Oskamp *et al.*, 1991; Axelrod & Lehman, 1993; Auhagen & Neuberger, 1994; Gamba & Oskamp, 1994; Smith-Sebasto & Fortner, 1994; Grob, 1995) or ecological behaviour intention (Huebner & Lipsey, 1981; Sherman *et al.*, 1981; Kantola *et al.*, 1983; Kals & Montada, 1994). Unfortunately, the relationship between perceived control and ecological behaviour is inconsistent and ranges from slightly negative (Grob, 1995) to nonexistent (Oskamp *et al.*, 1991; Gamba & Oskamp, 1994) to very positive (Auhagen & Neuberger, 1994).

Moderators. A selection of moderators used that affect the environmental attitude–ecological behaviour relationship includes gender (Schahn & Holzer, 1990*a*, 1990*b*), socio-economic status (Midden & Ritsema, 1983), mode of behaviour assessment (Hines *et al.*, 1986/87), group membership (environmentalists vs nonenvironmentalists: Hines *et al.*, 1986/87), income (Lynne & Rola, 1988), access to recycling programmes (Derksen & Gartrell, 1993), season (Becker *et al.*, 1981) and nationality (Meseke, 1994). All these moderators represent different sorts of nonvolitional, socio-cultural behaviour constraints. Usually, questions concerning their scope remain unanswered: do they affect all or just a few ecological behaviours?

Because moderator effects (indicating situational, socio-cultural influences) are either difficult to explain or they demand further theoretical clarification (*cf.* Baron & Kenny, 1986) 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 behaviour measure

As the probability of a behaviour considers influences beyond people's actual control, an accurate measure of ecological behaviour is actually a probability that one carries out the specific behaviour 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 behaviours in a way that make them varyingly difficult to carry out. Hence, some behaviours 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 behaviour (i.e. behaviour difficulty).

The General Ecological Behaviour (GEB) scale assesses general ecological behaviour by considering different ecological and prosocial behaviours (see Appendix 1). Each of these behaviours 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 behaviour is to carry out, the less constraints have to be assumed. This behaviour difficulty is estimated for each behaviour 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 behaviours he or she has carried out (i.e. the probability that somebody will behave ecologically given that behaviours differ in difficulties).

Because a measure of one's ecological behaviour considers the tendency to behave ecologically as well as behaviour difficulties, people are free, to a certain extent, to behave inconsistently across different ecological behaviours. Someone, for instance, who tends to behave ecologically on a very high level across different behaviours, may fail to recycle

newspapers, even though this behaviour is easy to carry out. In contrast, someone who usually behaves very unecologically may, for whatever reason, not drive an automobile, a behaviour that is commonly difficult *not* to carry out. And as such inconsistencies result from, individually, different socio-cultural constraints beyond people's actual control, situational influences are represented in this behaviour measure in two different ways (for more details see Kaiser, 1998).

Hypotheses

As explained in the previous sections, three shortcomings affect the predictive power of environmental attitude concepts regarding ecological behaviour: (1) the lack of a unified attitude concept, (2) the lack of measurement correspondence between attitude and behaviour on a general level, and (3) the lack of considerations of situational behaviour constraints beyond people's control. The present paper proposes to use an abbreviated version of the theory of planned behaviour 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 behaviour intention are suggested as the conceptual skeleton of the theory of planned behaviour that encompasses the three most commonly used attitude approaches in environmental psychology: attitude towards the environment, attitude towards ecological behaviour and the NEP. In addition, the relationship between environment attitude and ecological behaviour should be considerably strengthened by adopting a general ecological behaviour measure that assesses behaviour by means of behaviour difficulties and behaviour tendencies. This relationship between general attitude and general behaviour 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 behaviour intention (see Figure 1); (2) ecological behaviour intention affects ecological behaviour strongly if both of them are assessed rather generally and if the ecological behaviour measure considers situational behaviour constraints; and (3) all relationships between the three environmental attitude concepts (i.e. environmental knowledge, environmental values and ecological behaviour intention) and between ecological behaviour intention and ecological behaviour 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 from 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, and the other represents primarily automobile drivers' interests. To include as much 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 per cent (1643) were willing to participate. This presumably, even for the two associations, unrepresentative pool was asked to complete three questionnaires: the first was sent out during December 1993, and 1371 people (83·5%) completed it (Seiler, 1994; Fuhrer *et al.*, 1995). The targeted participants of the second questionnaire were those who had completed the first questionnaire. The second questionnaire was mailed in May 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 numbers 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, $M = 46{\cdot}6$, range = 20−82.

The high participation rate within the pool can be seen as a result of a 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%). Hence, the sample seems to be biased towards more ecologically concerned participants. 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. Since relationships and not means are tested, any sample bias is of minor importance. Additionally, the generalizability of the proposed relationships will be scrutinized by statistical means, which is basically what fit statistics are all about.

Measures

The questionnaires consisted of a Social Desirability scale, a General Ecological Behaviour measure, and three scales that represent the environmental attitude related concepts.

The *Social Desirability* (SD) scale presented by Amelang and Bartussek (1970) consists of 32 items.[9] Fourteen items had to elicite a 'yes' response (e.g. 'I never claim to know more than I actually do') and 18 items a 'no' response (e.g. 'I have taken advantage of people in the past') to contribute to the SD sum score. To be consistent with the response options for the ecological behaviour items, the original true/false format was changed to a yes/no format. Missing values ($n = 109$; 0·8%) were treated as if participants answered in a nonsocially desired way.

The *General Ecological Behaviour* (GEB) measure consists of 38 items representing different types of ecological behaviour and some nonenvironmental, prosocial behaviours as well (see Appendix 1). A yes/no response format for these items was used. Negatively formulated items were reversed in coding. Missing values ($n = 80$; 0·5%) were handled as 'no' responses in general (assuming missing values represented participants' doubt, an indicator of not behaving alike in general). The GEB measure has been calibrated as an unidimensional Rasch-scale (Kaiser, 1998) based on item response theory (Wright & Masters, 1982). Additionally, all attempts to validate the GEB measure with criterion-related self-reported data and with observed behavioural data were promising (see Kaiser, 1998). The GEB items and the 32 SD 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 (Seiler, 1994; Fuhrer *et al.*, 1995; Fuhrer & Wölfing, 1997), were re-evaluated. These scales are Environmental Knowledge (EK), Environmental Values (EV) and Ecological Behaviour Intention (EBI). A 5-point Likert scale that ranged from agree totally (1) to disagree (5) was the response format used. It is worth noting that only three out of 28 items are negatively turned, which puts these scales at a certain risk to be biased (i.e. acquiescence response set). All 10 knowledge items, which represent the EK scale, were distributed randomly throughout a total of 24 knowledge items. All seven 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. Negatively formulated items were reversed in coding. A principal-factor analysis (PFA) was performed to confirm the three-factor structure of the first study (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 per cent explainable variance remained in the analysis. The final three-factor solution accounted for 74·9 per cent of this remaining variance. Factor loadings of the varimax rotated final solution can be seen in Table 1.

After rotation, the explained variance was attributable to each of the three factors as follows: EK = 31·9 per cent, EV = 24·4 per cent and EBI = 43·7 per cent. The three factors either correlated nonsignificantly ($p > 0·05$) or correlated only marginally ($R^2 = 1·2\%$), though significantly ($p < 0·05$): $r(\text{EK}-\text{EV}) = 0·11$, $r(\text{EK}-\text{EBI}) = 0·08$, $r(\text{EV}-\text{EBI}) = 0·09$. Note that these rather weak or nonexistent relationships between EK, EV and EBI derive from applying a varimax rotation. They confirm that the three scales measure statistically independent constructs which is required to reasonably check their empirical interrelations (see **Results**). Generally, the content of all 28 items is related to the topic of pollution (see Table 1). The internal consistencies of the three factors in the solution were estimated by using Cronbach's alpha: $\alpha(\text{EK}) = 0·84$ ($n = 418$), $\alpha(\text{EV}) = 0·73$ ($n = 425$) and $\alpha(\text{EBI}) = 0·85$ ($n = 423$). For subsequent analyses, scores for EK, EV 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 the latter are useful approximations of the former: $r(\text{EK}) = 0·89$, $r(\text{EV}) = 0·90$, $r(\text{EBI}) = 0·95$, $n = 391$. By using mean values [$n(\text{EK}) = 441$, $n(\text{EV}) = 440$, $n(\text{EBI}) = 442$] instead of factor scores ($n = 391$), data for additional participants could be included in further analyses.

TABLE 1
Twenty-eight items and their factor loadings grouped into three factors: environmental knowledge (EK), environmental values (EV) and ecological behaviour 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.	0·46	0·70
2.	... fossil fuels (e.g. gas, oil) produce CO_2 in the atmosphere when burned.	0·42	0·67
3.	... all living beings (micro-organisms, plants, animals, and humans) are interdependent with one another.	0·37	0·62
4.	... poisonous metals are introduced into the food chain, for instance, via ground water.	0·37	0·50
5.	... ozone near the ground may cause respiration problems.	0·37	0·47
6.	... a change in climate caused by increased levels of CO_2 in the atmosphere is called the greenhouse effect.	0·46	0·47
7.	... poisonous metals remain in the human body.	0·35	0·47
8.	... the world climate will probably massively change if CO_2 continues to be emitted into the atmosphere in as huge amounts as it is now.	0·56	0·45†
9.	... a reduced number of species may interrupt the food chain, affecting some subsequent species in the chain.	0·45	0·40
10.	... the greenhouse effect does not result in the melting of glaciers in central Europe.*	0·34	0·39
Values (EV): I agree that (meaning: I admit that) ...			
1.	... all things, whether humans, animals, plants, or stones have the right to exist.	0·58	0·72
2.	... animals should have legal rights.	0·51	0·59
3.	... all organisms' lives are precious and worth preserving.	0·52	0·57
4.	... nature must be preserved because God or another supernatural force is part of it, even in its nonliving aspects.	0·55	0·47
5.	... in general, raising animals in cages should be forbidden.	0·39	0·41
6.	... for everything that I do, including deeds affecting the environment, I am responsible to a supernatural force, for instance God.	0·39	0·36
7.	... the earth's value does not depend on people; it is valuable in itself.	0·37	0·34
Intention (EBI): I agree that (meaning: I admit that) ...			
1.	... I support raising parking fees in cities.	0·60	0·74
2.	... I am ready to pay environmental taxes (e.g. raising fuel or automobile taxes).	0·59	0·71
3.	... I support speed limits on freeways [100 k.p.h. (62·5 m.p.h) and 80 k.p.h. (45 m.p.h.) where freeways cross residential areas].	0·61	0·69
4.	... I support efforts to create automobile-free inner cities.	0·59	0·65

TABLE 1—*Continued*

Item	Original	Replication	
5.	... I would prefer to drive only if absolutely necessary (i.e. no other mode of transportation is available).	0·59	0·53
6.	... I would prefer not to drive to work any longer.	0·56	0·52
7.	... I would prefer to be able to go shopping without my automobile.	0·56	0·48
8.	... I will stop the engine at red lights in the future.	0·47	0·43
9.	... I will still need by automobile in the future.*	0·43	0·43
10.	... my next automobile will be small and as ecologically sound as possible.	0·46	0·41
11.	... I will travel by automobile or by airplane during my vacations.*	0·42	0·40

Note: Analyses are based on 28 items: 10 knowledge, 7 value, and 11 intention items.
* 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.
† Item that loads mainly (i.e. 0·48) on the EBI instead of the proposed EK.
Original: $n = 922$; the three-factor solution accounted for 72·6 per cent of the explainable variance (i.e. 40%) among 28 items. After rotation, the three factors explained EK = 29·8 per cent, EV = 25·3 per cent and EBI = 44·9 per cent of this variance. The three factors correlated marginally with one another ($R^2 < 2\%$): r(EK–EV) = 0·08, r(EK–EBI) = 0·14, r(EV–EBI) = 0·06 (Seiler, 1994).
Replication: $n = 391$: all of them participated in the original study as well.

Analysis

According to the factor loadings of the PFA, each of the three environmental attitude related scales EK, EV and EBI was divided into two balanced subscales (EK1, EK2, EV1, EV2, EBI1, EBI2)[10] that were used as input variables for the structural equation analyses. Not all of these subscales were equally reliable indicators of its corresponding environmental attitude related scale. Particularly EV2's reliability turned out to be quite low (see Figure 2). All structural equation models were assessed using the Maximum Likelihood method (*cf.* Jöreskog & Sörbom, 1993). Unless otherwise indicated, the correlation matrix was used as the input matrix. [See Appendix 2 for the correlation matrix, variable means (M), and their standard deviations (S.D.).]

Results

The present findings are reported in three sections. First, constructs were checked for social desirability effects. Second, hypotheses 1 and 2 (EBI is a function of EK, and of EV, and, in turn, determines GEB) were tested. Third, hypothesis 3 (can hypotheses 1 and 2 be generalized even across ideologically heterogeneous groups) was scrutinized.

Social desirability effects

All four measures of interest, EK, EV, EBI and GEB, were, as a preliminary testing for social desirability (SD) effects revealed, just marginally influenced by S.D. All measures either correlated nonsignificantly ($p > 0{\cdot}05$; r(S.D.–EV) = −0·01; n = 440) or correlated only marginally, indicated by the amount of explained variance (R^2), although significantly ($p < 0{\cdot}05$) with S.D.:

$$r(\text{S.D.–EK}) = -0{\cdot}13, \quad R^2 = 1{\cdot}7\%, \quad n = 441$$
$$r(\text{S.D.–EBI}) = -0{\cdot}13, \quad R^2 = 1{\cdot}7\%, \quad n = 442$$
$$r(\text{S.D.–GEB}) = -0{\cdot}10, \quad R^2 = 1{\cdot}0\%, \quad n = 443.$$

Environmental attitude and ecological behaviour

Confirmatory testing of the two hypotheses—EBI is a function of EK and of EV, and, in turn, determines GEB—revealed that both can be, without any model modification, accepted from an empirical

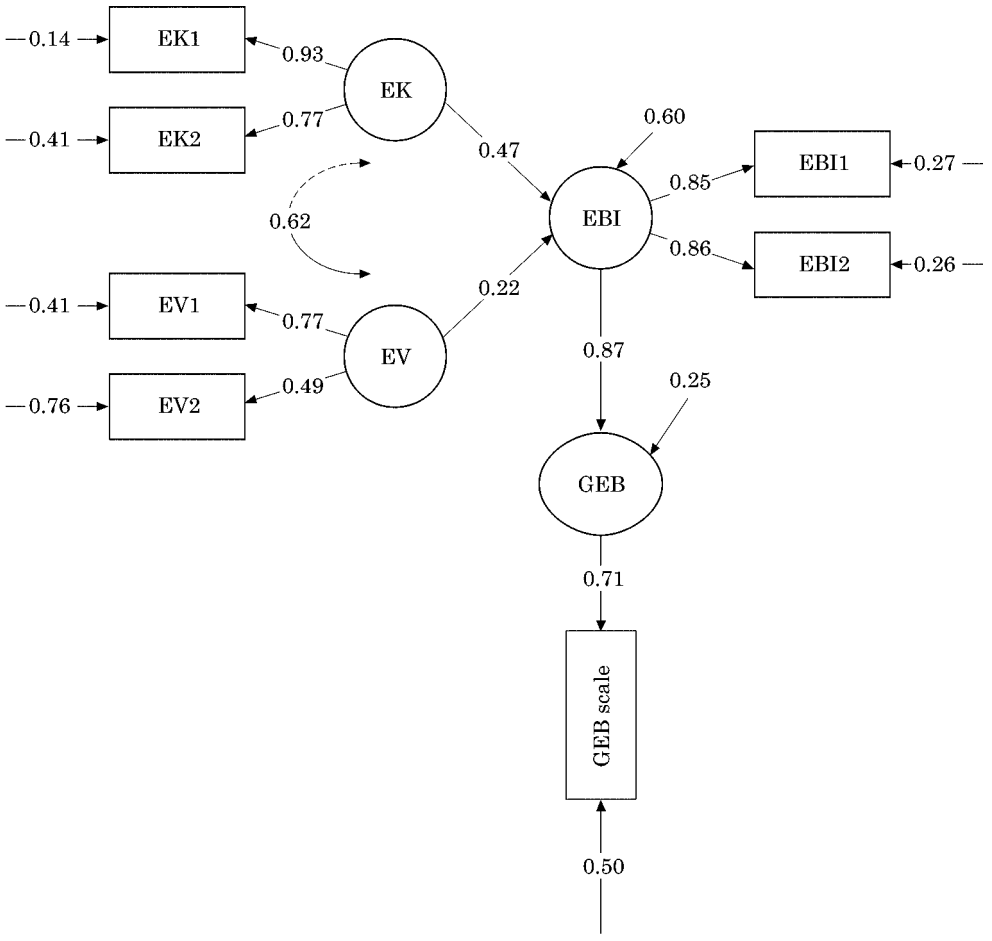

FIGURE 2. General ecological behaviour (GEB) predicted by ecological behaviour intention (EBI), which, in turn, is a function of environmental knowledge (EK), and of environmental values (EV).
Note: Since the relationships between constructs are directed, arrows indicate such relations. β-coefficients (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 origin. The item response theory-based reliability (for formulas see Wright & Masters, 1982) of GEB [β(GEB–GEB scale) = 0·71] and accordingly, the error variance [ME(GEB scale) = 0·50] is not estimated by the LISREL approach; rather, it is provided by the proposed GEB measure (see Kaiser, 1998).

point of view ($\chi^2 = 17{\cdot}86$, df. = 11, $p = 0{\cdot}085$, non-normed-fit-index (NNFI) = 0·99, root-mean-square-error-of-approximation (EMSEA) = 0·038). The number of participants for this model's test was $n = 436$. Figure 2 presents the tested model.

Forty per cent of the variance of EBI could be explained by the two determinants EK ($\beta = 0{\cdot}47$) and EV ($\beta = 0{\cdot}22$). These two indicators of EBI themselves correlated considerably with one another ($r = 0{\cdot}62$). Note that this empirical finding is based on independent constructs since the scales' unrelatedness can be forced statistically (e.g. varimax rotation; see **Method**). Seventy-five per cent of the variance of GEB could be explained by one single indicator, EBI ($\beta = 0{\cdot}87$). Not surprisingly, measurement error, due to the unreliable aspects of the GEB scale [ME(GEB scale) = 0·50], attentuates the EBI influence on GEB. Thus, without correction for measurement error attentuation by assuming a perfect GEB measure [β(GEB–GEB scale) = 1·0], the proportion of explained variance of GEB dropped to 38 per cent.[11]

Transportation association as a moderator

Indicated by the different participation rates of the members of the two transportation associations, the present sample was biased towards more ecologically-concerned participants. This methodological shortcoming could affect the generalizability of our findings (*cf.* Hines *et al.*, 1986/87). Therefore, we compared members of the automobile drivers' asso-

ciation ($n = 111$) with members of the association promoting a more ecological transportation system ($n = 322$). Covariance matrices were used as input matrices.[12] This comparison supported, on the one side, the generalizability of the proposed model. On the other side, it pointed to two moderation effects caused by the association membership.

A model, in which the two association subsamples differed in the reliability of their EBI measures as well as in both the variances of EK and EV and the strength of the relationship between EK and EV, supported the proposed theoretical framework in principle although the model misfitted, strictly speaking, significantly ($\chi^2 = 61{\cdot}45$, df. = 32, $p = 0{\cdot}001$, NNFI = 0·95, RMSEA = 0·046): in both groups EK and EV still predicted EBI which, in turn, determined GEB as proposed. Seven modifications of this model, however, had to be included for an acceptable model fit (indicated by the NNFI, a sample size independent measure). Note that these modifications were conducted to explore the nature of a potential influence of association membership on the proposed model rather than to modify the model theoretically. All seven modifications are listed in Table 2. Consequently, all other estimates are reasonably represented by the ones in Figure 2.

Association membership appears to have two major impacts on the model. First, four modifications refer to reliability indicators of the EBI measures: (1) β(EBI–EBI1), (2) β(EBI–EBI2), (3) ME(EBI2) and (4) an additional measurement error correlation {r[ME(EBI1)–ME(EBI2)]} for members of the ecological transportation association. Together, they suggest that for the automobile driver's interest association, the assessment of EBI was 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, differential (i.e. free) variances for EK and EV as well as the difference in the strength of the relationship 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 behaviour. The propositions are: (1) an abbreviated version of the theory of planned behaviour (Ajzen, 1985) should be used as the theoretical framework; (2) environmental attitude concepts as well as ecological behaviour should be measured rather generally; and (3) any ecological behaviour measurement approach should assess one's ecological behaviour by means of behaviour difficulties. The present results support all three propositions.

Three concepts, environmental knowledge, environmental values and ecological behaviour intention, are suggested as the conceptual skeleton of the theory of planned behaviour. Moreover, these concepts are the core of most of the commonly used attitude approaches—attitudes toward the environment, the new environmental paradigm, and attitudes toward ecological behaviour—used to predict ecological behaviour. The first substantive outcome refers to the notion that environmental knowledge and environmental values are significant preconditions of ecological behaviour intention: as 40 per cent of the variance of ecological behaviour intention was explained by environmental knowledge and environmental values such a claim appears to be sufficiently supported. Surprisingly, the strength

TABLE 2
Seven differences for members of the ecological transporation and members of the automobile driver's interest association

	Association	
	Automobile driver's interest ($n = 111$)	Ecological transportation ($n = 322$)
β(EBI–EBI1):	0·85	0·58
β(EBI–EBI2):	0·93	0·43
ME(EBI2):	0·14	0·82
r[ME(EBI1)–ME(EBI2)]:	—	0·27
Variance (EV):	Free	Free
Variance (EK):	Free	Free
r(EK–EV):	0·63	0·39

of both of these relationships, i.e. the one between environmental knowledge and ecological behaviour intention as well as the one between environmental values and ecological behaviour intention (see Figure 2), are quite comparable to the ones reported by Ajzen and Madden (1986). Although neither of the additional mediation processes, i.e. the one in which environmental knowledge is mediated by attitude towards ecological behaviour and the one in which environmental values are mediated by subjective norms (see Figure 1), were considered in the present model, ecological behaviour intention could be predicted reasonably well. Nevertheless, accurate measures of one's attitude towards ecological behaviour and one's subjective norms, presumably, would decrease the rather respectable amount of unexplained variance of ecological behaviour intention.

Moreover, alternative predictors of ecological behaviour 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 towards the environment. Environmental affects are crucial concepts in the environmental concern domain (e.g. Maloney & Ward, 1973; Maloney *et al.*, 1975). Whereas responsibility towards the environment not only appears to affect different ecological behaviour intentions considerably (Fridgen, 1994; Kals & Becker, 1994; Kals & Montada, 1994), but it also predicts general ecological behaviour itself (mediated by one's responsibility judgment towards the environment, which in turn is most prominently an intentionality judgment too; see Kaiser & Shimoda, in press).

The second substantive outcome refers to the proposition that ecological behaviour intention predicts ecological behaviour remarkably, given that both of them are assessed rather generally and that the ecological behaviour measure considers behaviour constraints beyond people's control. As socio-cultural, situational constraints determine to some extent which ecological behaviour is easier to carry out and which is harder, two methodological claims are made. The first is that general measures, in this case behaviour intention and behaviour, are less susceptible to influences beyond people's control which should result in a considerably enhanced strength of the relationship between ecological behaviour intention and ecological behaviour. Unfortunately, some studies still report less than strong relationships between general ecological behaviour intention and general ecological behaviour (e.g. McGuinness *et al.*, 1977; Diekmann & Franzen, 1995). Such findings may be due to the general ecological behaviour measurement approach used. The second methodological claim, thus, is that a probabilistic measurement approach, which estimates ecological behaviour difficulties to assess general ecological behaviour, is better suited than alternative measurement approaches, which are based on classical testing theory (Kaiser, 1998). Seventy-five per cent explained variance of general ecological behaviour by ecological behaviour intention supports the above proposition impressively.

A behaviour measure, which considers behaviour constraints beyond people's control, allows the disentangling of psychological and nonpsychological,[13] i.e. socio-cultural, situational influences, determinants of ecological behaviour. Such a measure has two major advantages.

The first is related to the fact that nonpsychological influences affect ecological behaviours dominantly (Stern, 1992*b*; Guagnano *et al.*, 1995). As a consequence, socio-cultural influences might cover psychological ones (see Stutzman & Green, 1982; Derksen & Gartrell, 1993) or distort comparisons of different psychological concepts (see Oskamp *et al.*, 1991; Lansana, 1992; Moore *et al.*, 1994). If all nonpsychological, situational influences are controlled, which can be done by using a probabilistic measurement approach, psychological concepts such as environmental attitude can be tested and compared as predictors of behaviour unbiased from nonpsychological influences. Also, as the present study suggests, they can become remarkable predictors of behaviour. However, all other influences, 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 nonpsychological influences, but not all of them, are scrutinized (as moderators or as predictors).

The second advantage of the proposed General Ecological Behaviour measure, which assesses behaviour difficulties of different ecological behaviours, can be seen in its applicability as an assessment tool for measures of communities and societies to affect individual behaviour (Kaiser, 1998). As nonpsychological, situational influences result in a given behaviour difficulty for any single behaviour, changes in behaviour difficulties can point out effects of nonpsychological measures that promoted these changes. For example, a community intends to change individual recycling behaviour by means of a curbside recycling programme. This political effort to reduce the amount of garbage in the community might, in fact, result in an alter-

ation of behaviour difficulties of different recycling behaviours, as for instance, glass, paper and can recycling. A comparison between the community and a second community without a curbside recycling programme or compared to itself before introducing the programme can reveal the effectiveness of the recycling programme by means of behaviour difficulty changes.

Thus, the General Ecological Behaviour scale can be used as an assessment tool for environmental behaviour measures of communities and societies. Moreover, the scale could also be used as a detection tool for effective measures that might affect ecological behaviours. The latter suggests that measures that make it easier for people to behave ecologically in one community might be effective in another community too. Also, measures that are already empirically established in one community or society as effective measures to enhance ecological behaviours can be adopted by other communities and societies as well, which results in a less arbitrary and vague adoption process of political measures (for more details see Kaiser & Wilson, in press).

In contrast to findings by Hines and colleagues (1986/87), the third substantive outcome supports the notion that the relationship between environmental attitude and ecological behaviour remains comparable even for ideologically heterogeneous groups. 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, yielded similar relations among the three environmental attitude-related concepts and between ecological behaviour intention and general ecological behaviour.

Besides all similarities, however, there were two differences between the two association groups worth noting. Ecological Behaviour Intention measures for members of the ecological transportation association were less reliable than for members of the automobile driver's interest group. As there were three times more environmentalists than other participants in the present study, their greater variety is likely. Additionally, the finding might indicate as well that there is a powerful predictor of ecological behaviour intention not considered yet. Such an additional predictor could be, as already pointed out, either environmental affects or responsibility feelings toward the environment. A greater variety 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 interrelationships 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 studied the more ecologically-concerned subset of the automobile driver'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 were barely distinguishable in the automobile driver's interest group, and these values were 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 behaviour intention and general ecological behaviour, were 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 behaviour (Ajzen, 1985) as a unifying frame for the environmental attitude research. Moreover, they support a behaviour measure approach that considers actual behaviour 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 nonpsychological influences on individual behaviour. Also as behaviour, ecological or non-ecological, is in general affected by psychological influences beyond people's control, psychological and nonpsychological influences have to be disentangled to be tested effectively. To scrutinize the predictive power of psychological concepts, as for instance attitude, the proposed behaviour measurement approach appears promising, presumably regardless of the domain.

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Notes

Reprint requests and correspondence should be sent to Florian G. Kaiser, Swiss Federal Institute of Technology (ETH), People–Environment Interaction, ETH Zentrum HAD, CH-8092 Zürich, Switerland; e-mail kaiser@uns.umnw.ethz.ch

(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 behaviour. 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) revealed a field of 1361 publications that deal with environmental problems. The psychological index terms used are: environmental attitudes (n = 847), conservation (ecological behaviour) (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%) refer to environmental attitude.

(3) One-third of all publications in the field deal with ecological behaviour (31%; n = 422). Of these, more than one-third (36·3%; n = 153) relate environmental attitude to ecological behaviour. 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, represents fairly well the principle findings of the environmental attitude and ecological behaviour literature.

(4) Ecological behaviour in this paper includes specific behaviours as well as general behaviour indices. Specific behaviours cover recycling (McCarty & Shrum, 1994; Smith *et al.*, 1994; Guagnano *et al.*, 1995), spatial mobility (Sherman *et al.*, 1981; Fuhrer & Wölfing, 1997), energy conservation (Geller, 1981; Midden & Ritsema, 1983; Van der Pligt, 1985), political action (Huebner & Lipsey, 1981; Stern *et al.*, 1993), consumerism (Scott & Willits, 1994), regulatory support behaviour (Berger & Corbin, 1992; Axelrod, 1994), ecological house keeping (Auhagen & Neuberger, 1994), commitment to environmental organizations (Weigel *et al.*, 1974), ecological farming (Lynne & Rola, 1988; Axelrod, 1994) and water conservation (Kantola *et al.*, 1983; Moore *et al.*, 1994). General behaviour indices are used, for instance, in Maloney and Ward (1973), Diekmann and Preisendörfer (1992), Axelrod and Lehman (1993), Smith-Sebasto and Fortner (1994) 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 behaviour (Becker *et al.*, 1981; McCarty & Shrum, 1994) or to one's judgment of the importance of a given ecological behaviour (Karns & Khera, 1983; Oskamp *et al.*, 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 *et al.*, 1977; Smythe & Brook, 1980).

(7) Factual knowledge about the environment is needed to build up attitudes toward the environment as well as attitudes toward ecological behaviour (see McGuinness *et al.*, 1977; Diekmann & Preisendörfer, 1992; Grob, 1995).

(8) Surprisingly, the reported strength of the relationship between knowledge and attitude ranges from nonexisting (Stutzman & Green, 1982) to weak (Langeheine & Lehmann, 1986; Diekmann & Preisendörfer, 1992; Grob, 1995).

(9) A translated version of the SD scale of Amelang and Bartussek (1970) is available on request.

(10) Ordered according to their loadings, the first, the third, two of the three tied for fifth, and the ninth items were used to calculate the EK1 mean value (n = 441), whereas EK2 is constructed out of the remaining EK items (items with the second, fourth, the third tied for fifth, the eighth and the tenth highest loading; n = 441). Note that 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. 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 second, fourth and the sixth highest loading; n = 438). EBI1 is composed of six items based on the items with the first, third, fifth, seventh, one of the 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 second, fourth, sixth, the other tied for eighth and the tenth 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.

(11) The present findings remained basically unaffected by the input matrix that was used (i.e. the covariance instead of the correlation matrix): χ^2 = 18·18, df. = 11, p = 0·077, NNFI = 0·99, RMSEA = 0·039.

(12) Covariance rather than correlation matrices were used to explore potential moderator effects more completely (i.e. including differential variances).

(13) The term *nonpsychological* refers to social, financial, material and so forth, determinants of ecological behaviour.

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Appendix 1

Thirty-eight items measuring general ecological behaviour

Prosocial behaviour items:

1. Sometimes I give change to panhandlers.
2. From time to time I contribute money to charity.
3. If an elderly or disabled person enters a crowded bus or subway, I offer him or her my seat.
4. If I were an employer I would consider hiring a person previously convicted of a crime.
5. In fast food restaurants, I usually leave the tray on the table.*
6. If a friend or relative had to stay in hospital for a week or two for minor surgery (e.g. appendix, broken leg), I would visit him or her.
7. Sometimes I ride public transportation without paying a fare.*
8. I would feel uncomfortable if Turks lived in the apartment next door.*

Ecological behaviour items:

1. I put dead batteries in the garbage.*
2. After meals, I dispose of leftovers in the toilet.*
3. I bring unused medicine back to the pharmacy.
4. I collect and recycle used paper.
5. I bring empty bottles to a recycling bin.
6. I prefer to shower rather than to take a bath.
7. In the winter, I keep the heat on so that I do not have to wear a sweater.*

8. I wait until I have a full load before doing my laundry.
9. In the winter, I leave the windows open for long periods of time to let in fresh air.*
10. I wash dirty clothes without prewashing.
11. I use fabric softener with my laundry.*
12. I use an oven-cleaning spray to clean my oven.*
13. If there are insects in my apartment I kill them with a chemical insecticide.*
14. I use a chemical air freshener in my bathroom.*
15. I use chemical toilet cleaners.*
16. I use a cleaner made especially for bathrooms rather than an all-purpose cleaner.*
17. I use phosphate-free laundry detergent.
18. Sometimes I buy beverages in cans.*
19. In supermarkets, I usually buy fruits and vegetables from the open bins.*
20. If I am offered a plastic bag in a store I will always take it.*
21. For shopping, I prefer paper bags to plastic ones.
22. I usually buy milk in returnable bottles.
23. I often talk with friends about problems related to the environment.
24. I am a member of an environmental organization.
25. In the past, I have pointed out to someone his or her unecological behaviour.
26. I sometimes contribute financially to environmental organizations.
27. I do not know whether I may use leaded gas in my automobile.*
28. Usually I do not drive my automobile in the city.
29. I usually drive on freeways at speeds under 100 k.p.h. (62·5 m.p.h).
30. When possible in nearby areas [around 30 km, (18·75 miles)], I use public transportation or ride a bike.

* Negatively formulated items.

Appendix 2

Correlation matrix, variable means (M) and standard deviations (S.D.) of all variables used in the LISREL analyses

Subscale*	*n*	*M*	S.D.	Correlation matrix					
EK1	441	4·72	0·43						
EK2	441	4·65	0·46	0·712					
EV1	439	4·45	0·59	0·447	0·334				
EV2	438	3·74	1·01	0·275	0·263	0·379			
EBI1	442	3·53	0·84	0·456	0·388	0·293	0·195		
EBI2	442	4·17	0·76	0·501	0·430	0·366	0·231	0·736	
GEB scale	443	1·58	0·88	0·360	0·290	0·298	0·165	0·549	0·498

Note: The possible range of scale means lies between 1 and 5 with one expection: 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; EBI1 = Ecological Behaviour Intention scale 1; EBI2 = Ecological Behaviour Intention scale 2; GEB scale = General Ecological Behaviour scale.