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DETERMINANTS OF ECOLOGICAL BEHAVIOUR: TESTING AN INTEGRATED THEORY OF ACTION IN THE DOMAIN OF RECYCLING

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1. Introduction

In recent years, environmental sociology has acquired the status of a discipline with clearly defined theoretical and empirical contours (see, for example, Diekmann and Franzen, 1995; Diekmann and Jaeger, 1996; de Haan and Kuckartz, 1996). But many of the theories of environmental behaviour that have emerged to date (see, for example, Urban, 1986, 1991; Mielke, 1985; Balderjahn, 1986; Langeheine and Lehmann, 1986; Billig, 1994) are unfortunately little more than ad hoc assumptions unsupported by a theoretical framework (on this point see also Fuhrer, 1995) so that they should really be characterized as atheoretical examples of "variable sociology" (Esser, 1987, 1996).

In addition to the dearth of theoretical foundations in empirical research, a further problem in many environmental studies is the frequent use of attitude variables, formulated in very general terms, to account for specific environmental behaviour (see Kley and Fietkau, 1979; Urban, 1986, 1991; Langeheine and Lehmann, 1986; Balderjahn, 1986; Dierkes and Fietkau, 1988; Diekmann and Preisendörfer, 1991, 1992; Altenburg and Balderjahn, 1993). But general attitudes have often proved inefficient predictors of specific types of behaviour.[1] Almost twenty years ago, Van Liere and Dunlap (1980, 1981) attributed the disappointing results of studies of environmental behaviour in the United States, on the one hand, to methodological flaws such as the absence of multivariate analysis, the use of different measurement instruments for the same theoretical construct or the use of aggregated data,[2] and, on the other hand, to the lack of an underlying theory of action. The studies focused on easily measurable demographic variables, while omitting theoretically relevant variables.[3]

1 This is also supported by meta-analyses of studies of attitudes and behaviour. For example, a meta-analysis of 128 studies of environmental behaviour (Hines et al. 1986/87) shows a corrected correlation of .33 between attitudes and self-reported environmental behaviour. The meta-analysis of 17 environmental studies conducted by Eckes and Six in 1994 resulted in a corrected correlation of .34 between environmental behaviour and attitudes.

Taking this critical approach as its starting-point, our study (cf. Lüdemann, 1997) will seek to explain environmental behaviour by means of an integrated behavioural theory, the theory of planned behaviour (TOPB). As a social psychological theory, the TOPB has a number of advantages that should appeal to sociologists. First of all, compared to many other sociological theories, it is precise and clearly formulated in terms of both structure and variables. Secondly, there are reliable measurement instruments for the variables used. Thirdly, the TOPB has performed relatively well in empirical tests relating to various areas of behaviour. Empirical studies have been undertaken in such environmentally relevant areas as purchase of organic products (Sparks and Shepherd, 1992), waste disposal (Altenburg and Balderjahn, 1993), recycling (Boldero, 1995) and choice of mode of transport (Bamberg and Schmidt, 1993, 1994). In previous tests, the predecessor of the TOPB, the theory of reasoned action, was applied in the areas of energy saving (Macey and Brown, 1983), water consumption (Kantola et al., 1982), recycling (Kok and Siero, 1985) and choice of mode of transport (Thomas, 1976). Fourthly, and we shall demonstrate this point in the next section, the TOPB behavioural theory can be described as "integrated" inasmuch as it incorporates a variety of theoretical approaches (role theory, reference group theory, rational choice theory, multicomponent view of attitude) in a single model.

2. The theory of planned behaviour as an integrated behavioural model

In response to the unsatisfactory status of research on the relation between attitudes and behaviour in sociology and social psychology (Wicker, 1969; Benninghaus, 1976; Meinefeld, 1977; Mummendey, 1979; Six, 1980), Ajzen and Fishbein (1980) developed the theory of reasoned action in the early 1980s, a theory which purports to explain behavioural intentions and actual behaviour. This social psychological behavioural theory, which was subsequently expanded to include behavioural possibilities and restrictions and was described as a theory of planned behaviour (TOPB) (Ajzen, 1988, 1991), comprises the

2 They criticized, for example, the fact that items relating to different areas of behaviour (e. g. traffic, refuse, purchase of consumer goods, energy consumption) were combined to produce an aggregate index, which was then used for overall measurement of behaviour. Possible relationships between individual types of behaviour may have been concealed by the use of aggregate measurements of behaviour.

3 On the limited potential of demographic predictors as tools for explaining environmental behaviour, see Hines et al. 1986/87; Van Liere and Dunlap 1980, 1981. For empirical evidence of the diminishing explanatory potential of socio-demographic predictors over the past 40 years, see Schnell and Kohler 1995.

following determinants of behaviour which are reflected in diverse sociological approaches.

(1) An individual's subjective notions of the instrumentality of acts ("means") in relation to specific outcomes or aims ("goals") and subjective evaluation of these outcomes or aims.

This component of the TOPB represents the "Homo oeconomicus" or the rational-choice approach, which has been gaining ground in sociology in recent years (Opp, 1983; Lindenberg, 1990; Coleman, 1990; Esser, 1991, 1993) and which focuses on the subjective probability and utility of the outcomes ("goals") of various behavioural alternatives ("means"). On the other hand, these variables are comparable to what could also be described in interpretative sociology as an "action plan" or "action project" in the sense in which the terms are used by Alfred Schütz (1971) (cf. Esser, 1991).

(2) Influence of the social environment in terms of the behavioural expectations of reference persons or groups and the motivation to fulfil such expectations.

This component relates to the "Homo sociologicus" model, which, according to role theory (Dahrendorf, 1958; Wiswede, 1977), is influenced by prevailing role expectations, social norms and sanctions in a person's social environment. It also reflects the classical sociological concept of the reference group (Merton, 1957; Hyman and Singer, 1968). As is well known, reference groups consist of persons who resemble oneself in terms of important individual characteristics (e. g. social background, age, sex, attitude) and establish a normative framework for one's own behaviour.

(3) Attitudes

The first point to note is that attitudes in the TOPB relate exclusively to the evaluation of any object: the evaluative or affective dimension of the well-known multicomponent view of attitudes (affective, cognitive, conative; see Rosenberg and Hovland, 1960). Secondly, attitudes in the TOPB always relate to specific behaviour, namely the behaviour that is to be explained. The fundamental difference between many measures of attitude used in environmental research, which are often only weakly related to behaviour, and attitudes in the TOPB is that the latter do not relate to general issues such as "preservation of the environment" or "ecological problems".

(4) Perceived behavioural opportunities and constraints

This component may be defined as a more precise reflection of the influence of restrictions on behaviour, an aspect that is consistently emphasized by economists and economically oriented sociologists (Opp, 1983; Lindenberg, 1990; Coleman, 1990; Esser, 1993).

(5) Intention to behave in a certain way

This variable relates (alongside the behaviour) to the conative component of the above-mentioned multicomponent approach to attitudes.

In global terms, therefore, the TOPB may be viewed as an integrated behavioural model containing, on the one hand, various aspects of the classical multicomponent view of attitudes as separate model variables. On the other hand, the TOPB incorporates notions relating to role and reference-group theory and cost-utility considerations as reflected in the rational choice approach.

3. Exploratory study to determine behavioural outcomes, pretest, sampling and main study

To determine salient behavioural outcomes for the interviews in the main survey, an exploratory study (N = 36) was undertaken, in which students were asked about the advantages and disadvantages that people associate with throwing waste glass into a household dustbin or a recycling bin. The twenty most frequently mentioned outcomes were selected for the main survey (see Ajzen and Fishbein 1980, pp. 70). These 20 outcomes were next reduced to 11 by means of semantic combinations. To avoid a response set, pleasant and unpleasant outcomes were "mixed up". We thus obtained the following 11 salient behavioural outcomes for the main study: O_1: household storage of waste glass; O_2: a good conscience; O_3: dustbin fills up more quickly; O_4: cleaning of waste glass; O_5: easy waste disposal; O_6: time-saving; O_7: ecological damage through incineration; O_8: recycling of raw materials; O_9: laborious transport; O_{10}: reducing waste at the national level; O_{11}: heavier dustbin.

In the light of a pretest (N = 40), the standardized questionnaire was revised and a final version produced for the main survey. In the main survey, 247 standardized interviews were conducted by students with citizens of Bremen, applying the following proportions (not to produce a representative sample but to ensure variance in the model variables): 50% women; 50% men; 50%

household dustbin users; 50% recycling-bin users; one third from each of the following age groups: 30 and under; between 31 and 50; 51 and over. Overall, 42,1% had thrown their waste glass in the dustbin on the last occasion and 57,9% in a public bin. The average age was 37,8 years.

As the sampling procedure was not intended to produce a representative sample but merely to ensure variance in the theoretically relevant variables, we consider that tests of significance are inappropriate, since they call for genuine random sampling. Such tests are likewise unsuitable because random sampling is basically impossible in testing a general theory such as the TOPB.[4] However, we have provided significance levels for those who do not agree with this argument.

4. Variables in the theory of planned behaviour and their measurement

As the formulation of hypotheses in the TOPB using differential scores can be relatively obscure until the model variables are defined and rendered operational, we shall first define the TOPB variables, their measurement and the construction of difference variables and only then formulate the relevant TOPB hypotheses in the form of linear regression equations.

Our model contains differential measures (see Ajzen and Fishbein, 1980, pp. 113 and pp. 173) for all TOPB variables as two disposal alternatives (dustbin vs. recycling bin) are involved. As the minuend relates to dustbin disposal and the subtrahend to recycling-bin disposal for all difference variables, positive values for a difference variable always mean that the value of the variable in question is greater for dustbin disposal than for recycling-bin disposal. Negative values mean the opposite.

Behaviour was measured, on the one hand, by asking the dichotomous question of how waste glass had been disposed of on the last occasion and, on the other, by asking how frequently waste glass was thrown in the dustbin or the recycling bin (a seven-point scale running from "always" 6 to "never" 0). The corresponding difference variable was constructed as follows:

4 As general theories such as the TOPB involve general statements that are unlimited in space and time and claim to be valid for all individuals at all times and in all places, random sampling from open populations of this kind (i. e. theoretically infinite populations) and hence inferential conclusions are impossible. See Gadenne 1984, pp. 113; Opp and Schmidt 1976, p. 12; Glaser 1979.

Behaviour differential = df. frequency with which waste glass is thrown in the dustbin – frequency with which waste glass is thrown in the recycling bin.

Positive values mean that waste glass is thrown in the dustbin more frequently and negative values that waste glass is thrown in the recycling bin more frequently.

Behavioural intention: Respondents were asked to rate the likelihood of their waste glass being thrown on the next occasion in the dustbin or the recycling bin (a seven-point scale running from "very likely" 6 to "very unlikely" 0). The following differential variable was constructed:

Intention differential = df. intention to throw waste glass in the dustbin on the next occasion – intention to throw waste glass in the recycling bin on the next occasion.

Positive values indicate that waste glass will be thrown in the dustbin on the next occasion and negative values that it will be thrown in the recycling bin on the next occasion.

Attitude: Respondents were asked how good or bad they rated the act of throwing their waste glass in the dustbin or the recycling bin (a seven-point scale running from "very good" +3 to "very bad" –3). The corresponding difference variable takes the following form:

Attitude differential = df. evaluation of dustbin disposal – evaluation of recycling-bin disposal.

Positive values mean that dustbin disposal is considered better and negative values that recycling-bin disposal is considered better.

Subjective norm: Respondents were asked how good or bad "most people of importance to them" (i. e. reference persons) considered it when they threw their waste glass in the dustbin or recycling bin (a seven-point scale running from "very good" +3 to "very bad" – 3). The following difference variable was constructed:

Subjective norm differential = df. subjective norm for dustbin disposal – subjective norm for recycling-bin disposal.

Positive values indicate that others find dustbin disposal better and negative values that others find recycling-bin disposal better.

Overall behaviour control: Respondents were asked how easy or difficult it was for them to throw waste glass in a recycling bin (a seven-point scale running from "very easy" +3 to "very difficult" –3). Overall behaviour control for dustbin disposal was omitted because all respondents would probably find this type of disposal "very easy". However, to ensure meaningful scoring for the resulting difference variable, the value range for the variable was inverted. The variable is called control differential:

Control differential = df. overall behaviour control for recycling-bin disposal.

Expectation: Respondents were asked about the subjective likelihood that outcomes $O_1 \ldots O_{11}$ could be expected to ensue in the case of dustbin or recycling-bin disposal (a seven-point scale running from "very likely" +3 to "very unlikely" –3). Utility: Respondents were asked how well or badly they rated outcomes $O_1 \ldots O_{11}$ (a seven-point scale running from "very good" +3 to "very bad" –3).[5] On the basis of utilities and expectations for these 11 outcomes, a product sum ("net utility of a behavioural alternative") was formulated for each of the two behavioural alternatives, on the basis of which a difference variable, which we call net utility differential, was constructed:

Net utility differential = df. ($\sum$ expectation of outcome O_i from dustbin disposal × utility of outcome O_i) – ($\sum$ expectation of outcome O_i from recycling-bin disposal × utility of outcome O_i).

Positive values indicate that dustbin disposal has more advantages and/or fewer disadvantages than recycling-bin disposal. Negative values indicate that recycling-bin disposal has more advantages and/or fewer disadvantages than dustbin disposal. Index i refers to the various salient outcomes $O_1 \ldots O_{11}$.

Normative beliefs: Respondents were asked how well or badly two reference persons freely specified by the respondent would rate the throwing of waste glass by the respondent in the dustbin or the recycling bin (a seven-point scale running from "very good" +3 to "very bad" –3; section 9 identifies the reference persons specified in this connection). Motivation to comply: Respondents were asked about the subjective likelihood of actually doing what the two

5 On the question of the appropriateness of unipolar or bipolar coding for expectations and utilities and the corresponding implications for product sum models, see Dohmen 1985; Dohmen et al. 1986; Ajzen 1991; Doll et al. 1991. Bipolar coding of both variables implies that the non-appearance (-3) of a negatively (-3) evaluated outcome contributes in equal measure to a positive net utility as the appearance (+3) of a positively (+3) evaluated outcome. As we consider Heider's logic of the double negative (1958) to be psychologically meaningful and intuitively plausible, we have used bipolar coding for both variables.

reference persons expected of them (a seven-point scale running from "very likely" 6 to "very unlikely" 0). Normative beliefs and motivation to comply were used to calculate a product sum for each of the two disposal alternatives and each of the two reference persons and this served as the basis for the norm differential:

Norm differential = df. ($\sum$ evaluation of dustbin disposal by reference person j × motivation to fulfil the expectation of the reference person j) – ($\sum$ evaluation of recycling-bin disposal by reference person j × motivation to fulfil the expectation of reference person j).

The index j, used to calculate the product sum, relates to the two reference persons specified by the respondent in the interview. Positive values indicate that perceived social pressure to throw waste glass in the dustbin is greater and negative values that perceived social pressure to throw waste glass in the recycling bin is greater.

Control belief: Respondents were asked about the likelihood in their view of the existence of specific circumstances that would make recycling-bin disposal easier or more difficult (a seven-point scale running from "very likely" +3 to "very unlikely" –3). Ease of action: Respondents were asked to what extent specific circumstances would make it easier or more difficult for them to throw waste glass in the recycling bin (a seven-point scale running from "much easier" +3 to "much more difficult" –3). The following circumstances were posited as making action easier or more difficult: C_1: knowing where the nearest recycling bin was located; C_2: good physical condition; C_3: good transport facilities; C_4: long distance to the next recycling bin. Here again, control beliefs and ease of action as regards dustbin disposal were omitted because it was "very likely" that circumstances facilitating that disposal alternative existed for all respondents. However, to ensure meaningful scoring for the possibility difference variable, the value range for the variable was inverted. A product sum was then derived from control beliefs and ease of action. We call the product sum possibility differential:

Possibility differential = df. $\sum$ subjective likelihood of the existence of a circumstance C_k that makes recycling-bin disposal easier or more difficult × evaluation of the extent to which recycling-bin disposal is made easier or more difficult by circumstance C_k.

Positive values indicate the predominance of circumstances that make recycling-bin disposal easier and negative values the predominance of circumstances that make it difficult. The index k, used to calculate the product sum, relates to circumstances $C_1 \ldots C_4$.

5. Theory of planned behaviour hypotheses based on differential scores

As our study involves two behavioural alternatives, the TOPB hypotheses may be expressed in the form of the following linear regression equations using differential variables (β = beta weights):

H_1: behaviour differential = + β intention differential

H_2: intention differential = + β attitude differential
+ β subjective norm differential + β control differential

H_3: attitude differential = + β net utility differential

H_4: subjective norm differential = + β norm differential

H_5: control differential = + β possibility differential

In addition to the independent effect of overall behaviour control (here: control differential), as formulated in hypothesis H_2, on intention (here: intention differential), Ajzen postulates (Ajzen, 1988, p. 134, 1991) the following alternative effects of overall behaviour control. To the extent that perceived possibilities of action correspond to actual possibilities or constitute a subset of actual possibilities, overall behavioural control exerts (alongside intention) a direct influence on behaviour:

H_6: behaviour differential = + β intention differential + β control differential

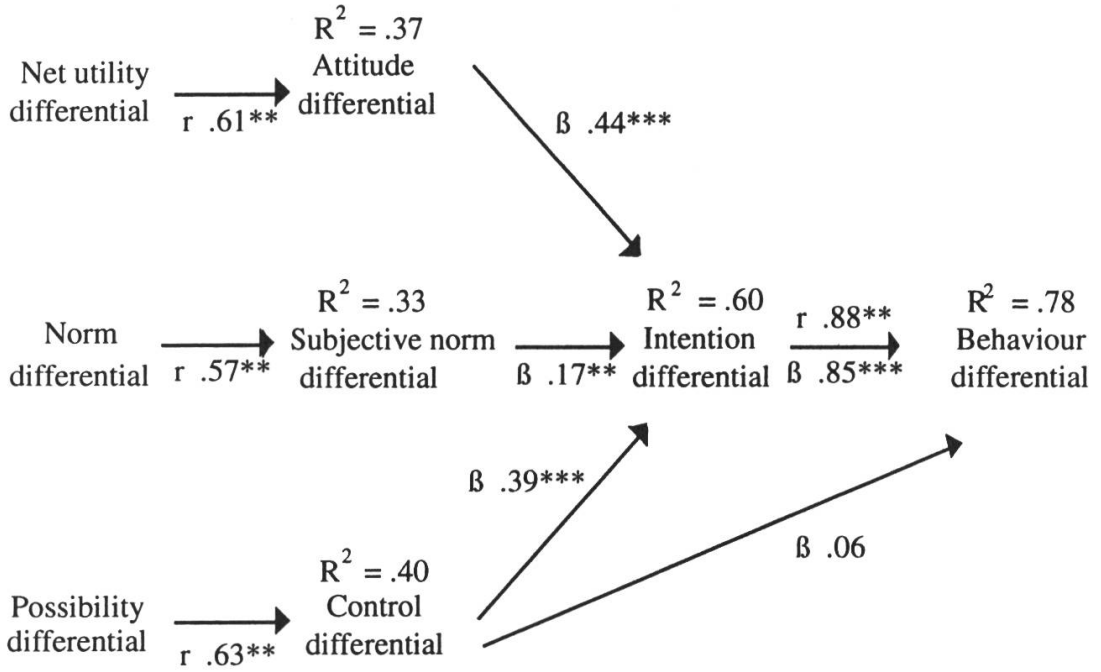
Overall behaviour control can, on the other hand, affect actual behaviour as a moderator variable together with intention, i. e. a multiplicative interaction occurs between intention and overall behaviour control:

H_7: behaviour differential = +β (intention differential × control differential)

6. The TOPB as a behavioural theory: Explanation of disposal behaviour

A test of the TOPB as a behavioural model using multiple regression analysis[6] yielded the results shown in model 1.

Model 1
The TOPB as a behavioural model



N = 239

* p < .01
** p < .001
*** p < .0001

Behaviour 1: Waste glass in dustbin
Behaviour 2: Waste glass in recycling bin

Hypotheses H_1 to H_5 are now confirmed by our data. The explained variances in the intention differential (R^2 = ,60) and behaviour differential (R^2 = ,78) must be considered high. The explained variances in the three intervening TOPB variables – attitude differential (R^2 = ,37), subjective norm differential

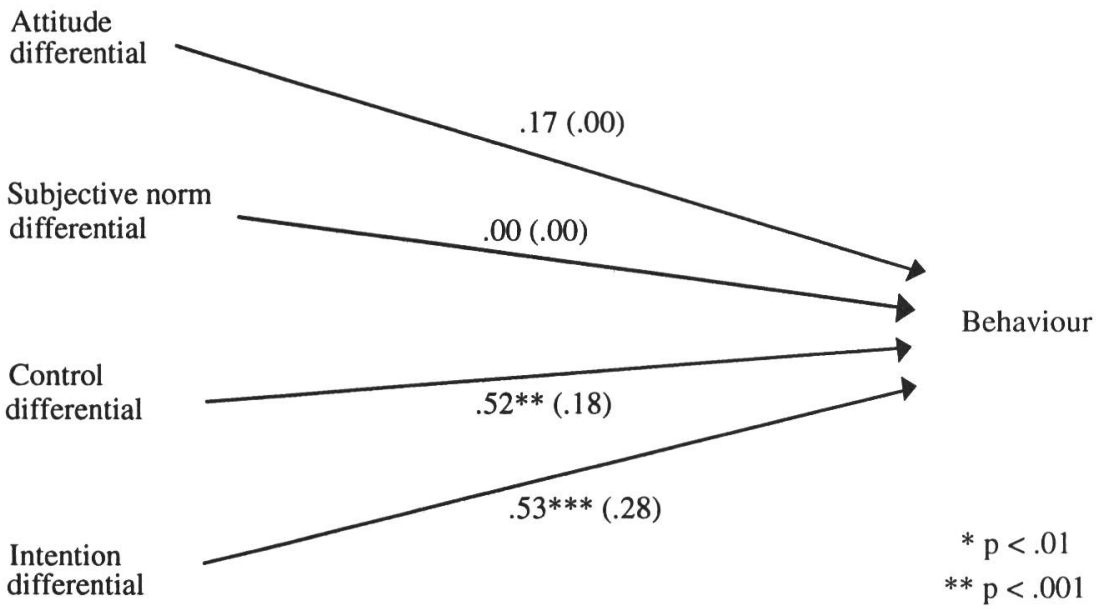
6 Except for Model 3, the degree of multicollinearity of the predictors and the residuals entailed no problems for any of the regression models. Model 3, however, is an exception inasmuch as two predictors in this model (intention differential, behaviour differential) correlate with r = .89. The correlation matrix of the TOPB model variables is appended hereto.

(R^2 = ,33) and control differential (R^2 = ,40) – are somewhat lower. At the same time, a comparison of the beta weights results in a surprisingly low value of ,17 for the subjective norm differential predictor. If a falsification criterion of $|\beta| \leq ,10$ is used (see Opp and Schmidt 1976, p. 157), hypothesis H_6 is refuted by a beta weight of ,06 for the effect of the control differential on the behaviour differential. But this is plausible inasmuch as the subjective reasons for evaluation of overall behaviour control such as, for example, knowing about the location of the nearest recycling bin (C_1), the sound physical condition needed for transport to the recycling bin (C_2) and good transport facilities (C_3), are relatively independent of the actual opportunities, i. e. the presence or absence of a public recycling bin close to home. Interaction hypothesis H_7 is also refuted by the data inasmuch as the bivariate correlation of –,29 between the interaction term (intention differential × control differential) and the behaviour differential contradicts the theoretically postulated sign.

In another behavioural model (model 2), we used the dichotomously measured behaviour variable relating to the way in which waste glass had been disposed

Model 2

as a behavioural model with dichotomous dependent variable



logistic regression coefficients b
in brackets partial correlation R

Percentage correct classifications: 88.36%

Behaviour 1: Waste glass in dustbin (1)
Behaviour 2: Waste glass in recycling bin (0)

N = 232

of on the last occasion (dustbin or recycling bin) as dependent variable in a logistic regression.

But on examining the logistic regression coefficients in model 2, we find that the (H_6) effects of the intention differential (,53) and the control differential (,52) on (most recent) behaviour postulated by the TOPB are confirmed. The fact that the subjective norm differential has no (,00) effect on behaviour is also in keeping with the theory. But the attitude differential exerts an effect (,17) on behaviour in Model 2 that is not postulated by the theory. However, if only the partial correlations (in brackets) are used in Model 2, hypothesis H_6 is confirmed without the emergence of theoretically inconsistent relationships.[7]

7. Repetitive actions and habits

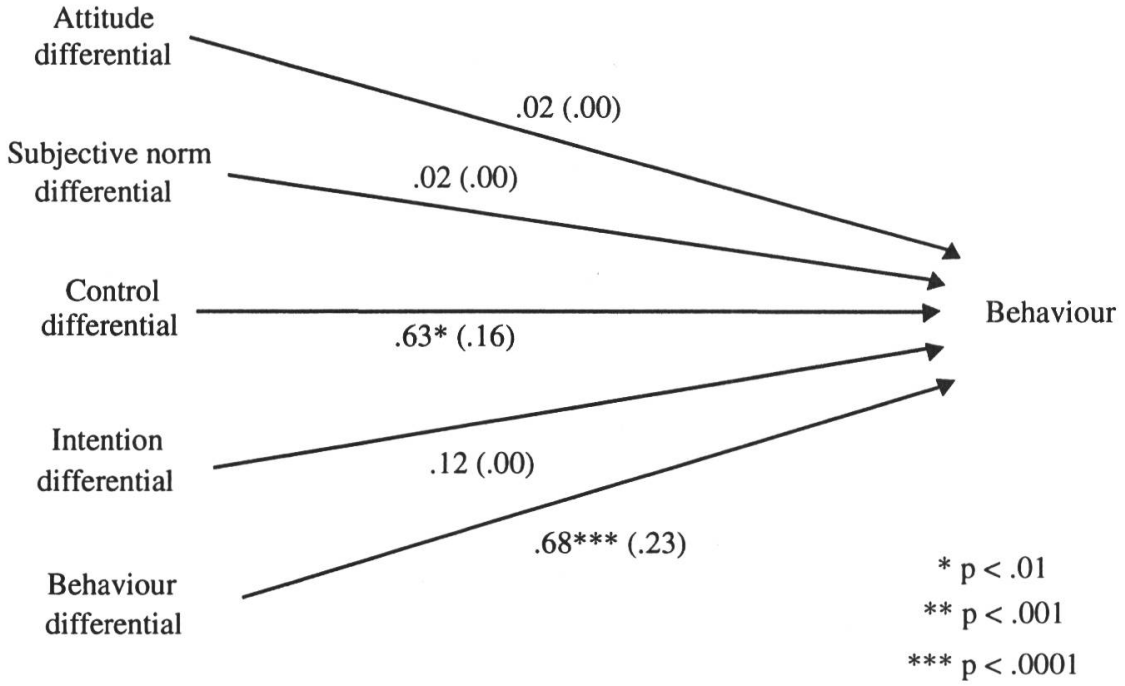
Actions that are performed frequently and are therefore decided on more or less "automatically", i. e. without major cognitive exertion, can be described as habitual actions or habits (Triandis, 1980, p. 204; Camic, 1986; Mittal, 1988; Ronis et al., 1989, p. 218, Esser, 1991, p. 65; Verplanken et al., 1994). For many people, the constantly recurring chore of waste glass disposal no doubt falls into the habit category. Thus, of the 247 respondents in our sample, 135 (54,7%) generally ("always", "very often", "often") threw their waste glass in the recycling bin and hardly ever ("never", "very rarely", "rarely") in the dustbin. This group therefore consists of habitual recycling-bin disposers. By contrast, 66 (26,7%) respondents in the sample generally ("always", "very often", "often") threw their waste glass in the dustbin and hardly ever ("never", "very rarely", "rarely") in the recycling bin. This group can be assigned to the category of habitual dustbin disposers. Only 12 respondents (4,9%) threw their waste glass "occasionally" in the dustbin and also "occasionally" in the recycling bin. It follows that the disposal-related behaviour of most of our sample is habitual.

As there are no generally accepted and validated measures of habit, we propose tentatively to use the behaviour differential relating to past behaviour as a proxy variable for habits (on this operationalization of habits, see also Triandis, 1977, 1980; Macey and Brown, 1983; Charng et al., 1988; but for another from of operationalization see Verplanken et al., 1994). If Model 2 is

7 In view of the problems involved in constructing a meaningful pseudo-R^2 in logistic regression models, the fit of the model is measured solely on the basis of the results of a classification analysis; see Hosmer and Lemeshow 1989, pp. 145.

Model 3

The TOPB as a behavioural model with dichotomous dependent variable and habit predictor



logistic regression coefficients b
in brackets partial correlation R

Percentage correct classifications: 91.30%

Behaviour 1: Waste glass in dustbin (1)
Behaviour 2: Waste glass in recycling bin (0)

N = 230

expanded by the behaviour differential predictor and this variable is used as a proxy variable for habits, the outcome is model 3.

On examining the logistic regression coefficients in model 3, we find a decline in the effects of the intention differential (from ,53 to ,12) and the attitude differential (from ,17 to ,02). However, the steep decline in the effect of the intention differential may also be attributed to problems of multi-collinearity, inasmuch as the intention differential and the behaviour differential are correlated with r = ,89 (see the correlation matrix appended hereto). On the other hand, the effect of the control differential has increased somewhat (from ,52 to ,63). The only finding that remains unchanged is that the subjective norm differential has virtually no effect (,02).

But it emerges from an examination of the partial correlations (in brackets) in Model 3 that correlations exist only between the control differential predictor (,16) and the habit indicator (,23) on the one hand, and behaviour, on the other. This finding is perfectly consistent with Triandis's behavioural theory (1977, 1980) which contains habits as a predictor variable. Triandis (1977, p. 9) formalizes the relationship between the probability of a particular behaviour (P_a), habits and intentions as follows:

$$P_a = (w_h \times \text{habit} + w_i \times \text{intention}) \times F$$

F stands for facilitating conditions and w_h and w_i are weighting parameters. Triandis's model implies the following "complementary" relationship between habits and intentions:

> *When a behavior is new, untried, and unlearned, the behavioral-intention component will be solely responsible for the behavior, while, when the behavior is old, well-learned, or overlearned and has occurred many times before in the organism's life span, it is very likely to be under control of the habit component [...] As behavior repeatedly takes place, habit increases and becomes a better predictor of behavior than behavioralintentions.*
>
> Triandis, 1977, p. 205

Thus, Triandis postulates that, the more repetitive a behaviour is, i. e. the more frequently it occurs, the more the probability of its occurrence will depend on habit formation and the less on behavioural intention ($w_h > w_i$). The disposal of waste glass seems to constitute precisely this kind of repetitive behaviour. Conversely, Triandis postulates that the more novel a behaviour is (see Macey and Brown, 1983; Ronis et al., 1989), the less the probability of its occurrence will depend on habit formation and the more on behavioural intention ($w_h < w_i$). Our model 3 fully confirms Triandis's assumption that the probability of a repetitive behaviour occurring depends more on the habitual nature of the behaviour than on the corresponding behavioural intention.

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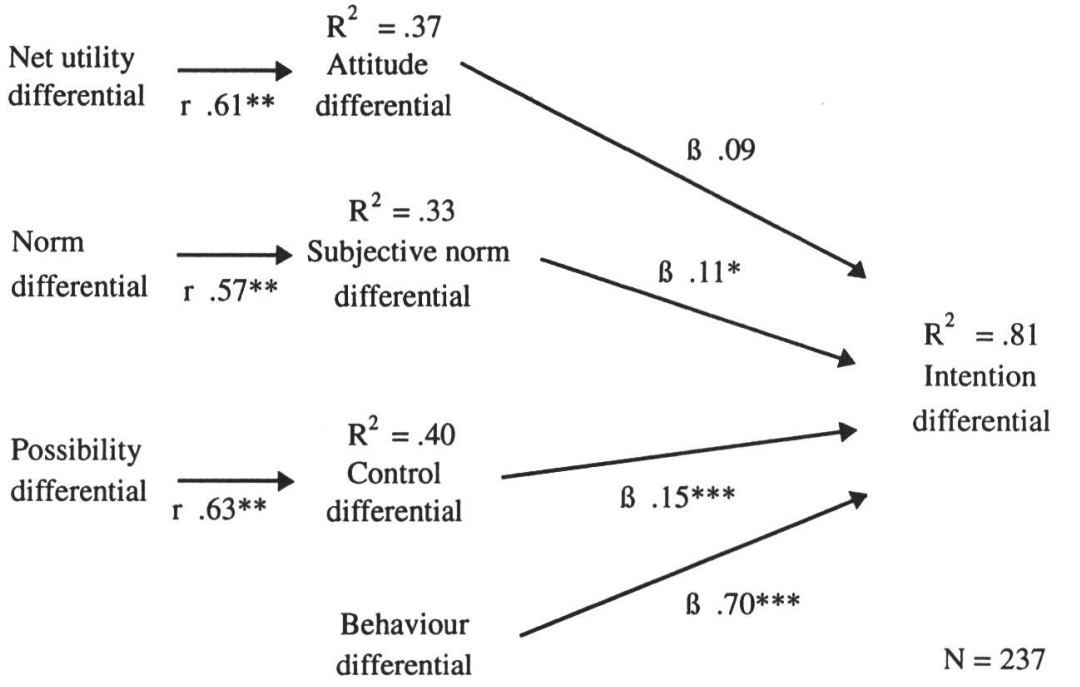
8 Liska (1984) challenged the assumption of additivity of the effects of attitude and subjective norm on intention and postulated an interaction effect of these two predictors. If perceived behaviour control is also taken into account and the possible effect of the interaction term (attitude differential × subjective norm differential × control differential) on the intention differential is investigated, the outcome is a correlation of $r = .54$ and hence an explained variance of .29 ($p < .001$).

Model 4
The TOPB as an intention model with habit predictor



Behaviour 1: Waste glass in the dustbin
Behaviour 2: Waste glass in the recycling bin

8. The TOPB as a disposition theory: The explanation of disposal intentions

Models 1 to 3 may be criticized on the grounds that the dependent behaviour variable relates to actions which, at the time of the survey, had already taken place, perhaps even some time previously. But this criticism can be countered by reference to the fact that the TOPB is being tested solely as an intention model designed to explain behavioural dispositions.[8]

In contrast to model 1, which also contains an intention model, model 4 presents surprisingly low beta weights (β) for the effects of the TOPB predictors, attitude differential (,09), subjective norm differential (,11) and control differential (,15). On the other hand, the effect (,70) of the behaviour differential variable

supported by studies which show that a person's past experience with the behaviour to be explained exerts a direct influence on intention or behaviour regardless of the TOPB model variables (see Bentler and Speckart,, 1979, 1981; Fredricks and Dossett, 1983; Macey and Brown, 1983; Budd et al., 1984; Mittal, 1988; Charng et al., 1988; Sparks and Shepherd, 1992). It may therefore be assumed from the point of view of the TOPB that, the more habitual a behaviour, the less pronounced the influence of the TOPB predictors on intention or behaviour. Thus, to the extent that the frequency of past behaviour, regardless of the TOPB variables, exerts an influence on intention, it could be taken as an indicator of habitualized behaviour (see also Triandis, 1977, 1980).[9]

However, it also becomes clear, precisely from the example in model 4 of the influence of frequency of past behaviour on intention, that the use of frequency of past behaviour as a proxy variable for degree of habitualization of a behaviour, which was first proposed by Bentler and Speckart (1979, 1981), is not without problems. For if habitualization is supposed to mean performing an action without conscious deliberation, the paradoxical conclusion must be drawn from Model 4 that the degree of habitualization of a behaviour exerts a strong direct effect on the conscious intention to perform that action. But it would be difficult to reconcile such a finding with a theory of *planned* behaviour.

Clarification of the question as to whether and how habits are to be theoretically integrated into the TOPB is therefore a prerequisite for further investigation of the causal role of habits in explaining intentions and behaviour. It is also necessary, in our view, to promote the development of more direct and validated measures for habits. Unfortunately, no satisfactory measuring tools are available to date (but see Verplanken et al., 1994).

9. Reference groups, expectations, utilities and meta-preferences in different groups of disposers

To measure normative beliefs, respondents were asked how well or badly two reference persons to be specified by the respondent, who were of special importance to them and whose opinion they held in high esteem, would rate the

9 Although Ajzen himself seems to view habits as a potentially interesting extension of the TOPB, he expressly rejects the operationalization of habits as past behaviour (Ajzen 1991, pp. 202; likewise Mittal 1988, p. 997). He tends instead to view the effect of past behaviour as an indicator of a specification error within the TOPB model.

throwing of waste glass by the respondent in the dustbin or the recycling bin. To measure motivation to comply, respondents were then asked about the subjective likelihood of actually doing what the two reference persons they had mentioned expected of them. Normative beliefs and motivation to comply subsequently formed the basis for the norm differential. The frequency distribution for the two reference persons specified is shown in table 1.

Table 1
Relative frequencies of specified reference persons

Category of specified reference person	Reference person 1	Reference person 2
Spouse/partner	51.0%	5.9%
Relative	27.5%	36.4%
Colleague	1.6%	5.0%
Fellow residents	4.5%	4.2%
Friends/acquaintances	15.4%	42.2%
Neighbour	0 %	6.3%
Total	100 %	100 %

The distribution of categories of reference persons reflects the order of salience of such persons. Thus, the "spouse/partner" category, at 51%, is manifestly predominant among first-named persons (reference person 1). On the other hand, "friends and acquaintances" feature most frequently (42,2%) among second-named persons (reference person 2).[10]

In the light of the answer to the question of how waste glass had been disposed of on the last occasion (dustbin, recycling bin), we formed two subgroups, which we call dustbin disposers (N = 88) and recycling-bin disposers (N = 127). Table 2 gives the mean values for expectations and utilities of behavioural outcomes for dustbin and recycling-bin disposers. We also calculated differential expectations of the behavioural outcomes (see table 2).

10 The fact that this specific order of salience of reference persons does not apply to every behaviour should be immediately evident when one considers, for example, the sexual behaviour of young people. In this area of behaviour, peer groups will undoubtledly exercise the strongest influence. But if we look at behaviour in the workplace, for example, colleagues or supervisers will certainly prove the most influential.

differential expectation of outcome O_i = df. expectation of outcome O_i for dustbin disposal – expectation of outcome O_i for recycling-bin disposal.

Positive values for a differential expectation indicate that this outcome is perceived by a person to occur in the case of dustbin rather than recycling-bin disposal. Negative values mean that the outcome occurs in the case of recycling-bin rather than dustbin disposal. The greater the score, the more likely the outcome in the case of dustbin disposal and/or the less likely in the case of recycling-bin disposal.

Table 2
Mean values for utility and differential expectation of behavioural outcomes for dustbin and recycling-bin disposers

	Utility rating		Differential expectation	
Behavioural outcomes of disposal	Dustbin disposers N = 88	Recycling-bin disposers N = 127	Dustbin disposers N = 88	Recycling-bin disposers N = 127
Household storage	–1.35	–.79**	–3.34	–3.43
Good conscience	1.47	1.93**	–2.16	–3.62***
Dustbin soon full	–1.38	–2.04***	3.47	4.22**
Cleaning of waste glass	–1.40	–.77**	–2.30	–2.65
Ease of disposal	2.05	1.78	3.91	2.63***
Time-saving	1.94	1.45**	4.19	3.12***
Damage to the environment from incineration	–1.62	–2.38***	2.01	3.22***
Recycling of raw materials	1.82	2.53***	–3.15	–4.13***
Laborious transport	–1.86	–1.47**	–3.39	–2.14***
Reducing waste at the national level	1.66	2.45***	–3.09	–3.68*
Heavier dustbin	–1.34	–1.43	3.52	4.28**

Significant mean difference: * = p < ,05; ** = p < ,01; *** = p < ,001

It could first be assumed that the utilities of the various outcomes by dustbin and recycling-bin disposers are identical and hence independent of the mode of disposal on the previous occasion. But there are systematic differences in utilities between the two groups which are related with previous mode of

disposal. Thus, it seems that outcomes which both groups are inclined to expect from recycling-bin disposal (whose differential expectations are therefore associated with negative values) are less negatively rated ("household storage", "cleaning of waste glass", "laborious transport") or more positively rated ("a good conscience", "recycling of raw materials", "reducing waste at the national level") by recycling-bin disposers than by dustbin disposers. The exact opposite pattern emerges for outcomes which both groups are inclined to expect from dustbin disposal (whose differential expectations are therefore associated with positive values). These outcomes are less negatively rated ("dustbin soon full", "damage to the environment from incineration", "heavier dustbin") or more positively rated ("ease of disposal", "time-saving") by dustbin disposers than by recycling-bin disposers.

Boldero's study (1995, p. 452) of the recycling of newspapers produced similar results. Recyclers in that study rated the ecologically positive outcomes of newspaper recycling more positively and the unpleasant outcomes of recycling less negatively than non-recyclers. The study of tin recycling by Kok and Siero (1985, p. 170) also indicated that recyclers consistently rate the disadvantages of recycling less negatively than non-recyclers.

It further emerges that the three most extreme utility ratings (absolute values) by recycling-bin disposers relate to collective and long-term ecological outcomes ("damage to the environment from incineration", "recycling of raw materials", "reducing waste at the national level"), while the three most extreme utility ratings by dustbin disposers relate to individual and relatively short-term "selfish" outcomes ("ease of disposal", "time-saving", "laborious transport").

If we use the concept of meta-preference,[11] which relates to the type of goals or outcomes that people prefer (see Sen, 1979), one finding of our study is the existence of a behaviour-specific distribution of meta-preferences for collective and long-term behavioural outcomes (among recycling-bin disposers) on the one hand, and for individual and short-term behavioural outcomes (among dustbin disposers) on the other. This supports the assumption that the root cause of many environmental problems consists in the fact that actors, when taking individual decisions, tend to rate short-term individual costs and utilities more highly than long-term collective costs and utilities, i. e. display meta-preferences for short-term and individual outcomes.

11 The concept of meta-preferences allows us to distinguish between, on the one hand, specific content-related preferences (such as the preference for one's own convenience in disposing of waste) and, on the other, meta-preferences for particular kinds of preferences (selfish vs. altruistic; short-term vs. long-term; individual vs. collective).

Negative signs for differential expectations in both groups mean that all respondents expect the outcomes "household storage", "a good conscience", "cleaning of waste glass", "recycling of raw materials", "laborious transport" and "reducing waste at the national level" in the case of recycling-bin disposal rather than dustbin disposal. Positive signs for differential expectations in both groups, on the other hand, indicate that all respondents expect the outcomes "dustbin soon full", "ease of disposal", "time-saving", "damage to the environment through incineration" and "heavier dustbin" in the case of dustbin disposal rather than recycling-bin disposal. As a result, there is no difference between the two groups in terms of the sign for differential expectations. There is a difference, however, in terms of the mean values for differential expectations. These differences in differential expectations within the two groups and the earlier mentioned different utility ratings result in different net utility values for the two behavioural alternatives and hence also in different net utility differentials, which in turn determine attitudes to the behavioural alternatives.

10. A test of subjective expected utility (SEU) theory

Our data may be used to test an alternative and very simple theory of action, the subjective expected utility (SEU) theory. This theory, also called "utility theory" or "value × expectancy theory", postulates that, among diverse perceived behavioural alternatives, the alternative associated with maximum SEU will be performed. The SEU of a particular disposal alternative H_i was earlier defined as "net utility":

> SEU ("net utility") of behavioural alternative H_i = df. $\sum$ expectation of behavioural outcome O_j from performing H_i × utility of behavioural outcome O_j

The following is a first version of the SEU theory, expressed at an aggregate level, for two behavioural alternatives H_1 and H_2:

> On average, persons who perform H_1 (H_2) perceive a higher SEU from H_1 (H_2) than from behavioural alternative H_2 (H_1).

Inserting "dustbin disposal" for H_1 and "recycling-bin disposal" for H_2 yields the following testable hypothesis for the case in point:

> On average, dustbin disposers (recycling-bin disposers) perceive a higher SEU from dustbin disposal (recycling-bin disposal) than from recycling-bin disposal (dustbin disposal).

Table 3 shows the mean values required for this test and the performed behavioural alternatives.

Table 3
Mean SEU values for two behavioural alternatives among dustbin and recycling-bin disposers

Variables	Dustbin disposers N = 88	Recycling-bin disposers N = 127
SEU of dustbin disposal	4.29	–15.71***
SEU of recycling-bin disposal	3.6	21.28

Significant mean differences *** = p < ,001

SEU theory is confirmed at this aggregate level, since dustbin disposal is associated with the greatest average SEU (4,29) in the group of dustbin disposers and recycling-bin disposal is associated with the greatest SEU (21,28) in the group of recycling-bin disposers. However, the mean difference is not significant among the dustbin disposers. SEU theory may also be expressed at an individual level:

> A person will perform the behavioural alternative which he/she perceives as entailing the maximum SEU.

In the case in point, this hypothesis will be expressed as follows:

> For every dustbin disposer:
>
> SEU dustbin disposal > SEU recycling-bin disposal.
>
> For every recycling-bin disposer:
>
> SEU recycling-bin disposal > SEU dustbin disposal.

This is an intra-individual analysis, inasmuch as the SEU values are compared for one and the same person and an individual behaviour prediction is made on that basis. It should be noted that there was nobody in our sample for whom the SEU of dustbin disposal was the same as the SEU of recycling-bin disposal. As may be gathered from Table 4, the predictions for actually performed behaviours are accurate in 72,55% (47 + 109) of all cases (N = 215). The correlations for this table work out at a phi of ,42 and a contingency coefficient of ,39 (p < ,0001).

Table 4
Individual test of the SEU theory for two disposal alternatives

Relationship between SEU values of disposal alternatives	Thrown in dustbin on last occasion	Thrown in recycling bin on last occasion	Total
SEU dustbin > SEU recycling bin	47	18	65
SEU recycling bin SEU dustbin <	41	109	150
Total	88	127	215

Accurate predictions: 72,55%; phi: ,42
Contingency coefficient: ,39 ($p < ,0001$)

However, there are clear-cut differences in predictive quality for the two disposal alternatives. Thus, dustbin disposal predictions are only 53,4% accurate, compared with 85,8% for recycling-bin predictions. The lower percentage of accurate predictions for dustbin disposers may be attributable to the small difference between SEU mean values (4,29 vs. 3,60) for the two behavioural alternatives within this group (see Table 3). On account of this small difference in mean values, the relation SEU dustbin disposal < SEU recycling bin disposal is more likely to be fulfilled in a number of cases (41 cases to be precise) and lead to inaccurate individual predictions. A third version of SEU theory states:

> The greater the SEU differential (= SEU dustbin – SEU recycling bin), the greater the corresponding behaviour differential.

This constitutes an inter-individual comparison between SEU values on the one hand, and behavioural frequencies on the other. As a hypothesis, it can be tested by means of the simple correlation between the two variables. But the relatively low correlation coefficient of $r = ,57$ ($p < ,001$) and a corresponding explained variance of ,33 are disappointing and indicate that no direct relation exists between the SEU of a behaviour and the performance of the behaviour. However, where the investigated disposal behaviours are habits, it is also possible that the process of mental "weighing-up" or deliberation, which is assumed to take place in the formation of SEU values, no longer occurs so that the relationship with behaviour is not particularly strong. It may be gathered from the data in Table 5 on the explanatory potential of the TOPB and the SEU theory respectively that the TOPB consistently yields better results than the SEU theory.

Table 5
Comparison of the explanatory potential of the TOPB and that of SEU theory in terms of disposal behaviour

Theory of planned behaviour	SEU theory
Model 1: explained variance in behaviour differential: .78	explained variance in behaviour differential: .33
Model 2: correct individual classifications: 88.36%	accurate individual predictions: 72.55%
Model 3: correct individual classifications: 91.30%	accurate individual predictions: 72.55%

11. Discussion, problems and outlook

Our study has shown, first of all, that the TOPB can meaningfully integrate a set of theoretically heterogeneous approaches in sociology (role theory, reference group theory, rational choice theory, multicomponent view of attitude) without degenerating into the kind of "blind" theoretical eclecticism that is frequently incapable of combining diverse theoretical approaches in a meaningful way. Our study is innovative in that it uses differential scores for the TOPB variables. To our knowledge, differential measures have not been calculated to date in any TOPB application to environmental behaviour.

Our results further show that a behaviourally specific distribution of meta-preferences occurs for, on the one hand, collective and long-term behavioural outcomes (among recycling-bin disposers) and, on the other hand, for individual and short-term behavioural outcomes (among dustbin disposers). This supports the assumption that many environmental problems may be attributed to the fact that actors, when taking decisions, tend to overrate short-term individual costs and utilities compared with long-term collective costs and utilities, i. e. they have meta-preferences for short-term and individual outcomes.

In empirical terms, the "pure" TOPB model (without a habit predictor) has proved its worth as a behavioural model (Models 1 and 2) and as an intention model (Model 1) to an unusually high degree in comparison with studies of environmental behaviour based on the traditional attitude-behaviour paradigm or without a theoretical basis. The TOPB also comes out on top in a comparison between the explanatory potential of the TOPB and SEU theory. This may be due to the fact that we have taken as our starting-point a conceptually mature

behavioural theory such as the TOPB which is backed up by tried and tested measuring instruments. But if we introduce a proxy variable for habits into the "pure" TOPB model, we find that this additional predictor exerts a considerable influence on behaviour (Model 3) and intention (Model 4). Our results are also supported by other TOPB studies in which repetitive environmentally relevant behaviour and the corresponding intention are determined to a great extent by past behaviour (on disposal of waste paper see Boldero 1995; on choice of mode of transport, see Bamberg and Schmidt, 1993; on purchase of organic products, see Sparks and Shepherd, 1992). Thus, when the TOPB is expanded by a proxy variable for habits, the results tend to confirm Triandis's behavioural theory, which states that the more repetitive a particular kind of behaviour, the greater the likelihood that it depends on habit rather than intention. The results therefore indicate that more thought needs to be given to the theoretical incorporation of habits in the TOPB model structure. We also feel that a measure for habits that is not identical to the frequency of past behaviour should be developed (see, for example, Verplanken et al., 1994).

Our results also raise the question of the sufficiency of the TOPB as a theoretical model for explaining the patterns of behaviour we have been investigating; by "sufficiency" we mean that the theory does not contain specification errors due to missing variables. For if the effect that the habit variable produces on most recent disposal behaviour (Model 3) and on intention (Model 4) is viewed as an indicator of a specification error within the TOPB model, this could be taken as a sign of the influence of potentially missing variables. Other variables have in fact been discussed in the literature as possible additional determinants of behavioural intentions. Reference may be made, for example, to self-identity (Sparks and Shepherd, 1992) or perceived moral obligations (Parker et al., 1995). As far as provision for moral obligations is concerned, however, it could be argued that we have covered this dimension. For example, "a good conscience" (outcome O_2) and degree of compliance with behavioural expectations of the social environment (i. e. motivation to comply) can be interpreted as factors involving a "moral" dimension.

In conclusion, attention needs to be drawn to certain problems in our study. The first relates to the validity of the data. Thus, the behaviour in the survey is based on information provided by the respondents themselves, so that behavioural measurements may have been biased by imperfect recall and social desirability. As nobody wants to be seen as an "environmental slob", social desirability may also have influenced the validity of the other TOPB variables. A further problem consists in the fact that behaviour was surveyed concurrently with predictors so that our behavioural predictions are not genuine prognostications. As our survey is cross-sectional, we cannot rule out the possibility that

simultaneous measurement of behaviour and its predictors gave rise to rationalization tendencies among the respondents. Although our aim was to test the TOPB and the SEU theory, a random sample would nevertheless have been desirable in the interests of increasing the heterogeneity of the sample and hence the rigour of the test. Another problem is the requisite level of measurement for the product terms used, since scale-score multiplication, a procedure used for a number of TOPB variables, should, strictly speaking, be based on ratio-scales instead of interval-scales as used by us (on the issue of the level of measurement in product-sum models such as the TOPB, see Orth, 1985, 1986, 1987, 1988). To achieve ratio-scale level required for score multiplication, the use of, for example, magnitude scaling procedures (see Lodge, 1981) might be considered. Lastly, in view of the problems involved in the theoretical integration and measurement of habits, we consider it advisable to refrain for the time being from theoretical interpretation of the effects of past behavioural frequency. However, this variable should be included in future applications of the TOPB as an additional control variable. At the same time, in the interests of further theoretical development of the TOPB, an effort should be made to specify the presumably confounded influential factors inherent in this variable and subsequently to develop direct and valid measures for these factors.

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Annex

Correlations of TOPB differential value variables (N = 198)

Variables	ATTD	SUNOD	INTD	BEHD	NORMD	POSSD	CONTD
NUD	.60	.52	.61	.57	.62	.62	.54
ATTD		.47	.68	.70	.61	.53	.44
SUNOD			.48	.43	.59	.37	.27
INTD				.89	.62	.64	.62
BEHD					.59	.61	.59
NORMD						.57	.46
POSSD							.63

All correlation coefficients are significant ($p < ,001$).

NUD	Net utility differential
ATTD	Attitude differential
SUNOD	Subjective norm differential
INTD	Intention differential
BEHD	Behaviour differential
NORMD	Norm differential
POSSD	Possibility differential
CONTD	Control differential