

Exploring Catalyst Behaviours

Executive Summary

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

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1 Exploring catalyst behaviours

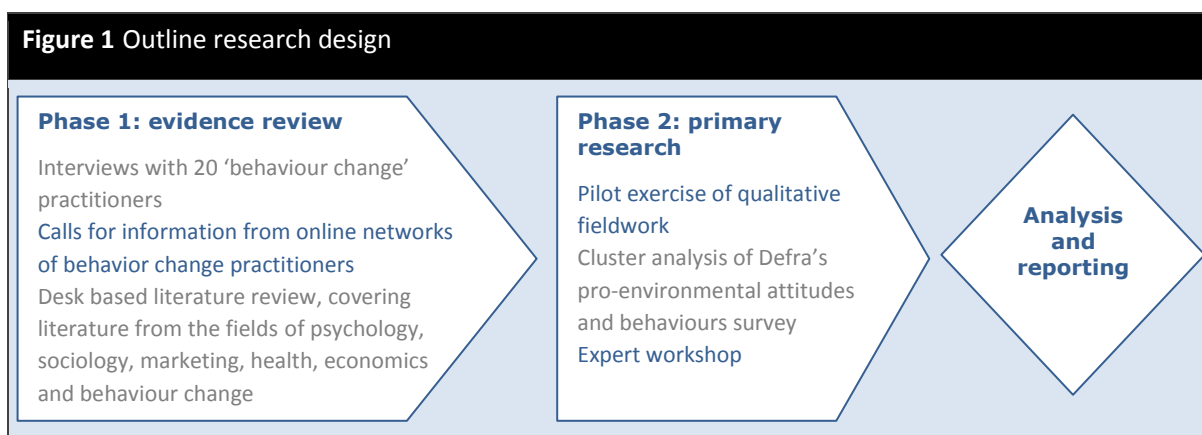
The ‘Exploring catalyst behaviours’ project, commissioned as part of Defra’s ongoing programme of research into pro-environmental behaviours, explores the idea that participation in certain pro-environmental behaviours may have a knock-on effect and cause wider behaviour change.

The idea of catalyst behaviours relies on the existence of structural, causal relationships between different behaviours – that participating in a behaviour (such as recycling) might cause an individual to then take up other behaviours (such as introducing energy efficiency measures at home). If this relationship between actions could be shown to exist, there would be important implications for initiatives designed to increase participation in pro-environmental behaviours, since identifying the right ‘catalyst’ behaviours could result in a ‘multiplier effect’ or ‘behavioural chain reaction’.

Despite the intuitive appeal of the catalyst behaviour hypothesis, this project was commissioned in recognition of major gaps and uncertainties in the evidence around catalyst behaviours. The project was structured around the following research questions:

- (i) Is there plausible evidence that catalyst based behaviour change occurs?
- (ii) If it does occur, how does the process or mechanism work (including psychological and sociological factors)? What types of mechanisms or factors (if any) mediate the relationships between behaviours?
- (iii) Do catalyst effects occur generally, or do they occur only for specific behaviours or sets of behaviours; specific groups of people; under specific conditions?
- (iv) If the process occurs, how can it be stimulated?

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 (Figure 1 summarises the research design). This Executive Summary outlines key findings; further details may be found in the Summary and Full Report.



The research evidence outlined 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 Executive Summary, as well as the Summary and Full Reports, should be read in the light of these limitations.

Section 2 of this summary provides an overview of the literature review; section 3 sets out the topline findings from the primary research; and section 4 contains a summary of conclusions and key implications for policy and practice.

2 Findings of the evidence review

The aim of Phase 1 of the project was to bring together the existing evidence around the theme of catalyst behaviours.

Evidence from practitioners

The first stage of the evidence review involved 20 interviews with practitioners of environmental behaviour change and a review of project evaluations, with the aim of collecting data and practical insight about pro-environmental behavioural spillover from individuals working in the field. To supplement this evidence, calls for information were sent out in two online networks of practitioners.¹

Many practitioners provided anecdotal evidence in support of the idea of 'behavioural spillover'. However, rather than focusing on specific 'trigger' behaviours, most interviewees took a very broad view of the catalyst (or 'spillover') process and referred to behaviour change being catalysed by information, knowledge, 'awareness' or social context. In other words, practitioners' understanding of the spillover process was based on a general sense that certain events, situations or conditions can result in the uptake of multiple behaviours, rather than there being a causal relationship between specific behaviours.

A number of different types of 'catalyst effect' emerged from the interviews and review of practitioner evidence, including:

- **Participation in a new behaviour catalyses further behaviours:** for example, National Energy Action (2008) found that performing energy and water saving behaviours were associated with increased pro-environmental purchasing decisions and waste management.
- **New behaviours 'spin off' from existing behaviours:** Tucker and Douglas (2007) found that increases in waste prevention activities (for example, avoiding packaging) were often described as simply "the next natural step", suggesting that existing behaviours may provide a 'platform' for the adoption of new behaviours.

¹ These were: Fostering sustainable development: community based social marketing listserve (<http://www.cbsm.com/public/world.lasso>) - an international information sharing network of more than 6,200 people; and the Food Climate Research Network mailing list, which goes out to over 1,000 people.

- **Feedback spillover:** Various projects demonstrated 'reverse' spillover, whereby the introduction of a behaviour (e.g. recycling food waste) had positive effects on participation in an existing, related behaviour (e.g. dry recycling) (e.g. Tucker and Spiers, 2002; Thomas, 2004; ERM, 2007).
- **Situational spillover:** for example, recycling and energy saving behaviours being carried over from school to home life (e.g. National Trust in Cox et al, 2009).
- **Negative spillover:** Participation in a particular behaviour may block future pro-environmental behaviours or trigger environmentally harmful behaviours. For example, some research and anecdotal evidence suggests that recycling may 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).

Even within this broader definition of catalyst based behaviour change, however, there was little concrete evidence available to support the widespread belief that catalyst effects do occur. Most evidence was anecdotal and very few projects had incorporated robust measurement techniques into their methodologies.

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 two different ways. It is possible that:

- methodological difficulties may 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 challenging; or
- the widespread belief in catalyst behaviours may constitute an attribution error: behaviour change and/or correlations (or 'co-occurring behaviours') are observed and post-rationalised as resulting from catalytic effects *between* behaviours, whereas in reality, some other, underlying causal factor constitutes a common cause of the observed behaviours.

In the absence of experimental research evidence and robust project/campaign evaluation data, it is difficult to evaluate which of these two possibilities lies at the root of the formal evidence gap around spillover. Further research and formal testing would be required to establish whether the anecdotal evidence about the appearance of spillover is valid.

We next turned to the academic and grey literature to investigate whether there was any formal support for the ideas around behavioural spillover that had emerged from the practitioner evidence. Although not a formal systematic review, the search and review strategy was based on a set of carefully designed criteria; these are outlined below, and more details may be found in the full report (see appendix 2).

Literature review

Wider literature

The review of academic and grey literature included a search for evidence of spillover and catalyst behaviours in the disciplines of psychology, sociology, economics, health and marketing (commercial and social). Key word searches were conducted in academic databases, including Web of Science, PsychInfo and Econlit, followed by more general web searches for grey literature. The methodological

robustness of the reviewed research was considered and discussed as part of the review (see section 2 of the full report).

Examples of spillover in the wider sense were identified in all of the disciplinary areas covered. Examples include:

- experimental research from the field of psychology, in which attitudes such as optimism and pessimism induced in one situation were demonstrated to have measurable behavioural effects in different, unrelated situations (Dickinson and Oxoby, 2007);
- marketing research that shows how brand alliances and brand extensions can 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).

A small number of examples of spillover triggered by specific actions were also uncovered, primarily in the health literature:

- there is some evidence that participating in exercise can be a catalyst for a healthier lifestyle among cardiac rehabilitation patients (Ross and Thow, 1997);
- it has been proposed that the act of taking soft 'gateway drugs' may cause some people to move on to harder drug abuse.

It is important to note that this latter example of possible causal effects between different behaviours has been shown to be an instance of the attribution error outlined above - correlation (or co-occurrence) has been shown to be mistaken for causation. Although soft and hard drug taking are frequently observed to co-occur, the 'gateway drug' theory has been widely discredited; the evidence shows that, in general, both types of drug taking behaviour ('soft' and 'hard') are *outcomes* of common underlying variables, rather than hard drug taking being significantly causally linked to previous soft drug taking. The evidence suggests that some gateway effects may exist for some people, but these are generally so context specific that it is difficult to untangle them from wider contextual factors.

Pro-environmental behaviours literature

Turning to the pro-environmental behaviour change literature, the evidence review showed that 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.

A small body of academic research sets out specifically to test hypotheses related to the question of pro-environmental behavioural spillover (Thøgersen, 2004; 1999; Thøgersen and Ölander, 2003; 2006; Kaiser and Wilson, 2004; Kaiser, Byrka and Hartig, 2008; Byrka, Kaiser and Hubner, forthcoming). This research is mainly based on survey data, with correlations between behaviours analysed using statistical tools designed to isolate the direct causal effects of earlier behaviours on later behaviours (and thereby reduce the possibility of the attribution error described above).

Thøgersen and colleagues' experimental research demonstrates the existence of some spillover effects between pro-environmental behaviours, although these effects are mainly weak and do not occur in all possible instances (Thøgersen and Ölander, 2003). They also find some negative effects, whereby participation in some behaviours (for example, recycling) is negatively correlated with participation in other behaviours (for example, waste prevention behaviours).

Other work (for example Bryka, Kaiser and Hubner, forthcoming) suggests that the wider context in which spillover is observed may be at least as, if not more, important than the relationships between the behaviours themselves.

In addition to the research specifically designed to test hypotheses relating to spillover, a number of authors 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 studies 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 suggested that spillover research is particularly prone to a false negative result due to measurement error and methodological difficulties stemming from the number of complex factors involved (Thøgersen, 2004; Byrka et al, forthcoming). 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 due to an attribution error.

Mechanisms of spillover

The direct evidence is limited and ambiguous, and reasonable alternative explanations for behavioural correlations often exist. However, the wider literature provides some theoretical support for the plausibility of behavioural spillover by setting out a number of social psychological mechanisms and theories that may help explain how one behaviour can lead on to another or others (although it is important to note that most of these have not been tested in relation to spillover effects).

Table 1 Some possible mechanisms of behavioural spillover		
Mechanism	Description	Theoretical underpinning
Desire for consistency in behaviour patterns and attitudes, perhaps relating to common goals	Adopting a new attitude or behaviour (e.g. trying to use the car less) may conflict with other attitudes and behaviours (e.g. going on holiday by plane), leading to changes in behaviour to reduce the tension.	Cognitive dissonance theory (Festinger, 1957) Balance theory (Heider, 1946) Foot in the door (Freedman and Fraser, 1966)
Altered self identity	Perceiving oneself as e.g. a 'green' person and acting accordingly. "If I'm willing to recycle and switch my appliances off standby, I must have a pro-environmental attitude."	Self perception theory (Bem, 1972)
Altered self efficacy	Increased belief in one's ability to succeed in an action ("If I can do A, maybe I could also do B").	Self efficacy theory (Bandura, 1977)
Altered personal (moral) norms	Increased sense of responsibility to avoid negative consequences for others may provide a platform for behaviour change.	Norm activation theory (Schwartz, 1977)
Altered attitude	If attitude is a determinant of behavioural choice, then a change in 'general attitude' (Bamberg 2003) may affect a number of behaviours.	Theory of planned behaviour (Ajzen, 1985) Transtheoretical model (Velicer et al, 1998)
Increased skills and knowledge	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.	Discussed in e.g. Thøgersen (1999)

This evidence suggests that ‘catalyst effects’ may be explained by a number of different social-psychological mechanisms. This in turn suggests that, as is the case with other types of behaviour change, the processes of catalyst based change are likely to vary across different groups of people with different values, motivations and barriers; different sets of behaviours; and different social contexts.

In summary, the evidence base may be characterised as providing little direct evidence, but some anecdotal and circumstantial evidence, in support of the idea of spillover between pro-environmental behaviours. Piecing together the evidence that exists, it seems reasonable to surmise that participation in a behaviour is rarely sufficient, in and of itself, to catalyse further behaviour change: the internal (psychological), external (social) and situational conditions – often thought of as ‘contextual noise’ – are often necessary factors in explaining spillover effects. We uncovered almost no formal evidence relating to many of our specific research questions – for example, the timescale required for catalytic effects to occur; or which behaviours might be most likely to trigger spillover effects among different groups.

3 Findings of the primary research

Given that one of the roots of the catalyst behaviours hypothesis is the observation of co-occurring pro-environmental behaviours, the primary research was designed to explore *which* pro-environmental behaviours co-occur and *why* these patterns arise. This phase of research consisted of a pilot exercise based on the multiple sorting procedure, and a cluster analysis of Defra’s Pro-environmental attitudes and behaviours survey (n=3,618; BMRB, 2007). The pilot qualitative work was designed to explore the conceptual associations people draw among different behaviours, and the cluster analysis was a cross-sectional exploration of which behaviours tend to co-occur in practice. It is important to note that neither of these types of evidence is sufficient to show causal connections between behaviours; however, together, the findings provide a foundation for understanding the nature of the relationships between pro-environmental behaviours, both at the conceptual and practical levels.

Pilot multiple sorting procedure

Thøgersen (1999; 2004) suggests that the strongest correlations are found between behaviours that are most ‘conceptually similar’ – in other words, perceived to be linked or associated with one another. Correspondingly, some studies conclude that spillover is greatest between behaviours that belong to the same ‘domain’ – for example, ‘waste’ or ‘energy’ behaviours (e.g. Barr, 2005; Thøgersen, 1999; Tucker and Douglas, 2008). The overarching aim of the pilot exercise was to explore the relationships and links that people perceive to exist 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.

To deepen our understanding of how people conceptualise pro-environmental behaviours and the relationships between them, we used the multiple sorting procedure (MSP), a qualitative methodology rooted in psychological theory. The multiple sorting procedure requires participants to 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 pilot exercise was run with a street sample of 18 participants, recruited on the basis of a range of ages, genders, socio-economic groups and environmental attitudes and behaviours. The pilot qualitative research was designed as a preliminary step toward understanding the conceptual frameworks within which pro-environmental behaviours are located and to test the application of the MSP for investigating pro-environmental behaviours. Use of a small convenience sample limits the generalisability of the results, and further research would be required to further substantiate this part of the research.

Table 2 Summary of the findings of the primary research
Pilot multiple sorting procedure
The ways in which participants categorised behaviours could be described as ‘impromptu’ or ‘ad hoc’, rather than based on well established, pre-constructed categorisations. The greenest participants perceived stronger associations between the pro-environmental behaviours than ‘non-greens’.
Participants generally did not categorise behaviours simply as, for example, “environment” or “food” type behaviours: categories were multifaceted, highly personal, contextual and influenced by different concepts and ideas that were salient in their own lives (for example, <i>‘things I do to save money and because of the thought of fire and not wasting electricity’</i>). ‘Environment’ was not a central part of most participants’ day to day conceptual systems, and when it was mentioned, it was frequently used in conjunction with other, non-environmental constructs such as “saving money.”
In general, energy related actions were perceived most strongly as pro-environmental

The results of the pilot exercise suggest that participants’ classification systems were complex and multifaceted, and did not always incorporate environmental constructs. In fact, many of the behaviours that experts think of as ‘pro-environmental’ (e.g. waste, water etc) may be described and grouped in different ways by participants (e.g. ‘things I do every day’, ‘things to do with the garden’ etc.). The absence of ‘environment’ as a common denominator or link between behaviours reduces the opportunity to co-promote behaviours on the basis that they are ‘environmental’. Spillover may indeed occur, but in the absence of a similarity relationship of ‘pro-environmental’, that spillover may be along any of the other ‘similarities’ that link those behaviours.

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 very personal, contextual reasons for their behaviours. These highly specific and personal reasons suggest that even if the behaviours were all perceived to belong to a coherent set of pro-environmental action, 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.

Cluster analysis

An exploratory cluster analysis was performed² on data derived from the Defra pro-environmental attitudes and behaviours survey (n=3,618) (BMRB, 2007).

² Cluster analysis performed on behalf of Brook Lyndhurst by Mohammad Ali, Environmental Statistics and Indicators, Defra.

Table 3 Summary of the findings of the primary research

Exploratory cluster analysis

The analysis revealed few coherent clusters of co-occurring behaviours. This suggests that, in general, pro-environmental behaviours were not performed consistently among the majority of the sample. The analysis showed that most pro-environmental behaviours had relatively low uptake.

Analysing the behaviours by Defra segment revealed some differences between the responses of these groups. The Positive Greens reported performing energy and water efficiency behaviours in the home more consistently than the other segments. Other qualitative differences can be seen between different segments; a striking example of this is the clear distinction amongst Waste Watchers between waste behaviours and other behaviours.

It is important to highlight that it is not possible to formally test hypotheses about causal relationships using cross-sectional data of this type; further research using longitudinal data, if this type of data becomes available, is required. However, the aim of this exploratory cluster analysis was to investigate the co-occurrence of pro-environmental behaviours among a representative sample of the public, in order to provide another dimension of analysis to our study of the relationships between different pro-environmental behaviours.

Since co-occurrence of behaviours points to the possibility of an underlying causal relationship between the behaviours that are observed to co-occur, we hoped to identify the strongest patterns of correlation as a starting point for further study of the relationships between those behaviours.

However, the most striking indication of the analysis was that most of the behaviours included in the survey did *not* co-occur among most individuals. Although methodological limitations may be partly responsible for this result (for example, the structure of the survey questions and the configuration of ‘domains’ specified for analysis – see the full report for a discussion), the overall lack of co-occurrence suggests that if pro-environmental behavioural spillover can, in theory, occur, it has not occurred to any significant extent between these behaviours.

4 Conclusions and implications

Summary of conclusions

One of the most striking observations to emerge from the evidence review and interviews with practitioners is the gap between the widespread belief that catalyst behaviour processes do exist and the formal evidence available in support of this. 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, the evidence review shows that the catalyst behaviours hypothesis is not supported by a coherent, robust evidence base. There is, however, a reasonable amount of anecdotal evidence, as well as a small body of more robust 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 the simple equation of

$$\text{action } a \rightarrow \text{actions } b + c$$

is not a realistic basis for understanding behaviour change. However, a wider conceptualisation of spillover, which includes the wider behavioural context of internal psychological and external social and circumstantial conditions, may provide a firmer and more realistic foundation. It is telling that 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 outcomes. Moreover, spillover effects are often suppressed by idiosyncratic, 'real life' variables, both in terms of actual behavioural outcomes and in the measurement of those behavioural outcomes.

The primary research conducted during the project sheds new light on the issue of pro-environmental behavioural spillover. Firstly, the pilot exercise suggests that 'environment' is not a central or well-established part of most people's day to day conceptual frameworks. Individuals' classification systems in this area are highly personally and contextually specific, and include 'environment' as only one of many considerations, if at all. Secondly, the exploratory cluster analysis suggests that consistent patterns of co-occurrence among pro-environmental behaviours are, on the whole, rare. The strongest conceptual associations, as well as the clearest patterns of co-occurrence, were found among the most environmentally engaged research participants.

The observation that 'environment' was not frequently used as a basis of 'similarity' between the behaviours has implications for the process of spillover. Many of the possible mechanisms of spillover identified in the literature are based on similarity relationships between behaviours: the absence of these similarity relationships reduces the likelihood of spillover occurring.

The finding that 'environment' is not a dominant construct in most people's conceptual frameworks may link to the finding of the cluster analysis that patterns of co-occurrence among the pro-environmental behaviours are rare. A corollary of this, which is supported by both the literature and our own findings, is that spillover effects are likely to occur more – and be stronger – among those for whom 'environment' is a salient and important concept, and who perceive the strongest environmental associations between different behaviours. We could speculate that the direction of causality here goes in both directions – that strong associations lead to higher levels of co-occurrence, which in turn leads to stronger associations, and so on.

Overall, the sum of the evidence suggests the following hypothesis: spillover can and does occur and is sometimes 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 spillover 'journey', or 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. 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' is not a core or established construct used in every day decision making, may help to explain why spillover is so difficult to predict, observe and measure.

Implications for policy and communications

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.

The sum of the evidence, including the new findings emerging from this project, suggests that the idea of catalyst behaviours is complex and many uncertainties remain. In the absence of clear evidence about how the spillover process works in the context of different behaviours, different people and different social groups, there is a material risk of the process leading to sub-optimal, or even negative, results. These risks are highlighted by the negative spillover uncovered in the academic evidence, and anecdotal evidence which suggests that encouraging participation in certain behaviours may, for some people, either block the adoption of future behaviours or even trigger the adoption of harmful behaviours. In consequence, the idea is unlikely, as a stand-alone concept, to provide an operationally sound platform for policy or interventions.

That said, the evidence does not rule out the possibility that, for some audiences under certain conditions, the uptake of multiple behaviours may sometimes be partially triggered by participation in certain actions (although this is rarely the full story). There may be scope, therefore, to *enhance the likelihood* of spillover occurring within the context of interventions or campaigns that do not necessarily have the idea of spillover at their core. 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.

Following on from this, a number of general considerations for policy and practice emerge from the evidence brought together in this study. All of these considerations could be useful additions to policy and communications campaigns and, under the right conditions, could help to increase the probability of pro-environmental behavioural spillover.

Highlighting the pro-environmental links between behaviours and cueing common goals: perceptions of similarity are crucial for many of the spillover processes identified during the evidence review.

Cueing existing behaviour as pro-environmental: this could potentially 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: the values held by the audience are a crucial independent variable in spillover processes; for example, feelings of discomfort caused by holding inconsistent attitudes and behaviours is likely to be stronger among those with stronger pro-environmental values.

Removal of external barriers: spillover effects may be suppressed by external conditions (for example, the cost of performing a behaviour), and removal of external barriers common to several behaviours could function as a trigger for change.

Being alert to risks of negative spillover: spillover can 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 risk for any campaign designed around 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: the messenger must be perceived to have the right skills and knowledge on the subject matter to effectively deliver a campaign.

Influencing the general social context and social norms on the environment: Positive enabling conditions at the level of social norms and attitudes are an important determinant of spillover, whether 'natural' or intervention led.

In summary, the available evidence does not support the idea of simple causal relationships between behaviours: performance of a behaviour is rarely sufficient to cause further behaviour change. The evidence does suggest that a number of processes may, under certain conditions and for certain audiences, provide partial explanation for knock on effects from one behaviour to other (positive or negative) behaviours. However, further research is needed to explore in more detail the dynamics between the different social-psychological mechanisms of behaviour change, different audiences with varying sets of values and attitudes and different patterns of behaviour. Two types of work could strengthen the evidence base in these areas: (1) monitoring and evaluation aimed at capturing data on spillover could be built into current and future behaviour change projects; and (2) further research, both action-based and theoretical, could explore in more depth some of the ideas outlined in this report.

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