Climate-relevant behavioural spillover: A review of the literature

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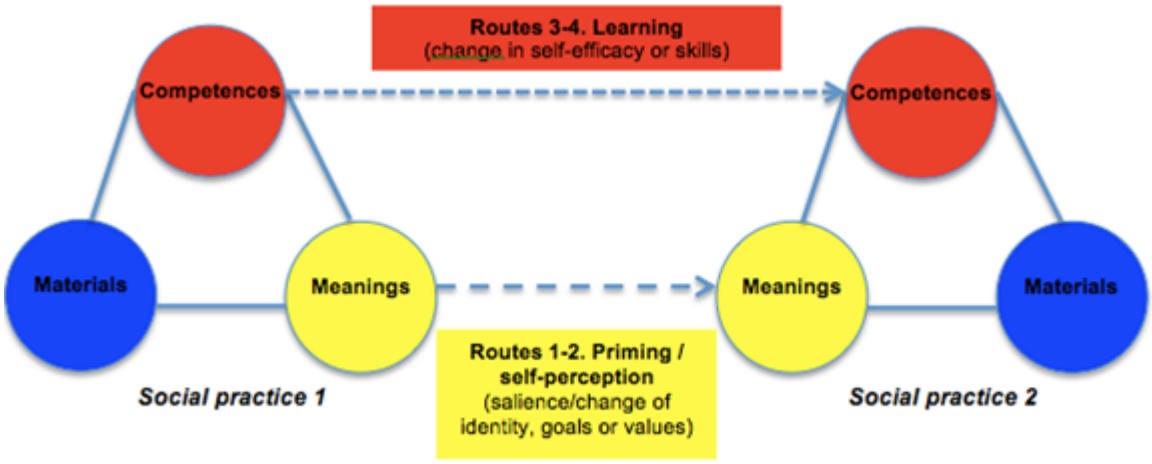
Abstract

Urgent and radical transition to lower-carbon forms of society is imperative to limit current and future climate change impacts. Behavioural spillover theory offers a way to catalyse broad lifestyle change from one behaviour to another in ways that generate greater impacts than piecemeal interventions. Despite growing policy and research attention, the evidence for behavioural spillover and the processes driving the phenomenon are unclear. The literature is split between studies that provide evidence for *positive* spillover effects (where an intervention targeting an environmentally-conscious behaviour leads to an increase in another functionally related behaviour) and *negative* spillover effects (where an intervention targeting an environmentally-conscious behaviour leads to a decrease in another functionally-related behaviour). In summarising findings, particular attention is given to the implications for climate-relevant behaviours. While few examples of climate-relevant behavioural spillover exist, studies do report positive and negative spillovers to other actions, as well as spillovers from behaviour to support for climate change policy. There is also some evidence that easier behaviours can lead to more committed actions. The potential contribution of social practice theory to understanding spillover is discussed, identifying three novel pathways to behavioural spillover: via carriers of practices, materiality, and through relationships between practices within wider systems of practice. In considering future research directions, the relatively neglected role of social norms is discussed as a means to generate the momentum required for substantial lifestyle change, and as a way of circumventing obstructive and intransigent climate change beliefs.

Graphical/Visual Abstract and Caption

One route through which social practices (adapted from Shove et al., 2012) may evolve, overlaid with spillover processes identified by Thøgersen, (2012)



Introduction

Environmental problems that derive from anthropogenic climate change are diverse and multifaceted, yet their origins share a common root in human behaviour (Steg, Bolderdijk, Keizer & Perlaviciute, 2014)[1]. Mitigating and adapting to the numerous challenges posed by climate change impacts will not be achieved by piecemeal solutions; what is required is more fundamental and far-reaching lifestyle change (Thøgersen & Crompton, 2009[2]; Corner & Randall, 2011)[3]. In this review we evaluate the prospects for behavioural spillover as a platform on which to build more sustainable lifestyles. Behavioural spillover theory focuses on the dynamic interrelationships between behaviours, and the processes linking these, in order to identify the catalysts that bring about wider behaviour change (Defra, 2008)[4]. From an applied perspective, research indicates that relatively modest changes to lifestyles might substantially reduce carbon emissions (Dietz, Gardner, Stern & Vandenbergh, 2009)[5]; additionally, voluntary behaviour change could avoid the need for costly regulation and risk of public resistance (Carter & Ockwell, 2007)[6]. From a theoretical perspective, behavioural models could be improved by shifting focus from individual actions toward more expansive and contextual behavioural perspectives. Two principal forms of behavioural spillover are covered in the literature, with relatively little crossover between them. Most studies have looked at *positive* behavioural spillover (where an increase in one environmentally-friendly behaviour leads to an *increase* in other behaviours – e.g. Lanzini & Thøgersen, 2014)[7]. Fewer studies have investigated *negative* behavioural spillover (where an increase in one environmentally-friendly behaviour leads to a *decrease* in other behaviours - e.g. Truelove, Yeung, Carrico, Gillis & Toner Raimi, 2016)[8]. The literatures on each are rendered more complex by the range of approaches, constructs and processes governing behavioural interrelationships. The literature on positive spillover covers phenomena taking in cognitive dissonance, behavioural clustering, and response generalisation; while moral licensing, rebound effects, and the contribution ethic are analogous to negative spillover.

Reflective of a growing interest in behavioural spillover, there have been previous reviews of the literature published since 2011; one in the UK grey literature incorporating anecdotal behaviour change practitioner evidence and empirical work on behavioural consistency (Austin, Cox, Barnett & Thomas, 2011)[9], an academic review in the US (Truelove, Caricco, Weber, Raimi & Vandenbergh,

2014)[10] in which the authors discuss the relevance of decision modes (and other factors) to behavioural spillover, a behavioural economics review of cross-domain spillover effects (Dolan & Galizzi, 2015)[11], and a review of temporal and contextual spillover (Nilsson, Bergquist & Schultz, 2016)[12]. Our review builds on this previous work and extends theory and application by making a number of novel contributions to the field. In reviewing the literature we cover new findings from some of the most recent studies published in this expanding field, including spillover effects across settings. In addition, following recent critiques of social psychological approaches to behaviour change (e.g. Batel, Castro, Devine-Wright & Howarth, 2016)[13], our review is the first that incorporates a social practice perspective to behavioural spillover. We also explore the potential of social norms for encouraging behavioural spillover, which has been relatively neglected in the literature. Furthermore, this is the first review to focus on the climate-relevant aspects of behavioural spillover. In the literature, while 'pro-environmental' and 'climate-relevant' behaviours are commonly conflated, climate-relevant behaviours are distinct, and therefore warrant special attention (Biesbrook, Klosterman, Termeer & Kabat, 2011)[14] not least because some pro-environmental behaviours as typically construed in the literature are relatively inconsequential for addressing climate change.

In accordance with the above, this review has four aims. After briefly defining behavioural spillover, we provide summaries of studies identifying positive and negative behavioural spillover. We then investigate the evidence for the potential processes underpinning behavioural spillover, including identity and consistency processes, knowledge and self-efficacy, values, norms and goals, and allied processes including moral licensing, rebound effects, the contribution ethic, and single-action bias. Following this, we consider climate change and climate-relevant actions as a special case in terms of promoting behavioural spillover. Finally, we investigate the potential contribution of social practice theory to understanding behavioural spillover, in light of emerging arguments for the utility of social psychological and practice approaches to re-energising fields of enquiry (Kurz, Gardner, Verplanken & Abraham, 2015)[15]. We conclude by bringing together findings and setting out areas for future theoretical development and applied work, highlighting the difficulty of targeting values and decisions, and discussing social norms as a potential way to encourage behavioural spillover.

DEFINING BEHAVIOURAL SPILLOVER

Behavioural spillover can generally be defined as an *observable* and *causal* effect one behaviour has on another (Poortinga, Whitmarsh & Suffolk, 2013)[16]. More specifically, to constitute spillover, the behaviours must be *different* (i.e. not related components of a single behaviour), *sequential* (where one behaviour follows another), sharing a *motive* (e.g. pro-environmentalism), and involving a common *link* (e.g. reducing CO_2 emissions - Dolan & Galizzi, 2015)[11]. In addition to observable changes, indicators of spillover-related effects might include less observable (conscious or unconscious) changes through parallel processes including *identity* (Poortinga et al., 2013)[16], *values* (Thøgersen & Noblet, 2012)[17] and *knowledge/awareness* (Thøgersen, Haugaard & Olesen, 2010)[18].

In addition to *deliberate interventions* designed to trigger behavioural spillover, spillover effects may also occur from other kinds of behavioural interventions, changes in awareness, availability of infrastructure and resources, and technological advances and policy change. In some cases, people may also be relatively unaware or disinterested in the environmental impact of their actions, though

behavioural spillover may still occur irrespective of an individual's mindset (e.g. where actions are motivated by other goals such as financial interest). Spillover effects may also extend beyond pro-environmental taxonomies, e.g. influencing prosocial (Howell, 2013[19]; Howell & Allen, 2016)[20], and health-related actions (Karmarkar & Bollinger, 2015)[20]. Exploring these broader processes can also illuminate the wider consequences (and antecedents) of behaviour change interventions. Understanding decision-making processes beyond pro-environmental behaviour is also consistent with an interdisciplinary focus, and reflective of alternative (e.g. social practice) approaches to salient and socially meaningful '*bundles of practices*' (Schatzki, 2010)[22] that have often been disinclined to think of people's actions in terms of discrete behaviours.

REVIEW OF THE BEHAVIOURAL SPILLOVER LITERATURE

We now move on to discuss work on positive and negative behavioural spillover, doing so separately for reasons of clarity because, while there are some notable overlaps, each draws heavily on distinct literatures. Positive behavioural spillover research has emerged chiefly from the social sciences (e.g. psychology, behavioural economics, marketing, management). Research on negative spillover is also found in the social science literature, as well as a broader range of disciplines including economics and energy modelling (Sorrell, Dimitropoulos & Sommerville, 2009[23]; but see also Gillingham, Kotchen, Rapson & Wagner, 2013)[24]. In practice, other than a few studies (e.g. Gneezy, Imas, Brown, Nelson & Norton, 2012)[25], it is unclear whether positive or negative behavioural spillover occurs more often and how associated processes interact, largely owing to these distinct literatures.

Much of the evidence for behavioural spillover examines correlates of common, private-sphere actions (e.g. recycling), which often represent only marginal ecological impact (Thøgersen & Crompton, 2009)[2]. Very little research has targeted committed, public sphere actions (e.g. political advocacy; though for an exception see Lanzini & Thøgersen, 2014)[7], which is consistent with the tractability of common, private-sphere actions to behavioural intervention studies (Capstick, Lorenzoni, Corner & Whitmarsh, 2014)[26]. In addition, while the majority of the behavioural spillover literature looks at relationships between generic pro-environmental behavioural taxonomies, we pay particular attention to climate-relevant actions. Whereas pro-environmental behaviours comprise actions intended to minimise negative environmental impacts in general and often unspecified ways, climate-relevant behaviours are primarily geared toward reduction of CO_2 and other greenhouse gas (GHG) emissions (Kollmuss & Agyeman, 2002)[27]. For purposes of clarity and inclusivity, when referring to both we use the term 'environmentally-conscious behaviour(s)'. Where climate change-relevant actions have been included in the literature, the sole focus has been mitigation; there appears to be no application of spillover theory to climate change adaptation behaviours. This is most likely because spillover processes are commonly considered to equate to pro-environmental intent in ways more relevant to mitigation than to adaptation (Howell, Capstick & Whitmarsh, 2016)[28].

Empirical evidence for positive behavioural spillover

Various correlational studies demonstrate that environmentally-conscious behaviours often co-occur (Barr, Shaw, Coles & Prillwitz, 2010[29]; Thøgersen, 1999)[30] - though correlations between similar behaviours tend to be weak in magnitude (Thomas, Poortinga & Sautkina, 2016)[31]. Factor analytic research has revealed that behaviours cluster into distinct conceptual categories, e.g. 'waste and recycling', 'green consumption' and 'transportation' (Lynn, 2014[32]; Whitmarsh & O'Neill,

2010)[33]. Therefore, if an individual engages in one behaviour from a given cluster, they are likely to also do others (Thøgersen & Ölander, 2006[34]; Thøgersen, 1999[30]; Daneshvary, Daneshvary & Schwer, 1998[36]; Bratt, 1999)[37]. Other studies show that people do also engage in dissimilar behaviours (Thøgersen & Ölander, 2003)[37], and that engaging in actions such as green consumption and eco-driving can lead to non-behavioural changes, such as *intentions* to engage in other dissimilar actions such as reducing meat consumption (van der Werff, Steg & Keizer, 2013a)[38], and environmental *policy support* (Thøgersen & Noblet (2012[17); Willis & Schor (2012)[39]. Policy support and reducing meat consumption have been identified as particularly effective ways to mitigate climate change (Bullard & Johnson, 2000[40]; Carlsson-Kanyama & González (2009)[41], therefore offer some indication that higher-impact climate-relevant actions can follow less impactful ones and may be amenable to spillover processes.

While correlational studies demonstrate co-occurrence between behaviours, they do not provide clear causal evidence of behavioural spillover. This is because reverse causality and the influence of common factors cannot be completely ruled out (Thøgersen, 2012)[42]. Studies using longitudinal designs offer better evidence of potential behavioural spillover. Thøgersen and Ölander (2003)[37] measured variations in behavioural engagement across three time points, concluding that high levels of recycling led to higher frequencies of future organic food purchasing and public transport use. Conversely, buying more organic food was linked to lower levels of future recycling. While recycling and organic food have been linked to lowering emissions (Moloney, Horne, Ralph & Fien, 2010[43]; Scialabba & Müller-Lindenlauf, 2010)[44], spillovers to actions such as public transport use provide evidence of the adoption of behaviours with increasing impact on emissions reductions (Chapman, 2007)[45].

Lanzini and Thøgersen (2014)[7], report positive spillover effects following a six-week intervention promoting the purchase of organic food and eco-labelled products, on a behaviour that included climate-relevant actions such as travel mode choice, recycling, energy/water conservation, and volunteering for a green cause - though effects were found only for those who performed these behaviours infrequently prior to the intervention. While such results are promising, caution must be taken as longitudinal designs remain limited by a reliance on self-reported behaviour (Bleys, Defloor, Van Ootegem & Verhofstadt, 2017)[46] and the influence of other causal factors (Truelove et al., 2014)[10]. In one of few examples of behavioural spillover studies using non-self-report data, Juhl, Fenger and Thøgersen (in press)[47] investigated the adoption of organic products using retail scanner and shopper loyalty card data of Danish consumers over 20 months. Consistent with behavioural spillover, results showed a consistent spillover effect from purchasing organic dairy products to a range of other organic food products.

Poortinga et al. (2013)[16] investigated behavioural spillover effects following the introduction of a single-use plastic bag charge in Wales, UK, but found only marginal increases in a number of other pro-environmental behaviours following the charge. Additional research using longitudinal data also found very small effects of behavioural spillover in the country where a bag charge was introduced, with stronger spillover effects in countries where no charge was enforced (Thomas et al., 2016)[31]. They speculate that the extrinsic nature of the charge might have accounted for a lack of spillover. However, a Swedish study examining the effects of an intervention comprising a vehicle congestion charging policy did detect behavioural spillover effects (Kaida & Kaida, 2015)[48] – though in the Swedish study, participants were exposed to the congestion charge for significantly longer, which

could have had a stronger influence on identity over time, which may have been why behavioural spollover was detected in the Swedish, but not in the Welsh study.

While behavioural similarity might account for the adoption of environmentally-conscious actions in some cases, recent research has found that activities such as energy-conservation behaviours are not conceptually related to pro-environmental motives (Gabe-Thomas, Walker, Verplanken & Shaddick, 2016)[49]. Moreover, most people are simply unaware of how much energy common lifestyle activities consume (Bleys et al., 2017)[46]. While correlations between dissimilar behaviours suggest the possibility of wider spillover effects, the reasons for consistency are not well understood. Nonetheless, promoting a holistic view of environmentally-conscious behaviours might help to strengthen the links between behaviours (Kaiser 1998)[50], though factors beyond conceptual relatedness such as perceived cost, effort, knowledge and experience, are also likely to determine whether one behaviour causes the adoption of another (Karlin, Davis, Sanguinetti, Gamble, Kirkby & Stokols, 2014)[51].

Positive behavioural spillover across settings

Further to the evidence for positive behavioural spillover within a given setting, other research has investigated the conditions for behavioural consistency between settings, (e.g. Nilsson, et al., 2016)[12]. Some studies show that behavioural consistency in one setting predicts consistency in another, in the context of recycling at home influencing recycling at work, based on prior experience and close correspondence between behaviours (Lee, DeYoung & Marans, 1995[52]; Tudor, Barr & Gilg, 2007)[53]. With particular reference to climate-relevant behaviour, other research has observed the transfer of energy conservation actions from work to home, predicted by identification with the employer's environmental ethos (Rashid & Mohammad, 2011)[54]. Andersson, Eriksson and Von Borgstede (2012)[55] report a similar effect for recycling and waste-related actions in which recycling at work increased concern and pro-environmental identity, which in turn boosted self-efficacy, leading to recycling at home. Though Littleford, Ryley and Firth (2014)[56] claim not to have found behavioural spillover effects, they noted that energy-conscious behaviours performed at home and work were similar in terms of shared equipment (using computers) and behavioural sequences (switching off electrical appliances when leaving the room). Similarly, Margetts and Kashima (2017)[57] report that green consumption predicted another financially committed action (charitable donations), but not non-financial commitments (e.g. donating one's time to charity work). Other work argues that contextual spillover occurs because pro-environmental values are of sufficient strength to transcend differences between settings (Rashid & Mohammad, 2011)[54]. Other research has however found significant variability in the consistency of environmentally-conscious behaviours across contexts (Maki & Rothman, 2016)[58]. Barr, Shaw, Coles and Prillwitz (2010)[59] report that people who conserve energy at home are less consistent in other settings, e.g. when on holiday. Behavioural consistency may also be constrained by differences in perceived autonomy and sense of responsibility to take action in different contexts (Steg, 2008[60]; Dwyer, Maki & Rothman, 2015)[61]. Consistency can also be facilitated or limited by the availability of resources and infrastructure (Kaiser & Schultz, 2009)[62], and the social dynamics of the setting (Maki & Rothman, 2016)[58].

The evidence on positive contextual spillover provides some evidence for behavioural consistency across different settings, linked to different psychological and structural factors. Where behavioural

consistency is found it appears that similarity of salient features in each context may produce spillover. However, there is little evidence for contextual spillover effects involving different behaviours. While environmental values and behaviour may be considered to originate from private-sphere influences such as parenting (Chawla, 1999)[63], workplace green initiatives can also spread to the home. Highlighting contextual specificity is also consistent with the broader literature on climate-relevant behaviour and habits, in which behaviours are strongly determined by contextual cues including location, timing and social influence (Verplanken & Wood, 2006)[64].

EMPIRICAL EVIDENCE FOR NEGATIVE BEHAVIOURAL SPILLOVER

A different literature postulates that performing one environmentally-conscious behaviour can make the performance of others behaviours less likely. We discuss a number of different types of negative spillover effects in the following sections, including rebound effects (where macro-level changes in technical efficiency lead to price adjustments and subsequent demand for a resource, affecting decision-making at the individual level), and moral licensing (in which performing one morally-virtuous behaviour creates a sense of entitlement to subsequent moral laxity). Thøgersen (1999)[30] reported negative correlations between recycling and perceived obligations to avoid excessive packaging waste when shopping – though self-reported shopping behaviour suggested a positive spillover effect. As mentioned above, Thøgersen and Ölander (2003)[37] report that purchasing organic food subsequently predicted lower use of public transportation, which could cancel out the emissions reductions achieved from potential positive behavioural spillover from recycling to public transport use. Meanwhile, following an intervention to promote domestic energy conservation based on smart meter feedback information, though participants decreased their energy consumption, subsequent investment in other energy efficiency measures also decreased compared with a control group (McCoy & Lyons, 2016)[65]. Negative spillover effects may occur where one behaviour is perceived to compensate for another. Catlin and Wang (2013)[66] found that people generated significantly more paper waste when a recycling bin was present than when a conventional bin was present. Group differences may also moderate negative spillover effects. In a recent US study, Truelove et al. (2016)[8] observed that Democrats who were persuaded to recycle a plastic water bottle were subsequently less willing to donate to a green campaign fund, though a similar pattern was not found for Republicans.

Evaluation of the initial behaviour in the context of identity may also influence the direction of spillover. Gneezy et al. (2012)[25] found that an initial *high-cost* behaviour is more likely to be perceived as diagnostic of a pro-social identity, increasing the likelihood of subsequently acting in a pro-social way. Conversely, an initial *low-cost* behaviour is less likely to be interpreted as reflective of a pro-social identity, reducing the likelihood of subsequently acting more pro-socially. As with positive behavioural spillover, behavioural perceptions and identity processes may also underpin negative spillover.

Moral licensing

Performing an initial morally virtuous behaviour can create the perception of moral entitlement to subsequent self-indulgent or morally-questionable behaviour (Merritt, Effron & Monin, 2010)[67]. Moral licensing effects have been observed in environmental decision-making, where environmentally-conscious product choices have been linked with subsequent dishonesty (Mazar & Zhong, 2010)[68] - though issues have been raised regarding the artificiality of the experimental

method and sample (Thøgersen, 2012)[42]. As highlighted above, similar licensing effects have been observed between taking one's own bags to the supermarket and purchasing organic food, and increased purchases of unhealthy snacks (Karmarkar & Bollinger, 2015)[21], while donating to charity predicted lower intentions to take action to reduce environmental pollution (Meijers, Verlegh, Noordewier & Smit, 2015)[69]. Buying a fuel-efficient vehicle has also been linked to reductions in environmentally responsible driving behaviour, including reduced willingness to limit mileage (Jansson, Marell & Nordlund, 2010[70]; Klöckner, Nayum & Mehmetoglu, 2013)[71]. As with some of the positive spillover studies, caution should be exercised when interpreting the findings of these studies as the influence of common variables cannot be ruled out. Moral licensing effects may be neutralised if individuals are reminded of a prior unethical action (Zhong & Liljenquist, 2006)[72]; e.g., Sachdeva, Iliev and Medin (2009)[73] found that pro-environmental behavioural intentions increased when participants were asked to write negative self-descriptions, in comparison to positive self-descriptions. Other research has proposed that fostering intrinsic motivation and sense of moral obligation through strengthening pro-environmental identity might also help to counter moral licensing effects (van der Werff, Steg & Keizer, 2013b)[74].

Affirmation of moral credentials may be central to the moral licensing effect, yet the idea of zig-zagging between morally-polarised options in order to regulate moral self-image, appears to conflict with the desire to appear morally consistent; e.g. Juhl et al. (2017)[47] report the gradual spread of organic food purchasing among Danish consumers, in contrast to moral licensing expectations. This may be partly due to the general salience of the cultural context. Sachdeva et al. (2009)[73] propose that licensing effects occur because people differ in the degree to which they are connected to an issue, leading to lower levels of moral aspiration for those who are relatively unconnected. This leads them to disengage from environmentally-conscious behaviour more quickly than those who are more deeply committed, with higher moral aspirations. Mullen and Monin (2016)[75] add that consistency can also be improved when a person focuses abstractly on the connection between the initial behaviour and their values, whereas consistency is lost when concretely focusing on what has been accomplished by the initial behaviour. Therefore, finding ways to connect people to environmental issues by appealing to intrinsic values they already hold may help to limit moral licensing effects and improve behavioural consistency.

Contribution ethic and the single action bias

Self-serving biases operate by persuading in favour of inaction (minimising a person's time and trouble), and may also interrupt behavioural spillover. The contribution ethic refers to the perception of the extent to which an individual feels they have made an appropriate contribution to a moral good such as the environment (Guagnano, Dietz & Stern, 1994)[76]. If a person perceives that they have fulfilled their obligations they may feel justified in 'resting on their laurels' (Thøgersen & Crompton, 2009)[2]. Such perceptions may rest partly on social norms and comparisons with others involving perceived inequity, e.g., linked to the notion of why one should act if others are not (Gifford, 2011)[77]. Thøgersen (1999)[30] reported that Danish consumers were less likely to contemplate reducing packaging waste when shopping, if they recycled, as this was believed to address the problem.

The single action bias (Weber, 1997[78]; 2006)[79] refers to the phenomenon that if two actions are perceived as fulfilling the same goal (e.g. reducing carbon emissions), they may be viewed as

substitutable, leading to an assumption that a single behaviour is sufficient to resolve the issue. For example, farmers who took precautionary measures to increase capacity for grain storage on their farms to adapt to climate variability were subsequently significantly less likely to adopt additional climate adaptation behaviours than other farmers who had not increased grain storage capacity (Weber, 1997)[78]. These perceptual biases may be compounded by a tendency to exaggerate the effectiveness of the environmentally-conscious behaviours one does (Attari, DeKay, Davidson & DeBruine, 2010)[80], reducing the guilt of inaction while simultaneously avoiding the need to make more significant lifestyle changes (Diekmann & Preisendörfer, 1998)[81].

Rebound effects

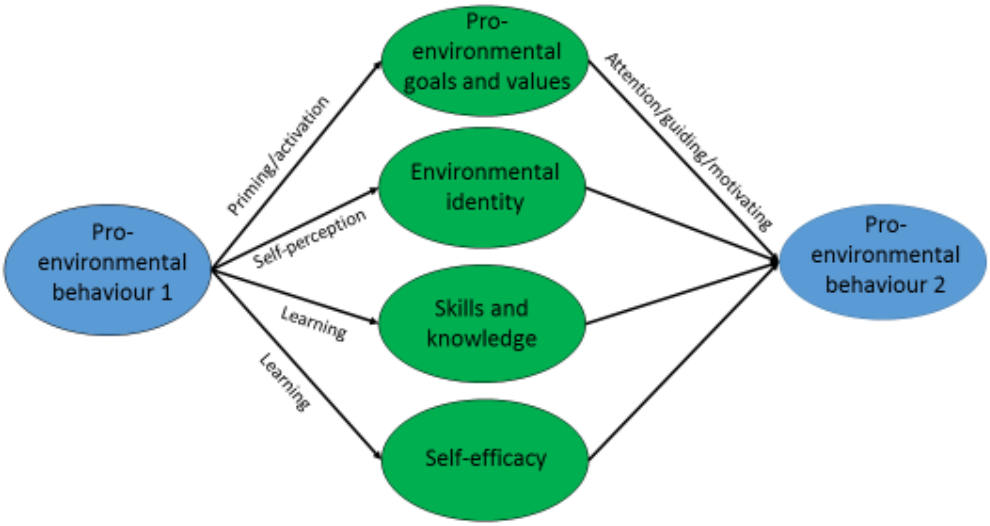
Rebound effects are phenomena typically conceived of in economic terms, where consumption of an energy service (e.g. heating, cooling, lighting, transportation) increases due to technical efficiency improvements, thereby offsetting the energy savings achieved (Gillingham et al., 2013)[24]. For example, research has documented increased energy consumption in households following the installation of energy efficiency infrastructure (Greening & Greene, 1998[82]; Hertwich, 2005[83]). Rebound effects can be both *direct* (occurring when energy efficiency improvements decrease the price of an energy service, leading to increased consumption of that service) and *indirect* (occurring when the savings made on energy increases demand for other goods and services) (Sorrell & Dimitropoulos, 2008)[84].

While some approaches argue that rebound effects differ from behavioural spillover (e.g. Dolan & Galizzi, 2015)[11], we view them as related phenomena, as parallel processes where macro-level economic changes can manifest at the individual level, through decreases in the cost of a behaviour (direct rebound) and increased disposable income (indirect rebound) affecting individual decisions on energy and resource consumption (Truelove et al., 2014)[10]. Midden, Kaiser and McCalley (2007)[85] that rebound effects occur because for most people the principal motivation for consumption is not energy efficiency, but other non-environmental goals. For example in the context of climate-relevant behaviours such as car driving, freed assets from efficiency improvements may be reinvested in higher mileages and less fuel-efficient vehicles for reasons of status (Steg, Vlek & Slotegraaf, 2001)[86], and vehicle performance and comfort (Greening, Greene & Difiglio, 2000)[87]. The importance of goal satiation has also been identified in other research, which proposes that rebound effects are more likely for people with minimal access to resources, or strong hedonistic values (Peters & Dütschke, 2016[88]; Peters, Sonnberger, Dütschke & Deuschle, 2012)[89]. The context of behaviour therefore makes accurately quantifying rebound effects difficult (Gillingham, Rapson & Wagner (2015)[90].

BEHAVIOURAL SPILLOVER: EXPLANATORY PROCESSES

The review so far has shown that the literature on behavioural spillover is inconsistent, with behavioural effects occurring in ways that appear to operate under specific conditions. These conditions are yet to be fully understood, and there are competing theories to explain them. Thøgersen (2012)[42] has proposed a theoretical framework comprising four mechanisms; pro-environmental goals and values, identity, skills and knowledge, and self-efficacy (see Figure 1 below). We now move on to consider the evidence for these and other processes.

Figure 1. Theoretical reasons to expect positive behavioural spillover effects (Thøgersen, 2012)



Identity and consistency processes

Studies linking spillover to identity processes commonly cite two psychological theories of identity. Social identity theory (Tajfel & Turner, 1986)[91] asserts that socially available categorisations are integrated with the self-concept and serve to prescribe how to act in conditions of uncertainty. Self-perception theory (Bem, 1972)[92] proposes that people infer how to act by reflecting on who they are, as well as on past behaviour. Therefore, engaging in an environmentally-conscious action could lead an individual to see themselves as 'green', thereby increasing the likelihood of adopting additional environmentally-conscious behaviours (Whitmarsh & O'Neill, 2010)[33].

Cueing an enhanced sense of green identity via experimental manipulation (in which participants recall commonplace pro-environmental actions) has been reported to increase intentions to behave environmentally responsibly (Cornelissen, Pandelaere, Warlop & Dewitte (2008)[93] Van der Werff, Steg & Keizer (2014[94]; 2013a)[38]. Reminding people of past environmental behaviour has also been found to strengthen green identity, which in turn mediates positive behavioural spillover (van der Werff, Steg & Keizer, 2013a)[38]. Lacasse (2016)[95] reported that strengthening green self-perceptions increased environmental concern and support for sustainability policies; it simultaneously reduced feelings of guilt, offsetting the effect of green self-perceptions on concern and policy support, thereby suppressing behavioural spillover. However, in a follow-up experiment, assigning the label 'environmentalist' was found to inoculate against guilt reduction, due to an awareness of behavioural expectations associated with the label.

While Poortinga, Whitmarsh & Suffolk (2013)[16] did not confirm behavioural spillover effects following the introduction of the Welsh single-use plastic bag charge, they did find an increase in pro-environmental identity, which they propose might precede behavioural spillover (see also Suffolk and Poortinga, 2016)[96]. Alternatively, lack of spillover may have been due to the extrinsic nature of the charge. However, the former explanation may be more likely in light of Kaida and Kaida's (2015)[48] findings, in which a similar extrinsic policy change did lead to measurable behavioural spillover. While Poortinga et al examined changes around six months after the policy

change, Kaida and Kaida's participants were exposed to the policy intervention for a significantly longer period (around 2 years), suggesting that identity change had enough time to translate into behaviour change.

Cognitive dissonance and the Foot-In The-Door effect

Cognitive dissonance theory (Festinger, 1962)[98] asserts that people are motivated to think and act consistently when behaviours are freely chosen, and that inconsistency can generate affective discomfort, which a person is driven to reduce by acting more consistently. The drive to reduce dissonance might therefore result in the adoption of additional environmentally-conscious actions as a pathway to behavioural spillover (Thøgersen, 2012[42]; 2004)[98]. However, dissonance may be reduced more easily, e.g. by attributing behaviour to an external agency (Thøgersen 2004)[42], or by denying the inconsistency (Tobler, Visschers & Siegrist, 2012)[99]. Consistency may also be less important to some people (Cialdini, Trost & Newsom, 1995)[100], and may not affect those for whom the environment is unimportant (Thøgersen, 2004)[42]. Managing the inconsistency between our environmental concern and our consumption-rich lifestyles and our limited commitment to the environmental cause is also something many of us negotiate on a frequent basis (Sapiains, Beeton, & Walker 2015)[101].

Consistency can be increased by making a specific commitment to behave in an environmentally-conscious way (Cialdini, 2001)[102]. There is also some evidence that commitment may increase the likelihood of behavioural spillovers. Hotel guests publicly committing to re-use towels to save energy not only did this more than other guests, but were more likely to also switch off lights when leaving their hotel room (Baca-Motes, Brown, Gneezy, Keenan & Nelson, 2013)[103]. Research on induced hypocrisy has also demonstrated that when people are forced to confront personal inconsistencies, they are more likely to then act with greater consistency (Fried & Aronson, 1995[104]; Aronson, Fried & Stone, 1991)[105]. Inducing hypocrisy has been found to increase environmentally-conscious actions including taking shorter showers (Dickerson, Thibodeau, Aronson, & Miller, 1992)[106], anti-litter campaigning (Fried & Aronson, 1995)[104] and donating to ecological organisations (Priolo, Milhabet, Codou, Fointiat, Lebarbenchon & Gabarrot, 2016)[107]. Consistency may also be moderated by the difficulty of the initial and subsequent behaviours. The literature on the 'foot-in-the-door' effect proposes that people are more likely to agree to comply with a larger request if they previously agree to a smaller request (Freedman & Fraser, 1966)[108]. To date, there is little evidence in the spillover literature to suggest that people progress from simple to more difficult environmentally-conscious actions (Thøgersen & Crompton, 2009)[2], though Lauren, Fielding, Smith and Louis (2016)[109] cite Thøgersen and Noblet's (2012)[17] spillover from green consumption to low-carbon policy support as one example, while finding evidence for easy water conservation behaviours leading to more committed actions in their own study (see below). Evidence from longitudinal spillover studies also suggest easy (recycling) actions lead to more committed ones (public transport use - Thøgersen & Ölander, 2003)[37].

Whereas positive behavioural spillover may be accounted for in terms of a drive for behavioural consistency, negative spillover is characterised by a lack of consistency; though it is conceivable that an individual might be consistent in acting irresponsibly. It is unlikely that cognitive dissonance alone will be sufficient to induce the degree of lifestyle change needed to effectively mitigate climate change impacts unless they are intrinsically motivated (Thøgersen, 2012[42]; Thøgersen and

Crompton, 2009)[2]. For many people, either behavioural consistency is unlikely to be of primary importance, or people will resolve inconsistency in simpler ways that do not require further commitment.

Knowledge, skills and self-efficacy

Engaging in an environmentally-friendly behaviour might enhance an individual's knowledge and expertise in ways that facilitate the adoption of other actions (Thøgersen, 1999)[30]. Developing expertise may also outlast the effects of behavioural incentives which revert back to previous habits once removed, providing a stronger link to spillover (Lanzini & Thøgersen, 2014)[7]. Individuals given a free low-flow shower head were subsequently more likely to adopt other environmentally-conscious actions in an accompanying information pamphlet (Hutton, 1982)[110], while consumers who were familiar with ecological product labels were more likely to purchase new ecologically-labelled brands on their prior experience with eco-labels (Thøgersen et al., 2010)[18]. As already mentioned, research on contextual behavioural spillover has found that behavioural experience in one setting can increase the likelihood of repeating that behaviour in another setting (Andersson et al., 2012)[55]. Enhancing carbon literacy could span a range of disparate behaviours and therefore increase the potential for engagement in multiple activities in which low-carbon practices are applicable (Thøgersen, 2012)[42].

Self-efficacy relates to a subjective appraisal of one's capacity to act in a given situation (Bandura, 1977)[111], and studies have demonstrated the importance of self-efficacy in responding to threats such as climate change (Adger, Dessai, Goulden, Hulme, Lorenzoni, Nelson, Naess, Wolf & Wreford, 2009)[112]. Self-efficacy can increase engagement with environmentally-conscious behaviours (Gifford & Nilsson, 2014)[113]. Steinhorst, Klöckner and Matthies (2015)[114] report on an intervention designed to increase energy conservation that assessed whether conserving electricity resulted in subsequent behavioural spillover effects (including climate relevant actions such as reducing meat consumption, avoiding car use and donating to a climate-protection project). They found that spillover only occurred when the intervention message appealed to pro-environmental motivations, and that the effects were mediated by personal norms and self-efficacy. The authors point to a spillover mechanism whereby a pro-environmental framing strengthened personal norms for climate-relevant actions, increasing behavioural intentions beyond the promoted behaviours; and that the pro-environmental framing similarly mediated spillover by increasing self-efficacy. Lauren et al. (2016)[109] also found self-efficacy to be a mediator of behavioural spillover effects measured across two time points, where increases in simple water conservation behaviours following an intervention led to higher self-efficacy, which in turn translated into stronger intentions to carry out more difficult behaviours; and thereafter to higher uptake of water-saving appliances.

Values, norms and goals

Values are desired goals that transcend situations and guide the behaviour of individuals and social entities (Schwartz, 1992)[115]. Research has shown how priming pro-environmental values can direct attention to those values and increase the likelihood of pro-environmental decision-making (Schultz & Zelezny (1998)[116]. Pro-environmental values and intrinsic motivations also underpin green identity (van der Werff, Steg & Keizer, 2013b)[38], as well as preference for consistency (Thøgersen, 2004[98]; Cialdini et al., 1995)[100].

Social norms encompass subjective assumptions about how people should behave and how they actually behave and are reliable predictors of environmentally-conscious behaviours (Abrahamse & Steg, 2013)[117], including energy conservation (Schultz, Nolan, Cialdini, Goldstein & Griskevicius, 2007)[118] and recycling (Schultz, 1999)[119]. Norms have also been linked to behavioural spillover processes (Steinhorst et al., 2015)[114]. Framing studies not only demonstrate that people are increasingly likely to save energy when interventions are framed as normative appeals (what other people do), over appeals to save the environment or money (Nolan, Schultz, Cialdini, Goldstein & Griskevicius, 2008)[120]. Behavioural spillover processes may be encouraged by the perception that engaging in certain behaviours is approved, and that others do them too. This may also inoculate against social comparisons and perceived inequity (Gifford, 2011[77]; Lorenzoni, Nicholson-Cole & Whitmarsh, 2007)[121].

Other research has found that pro-environmental motivation is more likely to lead to behavioural spillover. In one study, intention to car-share predicted subsequent paper recycling when car-sharing was framed as a good thing to do for the environment, but not when car-sharing was framed as a money-saving behaviour (Evans, Maio, Corner, Hodgetts, Ahmed & Hahn, 2013)[122] – though Lanzini & Thøgersen (2014)[7] do report financially-incentivised behavioural spillover. While not a direct demonstration of spillover, an investigation into smart-meter energy use feedback observed that presenting energy use as CO_2 saved was not only more effective than either money or energy (kWh) saved in amplifying climate change salience, but also predicted subsequent intentions to donate to climate change charities (Spence, Leygue, Bedwell & O'Malley, 2014)[123].

As mentioned above, rebound effects may occur at the individual level because energy efficiency goals are not aligned with other valued goals that require consumption of resources (Midden et al., 2007)[85]. Therefore, alignment of hedonic goals with biospheric (pro-environmental) goals could offer a way of facilitating positive spillover and limiting negative spillover (Steg et al., 2014)[1]. Other work on goals argues that superordinate goals (e.g. keeping fit) are comprised of smaller sub-goals (e.g. healthy eating, exercise, and sufficient rest) that guide goal-directed self-regulation (Fishbach, Dhar & Zhang, 2006)[124]. When focused on one sub-goal, other sub-goals may be perceived as substitutes and are less likely to be pursued. Conversely, when the focus is on the superordinate goal, sub-goals are less likely to be perceived as substitutes and more likely to be pursued. Therefore, priming superordinate goals may be more likely to produce positive behavioural spillover effects, whereas priming sub-goals may constrain the adoption of further actions aligned with the same goal. Values and goals may be particularly important for environmentally-conscious behaviour and positive spillover because intrinsically motivations are more strongly felt and likelier to persist without external incentives (De Groot & Steg, 2010[125]; Ryan & Deci, 2000)[126].

BEHAVIOURAL SPILLOVER AND CLIMATE-RELEVANT BEHAVIOUR

While the majority of work on behavioural spillover has examined relationships between pro-environmental behaviours, spillover effects relating to climate-relevant actions can be found in the literature, in relation to mitigation rather than adaptation. However, past work on response generalisation theory (where reinforcement of behaviour spreads to other functionally-similar behaviours) has been applied to risk and safety issues such as seat-belt usage (e.g. Ludwig, 2002[127]; Ludwig & Geller, 1997)[128], suggesting that behavioural spillover theory could be applied to risk reduction interventions for correlates of climate change adaptation. Behavioural

spillover effects may be complicated by a distinct set of obstacles of particular salience to climate change responses. To date, we are not aware of studies that test these factors in relation to behavioural spillover. These factors include climate scepticism (Dunlap, 2013)[129], perceptions of scientific disagreement (Ding, Maibach, Zhao, Roser-Renouf & Leiserowitz, 2011)[130], and the belief that policies to reduce emissions will entail adverse impacts for economic wellbeing (Hurlstone, Lewandowsky, Newell & Sewell (2014)[131].

Climate change itself is also a nebulous and complex array of phenomena, unlike other pro-environmental problems, the perception of which is malleable as a result of personal experience, which can in turn affect a people's willingness to take action to adapt (Demski, Capstick, Pigeon, Sposato & Spence, 2017)[132], and willingness to save energy (Spence, Poortinga, Butler & Pidgeon, 2011)[132]. Personal experience of weather and temperature anomalies can increase concern (Spence et al., 2011)[133], increase perception of risk (Akerlof, Maibach, Fitzgerald, Cedeno & Neuman, 2013)[135] and increase belief in anthropogenic climate change (Hamilton & Stampone, 2013)[136]. Therefore, climate-relevant behavioural spillover might be enhanced by highlighting the aspects of people's experience that are most conducive to action. For example, perceptions of greater psychological distance can lead to decreased concern and support for action (Weber, 2010)[137], while support for mitigation is greater when impacts are framed locally (Spence & Pidgeon, 2010)[134]. In addition, people prefer existing energy options even when greener alternatives are available (Dinner, Johnson, Goldstein & Liu, 2011[138]; Pichert & Katsikopoulos, 2008)[139]. Following observations concerning perceptions of intrinsic motivation for initial behaviour in the behavioural spillover literature, considering carefully the ways in which options are presented to people might therefore influence climate-relevant decision-making.

Interventions to specifically target climate-relevant behavioural spillover could be tested to optimise carbon/GHG reduction spillovers, focusing on the characteristic perceptual biases that colour the phenomenon. Based on the above, this could include emphasising communication confidence, and highlighting additional benefits to of taking action for those who express climate change scepticism (e.g. community cohesion and economic benefits - Bain, Hornsey, Bongiorno & Jeffries (2012)[140]. While this might not generate intrinsic motivation, it could offer a pragmatic means of encouraging behaviour change and lowering emissions. Further efforts to relate climate change to everyday life contexts and enhancing carbon literacy in day-to-day choice settings should also be considered.

A SOCIAL PRACTICE PERSPECTIVE ON BEHAVIOURAL SPILLOVER

So far we have mostly considered the psychological and economic literatures relating to the notion of behavioural spillover. A very different view of behaviour change comes from the sociological literature, particularly from theories of social practice (e.g., Shove, Pantzar & Watson, 2012)[141]. Theories of practice typically critique the methodological individualism of social psychological approaches to behaviour (e.g. Shove, 2010[142]; Hargreaves 2011[143]; Batel et al 2016)[13], arguing that such approaches neglect the wider socio-historical frameworks in which the capacity for individuals to change is fundamentally constrained. To overcome this, practice theories displace the individual and behaviour as core units of analysis and focus instead on the organisation and evolution of *practices,* such as cooking, driving, showering or gardening. Theories of social practice offer a fundamentally different account of climate-relevant action and how it might be brought about. We are not aware of any prior work that explicitly relates social practice theory to forms of

spillover. To some extent this may result from ongoing debates about potential points of synergy and divergence between psychological and sociological perspectives (e.g. Kurz et al, 2015[15]) and the extent to which these competing perspectives can or should be integrated to understand and intervene in social action (Boldero & Binder, 2013[144]; Wilson & Chatterton, 2011[145]; Whitmarsh, O'Neill & Lorenzoni, 2010)[146]. Nevertheless, while recognising the important ontological and epistemological differences between these perspectives (Shove, 2011)[147], we are mindful that attempts to understand and tackle 'wicked' problems like climate change can fruitfully benefit from a wide range of different disciplines and societal perspectives (Lorenzoni & Pidgeon, 2006)[148]. Consequently, where psychologists may lean towards methodological individualism and reductionism, sociologists, and social practice theorists in particular, can potentially shed light on the social and structural dimensions of social action (Little, 2013)[149]. In this section we begin by outlining the core components of theories of social practice, before providing what we think is a first attempt to conceptualise the potential relevance of social practice theories to spillover.

Understanding and changing social practices

Practices are broader spatio-temporal entities than behaviours that have broadly consistent structures, or configurations of elements, within and across particular societies and cultures. Thus, a core expectation of practice theory is that, while they may vary according to specific circumstances, performances of the same practice in different contexts should broadly resemble one another (Maller & Strengers, 2013)[150]. Practices, such as cooking, driving, showering or gardening, are socially and culturally recognisable entities made up of multiple interconnected elements (Reckwitz, 2002)[151]. Shove et al. (2012)[141] see practices as comprised of three distinct types of elements: *materials* (tools, technologies, infrastructures etc.), *meanings* (symbolic understandings, ideas, aspirations etc.,) and *competences* (skills, know-how, techniques etc.). A key point is that practices are made up of all of these elements interconnected together, and cannot be reduced to any single element. Indeed, elements themselves have lives of their own beyond specific practices and may be shared between multiple practices (Shove & Pantzar, 2005)[152]. Practice theories see individuals as the 'carriers' or 'crossing points' (Reckwitz, 2002)[151] of multiple different practices as they move through their everyday lives. While individuals are thus displaced from the centre of attention in favour of practices, they are nonetheless extremely important to the continued existence and evolution of practices. It is individual carriers who must perform different practices, all-the-while integrating different practice-elements as they, for instance, learn new skills, respond to social meanings, or navigate and use different materials and infrastructures.

Whereas from a social psychological perspective changing behaviour might include changing individuals' attitudes and values, practice theory argues instead that the focus should be on changing practices themselves. Here, practices are recognised as dynamic entities that evolve gradually as practitioners develop new skills, as new materials or meanings are circulated throughout society, or as other, connected practices evolve and change. In this way, change in practice is understood as constant and as something that can come from "any quarter and at any time" (Shove et al., 2012, p.31)[141]. Active interventions to change practices can thus seek to 'recraft' the specific elements of which they are made, to 'substitute' one practice for another in a particular sequence or location, or to change how they interlock or connect with one another (Spurling, McMeekin, Shove, Southerton & Welsh, 2013)[153]. Crucially, and in a key departure from approaches to behaviour change, attempts to change practices seek not merely to change the

practical, everyday 'performances' of practices as they are engaged in by individual practitioners on-the-ground, but rather to bring about a re-organisation or re-arrangement to the broader 'practice-as-entity' (Schatzki 1996[154]; Spurling et al., 2013)[153]. Thus, it is not enough merely to change how an individual cooks his/her food, for example. Rather, attempts to change practices, seek broader, societal shifts in the organisation, understandings and/or performances of 'cooking' as a recognisable entity.

Conceptualising behavioural spillover in social practices

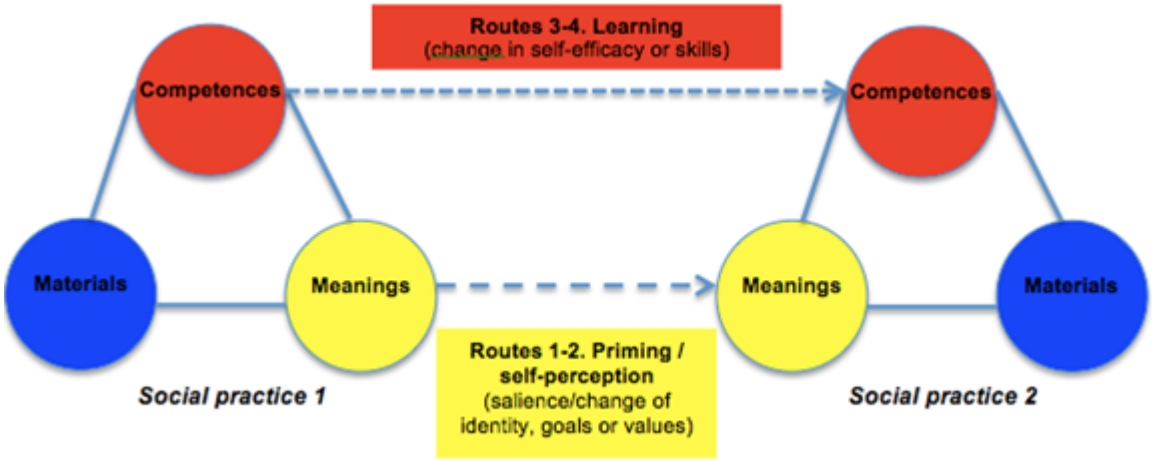
So what value might social practice theories bring to understanding spillover? Here, for the first time, we explore how spillover might be understood as occurring in and through social practices.

To some extent a loose concept of spillover, at least as it occurs across contexts, is already built-in to a social practice based approach. In short, even across quite different contexts, because practitioners are engaging in the same practice, and following the basic rules and procedures built-in to that practice, their performances of that practice should be broadly similar. For example, the way one cooks at home is likely to resemble the way one would cook at work or whilst on holiday, because one is likely to follow similar recipes, to cater to the same broad tastes and to rely upon the same set of skills that have been acquired over time. At the same time, practice theory also notes that the specific local and grounded circumstances will, necessarily, impact on performances of practices and how they are understood (Røpke 2009)[155]. Thus, for example, if a person only has access to a microwave oven at work, his/her performance of cooking practices will be more constrained than in contexts where a wider range of cooking facilities are available. Similarly, and as Wang and Shove (2014)[156] show, as a practice travels around the world, even if it is broadly recognisable as the same practice, it will adapt and re-shape, taking on a different character, cultural meanings and potentially picking up new or different materials as it slots in to locally specific systems of practice.

While some sort of spillover might therefore be expected to occur within the same practice across contexts (i.e., situational spillover), practice theory thus focuses attention instead on the extent to which spillover occurs across different practices (i.e., behavioural spillover). Here, practice theories point to at least three different mechanisms through which this might occur.

First, the same individual 'carrier' of different practices might be able to carry specific competences, materials or meanings with them across several of the different practices they perform. As Foulds, Robison and Macrorie (2017)[157] highlight, for example, individual practitioners can become very experienced at the practice of 'energy monitoring' and may carry the competences and meanings associated with energy monitoring across many of the different practices they ordinarily engage in (analogous to spillover via learning and priming/self-perception pathways identified in the psychological literature; see Figure 2). Thus, by carrying energy monitoring with them they may variously seek to improve the energy efficiency of their showering, cooking, TV watching or even working practices. At the same time, these carriers' attempts to introduce new elements to practices may be thwarted by other elements of those practices that may frustrate or reject the new energy monitoring practice. Thus, for example, Hargreaves, Nye and Burgess (2010)[158] demonstrate how the desire for a cosy, warm and well-lit home may over-ride a desire to act on the recommendations of energy monitors by being more energy efficient.

Figure 2. One route through which social practices (adapted from Shove et al., 2012) may evolve, overlaid with spillover processes identified by Thøgersen, (2012)



Second, and as noted above, practices can share elements with one another just as, for example, both cycling and driving practices share the same road network. This observation helps to make sense of several findings from the behavioural spillover literature, notably the co-occurrence of behaviours sharing material and procedural elements governing climate-relevant actions (Margetts & Kashima, 2017)[57]. For example, Littleford et al. (2014)[56] find that only behaviours that use the same equipment (e.g., computers) are consistent across home and work contexts. Referring to 'standby practices' (Gram-Hanssen, 2010)[159] helps explain this finding in practice-based terms by showing that the use of specific pieces of equipment is shaped less by an individual's rational analysis of the situation (i.e. trading off energy wasted for time saved) but instead by how 'standby consumption' has emerged from routinised practices of technological configuration and design. Crucially, while attempts might therefore be made to circulate elements that promote climate-friendly action and try and get them taken up across multiple practices, the extent to which they will actually be taken up within and become part of these wider practices will itself be mediated by the wider dynamics and elements of those practices. Thus, even if low-carbon meanings might already be widespread across society (e.g., Whitmarsh, Seyfang & O'Neill, 2011)[160], the opportunities for such meanings to be taken up within specific practices may be hampered by a wide range of factors. For example, even if society agrees on the importance of low-carbon forms of transport, this may be trumped by other meanings within mobility practices such as for speed or convenience, a lack of relevant infrastructure or materials (e.g., inadequate public transport or cycling provision) or by how practices are structured across time and space, such as the impossibility of walking or cycling to an out-of-town shopping centre (e.g., Cass & Faulconbridge, 2016)[161].

Third, there is a growing focus in theories of practice on the need to understand the inter-relations between multiple different practices within wider 'systems of practice' (Watson 2012[162]; Schatzki, 2011)[163]. Watson (2012)[162] discusses how attempts to decarbonise the transport system might be usefully recast as efforts to re-shape and re-organise a wide range of different social practices – from those of everyday commuters to those of politicians and business executives – to create a decarbonised system of practices, such as one based around velo- rather than auto-mobility. In a similar manner, Shove (2010)[142] suggests that policy-makers might attempt to try and generate

more 'envirogenic' environments that could promote sustainability or climate-friendly actions across a range of different practices. In essence, this third mechanism suggests that spillover might occur across practices to the extent that practices can be connected together into systems that pursue a shared, lower-carbon goal. Yet again, however, the extent to which this might be possible will be mediated by the wider elements and dynamics of the constituent practices within the intended 'system'.

With respect to a lack of spillover, whilst social psychological literatures highlight that understanding the conceptual categories held by individuals is key to understanding relationships between their actions (Canter et al., 1985)[164], the sociological literature highlights that actions are undertaken within spatial-temporal 'bundles' of social practices (e.g., Schatzki, 2010)[22] and that because these bundles are underpinned by common meanings, rules and material arrangements and evolve over time, they may seem 'inconsistent' from an environmental impact perspective but are, rather, socially meaningful. Thus, while psychologists have perhaps focused more on whether individuals *perceive* similarities between behaviours, sociologists have taken a broader view of what binds discrete actions together in socio-temporal space and how social practices (e.g., driving) are partly constructed in relation to alternative practices (e.g., cycling; Kurz et al., 2015)[15]. In contrast, where spillover does occur, social practice based approaches explain this in terms of shared carriers, shared elements or through the generation of broader systems of practice.

In terms of implications for interventions, social practices theories are also helpful. While psychologists focus on intervention at the individual level (e.g., priming values), sociologists consider how social practices as a whole might be reconfigured. Critically, there is no requirement for change in social practices to be achieved for pro-environmental reasons or motivations. While psychologists would also recognise that low-carbon behaviours are often adopted for reasons other than climate change concern (e.g., to save money, for health, convenience), an important precondition for pro-environmental spillover seems to be that behaviour is linked by pro-environmental (or at least intrinsic) motives. Appealing to extrinsic motivations (e.g., money saving) is likely to erode intrinsic motivations for adopting low-carbon behaviours, and may neutralise the potential for positive spillover (Thomas et al., 2016[31]; cf. Evans et al., 2013)[122]. Instead, social practice-informed interventions would focus on changing the elements of or relationships between practices. In particular, practice theory introduces a new focus on the 'material' elements of practice, such as building houses with 'drying rooms' rather than space and plumbing for a tumble dryer (Spurling et al, 2013)[150] which have been less explored in the spillover literature (though see Suffolk, 2016), and which have rather tended to focus on informational interventions; yet, such structural measures are theorised to produce more favourable outcomes for spillover too, since Truelove et al. (2014)[10] contend that moral licensing is less likely when changing more ambitious or structural-type behaviours than focusing on 'small and painless' actions).

In sum, then, by changing the core unit of analysis and focus, a social practice based understanding of spillover can both challenge and enrich psychologically dominated perspectives. We thus argue that a practice approach is of value in understanding why some actions co-occur and not others; this might also shed light on salient climate-relevant relationships outside of traditional behavioural taxonomies held by social psychologists (Karmarkar & Bollinger, 2015)[21]. Social practice perspectives can also expand the portfolio of interventions for spillover interventions by considering materiality, as well as meanings and skills, and critically considering the inter-relationships between

these elements. Spillover interventions focussed only on meanings (e.g., priming values) will not work – or be limited to very small-scale changes in similar behaviours – without consistent materials and skills to support a low-carbon practice change. As recognised across the social sciences (e.g., Capstick et al., 2014)[26], more ambitious behavioural spillover that produces reductions in emissions commensurate to the scale of the climate change challenge will require structural change – and behavioural spillover as narrowly understood in terms of change in one element of practice will not achieve this.

Figures and Captions

Tables

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Conclusion

The aim of this paper was to selectively review the separate literatures on positive and negative pro-environmental behavioural spillover effects and potential processes underpinning the phenomenon. In addition, we sought to pay particular attention to the relevance of the reviewed literature in terms of climate-relevant behaviour, and to expand the boundaries of enquiry by considering the potential value of incorporating social practice perspective to enlighten an understanding of the processes involved, and to suggest ideas for theoretical development and applied interventions. The evidence for positive and negative behavioural spillover is inconsistent and far from clear. Perhaps most notably, progress in the field has been slow, leaving important questions unanswered, especially in relation to the conditions and processes underpinning behavioural spillover. In addition, there remains a notable lack of clear causal evidence for behavioural spillover. We now proceed to offer some synthesis of the literature below, in light of limited progress being made in the field, and the contributions of previous work summarising the literature elsewhere (e.g. Truelove et al., 2014)[10], we consider the implications for climate-relevant behaviour.

Climate-relevant behavioural spillover and the prospects for broader lifestyle change

A number of conclusions can be drawn from the literature that point to potential areas of significance for understanding the conditions under which positive behavioural spillover occurs, and factors that increase or decrease its probability. While the behaviours and conditions identified in the literature vary significantly, there is evidence to support Thøgersen's (2012)[42] four pathways to spillover. Motivation and consistency are key to all of the pathways specified. However, given the sheer number of factors influencing an individual within a given context, predicting how they might

act in the moment is somewhat complicated. However, as a foundation for behavioural spillover, prior values and goals might offer a feasible target for interventions.

Encouraging behavioural spillover via changes in social norms

Engaging in a behaviour for intrinsic reasons (i.e. corresponding to a pro-environmental position), is more likely to lead to stronger and more persistent motivation that will persist without the need for external incentives (De Groot & Steg, 2008)[125], which is required to drive spillover of multiple behaviours. However, not everybody has this kind of intrinsic motivation; additionally, climate-relevant actions may involve commitment and lack of enjoyment (Steg, Lindenberg & Keizer, 2016)[165]. Therefore generating the groundswell needed to transform lifestyles in desired ways might depend on the intrinsic motivation to conform to social pressures via changes in social norms. Previous research suggests that while people may act based upon environmentally-conscious motivations, other motivations, such as conformity to social expectations, can exert a stronger influence on behaviour (Nyborg, Anderies, Dannenberg, Lindahl, Schill, Schlüter, Adger, Arrow, Barrett, Carpenter & Chapin, 2016)[166]. Ameliorative action can be undermined by the complexity, scale and psychological distance of climate change. Climate change is weak at motivating action partly because it is difficult to grasp, as well as leading to self-defensive biases, e.g. perceived uncertainty leading to misplaced optimism (Markowitz & Shariff, 2012)[167].

Nyborg et al. (2016)[166] discuss the way in which changing social norms can bring about a tipping point that transforms society toward more sustainable lifestyles. They remark that, whereas behaviours like recycling are observable (amenable to social sanction) and low cost/effort (conferring little benefit from abstention), many high-carbon actions (e.g. domestic energy consumption) are unobservable and yield significant benefits (e.g. comfort, convenience, status). In such cases, policy can help to make behaviour more visible (e.g. disclosing the names of residents signing up to energy conservation programs), and reinforcing benefits (e.g. providing grants for energy efficiency investments). Ockwell, Whitmarsh and O'Neill (2009)[168] also remark that regulation is necessary to address societal and institutional barriers to climate change action. Such interventions using social coercion as a basis for action may ultimately become internalised as intrinsic motivations over time (Ryan & Deci, 2000)[126] providing a basis for behavioural spillover.

Re-energising approaches to behavioural spillover via social practice theory

In addition to reviewing the behavioural spillover literature with regard to climate-relevant behaviour, we also advance a new approach based on social practice theory. We identify three novel potential pathways to spillover: via individual carriers of practices, the sharing of elements between different forms of practice, and through relationships between multiple different practices within wider systems of practice. The second of these most closely aligns with the psychological descriptions of spillover processes (as mediated by learning or priming goals/identity). Changing the core unit and analysis of focus enables practitioners to gain greater insight into the ways in which practices as a whole are (re)configured in ways that transcend the boundaries of individual-level interventions. In terms of application, new synergies would create ideas for novel interventions based on material aspects of practice that go beyond altering single elements of practice, thus deepening and complementing existing psychological approaches.

In setting the ground for new pathways of enquiry, we also assert the need for social psychological approaches to examine the correlates and drivers of behavioural spillover in ways that yield better causal evidence, using actual behavioural measures where possible. Future work should also examine behavioural spillover in relation to climate-relevant behaviours, including climate adaptation behaviours, which may differ qualitatively from pro-environmental behaviour, and which have been largely omitted from studies to date.

Notes

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