

# Differences Between Household Waste Reduction, Reuse and Recycling Behaviour: a Study of Reported Behaviours, Intentions and Explanatory Variables

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## Abstract

Research into individual waste management has focused primarily on recycling behaviour. It is argued here that there also needs to be a focus on reuse and reduction of waste. The diversity of waste behaviour and its antecedents is therefore emphasised. The declared reduction, reuse and recycling behaviour of 673 households in Exeter, Devon is detailed. Differences between behaviours are examined. This is then discussed in the context of the intentions stated by respondents towards these three activities. Comparisons are made. The data are then subjected to factor analyses and regression procedures to demonstrate the diversity of variables that explain each behaviour.

Key words: household waste behaviour, intentions to manage waste, explanatory framework

## INTRODUCTION: WASTE MANAGEMENT BEHAVIOUR

Considerable research exists concerning the description and analysis of individual recycling behaviour (e.g. Coggins 1994; McDonald and Ball 1998; Schultz *et al.* 1995; Thogersen 1994, 1996; Tucker 1998, 1999a,b). However, there has, as yet, been no widely published research that has described these types of data with regard to waste reduction, reuse, and recycling behaviour in the household. These three behaviours, taken together, are crucial to understanding how the municipal waste problem might be resolved, and need to be further researched if the top of the waste

hierarchy is to attain the prominence assigned to it by the current government (DETR 2000).

Previous work on *recycling* behaviour has sought to define the characteristics of the 'recycler' and 'non-recycler' (e.g. Vining and Ebreo 1990; Oskamp *et al.* 1991; Coggins 1994; Tucker 1999a). This has enabled researchers to define a given number of common characteristics that are unique to the recycler (see Schultz *et al.* 1995, for an excellent review). Essentially, recycling behaviours have been associated with three sets of variables. *Environmental values*, that form underlying attitudes towards the environment, have generally been linked to recycling behaviour (Vining and Ebreo 1992). Those who value the environment for its intrinsic worth have been found more likely to behave in environmentally appropriate ways. *Situational factors* embrace enabling and disabling influences, and are commonly classed as contextual (Guagnano *et al.* 1995; Derksen and Gartell 1993), socio-demographic (Berger 1997), knowledge based (Schahn and Holzer 1990), and experience based (Daneshvary *et al.* 1998). *Psychological factors* are unique perceptual traits of the individual, and include altruistic motives to recycle (Hopper and Nielsen 1991), intrinsic and extrinsic motivations (De Young 1986), perception of environmental threat (Baldassare

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and Katz 1992), outcome beliefs (Hopper and Nielsen 1991), subjective norms (or social influence; Chan 1998), a set of logistical factors and personal efficacy variables, such as time to undertake the activity (Steel 1996), and believing that individuals have a responsibility to protect their environment as well as expecting rights pertaining to that environment, in what might be termed environmental 'citizenship' beliefs (Selman 1996).

However, the degree to which these characteristics can be assigned any importance in actually predicting recycling behaviour has been less researched, although there are good examples of research that has attempted to 'fit' existing theoretical models to recycling behaviour (for example Goldenhar and Connell 1992-93; Hopper and Nielsen 1991). Although the descriptive work of researchers referred to above has enabled a litany of characteristics to be assigned to the recycler, it is important to understand the relative importance of these variables.

Indeed, the extent to which these characteristics are representative of all waste behaviours (i.e. recycling, reuse and reduction) is unknown. There are thus two reasons why we need to attempt an understanding of a holistic range of waste behaviours. First, there is a need to describe the level of each behaviour in comparison to other behaviours and the extent to which these differ not merely in the population as a whole but within population groups. Second, it is vital to explain the differences between the different behaviours. If differences were found between levels of behaviour, then it would be anticipated that the antecedents of these actions would be different as well. In addition, it is necessary to understand the extent to which the pre-defined characteristics of the 'recycler' function when placed in order of importance and the extent to which these are similar to the predictors of reuse and reduction.

Only when these questions have been answered will it be possible for policy makers to realistically tackle the full range of behaviours within the waste hierarchy, from reduction to recycling. Currently, publicity campaigns such as the *Are You Doing Your Bit?* campaign, the *Going for Green* initiative and the *National Waste Awareness Initiative* treat 'waste' as one issue, but if there are significant differences between such behaviours and these are underlain by fundamentally different antecedents, then a case could be made for a rethink of how policy makers formulate messages concerning waste management in the household.

In order to address these concerns it is necessary to conceptualise the large set of variables that might predict individual behaviours and provide a suitable

framework for assigning importance to individual predictor variables. A conceptual framework of waste behaviour was therefore devised by the authors from a survey of the literature. As shown in Figure 1, the cornerstones of this conceptualisation are environmental values, situational variables and psychological factors, as outlined earlier in the paper. The basis of the framework hinges on the notion of Fishbein and Ajzen (1975) that there is an intrinsic link between intentions and behaviour. However, in line with workers such as Taylor and Todd (1997) it is recognised that there are numerous predictors of behavioural intention, and that situational and psychological factors can also intervene to affect the intention-behaviour relationship (Fishbein and Ajzen argued that the only predictors of intention were attitude and subjective norms). The logical process within the framework moves from values, to intentions, to action, and forms the central line of the framework. Behavioural intention is operationalised as an individual's willingness to undertake a given behaviour. However, it is acknowledged that, as stated above, situational and psychological variables will intervene to alter the relationships between attitude and behaviour. Thus a flexible but structured framework is formed that can be used to conceptualise previous work in this area, and also organise data collection and analysis. Further, it is possible to utilise the framework to both examine the descriptive differences in waste behaviours as well as provide an explanation for these differences.

Use of such a framework, grounded as it is in North American research on environmental behaviour, raises questions regarding the efficacy of the application of such a conceptualisation within the UK. It could be argued that, for example, the cultural differences between the UK and North America do not permit the utilisation of concepts that have been tried and tested in a setting where recycling is more common and where the value structure of the society is different. However, it is argued here that the fundamental concepts within the conceptual framework are likely to be recognisable within any society, but rather the function of these is likely to be where variance will occur. Indeed, it is argued that the theoretical insights offered by social-psychological research methodologies provide a means of analysing and explaining behaviour. Although valuable work exists in the UK regarding individual attitudes towards waste, this has on the whole not been within a theoretical or explanatory framework (Aylesford Newsprint 1996; Ball and Lawson 1990; McDonald and Ball 1998; MEL 1989; Wastewatch/NOP 1999; Watts and Probert 1999).

Figure 1. Conceptual framework of the research

## THE STUDY

The research was undertaken in Exeter, a city of 90 000 inhabitants in south west England. The city council currently has an enviable record for municipal waste recycling of 21% and hopes to reach the 25% target for recycling by the end of 2000, in line with the previous government's waste strategy *Making Waste Work* (DoE 1995). The council maintains a network of static recycling sites taking a range of recyclables and operates a 'Recycle from Home' scheme whereby residents separate recyclable materials from non-recyclable residual waste and place the former in a green wheeled bin, the latter being deposited in a black wheeled bin. Both bins are emptied on a fortnightly basis. This scheme operates over half the city, the remaining 50% relying on the static sites. Glass is not collected at the kerbside and so all residents only have access to static bottle banks.

In the autumn of 1999 a questionnaire was employed by the authors to measure the behaviours and attitudes of residents in Exeter. The questionnaire examined declared reduction, reuse and recycling

behaviour as well as respondent willingness to undertake these actions. In measuring declared rather than actual behaviour there is likely to be a difference between what individuals say they do and what they actually undertake. However, although there is likely to be an over-estimation by respondents concerning their actual behaviour, this can be treated as reliably as observational data (for example weighing material placed out for recycling or monitoring set out rates) and readers should note that research on reporting environmental behaviour has shown that declared behaviours, whilst probably over-estimates of actual action, are likely to be proportionally accurate (e.g. Warriner *et al.* 1984).

The questionnaire also asked respondents to assess a series of statements alluding to possible barriers and motivations for undertaking each action. These were derived from extensive literature reviews of the determinants of recycling behaviour, outlined above (see for example Schultz *et al.* 1995) and were categorised in the form given in Figure 1. Because of the temporal and logistical constraints placed on this research, the authors were interested purely in a snapshot of atti-

*Figure 2. Frequency of declared behaviour (RED: reduction items; REU: reuse items; REC: recycling items). See Appendix A for details.*

tudes and behaviour, and so longitudinal trends in behaviour are not assessed.

The questionnaire was administered by the 'contact and collect' method, whereby the researcher personally delivers and collects the questionnaire. This method yielded 673 usable questionnaires, a response rate of 69%. The socio-demographic composition of the sample was representative of the wider population of Exeter, and so the results reported here are consistent with the aim of a randomly drawn sample.

## RESULTS

### Declared recycling, reuse and reduction behaviours

Figure 2 shows the distribution of declared behaviour scores across the whole sample. It is immediately apparent that recycling is different in terms of the frequency with which individuals undertake this activity. Recycling appears to be undertaken far more definitively, as 'all or nothing' behaviour. Conversely, most individuals undertake reduction and reuse less frequently, but there are more reports of occasional action. The reasons for these differences are examined later in this paper. However, it would appear that at this most general of levels, recycling is fundamentally a different behaviour from reduction and reuse. This is confirmed by a Chi-squared statistic of 2793.46 ( $p < 0.05$ ) which demonstrates that the scores for recycling, reuse and reduction are not equally spread, but

rather are dependent upon the frequencies shown in Figure 2. This confirms the differential spread of behavioural frequency scores and would imply that recycling, as a structured activity, is undertaken on a more frequent basis than waste reuse or reduction. Of course, it must always be remembered that such questionnaire data is susceptible to problems of both quantifying what 'sometimes' means to a given individual and the tendency of individuals to over-estimate their behaviour (Corral-Verdugo 1997).

Clearly the population as a whole undertakes recycling more often than the other behaviours. However, although there are obvious differences in frequency of behaviour between the three behaviours, it is helpful to understand these differences between individual population groups as well. Cluster analysis was undertaken on the behavioural data set in the MINITAB statistical package and uncovered four principal clusters relating to waste behaviour in Exeter residents. Cluster analysis is a technique for classifying individual cases in an analysis with reference to their scores on a set of variables, in this case the twenty waste behaviour items in the questionnaire (West 1991). Figure 3 shows that the generalised pattern given in Figure 2 is confirmed on an individual basis, with four principal groups being identified by the analysis. The differences between the behaviours is starker here, with, as before, the largest and most visual discrepancy being between recycling and the other behaviours. Clearly those individuals

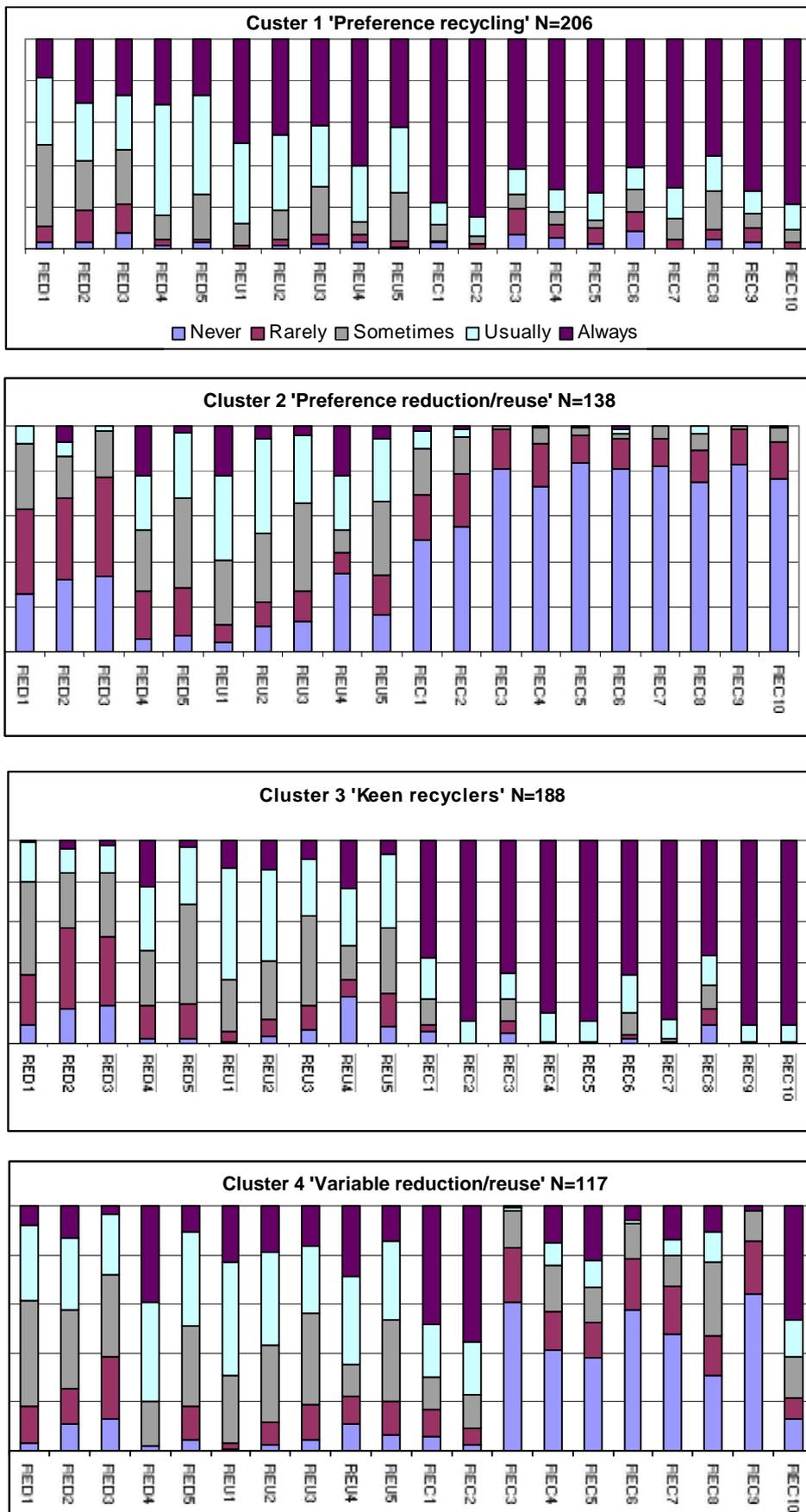


Figure 3. Behaviour clusters

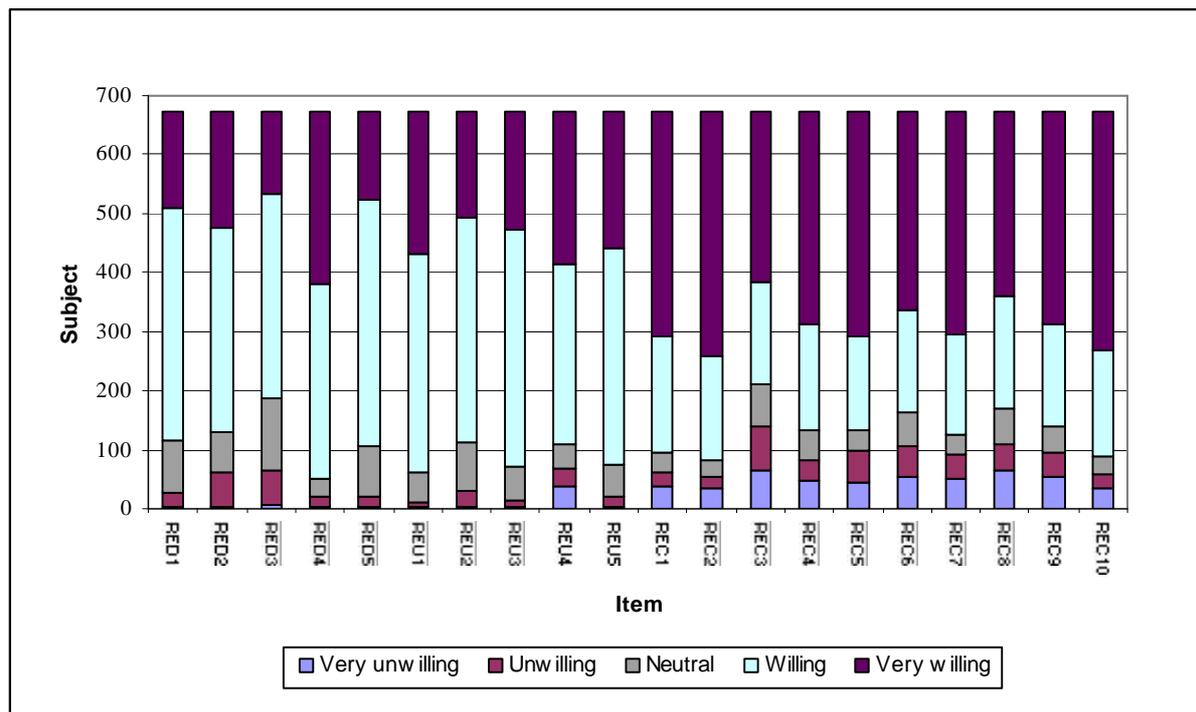


Figure 4. Intention to undertake behaviour (willingness to act) (RED: reduction items; REU: reuse items; REC: recycling items). See Appendix B for detail

who recycle most, tend to reuse and reduce less, and conversely, those who reuse and reduce more often tend to recycle less frequently. Nonetheless, all four clusters show variation in reduction behaviours within the clusters. Indeed, the nature of the differences between the three behaviour types, whilst evident from the data, is variable in strength. For example, those with a preference for recycling ('Preference recycling', Cluster 1) have higher aggregate scores than those for the 'Preference reduction/reuse' cluster (Cluster 2). Nonetheless, these differences are secondary in importance to the fact that there are visible differences in the data between the three behaviours, and in particular reduction/reuse and recycling. This pattern holds strongly for three of the clusters ('Preference recycling', 'Preference reduction/reuse' and 'Keen recyclers'), but is more variable for the fourth cluster ('Variable reduction/reuse'). This group shows some interesting patterns of declared behaviour. It is seen that unlike the other three clusters the positive scores for some reduction and reuse behaviours also hold with certain recycling actions, in particular recycling glass, newspaper and magazines. It would appear that this group claims generally to take part in a range of reduction and reuse actions, albeit variably, but also these three recycling activities. Thus although there is a difference between the behaviours at the general level, it cannot be said that these are necessarily repre-

sented on an individual basis. Again, the reasons for this differential behaviour are given below.

In terms of individual willingness to recycle (or behavioural intention), Figure 4 shows the attitudes of individuals towards reduction, reuse and recycling. The dichotomy between recycling and the other behaviours is starker here, and it is also noticeable how individuals are more positive towards all behaviours as opposed to undertaking them! A Chi-squared test for dependence showed that as with behaviour, recycling, reuse and reduction scores fall into very different frequency categories ( $\chi^2 = 2106.241$ ,  $p < 0.05$ ). Figure 5 shows the four clusters associated with these analyses, which in all but one case (Cluster 4 'Positive all behaviours') demonstrate the difference between recycling and the other behaviours.

Clearly there is some evidence of a more pronounced intention towards the behaviours such that a willingness to recycle is associated with a less favourable intention to reuse and reduce (for example in Cluster 3, 'Enthusiastic recycling'). Indeed, Cluster 2 ('Preference reduction/reuse') shows that those who are more willing to reduce and reuse tend to be more neutral or negative concerning recycling. However, as with behaviour above, care should be taken when interpreting these data, since although Cluster 1 appears to show differences between recycling and the

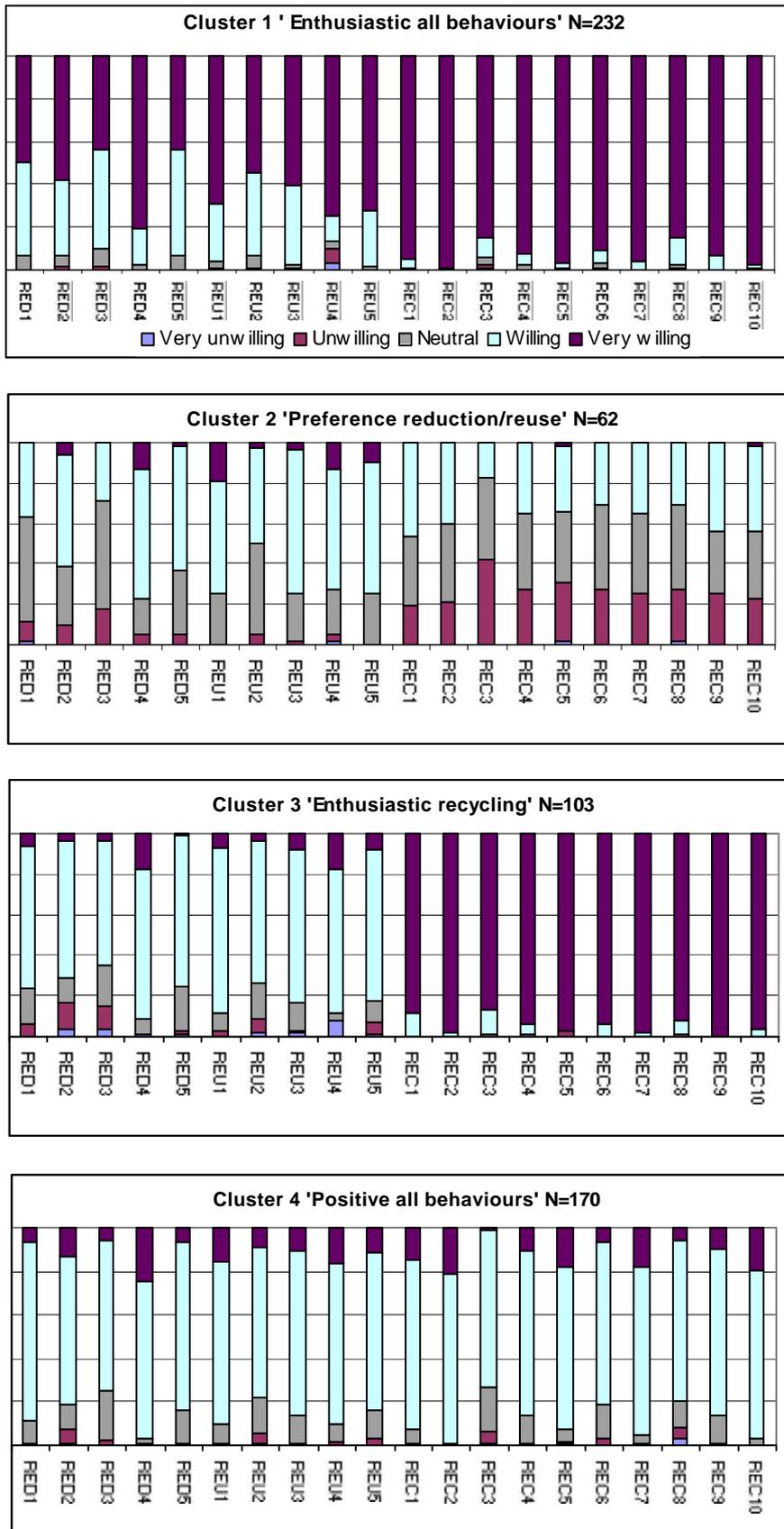


Figure 5. Intention clusters

other behaviours, these are in effect minor, and thus this cluster is termed 'Enthusiastic all behaviours'.

It would therefore appear that in general those who are more prevalent recyclers, and who are willing to do so are not reducers and reusers. This would imply that these descriptive differences are underpinned by explanatory differences. It is therefore necessary to understand why differential levels of these behaviours are observed and which characteristics underlie each behaviour.

### Explaining recycling, reuse and reduction behaviour

Having found that there were descriptive differences between the three types of activity at both the behavioural and intention levels, it was necessary to elucidate whether the behaviour and attitudinal items represented distinct groups that could be aggregated for further analysis. The behavioural and intention data were therefore subjected to principal components factor analysis in order to examine the degree to which there was indeed a split between the behavioural and intention recycling, reduction and reuse items within the answers of the questionnaire. Principal compo-

nents factor analysis attempts to assess the degree to which a set of variables can be characterised according to their common variance into distinct factors (Bryman and Cramer 1996). In other words, if the recycling, reuse and reduction items were indeed different, then it would be expected that three distinct factors would emerge. Table 1 gives these factor loadings, highlighting the trend in these loadings for each item. Appendix C gives a technical description of these analyses.

The positive and negative correlations represent the relationship between each factor and the respective item in the analysis, but for the purposes of interpretation it is sufficient to state that groups of larger correlations represent distinct factorial categories. In terms of the behavioural items, there is a pattern that is consistent with expectation with the ten recycling items loading on the same factor and all but one other item (wash dishcloths) loading on appropriate factors representing reduction and reuse behaviours. This would indicate that the questionnaire was successful in tapping three distinct behaviours that form three separate dimensions. However, the intention items have only loaded onto two factors, reduction/reuse and recy-

**Table 1. Principal components factor analysis of behaviour and intention items**

Variable	Behaviour items				Intention items		
	Factor 1	Factor 2	Factor 3	Communality	Factor 1	Factor 2	Communality
Recycle cardboard	0.899	-0.093	0.042	0.819	0.942	0.085	0.895
Recycle junk mail	0.896	-0.076	0.049	0.811	0.933	0.090	0.878
Recycle plastic bottles	0.895	-0.055	0.062	0.808	0.931	0.081	0.874
Recycle magazines	0.867	-0.092	0.152	0.794	0.889	0.142	0.810
Recycle food cans	0.837	-0.192	0.045	0.739	0.885	0.134	0.802
Recycle drinks cans	0.826	-0.088	0.125	0.706	0.885	0.172	0.812
Recycle foil	0.825	-0.139	0.088	0.708	0.872	0.160	0.785
Recycle newspaper	0.805	-0.115	0.204	0.702	0.808	0.258	0.720
Recycle textiles	0.705	-0.289	0.076	0.587	0.801	0.195	0.679
Recycle glass	0.596	-0.295	0.268	0.514	0.792	0.222	0.677
Loose produce	0.080	-0.789	-0.036	0.630	0.125	0.783	0.628
Less packaging	0.187	-0.779	0.135	0.661	0.200	0.772	0.637
Own bag	0.116	-0.700	0.182	0.537	0.071	0.748	0.581
Buy re-usable	0.059	-0.667	0.320	0.551	0.126	0.747	0.564
Buy recycled	0.213	-0.641	0.253	0.520	0.087	0.746	0.572
Wash dishcloths	0.148	-0.584	0.133	0.380	0.102	0.744	0.561
Reuse bottles	0.127	-0.202	0.813	0.718	0.166	0.742	0.561
Reuse paper	0.163	-0.136	0.812	0.704	0.133	0.734	0.567
Reuse tubs	0.148	-0.262	0.696	0.576	0.158	0.732	0.554
Repair items	0.031	-0.482	0.498	0.481	0.088	0.717	0.539
Variance	6.9203	3.5507	2.4654	12.9365	7.8488	5.8458	13.6946
% Var	0.346	0.178	0.123	0.647	0.392	0.292	0.685
Cronbach's Alpha	.95	.81	.76		.96	.90	

Shaded areas show the individual factors

cling. This would indicate that as shown in Figure 4 there is a significant difference between these two sets of intentions. Clearly intentions to reduce/reuse are more similar than the actual behaviours themselves. This is of interest, since it would indicate that people have similar intentions towards both reducing and reusing their waste, even though they appear to do this with different frequencies.

The resultant factors were used to form scales for representing each factor in the multivariate analysis which entailed summing the individual item scores for each recycling, reuse or reduction behaviour. Scales were tested for their internal consistency by means of a Cronbach Alpha reliability test, measured on a scale of 0 to 1, with statistics closer to 1 being more reliable. Table 1 demonstrates that the scales provided excellent reliability and internal consistency.

These scales were analysed as dependent variables in a stepwise regression analysis (the intention factors being used also as independent variables, as in the conceptual framework in Figure 1). The environmental values, situational and psychological variables from Figure 1 were all added as independent variables into this analysis. Table 2 gives the results of these analyses. Stepwise regression is a procedure that enables the researcher to add a large number of possible variables into an analysis that seeks to predict a given dependent variable (for example, recycling behaviour). At each stage, or step, variables are selected to remain as predictors of the dependent variable only if the overall explanation offered by that combination of variables is increased and does not lead to a significant reduction in the statistical significance of the model. Hence, at the end of the process, the researcher is left with those variables that explain the variance in the

**Table 2. Standardised regression coefficients showing significant predictors of the three behaviour and two intention constructs identified by factor analyses**

Factor scale/regressor	Intention Reduce-reuse	Intention recycle	Behaviour reduce	Behaviour reuse	Behaviour recycling
Intention reduce-reuse			0.29	0.27	
Intention recycle					0.33
Human priority	0.13		0.13		
Importance of nature	0.11	-0.06	0.11	0.1	0.05
Convenience and effort		0.2		0.15	0.2
Active concern	0.25	0.2			
Problem and threat	0.17				
Motivation to respond				0.2	
Awareness of norm					0.1
Acceptance of norm	0.07	0.24		-0.08	-0.07
Community/democracy			0.13		
Citizenship	0.11				
Age			0.16		0.07
Gender	0.07		0.11		
House type		0.1			
Total group membership				0.11	
Environmental knowledge	0.07				
Local waste knowledge		0.21			0.19
Policy knowledge			0.11		
Knowledge sources		0.08	0.15		
Experience	0.16			0.04	
Recycling provision index		-0.08			
Kerbside collection bin	-0.2				0.28
$R^2_{adj}$ (per cent variance explained)	50%	53%	43%	31%	79%
$F$ (significance, all <0.05)	63.5	87.7	60.0	41.2	293.5

dependent variable most effectively (Shaw and Wheeler 1994). Because all of the variables were standardised for analysis, the coefficients in Table 2 represent a one unit change in a standard deviation place of the dependent variable for a one unit change in the independent variable. Essentially, the larger the coefficient, the greater predictive value is placed on that independent variable.

The Table clearly shows that both the predictors of a willingness to undertake a given behaviour, as well as behaviour itself (see Figures 2 and 3 above), are fundamentally different. With regard to willingness to reduce and reuse, there is a strong predictive value placed upon a willingness to reuse and reduce, and the respective behaviour. However, it can be seen that although the predictors of reuse and reduction behaviour are very similar, these behaviours have different direct predictors. It appears that in the case of the Exeter respondents, willingness to undertake reuse and reduction activities is fundamentally values based, relying on positive environmental attitudes and an active concern for waste issues. Higher scores on the environmental values scales predicts a greater willingness to recycle, as do higher scores on scales measuring environmental concern, perceptions of the waste problem and its threat, as well as a belief that we all share common rights and responsibilities towards the environment. This would imply that those with more positive intentions towards reducing and reusing their waste have both related the waste problem to themselves and to their underlying environmental ethics. The importance of environmental knowledge implies that this is the case. The two situational influences demonstrate that whilst those with access to a recycling bin are less likely to be willing to reuse and reduce, those with experience of recycling before gaining access to such a kerbside bin are in fact more likely to be willing to reuse and reduce their waste.

With regard to declared reduction behaviour, the major predictor of this variable is a willingness to undertake this action. There are, however, a number of important predictors that intervene to predict reduction behaviour directly. Crucially, it appears that women tend to reduce more, and also those in higher age groups. Those who have knowledge of policy instruments and use a large number of sources to gain knowledge are also more likely to reduce waste. What these data show is that although attitudes towards reduction are fundamentally predicted by values-based criteria, declared behaviour is a function of both socio-demographics, knowledge, as well as these value-based attitudes. This implies that any policies aimed at encouraging reduction activity would need to

focus on both awareness and targeting of key groups in society.

In contrast, reuse behaviour, whilst still predicted heavily by willingness to reuse, has three principal direct effects from the psychological variables. The convenience of reusing waste material and storing reusables, believing that this makes a difference environmentally, as well as being part of community groups, implies that although reuse behaviour is primarily a function of intention, those who perceive fewer logistical problems, who believe that reusing can make a difference and that have some form of intrinsic motive to reuse are more likely to reuse.

Recycling behaviour is, on the other hand, more definitive. Prediction of willingness to recycle is not values-based, but primarily norm based, relying on the acceptance of norms to recycle as well as knowledge of recycling schemes and logistical ease. However, although attitude is an important predictor of recycling behaviour, access to a kerbside recycling bin is also very important, and the overall importance of knowledge of local facilities and logistical factors is emphasised.

It should be stressed that the explanatory variables in Table 2 are only those that proved significant in predicting behavioural intention and behaviour, and do not represent the full range of possible explanatory variables. Thus certain factors are notable by their absence, such as the majority of socio-demographic variables. In particular, life cycle variables such as household type and composition, income and occupation are notable by their absence.

## DISCUSSION

Recycling, reuse and reduction behaviour are fundamentally different behaviours. In terms of description, reduction is undertaken least often, with fewer people 'always' undertaking waste reduction actions. Reuse is similar, but is undertaken on a more regular basis. However, recycling is fundamentally different. The majority of people either 'always' or 'never' recycle. The cluster analysis demonstrated that there is a diverse structure of environmental behaviour in Exeter. A person cannot, therefore, be classed simply as an 'actor' or 'non-actor'. Some clusters show a good level of recycling, with decreasing, but reasonable levels, of reuse and reduction. Others demonstrate definitive levels of recycling but variation in the other behaviours. It is clear that analysing the subtle changes in each behaviour, and intentions towards that behaviour, is likely to be more fruitful than attempting to classify each type of individual.

The conceptual framework formulated here demonstrates the value of this approach and provides a clear explanation for the various predictors of the general behaviours identified by the cluster and factor analyses. It appears from these analyses that recycling behaviour is very different from reuse and reduction behaviour. The predictors of recycling activity are essentially logistical. Having access to a structured kerbside recycling facility, as well as good knowledge of this facility, and perceiving that recycling is easy and convenient is crucial for predicting recycling behaviour. The influence of others' recycling behaviour, given that recycling is by its very nature more visible, ensures that recycling is fundamentally norm based, implying that enhanced participation by others that is visible is likely to lead to more positive intentions to recycle, and consequent action by individuals.

Conversely, attitudes towards reuse and reduction are values and concern based. Relating the waste problem to oneself, as well as the global environment is seen to enhance a willingness to reuse and reduce waste. However, waste reduction is enhanced itself by being female, older, and having a knowledge of policy instruments. Reuse of waste is enhanced by feelings of the ease of reuse and the extent to which reuse will make a difference.

As far as policy making and practical action by central and local government are concerned the research findings have clear messages. First, individual policies must be directed at each of the three household waste management behaviours, since it has clearly been demonstrated that they have their own individual attributes. Second, households differ in their willingness to reduce, reuse or recycle waste and so certain households could be targeted. Third, knowledge of what can be recycled or reused and how to do this was a significant variable and so information campaigns should be directed at those areas where the survey has revealed poor levels of knowledge, for example, the high explanation given in Table 2 for 'local waste knowledge'. Fourth, and finally, attitudes have been shown to be crucial in shaping behaviour and thus public policy must continue to drive home the message of sustainability by emphasising that the environment is a joint resource which everybody needs to care for.

It is argued here that this framework offers a holistic means by which to answer key questions concerning the enhancement of environmentally responsible behaviour. As this paper has shown, waste behaviour is diverse. Rather than characterising the individual traits of individuals, this framework permits both description of the data and explanation of the behaviours that policy makers are concerned with. The

framework provides an effective means of characterising the variables involved in determining waste behaviour, as well as a method for constructing a survey instrument and organising data analysis. The results clearly show the diversity of waste behaviour and the numerous factors involved in predicting these activities. Fundamentally, this research demonstrates that policies aimed at encouraging waste reduction, reuse and recycling are unlikely to be effective if the messages are not tailored to the individual behaviours and predictors involved.

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**Appendix A: Behaviour items from the questionnaire**

RED 1	Buy produce with as little packaging as possible
RED 2	Use my own bag when going shopping, rather than one provided by the shop
RED 3	Look for packaging that can be easily re-used or recycled
RED 4	Buy fruit and vegetables loose, not packaged
RED 5	Buy products that can be used again, rather than disposable items
REU 1	Try to repair things before buying new items
REU 2	Reuse paper
REU 3	Reuse glass bottles and jars
REU 4	Wash and reuse dishcloths rather than buying them new
REU 5	Reuse old plastic containers, like margarine tubs
REC 1	Recycle glass
REC 2	Recycle newspaper
REC 3	Recycle food cans
REC 4	Recycle drinks cans
REC 5	Recycle junk mail
REC 6	Recycle foil
REC 7	Recycle cardboard
REC 8	Recycle textiles
REC 9	Recycle plastic bottles
REC 10	Recycle magazines

*Scored on a five-point Likert scale (1 = never to 5 = always)*

**Appendix B: Behavioural intention (willingness to act) items from the questionnaire. Items were placed in a different order than the behaviour items to avoid the perception of repetition**

RED 5	Buying few disposable products
REU 3	Reusing jars and bottles wherever possible
REU 2	Reuse paper, rather than buying it new
RED 2	Take old plastic bags shopping, rather than using new ones, or take a durable bag
RED 3	Look for wrapping that can be easily reused or recycled
RED 1	Reduce the amount of produce that's bought which has lots of packaging
RED 4	Buying certain produce without packaging, like fruit and vegetables
REU 5	Reuse old containers, like ice cream tubs or margarine boxes
REU 4	Wash and reuse certain items before disposing of them, like dishcloths
REU 1	Repairing items before deciding they have to be thrown away

Recycle:	REC 10	Magazines
	REC 5	Junk mail
	REC 3	Food cans
	REC 4	Drinks cans
	REC 9	Plastic bottles
	REC 8	Textiles
	REC 6	Foil
	REC 1	Glass
	REC 2	Newspaper
	REC 7	Cardboard

*Scored on a five-point Likert scale (1 = very unwilling to 5 = very willing)*

### Appendix C: Explanation of factor analyses

Factor analysis is a technique commonly employed by psychologists and social scientists in order to determine the degree to which questionnaire items can be aggregated into more generalisable variables (or factors) and the extent to which such items can be empirically related, and therefore be said to be 'factorally valid' (Bryman and Cramer 1996). Thus on which 'factors' these items 'load' and the extent to which these loadings mirror expectations of how items aggregate enables the researcher to validate their conceptual structure. Indeed, aggregation enables the researcher to meet some of the requirements for multiple regression analysis (such as normality).

In the current study, those questionnaire items that were measured on a five-point Likert scale were analysed using 'principal components' factor analysis, a technique for describing the extent to which individuals share variance in their scores on specific items. When factor analysis is initially undertaken, this variance is described in terms of 'factors' or 'components', with the first factor extracted from an analysis accounting for the largest amount of variance. At this stage, there are as many factors as items. In order to reduce these to a meaningful set of factors (to meet the requirements of aggregation), certain factors must be dispensed with and others 'retained'.

Retention of factors is undertaken on the basis of the amount of variance explained by factors. Thus, those factors that explain less variance than for a single item are excluded. This is done by examining the 'eigenvalues' that express this variance and excluding any with

scores under one. Alternatively, a visual retention technique can be employed, whereby the eigenvalues are plotted as a 'scree plot' and the factors on the flat end of the slope are excluded.

Once a set of factors that represent acceptable amounts of variance have been retained, it is necessary to 'rotate' these factors, since initial analysis will have meant that most items loaded on the first factor, but with low correlations. In most cases social scientists utilise 'orthogonal' rotation, since it can be assumed that item scores on one factor are generally unrelated to their scores on another factor.

Once rotated and 'sorted' for ease of interpretation, the resulting output from the MINITAB statistical package represents the number of principal components or 'factors' that represent the shared variance of the items in question. Thus at the bottom of the tables, the 'Variance' represents the eigenvalue for each factor, whilst the '% Var' represents the total variation explained by that factor and is interpreted as a percentage (e.g.  $0.392 = 39.2\%$ ). Factors are identified by the shading of the correlation coefficients and conform to the degree to which each item 'loads' on that factor, the higher the coefficient, the higher the loading. Thus within the theoretical constraints placed upon the researcher, the questionnaire items can be examined for common variance in order to assess the degree to which questionnaire items load and enable the researcher to proceed with more complex analyses in the knowledge that the aggregated data has been constructed using an established technique.