Exploring Catalyst Behaviours

Summary Report

A research report completed for the Department for Environment, Food and Rural Affairs by Brook Lyndhurst

November 2011
Exploring Catalyst Behaviours

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1 Introduction

The aim of the ‘Exploring catalyst behaviours’ project, commissioned by Defra and conducted by Brook Lyndhurst in conjunction with the University of Surrey and the Open University, was to investigate the idea that performing certain pro-environmental behaviours can have a knock on (or ‘catalyst’) effect and lead to the adoption of a broader range of pro-environmental behaviours.

There is evidence to suggest that pro-environmental behaviour patterns may evolve in accordance with a ‘journey’ that seems to start with certain behaviours and lead on to others. Additionally, pro-environmental behaviours are often observed to co-occur, which may be an indication of the existence of underlying catalyst, or causal, relationships between them.

The concept of catalyst behaviours is highly appealing: the idea of a self-sustaining chain reaction of positive behaviours, or positive outcomes over and above the scope of an intervention, represents a potential ‘multiplier effect’ of benefits. However, it is unclear what kind of evidence exists to support these ideas.

The project comprised a literature review (which was extensive and highly structured, but not a full systematic evidence assessment), 20 interviews with organisations and practitioners working in the field of behaviour change, exploratory and innovative qualitative research with members of the public, statistical analysis of Defra's attitudes and behaviours survey, and an expert workshop with 15 international experts on behaviour change. This multi-method project was designed to explore the following research questions:

- Is there plausible evidence that catalyst based behaviour change occurs?
- If it is observed, how has causality been demonstrated? (i.e. how can we be sure that correlated behaviours are related at a motivational/cognitive/other level?)
- How does the process or mechanism work (including psychological and sociological factors)?
- Under what conditions does catalyst based behaviour change occur? Do catalyst effects occur generally, or do they occur for some very specific behaviours, or audiences, or in very specific settings?
- How wide are the spillovers? Do they cut-across apparently dissimilar behaviours or are they confined to sets of behaviours that are mentally categorised in the same way?
- How can the process be stimulated?
This Summary report brings together the findings of the different research components (see table 1 on page 3 for a summary of the research design). Notes throughout the report (in the left hand margin) direct the reader to the corresponding sections of the full evidence report, which contains the detail of each of the elements of the research. Additionally, a brief description of the fieldwork outputs may be found in the annexes of this report.

The research evidence set out below should be thought of as laying the groundwork for further research: many questions remain unanswered and more have been raised. The qualitative research with practitioners and members of the public was exploratory and small in scale but nonetheless provides a rich, descriptive starting point for understanding the relationships between different pro-environmental behaviours. The statistical analysis of Defra’s Attitudes and Behaviours survey used robust statistical methods but is limited in scope by the cross-sectional nature of the data – causal connections between behaviours cannot be shown in this type of ‘snapshot’. This Summary Report should be read in the light of these limitations.
# Table 1 – Research components

<table>
<thead>
<tr>
<th>Research element</th>
<th>Aims</th>
<th>Method</th>
<th>Outputs</th>
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</table>
| **Evidence review** | To provide a firm foundation to explore catalyst behaviours through the current and possible future research.  
- To clarify whether evidence exists in support of the idea of catalyst behaviours, both in the pro-environmental behaviour change arena and further afield.  
- If the evidence suggests catalyst based behaviour change does occur, how does it work, and under what conditions? | **Scoping exercise**, to set the parameters of the evidence review and refine research questions.  
**Full review** of academic and grey literature from the following areas:  
- psychology (social and cognitive);  
- economics;  
- sociology;  
- marketing (commercial and social);  
- behaviour change (health, pro-environmental); and  
- the wider environmental sciences.  
This phase also included a review of practitioner evidence from the field of pro-environmental behaviour change. This evidence was gathered through interviews with 20 practitioners and also through review of programme and project evaluation reports and articles. | Review and discussion of the evidence |

See:  
- section 2 of the full evidence report for full details  
- section 2 of this summary report for an overview

*Continued overleaf*
### Table 1 – Research components

<table>
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<tr>
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<th>Method</th>
<th>Outputs</th>
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| **Pilot exercise** | *To investigate perceived relationships between pro-environmental behaviours.*  
*To explore the categories and conceptual systems people use to think about the pro-environmental behaviours.*  
*To test the methodology as a means of exploring perceptions of pro-environmental behaviours.* | Pilot of a **multiple sorting procedure** and multidimensional scalogram analysis.  
These are techniques grounded in psychological theory that allow systematic analysis of qualitative data. A sorting exercise based on a set of pro-environmental behaviours was conducted. The aims were to explore the mental categorisations participants used to understand and think about pro-environmental behaviours; and to investigate the links between these categorisations and actual behaviour patterns.  
A street sample of 18 participants was recruited; each participated in a face to face interview. | **Multidimensional plots** providing a visual representation of perceived relationships between pro-environmental behaviours. |

See:  
• annex 1 of this summary report for more details of the method and an overview of the outputs  
• section 2 of this summary report for a discussion  
• section 3 of the full evidence report for full details |

| **Exploratory cluster analysis** | To explore co-occurrence of pro-environmental behaviours.  
*Which behaviours are performed consistently?*  
*Which behaviours seem to ‘go together’?* | **Cluster analysis** on data derived from Defra’s *Survey of Public Attitudes and Behaviours towards the Environment* (2007).  
Tree diagrams showing the instances of co-occurrence across a *wide range* of behaviours and also within *behavioural ‘domains’* (e.g. ‘energy’ behaviours). |
### Table 1 – Research components

<table>
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<tr>
<th>Research element</th>
<th>Aims</th>
<th>Method</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert workshop</td>
<td>To bring together the experience and insight of experts in the field of behaviour change to feed into the analysis of the research evidence</td>
<td>15 experts identified during the evidence review invited to a day long, facilitated workshop</td>
<td>All data collected on the day fed into the analysis phase of the project</td>
</tr>
</tbody>
</table>

See:
- annex 2 of this summary report for an overview of the outputs
- section 2 of this summary report for a discussion
- section 4 of the full evidence report for full details
2 Is there plausible evidence for catalyst behaviours?

The desk based review – the literature search, interviews, and calls for information - revealed major gaps in the evidence base around the catalyst behaviour hypothesis. Despite some anecdotal evidence, little formal evidence of pro-environmental behavioural spillover emerged. However, the review did uncover some evidence of behavioural spillover in a more general sense of certain events, situations or states resulting in the uptake of multiple behaviours. The sum of the evidence suggests that there may be various different ways in which pro-environmental behaviours are related to one another and could potentially influence one another in different contexts. This implies that there may be various different routes by which spillover (both in the general sense and the catalyst behaviour sense) can occur.

2.1 Practitioner evidence

The multidimensional nature of the relationships between different behaviours was underscored by the 20 practitioners interviewed as part of the evidence review. The practitioners took a very broad view of the catalyst process and referred to behaviour change being catalysed by information, knowledge, ‘awareness’ or social context, rather than particular behaviours triggering the process. In other words, the practitioners’ understanding of ‘catalysts’ included the wider context of behaviour change and spillover in a more general sense, rather than just the specific process of a particular behaviour leading to other behaviours.

The idea of spillover and catalyst behaviours resonated strongly among the practitioners, although spillover triggered specifically by catalyst behaviours was only a subset of the wider field of general spillover effects. Focusing on spillover triggered specifically by participation in behaviours, a number of different types of catalyst effect were mentioned by practitioners:

- new pro-environmental behaviours that result in the uptake of other, different pro-environmental behaviours (e.g. NEA, 2008; Global Action Plan);
- new behaviours ‘spinning off’ from existing behaviours, sometimes described by participants as “the next natural step” (e.g. Tucker and Douglas, 2007; Garden Organic);
- ‘feedback mechanism’, whereby participation in a new behaviour boosts participation in an existing behaviour (e.g. Open University and IPSOS-MORI; Somerset County council);
- situational (e.g. work/school to home) and inter-personal (e.g. one person influences another) spillover (Envision; SOLAR);
- negative spillover, where participation in a behaviour blocks participation in further behaviours, sometimes by giving people an ‘alibi’ or excuse not to take up more difficult or costly actions (see section 2.5.3).

Even within a broader definition of catalyst based behaviour change, however, there was little concrete empirical evidence available to support the widespread belief that catalyst effects do occur. Most evidence was anecdotal and very few projects had incorporated into their methodologies robust measurement techniques for capturing catalyst effects specifically. Additionally, much of the practitioner evidence was based on small, mainly unrepresentative samples that make it difficult to draw firm conclusions about the effects of the behaviours themselves. For example, National Energy Action conducted an action research project that sought to test the impact of providing households with energy advice and energy and water saving devices. NEA (2008) reports that the installation of energy and water saving devices and a home energy plan not only increased participation in energy saving behaviours, but had knock-on effects on sustainable purchasing and waste management behaviours. This appears to be a successful example of spillover; however, it is difficult to isolate the cause of these spillover effects, which could have been the behaviours themselves, but also may have been the type of intervention used or a self-selecting sample which was perhaps predisposed to take up multiple behaviours.

The lack of measured, replicable evidence of catalyst behaviours, or indeed any of the wider forms of spillover that were broadly categorised by practitioners as ‘catalyst based change’, can be interpreted in different ways:

- It is possible that methodological difficulties have prevented accurate isolation and measurement of spillover effects, perhaps because the process is highly context specific and holding enough variables constant to be able to observe spillover is difficult.
- Another interpretation of the lack of evidence is that the widespread belief in catalyst behaviours constitutes an attribution error: behaviour change is observed and post-rationalised as resulting from a catalyst behaviour type process, whereas in reality, some other, underlying causal factor was at work.
- It is also possible that the lack of evidence is due to the fact that many projects do not have a robust evaluation component built in and, even where they do, they may not include methods that could capture catalyst based behaviour change. The result is that, if spillover does occur, the effects go unrecorded.

In the absence of experimental research evidence and robust project evaluation data, it is difficult to evaluate whether methodological problems or a fundamental attribution error lie at the root of the formal evidence gap around spillover. However, the anecdotal and circumstantial evidence show that in practitioner circles, the idea has considerable intuitive appeal and provides a useful basis for designing behaviour change projects. In sum, despite the lack of formal testing of the ideas, the anecdotal and circumstantial evidence seem to suggest that spillover does occur. However, further research and
formal testing would be required to establish whether the appearance of spillover is grounded in reality. In practical terms, this would require methods for capturing data on spillover to be built into projects from the outset.

The next stage involved assessing the academic and grey literature to investigate whether there was any formal support for the ideas around spillover that had emerged from the practitioner evidence.

2.2 Evidence from the literature

Wider literature

The review of academic and grey literature included a search for evidence of spillover and catalyst behaviours in a number of fields, including psychology, sociology, economics, health and marketing. Although not a formal systematic review, the search and review strategy was designed to be methodical and thorough. Key word searches were conducted in academic databases, including Web of Science, PsychInfo and Econlit, followed by more general web searches for grey literature (see appendix 2 of the full report for a list of sources and search terms). Papers were selected for inclusion based on their relevance to the topic; the methodological robustness and validity of findings of the included papers were discussed as part of the review (see section 2 of the full report).

Examples of spillover in the wider sense were found in all the disciplinary areas set out above, including some examples of spillover triggered by catalyst behaviours. A selection of examples is shown below:

<table>
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<tr>
<th>Discipline</th>
<th>Example</th>
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<tr>
<td>Psychology</td>
<td>The spillover from one situation to another of attitudes and beliefs such as optimism and pessimism (Dickinson and Oxoby, 2007) and moral outrage (Mullen and Nadler, 2008). In a psychology lab experiment with volunteers, Dickinson and Oxoby (2007) were able to induce optimism and pessimism, which they showed was then carried over into an unrelated subsequent task. The results suggest that feelings of optimism or pessimism occurring in one context can be carried over to influence behaviour in other contexts. These attitudes and beliefs that were induced in one situation were demonstrated to have measurable behavioural effects in different, unrelated situations.</td>
</tr>
<tr>
<td>Sociology</td>
<td>Patterns of behaviour, attitudes and skills learned at work have often been demonstrated to spill over to home life and leisure time (Kremer and Harpaz, 1982; Kirchmeyer, 1992; Wilson and Musick, 1997).</td>
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Exploring catalyst behaviours | A summary report for Defra

Marketing

The techniques of brand alliances and brand extensions are designed to encourage positive attitudes (and therefore purchasing behaviours) towards one product to spill over to other, related products (e.g. Simonin and Ruth, 1998, 2000; Shine et al, 2007). Brand alliances and extensions involve co-marketing a new product with an established, successful ‘parent’ product. This literature emphasises the importance of ‘product fit’ and ensuring not only that the relationships between co-marketed products are clear to the potential consumer, but also that the right agency is sending the message (Aaker and Keller, 1990). One particular type of brand extension is known as completing the set, which plays on consumers’ desire to behave consistently towards a brand. For example, if an individual has a Kodak camera, by marketing other related products as a coherent set, the consumer is encouraged to ‘collect’ co-marketed accessories such as the Kodak photograph printer, the Kodak paper, and so on (Shine et al, 2007).

Health

One study (Ross and Thow, 1997) showed that participating in exercise can be a catalyst for a healthier lifestyle among cardiac rehabilitation patients.

It has been proposed that the act of taking soft, ‘gateway drugs’ may cause some people to move on to harder drug abuse (see below for further discussion).

Economics

Hertwich (2005) investigates negative spillover (rebound) effects of energy efficiency measures – as energy production becomes more efficient, demand for energy increases due to the decreased price. He suggests several mechanisms of spillover at the household level as a result of changes in energy policy. One example is the income effect: an increase in disposable income as a result of decreasing energy costs leads to the purchase of other products, which may include more energy-using equipment on one hand, or on the other more positive hand, reallocating the spare income to buy environmentally friendly products such as organic food.

A topic that has received much attention in the health arena is the question of ‘gateway drugs’, or the idea that taking certain kinds of ‘soft’ drug (e.g. cannabis) can lead on to more serious substance abuse (e.g. cocaine and heroin) (e.g. Kandel and Yamaguchi, 1994). This issue provides a parallel (albeit with negative or anti-social behaviours) to our question of pro-environmental catalyst behaviours. Soft drug taking and hard drug taking are frequently observed to co-occur and often in a temporal order from soft to hard, implying some kind of causal relationship. In the same way, ‘catalyst’ pro-environmental behaviours may be hypothesised to ‘lead on’ to further pro-environmental behaviours, and some formulations of pro-environmental spillover assume that ‘easy’ behaviours may be a gateway to ‘more difficult’ behaviours (for example, the foot in the door theory – see table 5 below; see Crompton and Thøgersen (2009) for a critique of the ‘small steps lead to big steps’ formulation of spillover).

However, health research has shown that the apparent causal path from one behaviour to the other is often an illusion: other latent variables are generally the most important cause of both types of drug taking. Although some ‘gateway effects’ exist for some
people, the paths are generally highly contextual and tied in so closely to each individual’s personal circumstances, that it is almost impossible to disentangle the gateway effect from the ‘contextual noise’ (Pudney, 2002; Rose, personal communication, 2009).

This suggests that what may appear to be a catalyst effect between pro-environmental behaviours may in fact be the result of some common underlying causal factor. The observation that correlation does not necessarily imply causation applies to all formulations of spillover that postulate a causal relationship between co-occurring behaviours, including those that hypothesise a progression from small/easy behaviours to bigger/more difficult behaviours.

**Pro-environmental behaviour change literature**

Turning to the pro-environmental behaviour change literature, the patchy nature of the practitioner evidence is mirrored in the academic literature, where only a handful of authors have produced research around pro-environmental behaviour spillover effects, and even fewer have produced any experimental evidence designed to test spillover hypotheses.

The academic research into spillover of pro-environmental behaviours falls into one of two categories. The first is research that sets out specifically to test hypotheses related to the question of spillover (Thøgersen, 2004; 1999; Thøgersen and Ölander, 2003; 2006; Kaiser and Wilson, 2004; Kaiser, Byrka and Hartig, 2008; Byrka, Kaiser and Hübner, forthcoming). This research is mainly based on survey data, with correlations between behaviours analysed using statistical tools designed to isolate the effects of earlier behaviours on later behaviours. This research focuses on a range of behavioural domains, from specific waste behaviours (Thøgersen, 1999) to a wide ranging set of behaviours that span domains such as energy, purchasing and waste management (Kaiser, Byrka and Hartig, 2008).

**Thøgersen and colleagues**

Thøgersen and colleagues’ experimental research finds spillover effects between pro-environmental behaviours to be weak and not to occur in all possible instances. For example, Thøgersen and Olander (2003) found high levels of recycling to be associated with a tendency to buy organic food, but there was no relationship between buying organic food and transport behaviours.

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**Explanatory Note**

It is interesting to note that Thøgersen’s (1999) research was conducted over a decade ago, when recycling was less normalised than it is now and as such was much more diagnostic of a ‘green’ attitude. It would be interesting to repeat this experiment in the current social context, where recycling is a much more common behaviour and much less diagnostic of green attitudes. There is some evidence that recycling may in fact be a cause of negative spillover by virtue of providing people with an ‘alibi’ for not participating in other, more difficult pro-environmental behaviours (Tucker and Douglas, 2006; anecdotal evidence from practitioners – see sections 2.3 and 2.5.3).

In work published in 2004, Thøgersen applied the theory of cognitive dissonance (see table 5 below) to correlations between pro-environmental behaviours and found that, once measurement error was controlled for, the data provided support for the theory that individuals strive for consistency across related behaviours. However, the work shows that the influence of ‘idiosyncratic conditions’ and the use of fallible measurement tools (in particular self reported survey data) often suppress these correlations. In other words, academic studies often find no relationship between behaviours where relationships do exist, since relationships remain undetected due to contextual ‘noise’ and inaccurate measures.
Negative spillover effects were found between high levels of buying organic food and a less than average increase in recycling, although the authors point out that this may be explained by a possible ceiling effect – those people who bought organic most also recycled most from the outset, so had less room for improvement.

**Kaiser and colleagues**

Thøgersen and colleagues take a ‘psychological’ approach to the concept of spillover, investigating how the psychological antecedents of behaviour are affected by participation in particular behaviours. In contrast, Kaiser and colleagues take a ‘structural’ approach to spillover: they start with reported behaviours and seek to identify reciprocal relationships between the behaviours by means of a mathematical model. This definition therefore does not focus on causal paths between behaviours, but rather treats them as being in reciprocal relationships with each other.

Within this framework, Bryka, Kaiser and Hubner (forthcoming) seem to have more success in observing wide ranging pro-environmental behavioural spillover. Their latest work is based on a large set of behaviours taken from Kaiser and Wilson's (2004) General Environmental Behaviour Scale, which contains a large range of pro-environmental behaviours, from “I bought solar panels” to “After a picnic, I leave the place as clean as it was originally.” This research found that interventions designed to encourage energy saving behaviours had spillover effects on ecological behaviours from other domains, including ‘buying products in refillable packaging’ and ‘buying meat with eco-labels.’ The authors hypothesise that participating in an action will influence an individual’s ‘general environmental attitude’, which in turn affects subsequent behavioural choices. However, the focus of this research is on the persuasive techniques used to encourage the energy saving trigger behaviours, with face to face persuasive techniques found to lead to the widest spillover. Performance of the catalyst behaviour is only part of the story, and the way in which the catalyst behaviour itself is triggered is a key factor in whether spillover takes place. There are other important explanatory factors in the observed spillover; for example, the group where most spillover was observed was found to have stronger pro-environmental attitudes and values to start with. This evidence suggests that the wider context of spillover, such as the target audience and the type of intervention, is at least as, if not more, important than the relationships between the behaviours themselves.

**Other research**

The second category of academic research on spillover contains a slightly greater number of authors who have observed temporal correlations between behaviours and suggested that this may be indicative of a spillover effect (e.g. on waste: Tucker and Douglas, 2006; Berger, 1997, Barr, 2005; 2007; on microgeneration: Open University/EST, 2008; Dobbyn and Thomas, 2005). These papers provide further evidence that certain pro-environmental behaviours tend to co-occur; they do not prove a catalyst relationship between behaviours, but arguably provide some circumstantial evidence in support of the spillover hypothesis.

Academic researchers have attached some caution to the research and approaches taken to explore spillover hypotheses. It has been suggested that spillover research is particularly prone to a type 2 error (a false negative result) due to measurement error and methodological difficulties stemming from contextual noise (Thøgersen, 2004; Bryka et al, forthcoming). Thøgersen (2004) does find evidence that spillover effects can be suppressed by measurement error; however, as with the practitioner evidence, the
absence of an established body of evidence that has been extensively tested, retested and verified, makes it difficult to assess whether the problems are methodological or again down to an attribution error.

Overall, the evidence for catalyst behaviours is mixed. The sum of evidence from the fields reviewed suggests that spillover, in the sense of outcomes above and beyond the scope of an intervention, does occur. However, using the term ‘spillover’ or ‘catalyst behaviour’ is deceptively simplistic, since these terms actually refer to a group of processes or mechanisms that can result in the uptake of multiple behaviours. There is also an absence of qualitative work that explores the effects of performing specific behaviours on people’s attitudes and willingness to change. Section 2.2 of this summary report considers some of the processes by which catalyst based change may occur.

The evidence indicates that spillover can occur at many levels and in many different ways, including at the levels of attitudes and beliefs, skills and behaviours. However, these processes are highly context specific and there may often be too much ‘noise’ to observe or measure them accurately. Context specific factors include the characteristics of the audience, the operant social norms, the practical barriers in operation and the specific behaviours that are chosen. It also seems that the idea of catalyst behaviours is often subject to a fallacy of attribution. Correlation can easily be mistaken for causality; as with the ‘gateway drug’ theory, there is a danger that certain types of behaviour change may be post-rationalised as spillover from one behaviour to other behaviours, when in fact an underlying, often invisible variable constituted a common cause.

There is very limited evidence about spillover of pro-environmental behaviours catalysed by actions (e.g. ‘switching off lights’ or ‘taking your own bag shopping’) leading to a wider range of sustainable behaviours. Where catalyst behaviour effects are found, they are demonstrated to be weak and often obscured by contextual noise. Where spillover effects are reported, they are rarely explained simply by participation in a behaviour. For example, a face to face intervention or a self selecting sample are often more likely explanations of observed spillover effects. In addition, spillover research may be prone to a particular fallacy of attribution: although behaviours are observed to co-occur in a linear temporal order, they may both (all) in fact be products of common underlying causes (mirroring the ‘gateway drug’ argument – see above). Focusing on the apparent ‘trigger’ behaviour could therefore be misleading because it may not, in itself, be a sufficient condition to cause knock-on effects in the absence of the supporting conditions provided in the specific, wider context in which it is observed.
2.3 Evidence from the pilot exercise and cluster analysis

The pilot exercise and the cluster analysis were designed to start to explore which pro-environmental behaviours co-occur and why these patterns occur – in particular, the relationships that are perceived to exist between them. This cannot tell us about the process of spillover, but it provides a foundation for understanding the nature of the relationships between pro-environmental behaviours, both at the practical and conceptual levels.

2.3.1. Overview of the multiple sorting procedure

Method

A multiple sorting procedure was chosen as the method for an initial exploration of how people perceive pro-environmental behaviours and the relationships between them. The multiple sorting procedure is a qualitative methodology rooted in psychological theory which centres on a sorting task, whereby participants sort a set of elements (in this case pro-environmental behaviours) into different categories. This allows participants to generate their own classification systems for the behaviours, rather than constraining responses according to constructs prescribed by the researcher.

“...the conceptual framework of constructs and the categories on which the respondent draws are...the starting point for understanding the respondent’s action in the world.”

(Canter, 1985)

For the purposes of this small scale pilot exercise, a street sample of 18 participants was recruited. The sample covered a range of different age groups, ethnicities, genders and socio-economic groups, as well as people with different levels of engagement in pro-environmental behaviour (see appendix 4 of the full report for the recruitment questionnaire and results; see also the full report for more detail on the multiple sorting procedure method).

The size of the pilot sample is too small to draw general conclusions about the patterns of associations revealed, or about the importance of background characteristics such as age or socio-economic group. However, the multiple sorting procedure and multidimensional scalogram analysis are tolerant of small sample sizes – around 8-10 people are sufficient for the tool to reveal underlying patterns in the categories and

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1 The word construct is used in psychology to describe the concepts, ideas and language that people use to mentally construct the world. Kelly (1955) states: “Man looks at his world through transparent templates which he creates and then attempts to fit over the realities of which the world is composed. (pp.8-9) Constructs are used for predictions of things to come, and the world keeps on rolling on and revealing these predictions to be either correct or misleading. This fact provides the basis for the revision of constructs and, eventually, of whole construct systems. (p.14)” In the case of this research, the word ‘construct’ refers to the category descriptions used by participants.
concepts people use to understand a given subject. As used in this pilot, the method produced useful initial insights which could be explored further in larger scale research; and it fulfilled its purpose of showing how this methodology could be used as a component in such research.

Data collected in the interviews was analysed using multidimensional scalogram analysis, which produces visual representations of the patterns emerging from the sorts of the whole group. Selected results are shown below.

**Free sorts**

The first stage of the interview involved *free sorts* – that is, participants were invited to sort the cards into categories of their own choosing, based on whatever criteria they wished. Participants were instructed that each group should contain behaviours that were similar to each other *in some important way* - the basis of this similarity judgement was left up to them. Participants could sort the cards into as many groups as they chose and each group could have as many cards in it as they liked. Participants were assured at the beginning of each sort that there were no right or wrong answers, but it was their views that counted.

Multidimensional scalogram analysis (Lingoes, 1968) was used to produce a visual representation of participants’ sorts in the form of scatter plots. In the plots, each behaviour is represented as a point in geometric space. The distance between points represents how often behaviours were classified as similar: the closer the points are on the plot, the more similar they were judged to be by participants; and the further away they are, the more dissimilar they were viewed to be.

Two main themes emerged from participants’ free sorts: when they described the basis on which they had sorted the cards participants’ rationales fell into one of two groups - ‘behaviour type’ or ‘things I do’. Even though participants were given no suggestions beforehand, all sorts were in fact conducted on the basis of one or other of these themes. Both plots are shown below.
In general, participants considered energy behaviours to be ‘environmental’ behaviours, in contrast to the cluster of waste and recycling behaviours that is located at the opposite side of the plot and was not identified specifically as “environmental.”

There also appears to be some movement across the top section of the plot from purchasing behaviours on the left to re-use and waste behaviours on the right, suggesting perhaps that participants distinguished between the buying and consumption of products and the end-of-life of those products.

Overall, the main observation to be made about the distribution of points on this plot is that the most coherent cluster seems to comprise the energy-related ‘environmental’ behaviours, whereas the other, non-energy behaviours fall into less clearly delineated regions of the top part of the plot.
As we can see, the plot moves from very common behaviours at the bottom left\(^2\) to less common behaviours at the top right. Partitioning this plot, however, was not straightforward; the dispersed distribution of the points on the plot indicates high variability between participants’ categories, and the lines did not fall neatly or clearly between regions. This is confirmed by the interview data: some participants used only two categories – “Things I do” and “Things I don’t do”, while other participants created a subtle and complex set of reflections on their own behaviour. An example of the latter was one participant who identified six categories, including “I do these sometimes and feel guilty when I don’t”; “I do these sometimes but don’t feel guilty if I don’t”; and “I positively don’t do these and I don’t feel guilty about them.”

\(^2\) It is important to note that just because a behaviours falls into the ‘do always’ region of the plot, it does not mean that all participants said they always do it.
‘Behaviour type’ (e.g. ‘energy-related behaviours’) did not seem to be a dominant construct in the ‘things I do’ distribution; that is, it seems that ‘behaviour type’ does not underpin everyday actions. The fact that this particular categorisation does not seem to be important in behaviour patterns may suggest that (a) practical considerations such as the cost or difficulty of the behaviour suppress ‘behaviour type’ sets and/or (b) some other categorisation is more important in determining actual behaviour patterns. Participants’ ad hoc and fluid categories seem to suggest that similarity relationships between the set of behaviours used for the exercise are not well established in the minds of most participants.

Differences between ‘greens’ and ‘non-greens’

Overleaf are the plots of the behaviour type free sorts, this time separately for ‘green’ and ‘non-green’ participants.
Figure 3 Comparison of free sorts – green (top) and non-green (bottom)

1. Walk
2. Recycle/carrier bags
3. Recycle
4. Waste less food
5. Less KM products
6. Wash at 30
7. Repair
8. Donate clothes
9. Tap
10. Bags
11. Fair trade
12. Sulks
13. Insulation
14. Solar: green energy
15. White goods
16. Donate clothes
17. Compost
18. Grow
19. Organic/season
20. Wood
21. Fish
22. Volunteer
23. Buy plants

“Products”
“Avoiding wastefulness”
“Garden, food, ‘good life’ lifestyle”
“Lifestyle, money, frugality”
“Recycling, waste and resources”
“Environment”
“Energy and environment”
Comparing the green and non-green plots, it is clear that the greens identified more defined, coherent categories of behaviours than the non-greens’, whose plot shows a less coherent distribution. This signifies higher levels of consensus between the greens in terms of the constructs and category structures they used. The weaker associations between the behaviours perceived by the non-greens could be suggestive of lower levels of awareness and/or familiarity of the behaviours among this group. We return to a discussion of the differences between different groups of people in section 3.2 of this report.

**Observations on the findings of the pilot exercise**

The findings of the pilot exercise may shed some light on why spillover and catalyst behaviours, particularly in the environmental arena, are so difficult to pin down. Firstly, the pilot exercise showed that participants did not have well established environmental behavioural categories, but thought about the behaviours on an ad hoc basis, without reference to a fixed conceptual framework. This poses a potential problem for many of the suggested mechanisms of catalyst behaviours, which generally assume or rely on some kind of structural relationship or perceived similarity between the behaviours.

Secondly, the constructs (or category descriptions) participants used to classify the pro-environmental behaviours were generally a multifaceted combination of factors – rather than using simple, abstract concepts, people generally constructed complex categories that involved various aspects of their lives, attitudes and affective (emotional) reactions. Moreover, it seems that ‘environment’ was not a construct that was commonly used by participants to categorise the behaviours, and when it was used, it was frequently used in conjunction with other, non-environmental constructs such as ‘saving money.’

This suggests that participants did not perceive many of the behaviours included in the set as ‘pro-environmental’, but generally categorised the behaviours on the basis of other, non-environmental constructs. Some people included a pro-environmental dimension in their categorisations of some behaviours, but overall, ‘environment’ was an uncommon construct for most people with regard to most behaviours. If, as the literature suggests, spillover relies on similarity relationships, the absence of ‘environment’ as a common denominator may limit the possibility of triggering catalyst effects by flagging any individual behaviour as ‘environmental’. Spillover may occur, but along other dimensions that might act as ‘hooks’ to engage people more readily.

Finally, and related to this, when participants were asked about why they did and did not do the behaviours in the set, it was striking that most gave highly personal, contextual reasons for their behaviours. Such specific and personal reasons such as this for why people did and did not participate in the behaviours suggest that even if the behaviours were all perceived to belong to a coherent set of pro-environmental behaviours, underpinned by a common goal and a strong set of values, spillover still might be suppressed by the inevitable ‘idiosyncratic conditions’ (Thøgersen, 2004) around different behaviours for different people in different situations.
Exploring catalyst behaviours
A summary report for Defra

Table 3 Summary of the findings of the pilot exercise

<table>
<thead>
<tr>
<th>General observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>The way in which participants performed free sorts on both the general and specific behaviours could be described as ‘impromptu’ or ‘ad hoc’ (Barsalou, 1991), rather than well established, pre-constructed categorisations.</td>
</tr>
<tr>
<td>Participants’ categories were fluid and malleable. Participants did not draw on well established categories, and many tried out various combinations of cards until they were happy to say they had finished the sort.</td>
</tr>
<tr>
<td>Participants generally did not categorise the behaviours simply as “environment” or “food” type behaviours, but their categories were multifaceted, highly personal, contextual and influenced by a number of different constructs that were pertinent to participants’ own lives.</td>
</tr>
<tr>
<td>‘Environment’ was not a central construct in most participants’ day to day conceptual systems – in other words, most participants do not think about the environment or incorporate environmental concern into their decision making, even about behaviours that are often classed by experts as ‘pro-environmental.’</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Behavioural categories</th>
</tr>
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<tbody>
<tr>
<td>There were two main themes along which participants categorised – ‘behaviour type’ (e.g. ‘energy-related behaviours’) and ‘things I do’ (e.g. ‘things I always try to do’).</td>
</tr>
<tr>
<td>The energy related behaviours in the set were conceptualised by participants as separate from waste behaviours and ‘lifestyle’ behaviours such as purchasing.</td>
</tr>
<tr>
<td>In general, it was the energy related actions in the set of general behaviours that were perceived most strongly as pro-environmental, perhaps because of the climate change focus of most campaigns in the UK at the moment.</td>
</tr>
<tr>
<td>‘Greens’ perceived much stronger associations between the pro-environmental behaviours than ‘non-greens’.</td>
</tr>
<tr>
<td>‘Behaviour type’ (e.g. ‘energy-related behaviours’) did not seem to be a dominant construct in the ‘things I do’ distribution; that is, it seems that this set of behaviours did not fall into natural categories that provide a basis for everyday actions for most participants.</td>
</tr>
<tr>
<td>People gave highly detailed and context specific reasons to explain why they did and did not do the behaviours. Again, ‘environment’ often did not feature as a principal motivation.</td>
</tr>
</tbody>
</table>
2.3.2. Overview of the exploratory cluster analysis

The literature shows that an important potential indicator of relationships (catalyst or otherwise) between pro-environmental behaviours is the behaviours’ tendency to co-occur. The pilot fieldwork exercise investigated the links between the behaviours that exist at a cognitive level among different individuals. As a supplementary exercise, an exploratory cluster analysis was performed on data derived from the Defra pro-environmental attitudes and behaviours survey (n=3,618) (BMRB, 2007). The aim of this exercise was to investigate the co-occurrence of pro-environmental behaviours across a larger, representative sample of the British public.

Analysis of all behaviours across the whole sample revealed few positive patterns of co-occurrence: the majority of respondents did not perform the behaviours in the survey consistently (see figure 9 in appendix 2). Since analysis of the full data set did not reveal any patterns, further analyses were run on sub sections of the data in order to investigate patterns that may have been obscured at the aggregate level.

The following dendograms show the results broken down by behavioural domain (these results are for survey question C25 – household behaviours) and by three of the Defra environmental behaviours and attitudes segments (see Defra, 2008):

- Positive Greens;
- Waste Watchers;
- Honestly Disengaged.

The more similar behaviours are in terms of patterns of response, the shorter the horizontal distance between them (for example, in figure 4 below, behaviours 1 - 3 are closest, and therefore most similar, to each other). The tree diagrams are interpreted alongside cross-tabulated data and proximity matrices in order to ascertain whether behaviours are clustered due to positive or negative responses.

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3 Cluster analysis performed on behalf of Brook Lyndhurst by Mohammad Ali, Environmental Statistics and Indicators, Defra.
5 This set of behaviours (question C25) was chosen as it constitutes a single question so minimises inconsistencies in response and coding. These three segments were chosen as having the clearest differences in attitude and behaviour patterns (see Defra 2008).
This dendogram of the Positive Green group’s household behaviours shows clear associations of positive, pro-environmental behaviours: for example, behaviours 1-7 received a high number of positive responses and the short distances between them on the x-axis shows they were strongly associated with one another.

This cluster could be treated as a subset of a slightly larger cluster that extends to behaviour 10, which includes waste and waste prevention behaviours, although the associations with these behaviours are weaker. There is a large distance between this main cluster and the remaining two behaviours – ‘when there is a choice, have a shower rather than bath’ and ‘decide not to buy something because you feel it has too much packaging’. The data show that these behaviours are less common and not performed as consistently among this group as the other behaviours.
The dendogram of Waste Watcher responses is different from the diagrams for the other two groups (Positive Greens shown above and Honestly Disengaged shown below), in that two separate clusters are clearly distinguishable (1-4 and 5-12). The first cluster groups ‘having a shower rather than a bath’, which may be perceived as avoiding wasting water and/or energy, with other non-food waste prevention activities. The most similar behaviours in this group are ‘have a shower rather than a bath’ and ‘avoid packaging.’ ‘Take own shopping bag’ and ‘reuse things like empty bottles’

The other cluster (5-12) contains the energy behaviours, as well as turning off the tap when cleaning teeth. Switching off lights, TVs and mobile phone chargers again form a coherent subgroup.

It is interesting to note the relationship of ‘throw food away when it’s gone off [never]’, which we know to be a behaviour central to the value system of the Waste Watchers (see Defra, 2008; Brook Lyndhurst, 2008). This behaviour had a large amount of positive responses and is linked to both main clusters of behaviours. This suggests that it could be a common or underlying component of both. The shape of the diagram suggests that avoiding food waste was equidistant from both clusters – perhaps falling in between or providing a bridge between the two.

![Figure 6 Dendogram of household behaviours: segment 7 (Honestly Disengaged; question C25)](image)

The dendogram of Honestly Disengaged responses does not reveal any clear clusters of consistently performed behaviours, with all behaviours at a large distance from all other behaviours and very small numbers of positive responses for most behaviours. Behaviours 1 - 4 (‘avoid packaging’ and ‘take own shopping bag’, ‘reuse bottles etc’ and ‘take a shower rather than a bath) form a clear cluster of non-occurrence. Turning off lights, mobile chargers and TVs received more positive responses but the large distances between behaviours suggests that they were not similar in terms of co-occurrence.
Comments on the differences between segments

In general, the different segments’ dendograms showed few patterns of positive co-occurrence. The strongest clusters are made up of behaviours that most people did not practise – these behaviours were similar in their infrequency. However, there are some differences between the three segments studied here. It is interesting to note that, just as the pilot exercise showed that ‘greens’ employed relatively coherent, well defined constructs, the Positive Green dendogram above reveals some patterns of positive co-occurrence, notably amongst energy and water saving behaviours:

- Turn off lights when not in room;
- Do not leave tap running;
- Unplug phone charger;
- Put on extra clothes instead of turning heating on or up;
- Turn TV off standby;
- Turn off heating if out;
- Don’t overfill kettle.

This contrasts with the Honestly Disengaged group’s dendogram and the non-greens in the pilot exercise; the pilot exercise showed that this group made much weaker associations between the behaviours and this is mirrored in the dendogram above, which shows that the behaviours did not emerge as ‘alike’ for this group, except in their non-occurrence.

The Waste Watchers’ dendogram indicates that these respondents made a broad distinction between the waste and energy behaviours included in this question. Avoiding packaging, re-using shopping bags and reusing jars and bottles clustered together; and the energy saving behaviours were in a separate cluster. Energy saving behaviours relating to household appliances formed a notable cluster of ‘similar’ behaviours among this group (‘turn off lights’, ‘unplug phone charger’, turn TV off standby’, and ‘don’t overfill kettle’). Although receiving high numbers of positive responses, there were relatively large distances between waste-related behaviours such as ‘avoid packaging’ and ‘reuse bottles’. This suggests that these behaviours, although individually popular, did not tend to co-occur in the same respondents.
Table 4 below summarises the main findings of the exploratory cluster analysis.

<table>
<thead>
<tr>
<th>General observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of all behaviours across the entire sample shows that, in general, pro-environmental behaviours are not performed consistently among the majority of people. The analysis showed that many behaviours had low uptake and most did not cluster together on the basis of co-occurrence. At the highest level, including all of the behaviours in the survey and the entire sample of individuals, co-occurrence of behaviours was hard to find.</td>
</tr>
<tr>
<td>The clearest clusters contained the least common pro-environmental behaviours, such as installing microgeneration and participating in carbon offsetting schemes. Analysis of the underlying data shows that these behaviours received very few positive responses: the basis of their similarity was not that they tended to co-occur, but rather their common non-occurrence.</td>
</tr>
<tr>
<td>Breaking the sample down into the Defra segments, patterns of co-occurrence did emerge, but generally among only the greenest participants (see figure 4 above).</td>
</tr>
<tr>
<td>Analysing the behaviours by Defra segment revealed some fundamental differences between the responses of these groups.</td>
</tr>
<tr>
<td>- The Positive Greens reported performing the household behaviours more consistently than the other segments (see figure 4 above).</td>
</tr>
<tr>
<td>- There was a clear distinction amongst Waste Watchers between waste behaviours and other behaviours (see figure 5 above).</td>
</tr>
<tr>
<td>- No clear patterns of co-occurrence were found among the Honestly Disengaged group (see figure 6 above).</td>
</tr>
</tbody>
</table>

2.4 Overall comments on the evidence

The concept of catalyst behaviours is highly appealing: the idea of a self-sustaining chain reaction of positive behaviours, or positive outcomes over and above the scope of an intervention, in its best case scenario represents a potential ‘multiplier effect’ of benefits from relatively small scale inputs. However, one of the most striking observations to emerge from the evidence review and interviews is the gap between the intuitive appeal of catalyst behaviours, and the actual evidence available in support of this.

The evidence review shows that the idea of catalyst behaviours is not supported by a coherent, robust evidence base. There is, however, anecdotal evidence, as well as a small amount of academic evidence, relating to a group of ideas and theories that are loosely referred to by those working in the field as ‘spillover.’ The sum of this evidence
suggests that, in practice, there are no simple linear causal relationships between pro-environmental behaviours: the simple equation of $\text{behaviour } a \rightarrow \text{behaviours } b + c$ does not hold. However, the evidence does indicate that behaviours can have knock on effects on other behaviours in particular social and psychological contexts and subject to a range of different causal variables.

There is almost no practitioner evidence that focuses solely on catalyst behaviours or spillover processes. Instead, it is treated as part of a much wider and more complex process of behaviour change. Similarly, the academic evidence suggests that spillover effects from one behaviour to other behaviours can explain only a very small part of the variance in behavioural correlations, and, moreover, that these effects are often completely suppressed by idiosyncratic, ‘real life’ variables.

The sum of the evidence therefore suggests the following hypothesis: spillover can and does occur, and under certain circumstances may be partly triggered by participation in actions (although it can also be triggered in many different ways, for example through group learning, awareness raising, or by influential individuals).

However, the path that leads from one behaviour to another or other behaviours is likely to be highly context specific and surrounded by idiosyncratic conditions at the levels of the behaviour, the individual and the social context. A practical conceptualisation of spillover must include this wider context; participation in a behaviour is generally not sufficient to explain spillover effects (or the absence thereof). This means that the spillover process is difficult to model and replicate across different individuals and contexts.

The probability of spillover occurring is therefore a function of both personal attributes and the wider social and situational context. The highly contextual nature of spillover processes, along with the finding of the pilot exercise that ‘environment’ was not a core or established construct used in every day decision making by participants, may help to explain why spillover is so difficult to predict, observe and measure.
3 If it is observed, how does the catalyst process work?

The review of the existing evidence in the previous chapter has suggested that taking up one pro-environmental behaviour can play a part in causing the uptake of other behaviours, but generally only as one part of a wider behaviour change context: any one ‘trigger’ behaviour is not sufficient on its own to cause wider behaviour change.

This view is supported by the following review of the processes or mechanisms that are suggested in the literature and by practitioners to explain spillover: it seems that trying to isolate a single catalyst process is a red herring, since there are a number of different ways in which participating in a behaviour can result in the uptake of more behaviours.

3.1 What processes could underpin catalyst effects?

There are several social-psychological processes that may have particular relevance in explaining how and why participation in a behaviour or behaviours can result in more generalised behaviour change. The table below includes both rational models of behaviour change and the less deliberative, sometimes unconscious mechanisms that may help explain this particular type of behaviour and behaviour change.

<table>
<thead>
<tr>
<th>Table 5 Some possible explanations of the spillover process</th>
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<tr>
<td>Theory type</td>
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<tr>
<td>Consistency</td>
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| **Self identity** | **Self perception** (Bem, 1972) – the theory that we infer our own attitudes from observing our own behaviour, especially in ambiguous situations or in the absence of a well established personal norm. Performing a behaviour leads to the inference that “I am the sort of person who...” and in conjunction with dissonance theory/general striving for consistency, behaviour may change. This may cause the individual to align their cognitions (beliefs, attitudes, values and self image) with the behaviour they observe themselves performing – “If I’m willing to recycle and switch my appliances off standby, I must have a pro-environmental attitude”. Self identifying as pro-environmental may provide the basis for further behaviour change to reduce dissonance between the pro-environmental attitude and other un-environmental behaviours. Strongly linked to the theory of self perception is the idea of self identity/self concept; people coming to see themselves as ‘green’ is found to be an important antecedent of behaviour in the literature and was often mentioned during interviews with practitioners |
| **Self efficacy** | **Self efficacy** (Bandura, 1977) – the belief in one’s ability to succeed in specific situations can have a direct effect on behavioural choices. People are more likely to engage in behaviours that they think they can do, and may have stronger motivations to perform a behaviour and persist in doing that behaviour, whereas low self efficacy can be a psychological barrier by making tasks seem more difficult than they actually are. Bandura singles out personal experience of a behaviour as the most important factor determining an individual’s self efficacy in relation to that behaviour. It seems plausible that increased self efficacy in relation to one behaviour may spill over to other related behaviours – “If I can do behaviour A, then I’ll probably be able to do behaviour B too.” |
| **Norm activation theory** | **Norm activation theory** (Schwartz, 1977) – altruistic behaviour triggered by personal norms that are activated by awareness of consequences and ascription of responsibility to self. Ascription of responsibility to self depends on self efficacy, which can be encouraged through action; cognitive dissonance/self perception could provide the basis for spillover or extension of the personal moral norm to related behaviours. |
| Theory of planned behaviour | (Ajzen, 1985) proposes that attitude, perceived social norm and perceived behavioural control (i.e. the extent to which I think I am able to perform that action with regards to both internal and external conditions) feed into behavioural intention, which, under the right external conditions, leads to action. It is possible that performing an action may increase perceived behavioural control and increase the salience of others’ similar actions (i.e. the perceived social norm). Dissonance theory also explains how an attitude may change to fit with a new behaviour, and it has been shown that attitudes based on personal experience are stronger and more salient than attitudes that are not (Fazio, 1986). |
| Habitusal behaviours | This literature suggests that the deliberative process described by the theory of planned behaviour and assumed by other psychological models can be bypassed and attitudes and behaviours can be automatically activated by situational cues (e.g. Aarts and Verplanken, 1998; Klockner and Matties, 2004). Habits and other pre-conscious/automatic elements of behaviour are sometimes thought to block spillover (e.g. Thøgersen and Ölander, 2003; Klockner and Matties, 2004) by bypassing the deliberative processes of behavioural decision making. However, as the marketing profession is well aware, pre-conscious processing may also represent an inroad into behavioural choices. For example, highlighting the environmental friendliness of an existing habit may increase the likelihood of individuals coming to see themselves as ‘green’, or ‘the sort of person who makes green choices’. Cornelissen et al (2008) call this ‘positive cueing’ of behaviours in order to make them more diagnostic of pro-environmental attitudes and self image. |
| Spreading activation theory | (Collins and Loftus, 1975) – linked to ideas about habits, Fazio’s (1986) hypothesis states that attitudes based on direct experience are stronger (more easily retrievable or accessible) and more predictive of behaviour than attitudes that are not. Building on this, spreading activation theory has been used (particularly in marketing research) to hypothesise that when experience causes an attitude to become more salient, other attitudes and beliefs that are associated with the catalyst attitude are also brought to the fore through an unconscious process of ‘spreading activation’ of attitudes. This may then provide the platform for further behaviour change based on an underlying attitude. |
**Learning models**

Thøgersen (1999) suggests that behavioural spillover may occur as a result of a ‘learning by doing’ mechanism. By helping an individual to gain skills and know-how, participating in a behaviour may reduce the cost or difficulty of performing new, similar behaviours.

Where acquired skills, knowledge or ‘know-how’ are hypothesised to be important, they are often found to be a necessary but not sufficient condition for the adoption of further behaviours. Added to the new skills must be a mixture of variables that account for one’s ‘taste’ for adopting the new behaviour (Wilson and Musick, 1997; see also Velicer et al, 1998, on the *transtheoretical model* and the stages of change): the new skills and a certain existing ‘state of readiness’ (perhaps comprising existing beliefs and values) must come together to create sufficient conditions for the catalyst effect.

**Values-beliefs-norms model**

According to Stern (2000), different behaviours are predicted by different combinations of norms, values and beliefs. A high association is often found between pro-environmental behaviours and a value set that includes the ‘big picture’ - variously called universalism (Dietz et al, 2005; Thøgersen, 2003); self transcendent values (Stern, 2003); and altruism (Schwartz, 1977; Dietz et al, 2005). Just as values, mediated by norms and beliefs, influence behaviour, it is possible to speculate that performing a new behaviour may also affect norms, beliefs and values. The altered values may then lead to more general behaviour change, perhaps through a consistency mechanism.

There is very little evidence that formally tests these processes to show that they can explain spillover, with the exception of cognitive dissonance (e.g. Thøgersen, 2004; Dickinson and Oxoby, 2007). They are mostly suggestions that seem on the surface to fit in with existing observational data and anecdotal evidence. However, the fact that we can postulate so many different explanations of how spillover occurs provides further support for the suggestion that conceptualising catalyst behaviours as a single process is problematic. In fact, it seems that we are dealing with a set of processes that can explain how participation in a behaviour might (under the right conditions) lead on to other behaviours. It is not a single process, but a group of explanations for how behaviour change can happen, that have common roots in *participation in a behaviour*.

This suggests that the process is likely to be different for different people at different times in relation to different behaviours. This makes it extremely difficult to predict the outcomes of spillover – either whether it will happen at all or how many other behaviours will be taken up as a result. It may be preferable to concentrate on the enabling conditions that are likely to maximise the probability of spillover, rather than designing interventions that start with an individual ‘trigger’ behaviour.
The ‘enabling conditions’ in question are likely to be specific to the behaviour, the individual and situation - but they may include the removal of practical barriers to behaviours, as well as interventions designed to enable one or many of the psychological processes outlined above. For example, interventions that aimed to help people recognise specific behaviours as ‘environmental’ may increase the possibility of change on the basis of the consistency theories. Similarly, interventions that promoted pro-environmental values or descriptive social norms would be likely to facilitate most of the processes outlined in table 5, and so increase the probability of spillover (see section 2.4 for further implications for policy and practice).

Regarding how and why spillover happens, the practitioners at the expert workshop suggested that the mechanism is often very simple and pragmatic; for example, the realisation that an energy saving measure has saved them money may inspire some people to try other energy saving measure in order to further reduce their bill. This suggests that the psychological processes outlined above can work on a number of different bases or motivations. For example, the rewards for consistency needn’t be simply psychological (e.g. a reduction in dissonance) but can also be practical (e.g. monetary).

Reference to the findings of the pilot exercise may also help us to understand why these processes often provide incomplete explanations of behaviour (e.g. Thøgersen, 2004). As well as the processes being highly context specific and difficult to generalise, we have seen that the behaviours themselves are not generally categorised as simply ‘environmental’. This may be why individuals often do not perceive their own behaviour to be inconsistent: the construct ‘environment’ is not dominant enough to function as a basis for inconsistency.

Overall, examination of the evidence on the existence of catalyst behaviours and the processes that might explain it indicates that:

- catalyst effects do occur, in the wider sense that behavioural chain reactions can be triggered in a variety of ways, including participation in behaviours;
- catalyst effects are extremely difficult to observe and even trickier to measure, given their highly contextual, non-generalisable nature;
- the ‘catalyst effect’ is not a single process, but a set of behaviour change processes;
- individual ‘catalyst’ behaviours are not sufficient for behaviour change but must be taken as part of a wider context.
3.2 Do catalyst effects occur generally?

There is a significant gap in the evidence base for work that systematically explores this question, although some specific aspects of it have been considered (e.g. Thøgersen (2004) looks at how different personal norms affect the likelihood of spillover). Other research on behaviour change has looked extensively at differences between groups of people and the links between attitudes, values, and pro-environmental behaviour. Again, this literature – together with our pilot fieldwork - can be used to surmise how spillover processes might differ according to different ‘sets’ of values held by different types of individual.

All the processes identified as possible explanations of spillover take place within the context of the internal psychological conditions of the individual. The behaviour change literature in general stresses the importance of values in the make-up of these internal psychological conditions, and therefore in understanding and predicting behaviour and behaviour change (e.g. Stern, 2000; Ajzen 1985). A recurring theme in the general literature is the strong correlation between pro-environmental behavioural tendencies and ‘bigger picture’ values or worldviews such as universalism6 (Dietz et al, 2005; Thøgersen, 2003); self transcendent values (Stern, 2003); and altruism (Schwartz, 1977; Dietz et al, 2005). This applies equally to the set of behaviour change processes that may be identified as catalyst based behaviour change, and the literature provides some specific evidence for this; for example, Thøgersen (2004) demonstrated that personal moral norms have crucial importance for spillover based on cognitive dissonance.

Given that values are shown in the literature to be an important determinant of behavioural outcomes, it is likely that the different processes of behaviour change identified in the previous section will work differently for people with different sets of values. Take, for example, the consistency theory of cognitive dissonance. The literature demonstrates that the dissonance caused by inconsistency increases with the importance of the subject to the individual. This implies that, within the spectrum of Defra’s segmentation model, Positive Green individuals are likely to suffer much stronger dissonance as a result of inconsistency among their environmental attitudes and behaviours than, for example, Honestly Disengaged individuals. This suggests that interventions designed to cause and leverage dissonance are likely to be more effective among those with stronger pro-environmental values. The same is likely to apply to interventions that aim to cause changes in self identity or self concept – that is, interventions that encourage people to see themselves as ‘green’ - as the basis for spillover.

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6 That is, the view that there are universal values and ethical principles relating to such topics as the human-environment relationship.
A similar case can be made for the importance of values for the learning by doing model. As highlighted above, skills, knowledge and know-how may be necessary conditions for the uptake of a behaviour, but they are not sufficient. Added to the mix must be a ‘state of readiness’ or a taste for not only learning, but then applying the new knowledge and skills to other tasks (see, e.g. Velicer et al, 1998). It is likely that a person’s values may have a direct effect on this state of readiness, which may comprise attitudes, norms and beliefs (Stern, 2000).

The above examples illustrate the importance of values as internal enabling conditions in the behaviour change processes that are implicated in spillover. It may also be the case that values can play a more direct role in the spillover process. As the literature suggests, values are a key determinant of behaviour, and so a change in values is likely to lead to a change in behaviour (in the absence of external barriers). It is possible to speculate that participating in particular behaviours may eventually lead to a change in values, which would then provide the platform for more generalised behaviour change. Although values are deeply embedded and difficult to change, it is possible that the path from values to behaviour is a two way street, with each influencing the other. However, the evidence is not clear on how different behaviours and value sets may interact; it is likely that the behaviours that trigger changes in values (if this does indeed occur) will be different for different types of people.

Related to this last point is the values modes model (see e.g. Rose, 2009). This segmentation model, which categorises people into 12 psychographic types, suggests that there are periods of transition between values modes during which individuals are particularly responsive to change and to new ‘big ideas’. Research based on this framework (e.g. Rose et al, 2007) has suggested that individuals making the transition from ‘immediate picture’ (thinking about immediate needs and taking cues from those external to them) to ‘bigger picture’ values (thinking about more distal needs, such as the needs of others or of future generations and taking cues from an internal moral framework) are often particularly open to adopting new attitudes that reflect a greater sense of universalism. This suggests that individuals in moments of transition or change might be those for whom participating in pro-environmental behaviours may lead to fundamental shifts in values, thereby creating a platform for further, volitional pro-environmental behaviour change.

The pilot fieldwork exercise and the cluster analysis conducted as part of this research may also shed some light on the type of person for whom the mechanisms of spillover are most likely to find traction. As discussed above, figure 3 in section 2.3.1 suggests that the green group within the sample used more coherent, well defined categories to think about and understand pro-environmental behaviours than the ‘non-green’ group. If spillover relies on the existence of (perceived) relationships between the behaviours, and if pro-environmental values are important for ‘green’ behaviour, it seems likely that spillover will occur more readily for those with stronger pro-environmental values, since

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7 See New Economics Foundation for Defra on ‘Moments of Change’ (Thompson et al).
pro-environmental values seem to be associated with the perception of stronger links between the behaviours. Further research would be needed to verify this suggestion.

Similarly, the exploratory cluster analysis (see section 2.3.2 for a summary) shows that the clearest clusters of co-occurring behaviours occur among the Positive Green group. This suggests that those individuals are most likely to behave consistently with regard to the common denominator of environmental concern and protection. The correlation of pro-environmental values and consistent behaviour again suggests that those individuals with a strong set of pro-environmental values are likely to be those for whom the self-sustaining ‘behavioural chain reaction’ idea is most realistic.

Overall, there has been almost no research conducted into the interactions of different sets of values and spillover processes. However, piecing together the clues from the wider practitioner evidence, the literature and our own fieldwork, it is possible to speculate that the breadth of spillover effect is likely to be correlated to the strength of the individual’s pro-environmental values. We may similarly speculate that spillover effects are least likely to occur for those with the weakest pro-environmental values, since these individuals are likely to perceive the weakest associations between the pro-environmental behaviours. Thøgersen (2004) provides support for this view; however, further research and testing would be required to validate these speculations.

3.3 Do spillover effects cut across apparently dissimilar behaviours?

The literature indicates that the strongest correlations are found between behaviours that are most conceptually similar (e.g. Thøgersen, 1999; 2004). Indeed, most of the research suggests that spillover is greatest between behaviours that belong to the same ‘domain’ (e.g. Barr, 2005; Thøgersen, 1999; Tucker and Douglas, 2008). However, this may be simply because these studies have set out to focus on a single domain; Thøgersen and Ölander (2003) and Byrka et al (forthcoming) find some evidence of more widespread, cross-domain spillover.

In general, the very limited evidence suggests that although spillover can and does occur between behavioural categories (as defined by the respective researchers), it is more likely to occur between behaviours that are conceptually or semantically similar. However, the pilot exercise shows that conceptual similarity founded in environmental constructs is uncommon amongst the set of behaviours studied in this research, and the cluster analysis showed that the pro-environmental behaviours seem notable for their unrelatedness and the fact that the majority of people do not perform them consistently.

Neither do the perceived commonalities between the behaviours seem very well established – the sorting exercise showed that participants’ categories for these behaviours were highly fluid and changeable; and the categories were not the same for those who could be considered ‘green’ or ‘not green’. The fact that participants’ categories were not seemingly anchored in a well established conceptual framework
could suggest that the participants did not normally think of these behaviours as ‘going together’.

In theory, spillover relies on the existence of structural or ‘similarity’ relationships between behaviours. Therefore, the question of whether spillover occurs across different behavioural domains depends on whether similarity relationships cut across different domains, or whether different domains are perceived to be fundamentally dissimilar. The sorting exercise suggests that pro-environmental behavioural ‘domains’ are different for different groups of people and are not well established for most. This suggests that in practice, spillover may not currently occur consistently or widely between pro-environmental behaviours. However, there is no a priori reason that spillover would not occur between any given set of behaviours, provided that the similarity relationships between those behaviours were well established and stable. The evidence from the marketing profession shows that new linkages and sets of behaviours are often successfully created.

The recurring insight from the evidence and pilot fieldwork is that it is not possible to identify single trigger behaviours that always and everywhere lead on to further action by an individual. However, it may be possible to optimise the chances that catalyst effects will occur by shaping the contexts that favour these processes, including how people perceive the links between behaviours. In that context, the next section considers how insights from the evidence could inform approaches that seek to foster behavioural spillover, or the multiple uptake of pro-environmental behaviours.
4 How can the process be stimulated? Implications for policy and communications

As the above discussion has shown, the evidence is clear on seven points:

- Practitioners and academics believe that catalyst effects occur – that is, that past behaviours can have knock-on effects on future behaviours.

- It is equally clear though that the process is more complex than the idea that take-up of multiple pro-environmental behaviours can be triggered by any one individual or specific behaviour. We have characterised a catalyst behaviour process as a specific form of more general spillover between behaviours which is rooted in more complex origins. These origins include personal attributes, preferences and values, the social context in which the behaviours occur and the practical barriers faced by individuals. Performance of a behaviour is often insufficient for spillover to take place, since a range of enabling contextual factors are often also required.

- Behaviours do co-occur, and are mentally categorised together by individuals, but in different combinations for different types of people and for different reasons.

- The process of spillover is hard to observe because so many different factors are implicated, which frequently causes too much ‘noise’ in research designed to capture it.

- That said, there are plausible mechanisms deriving from psychological theories that can help us to understand the reasons why spillover might happen and therefore how it might be facilitated.

- The ways in which people categorise behaviours, and the constructs they rely on to devise these categories, are strongly implicated in many of the mechanisms that underlie the spillover process (e.g. consistency theories, foot in the door). However, the categories may be highly personal and fluid (at the individual level and over time). No ‘ideal set’ can be identified in the literature or through our pilot fieldwork.

- Most participants in the pilot study did not employ categories or sets based on environmental constructs: constructs (i.e. category descriptions) were generally multifaceted and based on practical issues of high relevance to the individual; environment was peripheral for most people in the way they made links between behaviours.

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8 That is – the category descriptions used by participants – see note 1 on page 11 of this report.
• Context is crucial to any spillover processes, where this refers both to the external situation, social norms and personal psychological factors (values, identity, norms, and so on).

The most we can conclude, therefore, is that catalyst based behaviour change refers to a set of diverse processes that can help explain why and how participating in a behaviour can lead to more generalised pro-environmental behaviour change. Rather than a single, coherent model of behaviour change, the idea of catalyst behaviours encompasses a number of different processes and techniques. From this perspective, the question then becomes something like:

**How can we maximise the probability that individuals will take up multiple pro-environmental behaviours?**

There are various starting points for spillover; the evidence review shows that behaviour change may be triggered by participating in new behaviours, but also may ‘spin off’ from existing behaviours. The trigger for spillover may also be performing a new behaviour in a particular context – for example, in a group setting.

The evidence review also demonstrates that the idea of catalyst behaviours does not refer to a single behaviour change process, but rather a number of different processes that can explain how behaviour change can spring from participation in a behaviour. Further, the evidence suggests that none of these processes is likely to cause behaviour change on its own: participating in a behaviour is rarely sufficient to lead to more generalised behaviour change, since a whole variety of enabling factors (both internal and external to the individual) must be in place.

This suggests that the idea of catalyst behaviours may not provide an operationally sound platform for high level policy. Given the uncertainty around the processes and the fact that unique ‘trigger’ behaviours do not seem to exist, relying on catalyst based behaviour change poses far too many risks for it to be a central plank of behaviour change strategies, in our view. That said, being alert to opportunities for enhancing (but not relying on) the chances of spillover in high level initiatives would be worthwhile; as would on-going consideration of how the government’s position on different environmental issues contributes to the general social norms around ‘desirable sets’ of behaviours.

Spillover may in fact have more potential to be a useful part of the behaviour change toolkit at a lower, more focused level. On a small scale, with a targeted and researched audience, there may be ways in which practitioners could optimise spillover effects.

To this end there are some general things we can say about catalyst behaviours and spillover, plus some more specific things about which behaviours and which people

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9 Here we are concerned with behaviour change at the level of the individual rather than mass mobilisation or diffusion across communities or society as a whole, which has been explored in other Defra work, for example, Brook Lyndhurst (2009), *Influential individuals*
might respond well to this type of intervention. Appendix 3 of this report contains outline suggestions for further research in these areas that would test and strengthen the evidence base for these ideas.

4.1 General considerations

**Highlighting the links between behaviours**

One of the most important pre-requisites for spillover of pro-environmental behaviours is a perceived relationship between the trigger and outcome behaviours. Highlighting the links between behaviours – helping people to understand why they ‘go together’ – would be a crucial step in fostering a spillover process. It may also provide opportunities to actively foster practical links with messages such as “Now you’ve tried x, you might like to try y.”

**Which links?**

It is important to note that the particular links that are highlighted will be key in how the spillover process works. Highlighting the environmental links is likely to appeal most to the greenest people. Highlighting other commonalities (such as benefits to health or of lower financial outlay) may fit with how most people naturally think about the behaviours (as suggested by the pilot fieldwork), but also runs the risk of ‘crowding out’ environmental motivations. Crowding out has its own negative spillover risks for less common behaviours where difficulty or cost would otherwise be offset by the individual against their stronger environmental motivations.

**Cueing common goals**

Perceptions of similarity are crucial for many of the spillover processes identified during the evidence review. For example, consistency theories show that people strive to behave in a consistent manner; for consistency or inconsistency to be possible, there must be some links perceived between the behaviours. Similarity based on a common goal is required for techniques such as foot in the door, which leverage this desire to behave consistently, as well as commitment to the common goal.

**Learning by doing**

This may increase an audience’s perceived ability to perform and succeed in a behaviour (increase their sense of self efficacy), which may spill over to related behaviours. This points to finding opportunities for direct public engagement through ‘try it and see’ approaches, as well as encouraging the development (or retention) of skills that support pro-environmental behaviour (e.g. cooking, mending, gardening and so on). It is also a further reason why the practical message “Now you’ve tried x, you might like to try y” may also work.

**Cueing existing behaviour as pro-environmental**

As we have seen, spillover may stem not only from participation in new behaviours, but may also spin off from existing behaviours as “the next natural step.” This process could
potentially be optimised through the cueing of existing behaviour as pro-environmental. Making existing behaviour patterns diagnostic of ‘the sort of thing a green person would do’ could perhaps engage with an audience’s self perception and set the context for further change in accordance with a greener self identity.

**Understanding the limits posed by the values of different audiences**

It is important to note, however, that these processes will not work in the same way for all audiences. The values held by the audience are a crucial independent variable in all of them. For example, dissonance caused by inconsistency is stronger among those for whom the subject matter is more important, or closer to their self concept. Similarly, cueing behaviours as pro-environmental could backfire among an audience whose values were at odds with environmental concern. This suggests that, as with many behaviour change processes, spillover processes are more likely to find most traction among those who already have the strongest pro-environmental values.

**Removal of external barriers**

Spillover effects are often thought to be suppressed by external conditions, and removal of external barriers common to several behaviours could function as a trigger for change.

**Being alert to risks of negative spillover**

However, spillover can also be blocked by other factors, not least through participation in certain behaviours. Negative spillover, or behaviours that function as blockages to further behaviour change, are a real risk for any campaign designed around spillover. Negative effects are found throughout the spillover evidence base and seem to often occur ‘naturally’, outside of pro-environmental interventions or campaigns. For example, several studies indicate that, for some people in some situations, recycling may act as a terminal behaviour, rather than a trigger behaviour, by providing them with an excuse or alibi not to participate further. The latter is also relevant to national campaigns in which behaviours are signalled (directly or inadvertently) to the public as the aspirational ‘set’; there was a great deal of discussion in the expert workshop about the role of ‘small behaviours’ as either catalysts or terminal behaviours. Again, the importance of the values held by the audience is clear in relation to negative spillover.

**Trust that the messenger is competent to talk about the target behaviours**

The marketing literature suggests that the messenger is as important as the message. A company co-marketing a new product as an extension of, or under the umbrella of, an established, trusted brand, must be perceived to have the right skills and knowledge to effectively deliver that product. Successful brand extensions or alliances rely not only on the customer’s positive attitude towards the ‘parent’ product, but also on their trust in the company’s competence to deliver the new product.

This suggests a possible parallel in environmental behaviour communications – a lack of fit between the messenger and the message, or a messenger that lacks credibility in the eyes of the audience, may jeopardise a communications campaign. As highlighted in the
discussion of the spillover of moral indignation in section 2.4.2 of the full report, negative (or anti-social) behavioural outcomes can occur when an audience feels that an authority has lost legitimacy and following the rules becomes less important.

**Influencing the general social context and social norms on the environment**

Finally, a theme of the practitioner and academic evidence is that the general social context around the environment is of fundamental importance to how the process of spillover occurs and its outcomes. Positive enabling conditions at the level of social norms and attitudes are an important determinant of spillover, whether natural or intervention led, psychological or structural and so on. This again points to the importance of consistency in messaging about environmental issues and the government’s expectations of the public. At a practical level, it also points to support for those who are influential in shaping pro-environmental social norms on the ground, whether they are individuals or communities (e.g. through Defra’s Greener Living Fund or, previously, Every Action Counts).

**4.2 Specific considerations**

**Which people?**

There was little direct evidence in the literature on the kinds of people among whom spillover is most likely to occur. Our pilot fieldwork and exploratory data analysis, however, point to variations in the co-occurrence of behaviours across different groups; and the theoretical work suggests that spillover would be more likely among those with ‘greener’ values. There is no reason, though, why spillover would not occur among any audience, except those who perceived no links between the behaviours whatsoever.

The evidence that exists suggests that spillover among pro-environmental behaviours is more likely to occur among those people who have an established set of green pro-environmental values. This could be conceptualised, in the light of the pilot exercise, as those people who use ‘environment’ as a construct when categorising their behaviour. Similarly, the cluster analysis suggests that co-occurrence (or consistent performance of behaviours) is strongest among the greenest people (though it should be noted this was only a preliminary analysis and needs further investigation).

The pilot exercise indicated that most people’s categories around the pro-environmental behaviours are fluid and malleable - it seemed that participants were not drawing on well established categories but rather constructing these in an impromptu fashion. Marketing research suggests that new sets can be created and new products can be brought together using a variety of communications and advertising techniques. Together, this suggests that spillover need not be founded in established, pre-existing sets or categories. It may be possible, within certain boundaries, to foster new links between previously unrelated behaviours. Where the conceptual boundaries lie is likely to depend on the characteristics of the audience, including their existing behaviour patterns and categorisations, and their norms, beliefs and values.
Our preliminary work has suggested that behaviours co-occur in different ‘sets’ across the Defra segments and it may be worth undertaking further research to further identify both patterns and the mental constructs underpinning them. Knowing how different types of people or target audiences categorise behaviours is currently a gap in the literature. Suggestions for further research are included in appendix 3 of this report.

**Which behaviours?**

No single behaviour was identified in the literature as being a candidate for a ‘catalyst’ behaviour and equally no consistent ‘set’ of behaviours was identified as a basis for spillover.

The literature suggests that trigger behaviours may differ not only across people and contexts, but also over time. For example, evidence from the literature suggests that a decade ago, participation in recycling, which was relatively uncommon, sometimes led on to participation in wider behaviours (Thøgersen and Olander, 2003; Berger, 1997). However, as recycling has become more widespread, it has become less diagnostic of a green attitude and so ceased to play such an important role in spillover processes (if indeed it ever did play such a role). The evidence also suggests that recycling may even be responsible for some negative effects among some people.

We have argued in this research that the catalyst process is unlikely to be a linear path from one behaviour to other behaviours. Instead, spillover may more often depend on behaviours going together in a more reciprocal manner. Behaviour change is unlikely to result from the promotion of a single behaviour, but rather from a package of experience, including the behaviours themselves but also the context in which those behaviours occur – the ‘contextual noise’ (including internal conditions such as values, norms and so on, as well as external conditions) that either enables or blocks spillover. The fact that linear causal relationships between behaviours are likely to be at best weak gives rise to the question of whether we need to uncover the causal paths between behaviours at all, or whether it is sufficient to base interventions on the structural, reciprocal relationships between the chosen set. In practical terms, this represents the difference between focusing on a hypothesised ‘trigger’ behaviour versus ‘co-marketing’ a set of behaviours together.

To summarise, using spillover and catalyst behaviours as a foundation for behaviour change is as fraught with complications and potential pitfalls as other types of technique or approach. In many ways, spillover is not materially different from any other sort of behaviour change and, according to this review, it relies upon many of the same psychological processes that have been highlighted as important in relation to behaviour change generally in Defra’s other research. Anyone tempted to view catalyst behaviours as a silver bullet leading to behavioural chain reactions should be aware of the lack of hard evidence and the risks that have been flagged here.
5 Conclusions

The existing pro-environmental behaviours evidence base is clear that there is no single or simple solution to facilitating pro-environmental behaviour change. This research suggests that neither is there a ‘silver bullet’ catalyst behaviour or behaviours that may be relied upon to have a knock on effect and lead to the uptake of multiple pro-environmental behaviours. There may be some knock-on effects from some behaviours to others in some contexts for some individuals. However, the ‘catalyst behaviour’ hypothesis does not, on its own, provide an operationally useful platform, since it is difficult to isolate the catalyst process and to disentangle it from the host of other influencing factors that are necessary for behaviour change.

Indeed, this research, along with other behaviour change research, suggests that these different factors are likely to be indistinguishable because they are interdependent: our definition of a ‘behaviour’ should not be limited to the action alone, but should include a much wider set of contextual factors. The evidence suggests that encouraging a particular action is unlikely to result in the uptake of further, multiple actions in the absence of a complex set of internal and external enabling conditions. In other words, any behaviour change intervention - including those aiming to encourage spillover - would have to take a holistic approach and attend to the wider behavioural context in which actions occur, as well as the ‘core’ processes by which behaviour changes.

However, this is not to say that the idea of catalyst behaviours may not prove to be a useful frame for communications campaigns and action programmes. Rather than a single process that may be operationalised through policy and communications, the idea of catalyst behaviours may be viewed more realistically as a set of behaviour change processes and contexts. These processes and contexts can help to explain how and why participating in particular pro-environmental behaviours can, in some situations for some people, lead to the uptake of multiple pro-environmental behaviours. Gaining a deeper understanding of these processes and the conditions in which they are most likely to occur may provide a useful focus for campaigns.

A key insight from this work on catalyst behaviours is the importance of understanding how different target audiences make links between different pro-environmental behaviours, whether they think of them as a coherent ‘set’ and whether this ‘set’ is defined as being ‘environmental’ or something else. Understanding how audiences ‘construct’ a conceptual world of multiple behaviours will help policy makers and communicators to identify the right conditions for optimising the chances that catalyst effects will occur.

As with any behaviour change intervention, however, and perhaps more so with spillover, there are risks associated with using it as an intervention strategy. In the absence of clear evidence about how the process works in the context of different behaviours, different people and different social groups, there is a very real risk of the
process backfiring. The ‘wrong’ trigger behaviour (too big or too small, too hard or too easy) could in fact turn out to be a block; and promotion of the ‘wrong’ set could limit further progress or even reverse positive effects. The risks of negative spillover cannot be discounted from any discussion of catalyst behaviours.

As with any type of behaviour change, it turns out that catalyst behaviours do not provide the answer to the problem. They may, however, provide part of the answer, as part of a wider, more holistic approach to changing lifestyles.
Appendix 1: Overview of the multiple sorting procedure

Aim

The overarching aim of the pilot exercise was to explore the relationships and links between different pro-environmental behaviours. As a first step in understanding how one behaviour might catalyse (or block) the uptake of other behaviours, it is important to understand how and why people relate these behaviours to each other.

The classification systems people use to understand the world are a “central clue” to understanding behaviour (Canter et al., 1985). The pilot exercise methodology was designed to examine the way in which people categorise pro-environmental behaviours and, crucially, to understand why they categorise them the way they do. An additional aim of the pilot exercise was to test the methodology (the multiple sorting procedure – see below) and gauge whether this approach is an effective means of generating evidence about catalyst behaviours.

Method

For the purposes of this small scale pilot exercise, a street sample of 18 participants was recruited in West London.\(^{10}\) The sample covered a range of different types of people – it included equal numbers of men and women and also covered a range of age groups, ethnicities and socio-economic groups. Two short questionnaires were administered to allow us to split the sample into ‘more green’ and ‘less green’ individuals for the purposes of the analysis (see below).

The multiple sorting procedure is a qualitative interview technique for eliciting the views and judgements of participants. The exercise was conducted during a face to face interview with each individual. The technique requires participants to sort a set of elements (in this case pro-environmental behaviours) into categories. Participants were first asked to spend a few minutes familiarising themselves with a pack of 25 cards, each with a behaviour written on it.

The first stage of the interview involved free sorts – that is, participants were invited to sort the cards into categories of their own choosing, based on whatever criteria they wished. Each group had to contain behaviours that participants considered to be similar to each other in some important way - the

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\(^{10}\) The small size of the sample reflects our main aim of testing this methodology as a means for collecting qualitative data on perceptions of pro-environmental behaviours and issues. Additionally, the multiple sorting procedure is tolerant of small sample sizes; 6 people is enough to gain some insight (Barnett, 2004).
basis of this similarity judgement was left up to the participants. Participants were asked to describe and give reasons for why they had chosen their different categories. Participants also completed a number of semi-structured and structured sorts, whereby they were invited to sort the cards on a particular basis or into particular categories specified by the researcher. This allowed us to build up a rich picture of the different kinds of links participants perceived between the behaviours.

Results
Data collected in the interviews was analysed using multidimensional scalogram analysis, which produces visual representations of the patterns emerging from the sorts of the whole group.

Free sorts
The results of the free sorts are shown in section 2.3.1 of this report. Further results are shown below.

Semi structured sorts
In order to build up a detailed, multidimensional understanding of the reasons why people perceived particular relationships between the different behaviours, participants were invited to think about other people (not themselves) and the reasons why others might not do the behaviours on the cards. The categories – that is, the reasons why people might not do these things – are shown on the plot in figure 7.
There seems to be movement across this plot from “good reasons” not to do the behaviours on the left, comprising things like cost and lack of a garden, to “no good reason” not to do them on the right. The largest cluster of reasons attributed to ‘other people’ for not participating in these behaviours consists of reasons like “laziness”, “inertia” and “people just don’t think about it.”

“It’s just plain idleness.”
(Male, 65+, C2DE)

“People don’t think when they’re shopping. They just do the quickest thing.”
(Female, 26-35, C2DE)

As well as free and semi-structured sorts, participants also conducted some structured sorts, whereby they were invited to sort the cards into categories defined by the interviewer. One such structured sort involved participants sorting the behaviours into those they did “earlier” and “later”. The aim of this sort was to explore possible patterns between old, established behaviours and newer, more recent behaviours. Participants were also asked if there were any links between their earlier and later behaviours.

The results show that the green group were self-reported early adopters of behaviours such as ‘avoid single use carrier bags', ‘buy organic vegetables', ‘switch
TV and mobile phone charger off at the plug’ and ‘buy eco-friendly cleaning and laundry products.’ Interestingly, the non-greens reported using energy efficient light bulbs earlier, and ‘waste less food’ seems to have been taken up early by both groups. Overall, the results indicate, unsurprisingly, that the green group performed more pro-environmental behaviours – the average category size of actions they did ‘always’ or ‘sometimes’ was 19.33, compared to 11.00 for the non-greens. The results also show that the green group reported taking up more of these behaviours at an earlier time than the non-greens.

**Specific domain: waste behaviours**

As well as the sorts on the set of general behaviours, 8 participants also completed free sorts on a set of more specific waste behaviours. The results are shown below:

![Figure 8 - Waste behaviours: free sorts (behaviour type, outlier deleted)](image)

Overall, we can see that the plot of free sorts for waste behaviours shows a relatively diffuse distribution of points. The plot is clearly divided into two sections, with the behaviours that ‘go together’ because they are to do with waste (bottom region of the plot), and the ‘others’ that were perceived not to fit in at the top. Other than this, some clusters do emerge, notably the food behaviours and perhaps actions around packaging. However, in general, there were no particularly
strong differentiations made between the waste groups than they did with the more general behaviours.
Appendix 2: Overview of the exploratory cluster analysis

Throughout this research, we have seen that an important indicator of relationships (catalyst or otherwise) between pro-environmental behaviours is the behaviours’ tendency to co-occur. The pilot fieldwork exercise investigated the links between the behaviours that exist at a cognitive level among different individuals. As a supplementary exercise, an exploratory cluster analysis was performed\(^1\) on data derived from the Defra pro-environmental attitudes and behaviours survey (n=3, 618) (BMRB, 2007)\(^2\). The aim of this exercise was to investigate the co-occurrence of pro-environmental behaviours across a larger, representative sample of the British public.

**Method**

Questions relating to pro-environmental behaviour (rather than attitudes) were selected from the survey. We first analysed the responses of the entire sample. The survey questions are organised into domains such as ‘energy’ and ‘transport’; however, this first analysis included all questions on all behaviours so was unconstrained by pre-identified domains. This allowed us to explore any ‘cross-domain’ clusters.

We next analysed behaviours by ‘domains’, which corresponded to sections of the survey – for example, energy behaviours, transport behaviours, and purchasing behaviours. This highlighted clusters of behaviours within specific, pre-identified domains. Finally, we repeated the specific domain/question analyses for each of the seven Defra segments. The aim of this was to investigate different patterns of co-occurrence among people with different attitudes towards the environment.

The tree diagrams (dendograms) below are a visual representation of the cluster analysis. Behaviours linked by short branches form clusters of similar behaviours, whereas longer branches indicate that the behaviours are less similar (further away from) to each other. The number of branch connections represents the directness of the path or relationship between the behaviours.\(^3\) Figure 9 overleaf shows the tree diagram representing the cluster analysis of all behaviours for the entire sample.

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\(^1\) Cluster analysis performed on behalf of Brook Lyndhurst by Mohammad Ali, Environmental Statistics and Indicators, Defra.


\(^3\) It is important to note that this analysis was designed with the specific purpose of adding another dimension to our investigation of co-occurrence and relationships among behaviours. In order to use this analysis for other purposes or to explore specific questions, re-specification of the data, further analysis and quality assurance would be required.
Compost bin/heap
Use recycling/bottle bank
Buy from local producers
Don’t let food go off
Check where fruit veg from
Buy other
Buy eco-friendly products
Solar energy
Solar water
Wind turbine
Buy LEAF
Carbon offsetting
Avoid flying
Vegetable box delivered
Ethical grocery shopping
Green energy tariff
Vegetarian/vegan
Volunteer
Buy freedom food
But Red Tractor
Buy none*
Use public transport
Install insulation
Buy sustainable fish
Buy sustainable timber
Walk or cycle
Use energy saving bulbs
Install a water meter
Farmers market
Avoid packaging
Buy free range poultry
Buy organic
Take fewer flights
Use a fuel efficient car
High level recycling
Install a condensing boiler
Use car less
Install double glazing
Small independent shops
Shower not bath
Buy recycled paper
Buy recycled kitchen roll
Buy none*
Buy fair trade
Take own shopping bags
Avoid buying from unethical companies
Buy second hand goods
Cut down gas and electricity usage
Cut down water usage
Pay attention to water usage
Use car
Donate to charity or family/friends
Turn off lights
Recycle more instead of throwing away
Waste less food
Buy free range eggs
Turn off tap when brushing teeth
Turn TV off standby
Unplug phone charger
Don’t allow food to go off
Buy energy efficient kitchen appliances
Don’t overfill kettle
Turn off heating if out
Reuse empty bottles etc
Clothes not heating
Hot water tank insulation

* 'Buy none' variables included as possible responses to two separate purchasing questions
The analysis of all 66 selected behaviour variables is shown in figure 9\textsuperscript{14}. The overall picture provided by the dendogram is that there are very few clear clusters of similar behaviours. The diagram shows that there were relatively large distances between behaviours and clusters, indicating that in general, the behaviours in the survey are not ‘alike’ in terms of being performed consistently.

The clearest clusters are found amongst the least common pro-environmental behaviours, such as ‘install domestic microgeneration’, ‘participate in carbon offsetting schemes’ and various ethical purchasing behaviours. However, the data show that these clusters do not represent positive co-occurrence: these behaviours have formed tight clusters as a result of their not being performed by most people. The small distances between these behaviours are in fact indicative of a strong similarity between them on the grounds of their infrequency. Examination of the data reveals that other strong clusters, such as behaviours 20-25, have been formed on the same basis: their ‘similarity’ lies in their non-occurrence rather than in their co-occurrence.

**Specific behaviours**

Analysis was also performed on specific questions from the survey, which correspond to pre-defined behavioural domains. It is important to note that these domains were built into the survey design based on the professional judgement of environmental professionals, and may not correspond to ‘natural’ domains of behavioural co-occurrence. Below are three examples.\textsuperscript{15}

**Household behaviours (survey question C25)**

Within the separate household behaviour dendogram (Figure 10) we identified two clusters of interest: behaviours 1 and 2 (and 3); and behaviours 6 – 8.

\textsuperscript{14} Note that the behaviours are numbered for ease of reference only: these codes are not meaningful and the same behaviour may be numbered differently in different diagrams.

\textsuperscript{15} The way in which the survey was designed and the cluster analysis specified meant that certain examples of the domain specific analysis emerged as more suitable for analysis. The three examples in this section were chosen because they contained enough behaviours to be analytically interesting (some questions contained only two or three behaviours) and because the responses to the component questions were most suitable to be analysed together. Alternative domains could be analysed by combining different survey questions in different ways; this analysis represents only one of many possible specifications of the data.
Figure 10 Dendogram of environmental household behaviours (survey question C25)

The clearest cluster contains ‘having a shower rather than a bath’ and ‘avoiding food with excess packaging’, which also links relatively closely to ‘take own shopping bags.’ The data show that the first two behaviours received relatively small numbers of positive responses: again their similarity seems to lie in their non-occurrence. The behaviour to which this cluster of non-occurrence relates, ‘take own shopping bags’, received a higher positive response rate.

The other noticeable coherent sub cluster - behaviours 6-8 - includes turning off lights, TVs and mobile phone chargers. A large number of positive responses and proximity along the x axis suggest that these behaviours do co-occur in a relatively large number of people.

Taking the dendogram as a whole, there are two main subsets of behaviours, from 1-5 and 6-12. Although these clusters do not reflect strong associations between the individual behaviours (the distance between most behaviours on the x-axis is large), it is interesting to note that the two subsets are clearly separated from each other. Reflecting on Tucker and Douglas (2006) and Barr (2005), the top cluster suggests a relationship between waste prevention behaviours, with ‘deciding not to buy something because you feel it has too much packaging’, ‘re-using things like empty bottles, tubs or jars, envelopes or paper’ and ‘taking your own shopping bag’ grouping together.

Energy and water efficiency (survey section C)

This dendogram shows that ‘hot water tank insulation’ is at a large distance from all the other energy behaviours. The data shows that a large number of people reported having hot water tank insulation but doing no other energy saving behaviours. The data show that the second most common response pattern to this question was doing none of the energy saving behaviours included in the survey. The smallest number of positive responses related to the microgeneration and green tariff behaviours – again, the cluster from behaviours 1-4 represents a strong pattern on non-occurrence. There also appears to be some association
(albeit weak, as indicated by the relatively large x-axis distances between them) between behaviours 6 – 9 (using energy saving bulbs, having a water meter, having a condensing boiler and double glazing).

Overall, the dendogram of energy behaviours shows the strongest associations between behaviours that are not performed by large numbers of people and demonstrates generally low uptake of individual or groups of behaviours, with the exception of insulating hot water tanks, which many people reported doing.

**Figure 11** Dendogram of energy and water efficiency measures (entire sample)

![Dendogram of energy and water efficiency measures (entire sample)](image)

**Purchasing (survey questions F5 and F6)**

**Figure 12** Dendogram of purchasing behaviours (entire sample; questions F5 and F6)

![Dendogram of purchasing behaviours (entire sample; questions F5 and F6)](image)

*All responses analysed, including negative 'buy none' and unspecified 'buy other'.

The purchasing behaviours seem to form one undifferentiated group, undivided by clear, separate sub clusters. However, some members of the group are more closely related than others. There appear to be close connections between buying Freedom Food, Linking Environment and Farming (LEAF) products, Red Tractor, and sustainable fish products.
Examination of the data reveals that, again, the basis of this similarity is their rarity. The data show that ‘buy fair trade’ and ‘buy free range eggs’ both received relatively large numbers of positive responses but were not strongly associated with each other or with any other purchasing behaviours.

**Differences between Defra segments**

Cluster analysis was also performed in the different behavioural domains for each of the Defra segments. See section 2.3.2 of this report for results and discussion.
Appendix 3: Outline suggestions for further research and development

The table below contains a number of outline suggestions for further research and development stemming from this research. The aim of all the suggestions below is to strengthen, test and verify the evidence in support of how the spillover process works and how it could be optimised among different audiences. The table contains a mixture of theoretical and action based research ideas, since there is little of either type of evidence. All the suggestions would have the potential to inform policy and communications by clarifying whether and how the idea of spillover can be built into existing and future campaigns.

### Table 6 Outline suggestions for further research and development

<table>
<thead>
<tr>
<th>Area for further research</th>
<th>Description</th>
<th>Aim or objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple sorting procedure</td>
<td>Multiple sorting procedure with a larger, fully representative sample of participants. Multiple sorting procedure based on the Defra segments.</td>
<td>To build on the findings of the pilot exercise; to extend and validate findings. To build on the findings of the pilot exercise and explore differences between people with different behaviour and attitude patterns in more detail.</td>
</tr>
<tr>
<td></td>
<td>Multiple sorting procedure based on a wider set of behaviours.</td>
<td>To identify how pro-environmental behaviours are categorised in the context of a wider universe that includes other, day to day ‘non-environmental’ behaviours and habits.</td>
</tr>
<tr>
<td></td>
<td>Combinations of the above; e.g. multiple sorting procedure based on a wider set of behaviours with the Defra segments.</td>
<td>To explore how different groups of people understand, perceive and categorise the pro-environmental behaviours in the context of a set of wider behaviours.</td>
</tr>
<tr>
<td>Cluster analysis on Defra/BMRB survey data</td>
<td>Re-run the same cluster analysis on the 2009 data.</td>
<td>To identify changes in behavioural patterns over the course of a year.</td>
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<td></td>
<td>Re-specify the cluster analysis based on the ‘domains’ identified by further multiple sorting procedure work. Re-specify the cluster analysis based on different combinations of the variables; for example, combine different behaviours from different questions.</td>
<td>To identify behavioural patterns within the domains identified by participants. To identify the most common patterns of co-occurrence across previously unstudied ‘domains’ by creating different domains by combining different behaviours from different questions.</td>
</tr>
<tr>
<td>Other work with the</td>
<td>Scoping study to identify the potential for structural equation</td>
<td>To apply some of the techniques found in the literature (e.g.</td>
</tr>
<tr>
<td>Defra/BMRB data</td>
<td>modelling techniques to be employed with the data set; could include a single year’s data or various years.</td>
<td>Thogersen, 1999) to representative UK data.</td>
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<td>Longitudinal qualitative work to accompany tracker survey.</td>
<td>To gauge how constructs, attitudes, motivations, barriers and so on change over time, and to link this to the patterns identified within the tracker survey.</td>
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<tr>
<td></td>
<td></td>
<td>To track patterns of adoption for individuals that can support cross sectional quantitative analysis of representative samples.</td>
</tr>
<tr>
<td>Ethnographic approaches</td>
<td>‘Life story’ or narrative approaches to explore the experiences of early adopters of pro-environmental behaviours. See the work of Sarah Harder, University of York, for an example of good practice.</td>
<td>To better understand the internal and external conditions that have enabled ‘journeys’ through pro-environmental behaviours.</td>
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<td></td>
<td>Interventions designed to make pro-environmental links or common goals more salient.</td>
<td>To test whether this provides a basis for behaviour change via consistency theories. Interventions should involve baselining; evaluation over a period of time; and testing against a control group.</td>
</tr>
<tr>
<td>Action research based on the principles of the theories of spillover</td>
<td>Interventions based on the principles of learning by doing and self efficacy, at either the individual or group level. Research to test the effects of different behaviours on the self perception of different groups; and the outcomes of these changes in self perception in other areas.</td>
<td>To explore the subjective effects and the objective outcomes of learning by doing approaches.</td>
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<td></td>
<td>Interventions to test the foot in the door approach. Could be based on the behavioural categories identified through further multiple sorting procedures. This could also incorporate a test of the timescales required for this type of process. Interventions to test the relative values of ‘co-marketing’ different sets of behaviours for different audiences. Could draw on multiple sorting procedure work with the segments.</td>
<td>To develop evidence about whether this approach is effective; to identify the ‘sets’ of pro-environmental behaviours that are most conducive to this approach. These sets could include behaviours that are not pro-environmental.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To identify the most successful ‘sets’ of pro-environmental behaviours. These sets could include behaviours that are not pro-environmental.</td>
</tr>
<tr>
<td>Existing or future projects</td>
<td>All action research projects to have an evaluation component to capture spillover effects.</td>
<td>To strengthen the action research evidence base and identify good practice.</td>
</tr>
</tbody>
</table>
Appendix 4: Bibliography

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