The Proposition of a General Version of the Theory of Planned Behavior: Predicting Ecological Behavior[1]

FLORIAN G. KAISER[2]
Eindhoven University of Technology
Eindhoven, The Netherlands

HEINZ GUTSCHER
University of Zürich
Zürich, Switzerland

The present paper explores whether the theory of planned behavior (TPB) must abandon the notion that perceived behavioral control (PBC) has a direct influence on behavior. In a cross-sectional survey of 895 Swiss residents, our hypothesis was tested by means of structural equation models. Applied specifically, PBC turned out to be a significant direct predictor of one's performance. A general version of the TPB based on aggregated measures, however, revealed PBC's direct influence on behavior to be nonsignificant and, presumably, a non-universally applicable and thus nongeneralizable part of the theory. Intention determined 51% to 52% of people's ecological behavior, which supports the claim of a strong attitude–behavior relation. Attitude, subjective norms, and PBC, the 3 TPB components, account for 81% of intention's variance.

Someone with a positive attitude toward ecological behavior who is not engaging in conservational efforts seems rather counterintuitive. Yet, this appears to be not uncommon; attitudes still have a rather bad reputation when it comes to behavior prediction (Sheeran, Orbell, & Trafimow, 1999). Nevertheless, substantial progress has been made in understanding the relation between attitude and behavior since Wicker's (1969) groundshaking review (Eagly & Chaiken, 1993). Particularly significant was the acknowledgment of situational constraints and facilitators of behavior; that is, influences beyond one's own volitional control (Ajzen, 1985, 1991). These contextual influences (e.g., time, opportunity,

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[2]Correspondence concerning this article should be addressed to Florian G. Kaiser, Eindhoven University of Technology, Technology Management (DG 0.11), P.O. Box 513, NL-5600 MB Eindhoven, The Netherlands. E-mail: f.g.kaiser@tm.tue.nl

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dependence on others) can affect people's performance, resulting in differential endorsement probabilities (i.e., performance difficulties). At the same time, they also determine each behavior very specifically, which contributes to a behavior measure's particular, unique variance.

One widely accepted means of reducing a measure's specific components and increasing replicability and generalizability of findings is through aggregation (e.g., Epstein, 1979, 1980, 1983; Kirkpatrick, 1997), which has a longstanding tradition in attitude research as well (e.g., Fishbein & Ajzen, 1974; Wicker, 1969). A behavior's difficulty as a result of situational influences is commonly considered by applying the theory of planned behavior (TPB; Ajzen, 1985, 1991) instead of its predecessor, the theory of reasoned action (TRA; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). While easy-to-conduct behaviors were already accurately predictable in the TRA framework, the inclusion of perceived behavioral control (PBC) succeeded in more fully predicting behaviors that are difficult to engage in (Eagly & Chaiken, 1993).

Unfortunately, differential behavior difficulties and a behavior measure's specific components both affect the attitude–behavior relation negatively. Even worse, either canceling out unique variance by sampling a wide range of behaviors or considering differential behavior difficulties by applying PBC as a direct predictor of behavior is possible, but not both concurrently. They are mutually exclusive, as we will demonstrate. This claim, however, does not challenge PBC's significance for behavior intention. Not surprisingly, a general, universally applicable, and thus more valid version of the TPB—which does not violate the compatibility (i.e., correspondence) principle (Ajzen & Fishbein, 1977)—has not been used before to predict an entire class of behaviors, rather than an individual behavior, at least not to our knowledge.

The present paper aims at providing evidence that a most significant attitude–behavior relation exists when situational influences are considered by applying the Rasch approach (e.g., Wright & Masters, 1982) to the measurement of behavior. Converting the TPB into a cross-behaviorally, cross-situationally aggregated version reveals, however, that PBC's direct influence on behavior is a non-universally applicable part of the TPB (Figure 1).

Perceived Behavioral Control and Performance Difficulties

In the TRA, intention to perform the behavior in question is the immediate antecedent of overt behavior. Intention, in turn, is seen as a function of people's attitudes toward performing a particular act and their subjective norms (i.e., the perception of the expectations of relevant others). Attitude includes not only the evaluation of certain outcomes, but also an estimate of the likelihood of these outcomes. Subjective norms refer to the strength of normative beliefs and the motivation to comply with these beliefs.

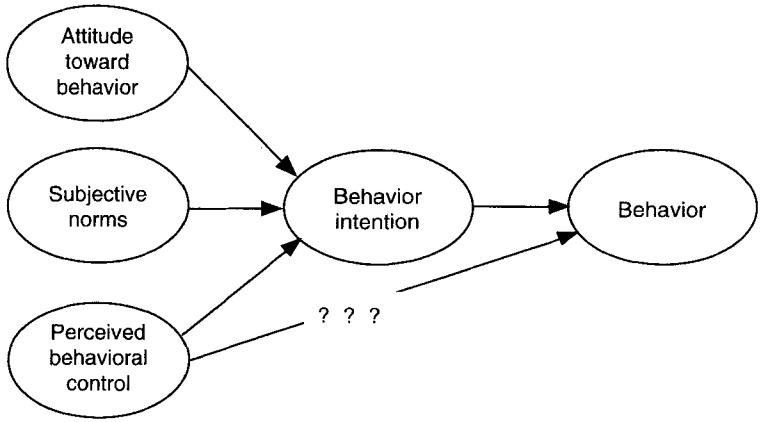

Figure 1. The theory of planned behavior. On a general level, perceived behavioral control loses its significance as a direct predictor of behavior. This is expressed with question marks attached to perceived control's immediate influence on behavior.

Situational influences that are external to a person affect his or her performance. In response to influences such as time and opportunity, different behaviors become distinguishably difficult to be carried out (Ajzen, 1985). The inclusion of PBC transforms the TRA into the TPB (Figure 1). This modified theory more fully predicts behaviors that are difficult to engage in (e.g., Madden, Ellen, & Ajzen, 1992). Evidently, the more the performance of a behavior depends on the presence of appropriate contextual circumstances, the less such a behavior is intentionally controllable. Yet, the TPB extends the TRA in the following two ways: It (a) includes an additional influence on intention and (b) considers, by its direct influence on behavior, also those influences on people's behavior that are beyond their volitional control (Ajzen & Madden, 1986; Madden et al., 1992). Obviously, the assumption is made that a person perceives situational influences appropriately with realizing what behavioral control is available to him or her.

On average, 25% to 30% of a behavior's variance appears to be predictable by intention and PBC jointly (e.g., Ajzen, 1991; Sheeran & Orbell, 1998). Not surprisingly, because the TPB is commonly tested rather specifically, considerable proportions of variance of the particular behaviors still remain unpredictable and behavior specific. One common way to further reduce such behavior-specific variance is by means of canceling out arbitrary, incidental influences (Epstein, 1979, 1980, 1983).

Canceling Out Incidental Influences

Aggregation of behaviors is one way to reduce behavior-specific, unique variance and to increase findings' generalizability and thus their validity (e.g.,

Epstein, 1983). Evidently, each behavior consists of at least two components of variance: a person-related, substantive, cross-behaviorally and cross-situationally generalizable component; and a behavior-specific, unique one (cf. Kirkpatrick, 1997). PBC addresses both of these variances within the TPB framework. PBC tackles behavior's generalizable variance via the psychological route, mediated by intention. As a substitute for actual control, it also addresses a certain behavior's particular variance via its immediate, direct influence on behavior. Not surprisingly, compared to the TRA, the TPB is more successful in predicting behavior and becomes even more so the more a behavior is affected by effective situational influences (cf. Ajzen, 1991). In other words, the less substantive, generalizable variance and the more behavior-specific, unique variance there is, the more advantageous the TPB becomes. Predicting behavior-specific variance, however, results in the establishment of a nongeneralizable, particular psychological theory as well.

When predicting people's performance at a certain time in a specific place, the unique contribution of a single contextual feature (e.g., the accessibility of bins for recycling) is, presumably, accurately and unanimously perceivable. Hence, when people's performance is predicted specifically, one's behavioral control is presumably quite obvious. Not surprisingly, perceived control is an accurate proxy for actual control and for situational influences. This is to say, PBC works as a proxy for actual control when the situational constraints and facilitators of a particular behavior must be considered.

When behaviors are aggregated across varied contexts (e.g., one's power conservation at home, his or her leisure time mobility, his or her ecological consumerism), the combination of all behavior-specific influences is an arbitrary aggregate of multiple effects, none particularly outstanding. Evidently, when behaviors such as energy conservation, recycling, and others are aggregated, situational influences become numerous and heterogeneous. The more heterogeneous the contextual effects, the less able one is to universally collapse these effects into a single uniform predictor of behavior. At the same time, aggregating behaviors across situations cancels out such unique variance because the aggregated behavior-specific variance (unlike generalizable variance) is constituted randomly. In other words, the aggregated behavior-specific, unique variance becomes unpredictable. Thus, on a general level, when cross-situationally aggregated measures are applied, PBC loses its significance as an immediate predictor of behavior. This is expressed in Figure 1 with question marks attached to perceived control's direct influence on behavior. Yet, situational influences, which result in behaviors' differential difficulties, can be considered alternatively by applying a behavior measure that is constituted as a Rasch scale.

Testing Behavior by Means of Difficulties

Evidently, situational influences affect conduct. They can create difficulties that make some behaviors easier to perform than others. For example, if recycling

bins are not readily accessible, recycling is not easy to carry out. To reduce such incidental situational influences external to the person, a behavior measure must be cross-situationally, cross-behaviorally aggregated (Epstein, 1980). A more general and thus conceptually redundant measure necessarily produces more generalizable findings (Epstein, 1983).

One example of a measure, aggregated across an entire class of behaviors with considerably varying degrees of difficulty to being performed, was developed by applying the Rasch model to ecological performances from different contexts (e.g., ecological garbage removal, water and power conservation, ecological automobile use; Kaiser, 1998). Because commonly used ecological behavior measures are not aggregated by making systematic use of behavior difficulties in assessing a person's ecological behavior level, they fail to acknowledge the influence of situations on different ecological behaviors (e.g., Maloney & Ward, 1973). As a result, a person's ecological behavior cannot be generalized across different behavior domains (e.g., Leonard-Barton, 1981): If someone recycles paper, he or she might or might not conserve energy as well.

A behavior's difficulty is estimated by considering the number of people who behave accordingly, such as refraining from using an oven-cleaning spray. A behavior difficulty is, obviously, not based on self-report. It is a function of the number of people who perform a particular ecological behavior, and it relates to the likelihood that a person will behave correspondingly, regardless of his or her general ecological behavior level. If only a few people behave in a certain way, we are dealing with a difficult behavior. The probability is low that anyone would demonstrate this particular behavior. The easier a behavior is to perform, the fewer situational constraints must be assumed and the more likely it is that people will take on the behavior.

The difficulties a person actually overcomes can, in turn, be used to measure a person's general behavior level. The more difficult the tasks someone takes on, the more this person generally behaves ecologically and vice versa. In other words, a person's ecological behavior level is a function of the situational constraints that he or she actually ignores. The bigger the barriers and the more numerous the difficulties a person masters, the higher is his or her behavior level. Conversely, the level of a person's ecological behavior tends to be low when the tiniest difficulty is enough to restrain him or her from action. Nevertheless, the Rasch approach does not require people to behave fully deterministically across the entire array of behaviors. People are free, to some extent, to behave inconsistently. Someone who behaves ecologically on a very high level across different behaviors, for instance, might fail to recycle newspapers, even though this behavior is easy to carry out. However, in its application of the Rasch model, the measure presupposes the behaviors to be comparably difficult for everyone. Strictly speaking, a Rasch scale represents an achievement test of a person's ecological performance.

Research Goals

Contextual influences, such as a person's living environment, affect people's performances significantly (Kaiser & Keller, 2001) and, concomitantly, the attitude–behavior relation negatively. When PBC is used as a proxy for actual situational influences, canceling out a behavior's particular variance by applying a compound behavior measure and considering differential behavior difficulties are mutually exclusive and cannot be done concurrently. The present paper aims to provide evidence for a rather significant attitude–behavior relation when contextual effects are controlled rigorously by applying a methodologically sound general behavior measure that is constituted as a Rasch scale. In addition, the present study scrutinizes the following two predictions in further detail:

> *Hypothesis 1.* Each of six specific versions of the TPB will reveal PBC to be a significant direct predictor of the six performances in question.
>
> *Hypothesis 2.* A general version of the TPB, aggregated across all six specific behaviors, will render PBC's immediate influence on behavior nonsignificant. To additionally scrutinize the general version of the TPB, participants' residential area (rural, suburban, or urban) is applied as a moderator.

Method

Participants and Procedure

The present sample was constituted from the resident registers of six Swiss communities. Out of 8,177 randomly selected German-speaking Swiss, who were asked to volunteer for a survey, 943 returned a written consent form (response rate = 11.5%). Of these, 896 (95.0%) returned completed questionnaires. One record was omitted because of missing values, which left 895 participants (401 men, 490 women; 4 persons had missing values) in the final sample. Participants' median age was 46.5 years ($M = 46.4$; range = 18 to 79 years). To secure diversity among our participants, a convenient selection of two cities and four rural villages in Switzerland was chosen. The urban (i.e., Zürich), suburban (i.e., Thalwil), and rural (i.e., Muotathal, Entlebuch, Schüpfheim, and Escholzmatt) research areas were quite evenly represented in our study: 32.2%, 32.7%, and 34.6% of the participants for the three areas, respectively. Nevertheless, as we used a convenience approach to select these communities, our participants cannot be regarded as fully representative for all German-speaking Swiss. In a follow-up study, about 50 weeks after the original survey, the behavior of 823 participants was reassessed (response rate = 92.0%).

Measures

The questionnaire consisted of attitude, subjective norms, PBC, behavior intention, and ecological behavior measures. In order to aggregate the four TPB components' measures, we sampled six behaviors with different endorsement probabilities: (a) "I collect and recycle used paper" (98.7%); (b) "I bring empty bottles to a recycling bin" (98.5%); (c) "I drive my automobile to or in the city" (57.1%; such nonconservational behaviors were reverse scored and should be read as "I refrain from . . ."); (d) "I am a member of an environmental organization" (25.1%); (e) "On freeways, I drive at speeds under 100 kph" (62.5 mph; 22.0%); and (f) "When I see someone behaving nonconservationally, I point it out to him or her" (16.5%). All behaviors were assessed with two bipolar scales for each of the four TPB components' measures. They were presented in groups of six items in the order suggested by Ajzen and Fishbein (1980).

Attitude measure. Attitude was measured by rating all six behavior statements (recycle paper, recycle glass, no car use downtown, environmental organization membership, limit speed on freeways, point out others behaving nonconservationally) on two 5-point bipolar scales (*good–bad, appropriate–inappropriate*) ranging from 1 to 5. The internal consistency of the 12 attitude items was estimated by using Cronbach's alpha (α). Evidently, a general attitude scale appears to be reasonably reliable ($\alpha = .79$).

Subjective norms measure. Subjective norms were measured by rating all six behavior statements on two 5-point bipolar scales. The first six ratings range from 1 (*likely*) to 5 (*unlikely*). They are introduced with the phrase "Most people who are important to me think I should. . . ." The second assessment of the six behavior statements are introduced with "Most people important to me . . .," and the response options range from 1 (*agree*) to 5 (*disagree*). The internal consistency of the 12 subjective norm items and thus their reliability were reasonable ($\alpha = .78$).

PBC measure. Perceived control was measured by rating all six behavior statements on two 5-point bipolar scales (*easy–difficult, simple–complicated*). The internal consistency of the 12 PBC items was acceptable ($\alpha = .72$).

Intention measure. Behavior intention was measured by rating all six behavior statements on two 5-point bipolar scales: "I intend to . . ." (*likely–unlikely*), and "I will . . ." (*determined–undetermined*). The internal consistency of the 12 intention items, and thus their reliability, was also acceptable ($\alpha = .74$).

Behavior measure. The ecological behavior measure used was an extended version of the General Ecological Behavior scale (Kaiser, 1998; Kaiser & Biel, 2000; Kaiser & Wilson, 2000). The scale consists of 65 items (6 that have been introduced already) that assess different types of ecological behavior. They can be grouped into different domains, such as power conservation, ecologically aware consumer behavior, garbage inhibition, and ecological automobile use.

Sample items are "I own an energy-efficient car (i.e., less than 3 gallons per 100 miles)," "I reuse my shopping bags," and "I use fabric softener with the laundry."[3] A *Yes/No* format was used ($n = 30$), or responses were recoded from a response format with five alternatives to a *Yes/No* format ($n = 35$) by collapsing *never*, *seldom*, and *occasionally* responses (indicating infrequent and, thus, unreliable performance) to *No*, and turning *often* and *always* responses (indicating reliable performance) to *Yes* responses (an empirical justification for this practice can be found in Kaiser & Wilson, 2000). *No* responses to negatively formulated items were recoded as *Yes* responses and vice versa. In 56 out of 65 items, *I don't know* was a response alternative when an answer was not possible. *I don't know* responses were coded as missing values: 5.5% of all answers were missing. For five of the six behaviors used in the measurement of the four TPB components, a response format with multiple alternatives was used. Only the membership item was assessed dichotomously.

People's ecological behavior was assessed using the dichotomous Rasch model (for item response theory details and formulas, see Wright & Masters, 1982; for computational details, see Adams & Khoo, 1996). The Rasch model distinguishes between items on the basis of item difficulty and assumes that all items are equally discriminating. Hence, within item response theory, the Rasch model represents the one-parameter model. The item-response-theory-based reliability coefficient of the General Ecological Behavior scale turned out to be .80. Its internal consistency α is .81. Four of the behavior items (6.2%) did not fit the 65-item General Ecological Behavior scale, $t > 1.96$. The overall fit statistics for the 65 items of this scale were as follows: M of mean squares, or $M(MS) = 1.00$, $SD(MS) = 0.05$, $M(t) = -0.07$, $SD(t) = 1.44$. Ideally, $M(MS)$ and $SD(t)$ should be 1.00, whereas $M(t)$ should be 0. For $SD(MS)$, no general reference value can be given. Out of 895 participants, 43 (4.8%) fit poorly ($t > 1.96$). The overall fit statistics for the participants were as follows: $M(MS) = 1.00$, $SD(MS) = 0.20$, $M(t) = -0.03$, and $SD(t) = 1.18$. In sum, fit statistics and the reliability information of the extended version of the General Ecological Behavior scale appear to be reasonable. Evidence for the General Ecological Behavior measure's validity is provided elsewhere (for construct validity information, see Kaiser, 1998; Kaiser, Wölfing, & Fuhrer, 1999; Kaiser, Ranney, Hartig, & Bowler, 1999).

Statistical Analysis

According to the data-collection procedure, each of the four TPB components' measures is represented by two items on the specific level and by two subscales of six items each on the general level. These measures and the corresponding behavior indicators represent the input variables for the structural equation analyses. All structural equation models were assessed using the maximum

[3]An English translation of the 65 items can be found in Kaiser and Keller (2001).

Table 1

Means, Standard Deviations, and Correlations of the Scales Used in the General Structural Equation Model

Sub-scale	*N*	*M*	*SD*	Correlations							
				Att1	Att2	SN1	SN2	PBC1	PBC2	Int1	Int2
Att1	894	4.23	0.56	—							
Att2	890	4.09	0.60	.808	—						
SN1	886	3.50	0.73	.435	.512	—					
SN2	888	3.23	0.62	.383	.435	.538	—				
PBC1	891	3.81	0.62	.605	.636	.455	.458	—			
PBC2	890	3.86	0.63	.563	.606	.413	.412	.773	—		
Int1	890	3.76	0.62	.705	.728	.497	.513	.724	.637	—	
Int2	893	3.73	0.68	.621	.618	.437	.441	.623	.546	.774	—
GEB	895	0.55	0.75	.533	.517	.336	.361	.485	.428	.601	.512

Note. The possible scale range is 1 to 5, with one exception; general ecological behavior potentially ranges between ± infinity (Wright & Masters, 1982). Empirically, behavior ranges between -1.78 and 3.01 logits. Logits stand for the natural logarithm of the performance/non-performance ratio or the natural log odds. Logits are the basic units of item-response-theory-based scales. Att = attitude; SN = subjective norms; PBC = perceived behavioral control; Int = behavior intention; GEB = general ecological behavior.

likelihood method (cf. Jöreskog & Sörbom, 1993). The correlation matrix was used as the input matrix (Table 1). Note that all models were tested confirmatorily without allowing for any model modification (cf. MacCallum, Roznowski, & Necowitz, 1992).

Results

The present findings are reported in three sections. First, six specific TPB model tests are presented. Second, it was tested whether the PBC–behavior influence turns nonsignificant when the components of the TPB are aggregated. Third, the findings from the aggregated, general model test were additionally scrutinized by comparing the three regional subsamples.

Six Specific Theory of Planned Behavior Models

Without model modification, confirmatory testing of the six models (one for each of six behaviors: recycle paper, recycle glass, no car use downtown,

Table 2

Fit Statistics for Six Specific Theory of Planned Behavior Models

Behavior	$\chi^2(20)$	SRMR	AGFI	NNFI	CFI
1. Recycle glass	26.61	.016	.99	.99	1.00
2. Recycle paper	41.07**	.021	.98	.98	.99
3. No car use downtown	23.57	.012	.99	1.00	1.00
4. Point out others behaving non-conservationally	63.77***	.023	.96	.98	.99
5. Limit speed on freeways	38.73**	.012	.98	.99	1.00
6. Environmental organization membership	48.67***	.016	.97	.99	.99

Note. $N = 895$. SRMR = standardized root mean square of residual; AGFI = adjusted goodness of fit index; NNFI = non-normed fit index; CFI = comparative fit index.
$^{**}p < .01$. $^{***}p < .001$.

environmental organization membership, limit speed on freeways, point out others behaving nonconservationally) revealed the TPB to be an empirically acceptable model. All six specific model tests replicated previous findings fairly closely (e.g., Madden et al., 1992).

Note that the chi-square statistic is generally affected by sample size, which is quite remarkable ($N = 895$). Not surprising, though, in four out of six model tests, the chi-square statistic was significant (Table 2). Note also that the model fit indicators, which are independent of sample size (i.e., adjusted goodness of fit index [AGFI]; non-normed fit index [NNFI]; and comparative fit index [CFI]), unanimously suggest that the model fits rather well with an acceptable overlap (i.e., at least 96%) and an acceptable discrepancy (i.e., the standardized root mean square of residual [SRMR] at most .023) between the observed and expected figures. Overall, the fit statistics of the six specific models, although in four cases significant, supported the TPB impressively. Figure 2 presents the estimates of one of the six specific TPB models (the no car use downtown model).

Attitude (Att, $\beta = .24$), subjective norms (SN, $\beta = .17$), and PBC ($\beta = .57$), these three determinants explained 79% of the variance in behavior intention. The three predictors of behavior intention correlated with one another considerably themselves: $r_{\text{Att–SN}} = .67$; $r_{\text{SN–PBC}} = .64$; and $r_{\text{Att-PBC}} = .70$. Two determinants predicted 46% of the variance in no car use downtown: behavior intention ($\beta = .43$) and PBC ($\beta = .27$). Table 3 summarizes the five paths' coefficients within the TPB across all six specific models.

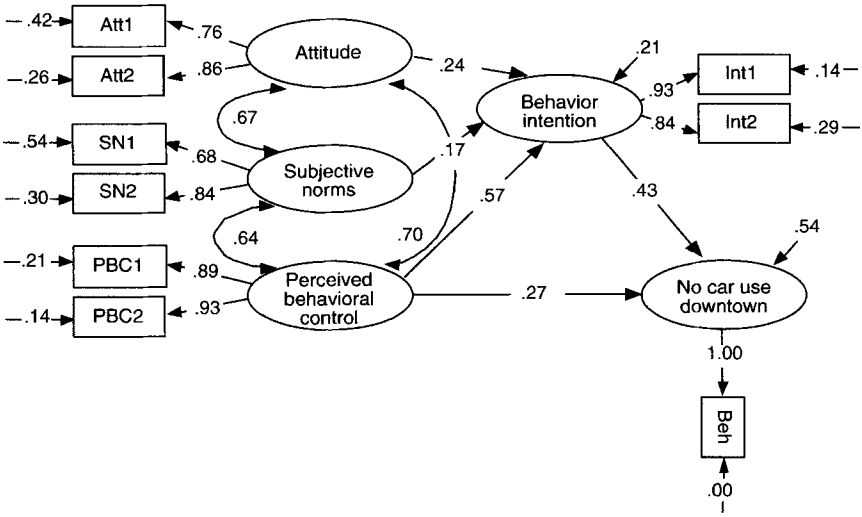

Figure 2. The theory of planned behavior on a specific level: predicting no car use downtown. No car use downtown (Beh) is predicted by perceived behavioral control (PBC) and behavior intention (Int), which, in turn, is a function of one's attitude (Att), subjective norms (SN), and PBC. The two indicators each of Att, SN, PBC, and Int (e.g., Att1 and Att2) represent specific items. Because the relations between constructs are directed, arrows indicate such relations. Beta (β) coefficients (i.e., standardized multiple regression coefficients) represent the strength of a relationship. Two-headed arrows indicate Pearson correlation coefficients. Arrows without origin indicate proportions of error and unexplained variances. No car use downtown (ecological behavior) represents a single item measure. Accordingly, its reliability is perfect (β = 1.00) and its error variance is 0 (σ^2_e = .00).

The General Theory of Planned Behavior Model

Confirmatory testing of the general version of the TPB can, without model modification, be accepted from an empirical point of view, $\chi^2(20, N = 895) = 55.84$, $p < .001$; AGFI = .97, NNFI = .99, CFI = .99, SRMR = .016. Figure 3 presents the tested model.

Attitude (Att, β = .46), subjective norms (SN, β = .19), and PBC (β = .35), these three determinants explained 81% of the variance in behavior intention. The three predictors of behavior intention themselves correlated considerably with one another: $r_{Att-SN} = .68$; $r_{SN-PBC} = .67$; and $r_{Att-PBC} = .75$. In one's ecological behavior, 51% of the variance was predicted by a single predictor, behavior intention (β = .73). Not surprisingly, measurement error arising from unreliable aspects of the General Ecological Behavior scale (σ^2_e = .20) attenuated the influence of intention on behavior. Thus, without correction for measurement error attenuation

Table 3

Standardized Multiple Regression Coefficients (β) of the Five Theory of Planned Behavior Paths Across Six Specific Models

Behavior	Att → Int	SN → Int	PBC → Int	PBC → Beh	Int → Beh
1. Recycle glass	.58***	.08	.21***	.18***	.57***
2. Recycle paper	.13	.22†	.53***	.19*	.50***
3. No car use downtown	.24***	.17***	.57***	.27***	.43***
4. Point out others behaving nonconservationally	.40***	.27***	.30***	.29***	.37***
5. Limit speed on freeways	.37***	.23***	.38***	.10†	.57***
6. Environmental organization membership	.25***	.13*	.54***	.21**	.20**

Note. Att = attitude toward behavior; SN = subjective norms; PBC = perceived behavioral control; Int = behavior intention; Beh = behavior.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

by assuming a perfect General Ecological Behavior measure ($\sigma^2_e = .00$), the proportion of explained variance of General Ecological Behavior dropped to 41%, reducing intention's influence to a still considerable value ($\beta = .65$).

As predicted, the PBC–behavior relation turned nonsignificant in the more general version of the TPB ($\beta = -.02$). The model's test remained basically unaffected when the PBC–behavior path was omitted, $\chi^2(21, N = 895) = 55.90, p < .001$; AGFI = .97, NNFI = .99, CFI = .99, SRMR = .016. It remained unaffected also when the input matrix (i.e., covariance instead of correlation matrix) was exchanged, $\chi^2(21, N = 895) = 55.12, p < .001$; AGFI = .97, NNFI = .99, CFI = .99, SRMR = .017. And finally, it remained quite unchanged even when the TPB components were assessed almost 1 year prior to the behavior measure, $\chi^2(21, N = 823) = 47.93, p < .001$; AGFI = .97, NNFI = .99, CFI = .99, SRMR = .015. This additional test of the TPB without a link between PBC and behavior—based on follow-up behavior data about 50 weeks after the original survey—revealed no remarkable differences to the coefficients reported in Figure 3: maximum beta weight difference ±.02, maximum error variance difference ±.02, and maximum Pearson correlation coefficient difference ±.01.

One fairly common argument against a strong relation between intention and behavior refers to the measurement approach that is suggested within the TPB framework. Since we used six behaviors on the predictor as well as on the criterion side, any strong relation between intention and behavior could be seen as a

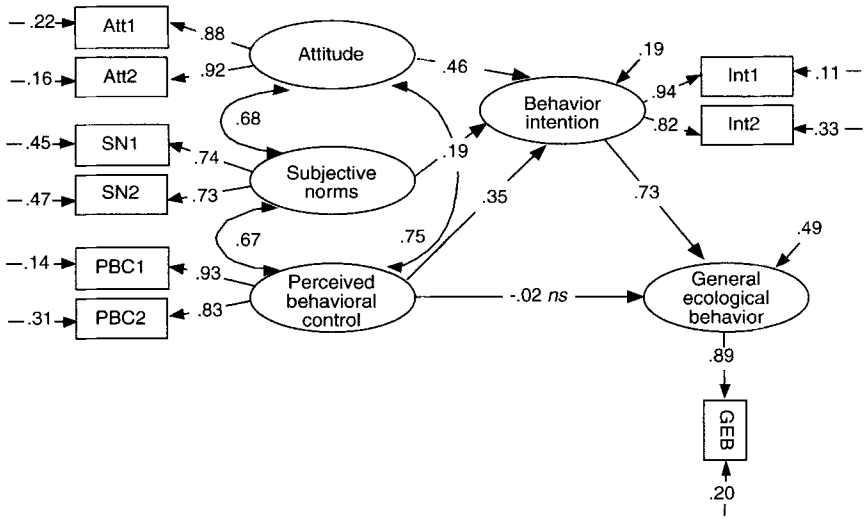

Figure 3. The theory of planned behavior on a general level: predicting general ecological behavior. General ecological behavior (GEB) is predicted by behavior intention (Int), which, in turn, is a function of one's attitude (Att), subjective norms (SN), and perceived behavioral control (PBC). The two indicators each of Att, SN, PBC, and Int (e.g., Att1 and Att2) represent scales composed of six items each. Because the relations between constructs are directed, arrows indicate such relations. Beta (β) coefficients (i.e., standardized multiple regression coefficients) represent the strength of a relationship. Two-headed arrows indicate Pearson correlation coefficients. Arrows without origin indicate proportions of error and unexplained variances. The error variance ($\sigma^2_e = .20$) and, accordingly, the reliability index (i.e., the square root of the coefficient) of the General Ecological Behavior (GEB) scale ($\beta = .89$) is not estimated by the structural equation approach. Rather, it is provided by the Rasch model test.

method artifact of the two overly similar measures. Violating the compatibility (i.e., correspondence) principle, we dropped the six behaviors that we had used to measure the TPB components from the General Ecological Behavior measure, ending up with a 59-item General Ecological Behavior scale. Neither the model's general fit statistics, $\chi^2(21, N = 895) = 55.55, p < .001$; AGFI = .97, NNFI = .99, CFI = .99, SRMR = .017, nor the proportion of explained behavior variance were dramatically affected or reduced (i.e., 8%). Still, 43% of the original 51% of general ecological behavior's variance was explained by one predictor, behavior intention ($\beta = .65$).

To test the fully corresponding general TPB model as well, we alternatively applied a six-item behavior measure that was also constituted as a Rasch scale. Because of their overall 0 or perfect behavior values, 13 participants were excluded from the estimations (cf. Adams & Khoo, 1996). Once more, the

model's fit statistics remained virtually unaffected, $\chi^2(21, N = 882) = 55.00, p < .001$; AGFI = .97, NNFI = .99, CFI = .99, SRMR = .017. Yet again, behavior's variance was strongly predicted by behavior intention ($\beta = .71$) and the proportion of explained behavior variance returned to a respectable 50%.

Residential Area as a Moderator

The general version of the TPB, without a link between PBC and behavior, was additionally tested by comparing the three residential areas' subsamples (i.e., urban, $n = 288$; suburban, $n = 293$; and rural, $n = 310$). Although significantly misfitting, the proposed model was supported empirically in this three-group comparison with reasonable fit indicator figures, particularly the ones that are independent of sample size, $\chi^2(111, N = 891) = 198.48, p < .001$; NNFI = .98, CFI = .98, SRMR = .040. At least tentatively, the estimates in Figure 3 appear to be generalizable.

Discussion

The present paper provides additional evidence for the TPB's impressive predictive validity (see also Ajzen, 1991). The three predictors—attitude, subjective norms, and PBC—accounted for 81% of behavior intention's variance, within the ecological conservation domain. These three predictors of intention also correlated considerably with one another. Intention, in turn, determined 51% of people's ecological behavior when situational influences were controlled rigorously by means of aggregation. Still, a noteworthy 41% of ecological behavior's variance was predicted by intention without correction for measurement error attenuation (i.e., when a perfect behavior measure was assumed). Although remarkable, this first substantive result might be challenged because it is based on TPB components' measures that partly violate the compatibility (i.e., correspondence) principle.

Strictly speaking, the behavioral overlap between the four TPB components' measures and the General Ecological Behavior scale was less than 10% (i.e., 6 out of 65 behaviors). However, this violation of the compatibility principle resulted in a marginally increased rather than reduced proportion of explained behavior's variance (cf. Ajzen & Fishbein, 1977): 51% compared to 50% when the completely corresponding model was applied (i.e., 100% behavioral overlap between the four TPB components' measures and the behavior scale). Even when the compatibility principle was fully violated (i.e., 0% behavioral overlap between the four TPB components' measures and the General Ecological Behavior scale), an astonishing 43% of ecological behavior's variance could be predicted. A 10% overlap that yields a predictive validity of 51% appears to be, at least in our view, indicative of a fairly generalizable model. Concurrently, the explanatory power of the TPB remains virtually unchanged, even when the behavior criterion is assessed about 50 weeks after the intention measure (i.e.,

52% of ecological behavior's variance explained). As predicted by Epstein (1983), canceling out incidental factors by means of a conceptually redundant, general measure results in cross-situationally, cross-behaviorally generalizable findings, at least within the conservation domain.

The second substantive result shows PBC's direct influence on behavior to be a particular, nongeneralizable part of the TPB because, strictly speaking, it addresses a behavior's specific, rather than its person-related, substantive, cross-situationally generalizable, variance. Significantly, in a test of six different models, PBC directly predicted five of six specific behaviors (leaving one barely significant; Table 3). Yet, a more general version of the TPB (aggregated across the very same six ecological behaviors) revealed PBC's direct influence on behavior to be nonsignificant (Figure 3). PBC is an accurate proxy for external, contextual influences when these situational constraints of a particular behavior are recognizable and unanimously obvious; when such influences are aggregated across several behaviors, however, accurate discerning perception becomes impossible. In other words, a multitude of situational influences cannot be collapsed universally into a single uniform predictor of behavior. At the same time, aggregating behaviors also blurs these behaviors' specific variance, making it unpredictable. Note that these findings do not challenge PBC's indirect (mediated by intention) influence on behavior.

Both of these substantive findings—TPB's impressive predictive validity, and PBC's challenged direct influence on behavior—are additionally supported by comparing three groups, each representing a different residential context (i.e., urban, suburban, and rural). Although promising, our findings are entirely based on self-reports. Yet, the accuracy of self-reports is often criticized as being affected by participants' readiness to adopt researchers' expectations and as being an unreliable indicator of overt behavior. In two former studies, we found social desirability effects on people's ecological behavior as assessed by the General Ecological Behavior scale to be marginal at best (R^2 maximum = 8.4%; Kaiser, Ranney, et al., 1999). It is noteworthy, too, that a comparable Swiss sample proved fairly unbiased in participants' readiness to respond in ways they might have thought we wanted them to (R^2 = 1.0%). On the contrary, the relation between social desirability and ecological behavior turned out to be negative (Kaiser, 1998). In still another study, we found self-reported behaviors from the current version of the General Ecological Behavior scale to be reasonably accurate indicators of people's overt performances (κ = .78). This appears to be particularly true when self-reported behaviors represent dichotomized practices ("I do" or "I don't") or circumstances ("I possess" or "I don't possess"; Kaiser, Frick, & Stoll-Kleemann, 2001).

Evidently, behavioral aggregates can be predicted much more completely than individual behaviors (Ajzen, 1991). As traditionally aggregated measures of ecological behavior do not consider differential behavior difficulties and thus

endorsement probabilities systematically, they commonly fail to establish unidimensional ecological behavior measures (Kaiser, 1998). These multidimensional findings (e.g., Leonard-Barton, 1981) are, most likely, based on difficulty factors (Ferguson, 1941). Using differential endorsement probabilities and hence behavior difficulties systematically necessitates applying the Rasch or possibly another item response theory model in the measurement of ecological behavior. For the current research, having a reliable general measure that covered the generalizable variance in a certain domain or class of behaviors was a necessary prerequisite.

As already pointed out, because our behavior measure does not entirely correspond to the four TPB components' measures, its general nature might be seen as a shortcoming. In fact, a very broad behavior measure also has some advantages; and not only in terms of reliability, but also in terms of concurrent measurability of the four TPB components and behavior. Ideally, general measures are indicative for cross-situationally generalizable classes of attitudes and behaviors, such as environmental attitude and ecological behavior. On a specific level, when they represent a particular attitude and behavior (e.g., buying energy-efficient light bulbs), the conceptual scope becomes narrow and relatively limited (Epstein, 1983). Not surprisingly, one-to-one item correspondence is an issue. On a general level, when concept rather than item correspondence is required, attitude components and behavior can be measured differentially, yet simultaneously. In other words, no time interval is needed between assessments of conceptually redundant, general measures because any strong relation cannot be referred to method artifacts of two overly similar measures.

Another shortcoming worth mentioning is the four TPB components' measures, which, although reasonably reliable, demonstrated only modest internal consistency (ranging from $\alpha = .72$ to $\alpha = .79$). Because all four measures are based on items that refer to intentionally chosen behaviors with diverse endorsement probabilities, ranging from 16.5% up to 98.7%, the difficulties of the TPB components items were rather varied as well: ranging from 40.8% to 99.1% with attitude items, from 12.5% to 92.7% with subjective norms items, from 39.4% to 97.7% with PBC items, and from 29.5% to 99.1% with intention items. Given that a measure's internal consistency is dependent on its having items with homogeneous difficulties (Ferguson, 1941), the four measures' modest internal consistency is most likely a result of these differential item difficulties.

In sum, the TPB predicts human behavior in different domains rather well. Evidently, the theory's scope is not restricted to any particular context, and findings strongly support its general applicability where human behavior is concerned (cf. Ajzen, 1991). By freeing the proposed relations within the TPB from arbitrary situational influences, theory development has reached a point (at least in the conservation domain) where individual behavior can be predicted with reasonable accuracy in the vicinity of 60% to 80% (cf. Epstein, 1979). Such a

general version of the TPB involves finding out about the theory's universally applicable and thus generally valid relations and estimating the particular relations' weights (Figure 3). In other words, a more general version of the TPB allows for quantifying the predictors' weights, which can be factored in and will become part of the theory themselves. Such a fully quantified theory might then be tested in and applied to other areas of interest.

References

Adams, R. J., & Khoo, S.-T. (1996). *QUEST: The interactive test analysis system.* Camberwell, Victoria, Australia: ACER.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From cognition to behavior* (pp. 11-39). Berlin, Germany: Springer.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.

Ajzen, I., & Fishbein, M. (1977). Attitude–behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin, 84*, 888-918.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior.* Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology, 22*, 453-474.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes.* Fort Worth, TX: Harcourt Brace Jovanovich.

Epstein, S. (1979). The stability of behavior: I. On predicting most of the people much of the time. *Journal of Personality and Social Psychology, 37*, 1097-1126.

Epstein, S. (1980). The stability of behavior: II. Implications for psychological research. *American Psychologist, 35*, 790-806.

Epstein, S. (1983). Aggregation and beyond: Some basic issues on the prediction of behavior. *Journal of Personality, 51*, 360-392.

Ferguson, G. A. (1941). The factorial interpretation of test difficulty. *Psychometrika, 6*, 323-329.

Fishbein, M., & Ajzen, I. (1974). Attitudes towards objects as predictors of single and multiple behavioral criteria. *Psychological Review, 81*, 59-74.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Jöreskog, K., & Sörbom, D. (1993). *New features in LISREL 8.* Chicago, IL: Scientific Software International.

Kaiser, F. G. (1998). A general measure of ecological behavior. *Journal of Applied Social Psychology, 28*, 395-422.

Kaiser, F. G., & Biel, A. (2000). Assessing general ecological behavior: A cross-cultural comparison between Switzerland and Sweden. *European Journal of Psychological Assessment, 16*, 44-52.

Kaiser, F. G., Frick, J., & Stoll-Kleeman, S. (2001). Zur Angemessenheit selbstberichteten Verhaltens: Eine Validitätsuntersuchung der Skala Allgemeinen Ökologischen Verhaltens [Accuracy of self-reports: Validating the General Ecological Behavior scale]. *Diagnostica, 47*, 88-95.

Kaiser, F. G., & Keller, C. (2001). Disclosing situational constraints to ecological behavior: A confirmatory application of the mixed Rasch model. *European Journal of Psychological Assessment, 17*, 212-221.

Kaiser, F. G., Ranney, M., Hartig, T., & Bowler, P. A. (1999). Ecological behavior, environmental attitude, and feelings of responsibility for the environment. *European Psychologist, 4*, 59-74.

Kaiser, F. G., & Wilson, M. (2000). Assessing people's general ecological behavior: A cross-cultural measure. *Journal of Applied Social Psychology, 30*, 952-978.

Kaiser, F. G., Wölfing, S., & Fuhrer, U. (1999). Environmental attitude and ecological behaviour. *Journal of Environmental Psychology, 19*, 1-19.

Kirkpatrick, L. A. (1997). Effects of multiple determinancy and measurement error on trait–behavior and behavior–behavior relations: An integrated conceptual model. *Personality and Social Psychology Bulletin, 23*, 199-209.

Leonard-Barton, D. (1981). Voluntary simplicity lifestyles and energy conservation. *Journal of Consumer Research, 8*, 243-252.

MacCallum, R. C., Roznowski, M., & Necowitz, L. B. (1992). Model modification in covariance structure analysis: The problem of capitalization on chance. *Psychological Bulletin, 111*, 490-504.

Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin, 18*, 3-9.

Maloney, M. P., & Ward, M. P. (1973). Ecology: Let's hear from the people. An objective scale for the measurement of ecological attitudes and knowledge. *American Psychologist, 28*, 583-586.

Sheeran, P., & Orbell, S. (1998). Do intentions predict condom use? Meta-analysis and examination of six moderator variables. *British Journal of Social Psychology, 37*, 231-250.

Sheeran, P., Orbell, S., & Trafimow, D. (1999). Does the temporal stability of behavioral intentions moderate intention–behavior and past-behavior–future-behavior relations? *Personality and Social Psychology Bulletin, 25*, 721-730.

Wicker, A. W. (1969). Attitudes versus actions: The relationship of verbal and overt behavioral responses to attitude objects. *Journal of Social Issues, 25*, 41-78.

Wright, B., & Masters, G. N. (1982). *Rating scale analysis: Rasch measurement.* Chicago, IL: MESA.