Spillover Effects in Pro-Environmental Behaviour Change

A Literature Review with an Emphasis on Classification and the Underlying Mechanisms and Implications for Air Travel Reduction

Ralph Hansmann & Susann Görlinger
ETH Zurich D-USYS TdLab & iilo GmbH

November 2025

This report is part of a study “Impact analysis flight reduction: from business flights to leisure flights”, mandated to Dr. Susann Görlinger, iilo GmbH, by the cantons of Basel-Stadt and Geneva and the city of Zurich.

Content

Executive Summary

Air travel is a major contributor to greenhouse gas emissions. In Europe and Switzerland, flight emissions represent roughly one-third of total GHG emissions, with leisure flights making up the majority of trips-an area that is particularly challenging to address directly. Reducing business travel offers a pragmatic entry point, with potential benefits amplified through spillover effects that influence private travel behaviour.

This study analyses the existing literature on *spillover effects* - where one behaviour influences the likelihood of another behaviour. A particular focus of this study is on *contextual spillover* from work to private life.

In the field of environmental psychology, spillover is classified in three main ways:

1. **By direction:** *Positive spillover* supports further pro-environmental actions, while *negative spillover* undermines them, often through rebound effects or moral licensing.
2. **By behaviour and context:** *Cross-behavioural spillover* links different actions; *temporal spillover* repeats the same action over time; and *contextual spillover* transfers behaviour between settings, such as from business to private life.
3. **By social scope:** *Personal spillover* affects the same individual; *interpersonal spillover* influences others; *organisational spillover* spreads within or between organisations; and *societal spillover* operates across larger social or political entities.

The similarity between behaviours and between contexts strongly moderates spillover strength. Stronger spillover is consistently found between similar behaviours, while cross-domain spillover is generally weaker.

Underlying mechanisms explaining why spillover occurs:

- **Positive spillover** is driven by cognitive dissonance reduction (maintaining consistency with values), self-perception (seeing oneself as environmentally responsible), pro-environmental values, norms, and identity, and habit formation. Workplace culture and peer behaviour can set injunctive (prescriptive, approved, moral) and descriptive (observed, empirical, neutral) norms that employees carry into their private lives. Action-based learning, self-efficacy, and breaking old travel habits can fortify these changes.
- **Negative spillover** can emerge through rebound effects (financial or time savings redirected to high-emission activities), moral licensing (compensating “good” behaviour with “bad” behaviour), and psychological reactance (resisting perceived restrictions).

To achieve a spillover from business to leisure flights, *a structured, facilitated, and participatory process with pro-environmental orientation* is essential. Such approaches are more likely to create underlying value changes-and only then is effective and sustained spillover possible. According to the Self-Determination Theory, interventions that give people autonomy, build competence, and foster positive social connections increase intrinsic motivation, reduce resistance, and sustain pro-environmental behaviour change.

Quantitative evidence shows that spillover effects are often small on average but can be significant when behaviours are similar and contexts are closely linked. A theoretical scenario modelling for business flight reduction combines primary effects (e.g. 10%, 50%, 80% business flight cuts) with varying spillover rates to leisure flights (0–50%) and different spillover influence paths (intervention based, behaviour change based and both combined). Even modest spillover, when added to strong

primary effects, can yield substantial reductions of both business and leisure flights, adding up in total to substantial emission reductions.

This study identifies mechanisms of action, obstacles, and enabling factors, alongside quantification strategies and an assessment of the transferability and extent of spillover from business to leisure flights. These insights will be applied in a planned follow-up *cooperation project* supporting organisations in transforming their travel practices towards new pathways for international business and exchange relations.

Acknowledgements

SG would like to sincerely thank the cantons of Basel-Stadt and Geneva and the city of Zurich for taking up the topic and mandating her with this study. Both authors would also like to thank Michael Stauffacher and Heini Wernli (both ETH Zurich) for their valuable input to this study.

1. Background

Air travel has become a dominant mode of transport in both business and leisure contexts, with significant implications for global greenhouse gas (GHG) emissions. Globally, aviation accounted for approximately 2-3% of total anthropogenic CO_2 emissions before the COVID-19 pandemic (ICAO, 2019), with additional non-CO_2-related climate effects. Both business and leisure flights grew steadily before the COVID-19 pandemic, and total aviation emissions In Switzerland, air travel accounts for nearly 30% of total GHG emissions (Swiss Federal Assembly, 2021). The disparity between global and western contribution to air travel emissions is also due to the unequal distribution of air travel – only 1% of the world population causes half of all aviation emissions (Gössling and Humpe, 2020). Even under ambitious mitigation scenarios, emissions from aviation are expected to rise further (Bergero et al., 2023). While technological options such as sustainable aviation fuels, carbon removal technologies, and improved aircraft efficiency are under development, they are unlikely to scale fast enough to meet near- to mid-term climate targets. Carbon offsetting, though widely used, is limited in effectiveness and credibility. Sufficiency strategies-especially flying less-are therefore essential (Hansmann & Binder, 2021). A recent study estimated that demand reduction alone could reduce emissions by up to 60% by 2050 compared to a business-as-usual trajectory (Bergero et al., 2023).

The frequency and purpose of air travel vary substantially between business and leisure. Business flights represent around 10–15% of total passenger flights globally, but they contribute disproportionately to emissions due to a higher share of long-haul travel and premium seating, both of which are significantly more emission-intensive per passenger-kilometre (Gössling & Humpe, 2020). Leisure travel accounts for the majority of flights and is typically more difficult to influence directly. It is shaped by private preferences, household decision-making, and social norms-factors that are difficult to influence within regulatory or institutional frameworks. Moreover, a small group of frequent flyers-often active in both business and leisure contexts-is responsible for a disproportionately large share of total aviation emissions (Gössling et al., 2019).

Financial considerations have also increasingly motivated organizations to reassess business travel. Cost reduction can be a driver for decreasing business flights, in addition to environmental sustainability goals. Rising travel costs and budget scrutiny have led companies to tighten travel policies, limit discretionary trips, and increasingly rely on virtual collaboration as a cost-control strategy. The reduction of travel not only leads to savings in direct expenses such as transportation and accommodation, but also in associated opportunity costs and productivity losses during travel (Deloitte Insights, 2024; Morgan and Stanley, 2023; Crowe, 2025).

Furthermore, the EU's Corporate Sustainability Reporting Directive (CSRD) requires companies to disclose their emissions and develop reduction pathways aligned with the 1.5°C target - an obligation that also extends to Swiss firms operating within the EU market. Despite this regulatory pressure, so far only few organisations have taken systematic action to address business-related air travel.

Given the urgency to reduce aviation emissions and the difficulty of directly limiting leisure travel, business flights present a pragmatic starting point. They are not only institutionally controllable but also offer a potential spillover effect: reducing business air travel might influence leisure travel patterns by changing individual norms, workplace cultures, and public narratives around flying. This contextual spillover may occur in both private spheres (e.g., discussions within families or among friends) and public domains (e.g., media framing of flight reductions as examples for taking leadership in sustainability).

2. Definition of 'Spillover' and Empirical Roots

In **general language** a **'spillover'** is *"commonly understood as something that flows out of or spreads beyond its containment"* (Mørk et al., 2017, p. 409). In social and environmental psychology, spillover means that the performance of a behaviour can exert an influence on the probability of subsequent actions, as formulated in current **definitions**. According to Nilsson et al. (2016), spillover effects entail "*that engaging in one behaviour affects the probability of engagement or disengaging in a second behaviour*" (p. 573). Consistent with this, Reimers et al. (2022) explain that spillover effects are operative when "*a consumer's initial behaviour positively or negatively influences the probability of their subsequent behaviour*" (p. 3). Similarly, Behn et al. (2025) define environmental spillover as "*the phenomenon where engaging in one environmental behaviour influences the likelihood of engaging in another environmental behaviour*" (p. 3665).

However, according to a review by Kumar et al. (2023) there also exists a second type of definitions, where "*behavioural spillovers are understood as the effect of an intervention (rather than the primary behaviour) on subsequent behaviours not targeted by the intervention (Truelove et al., 2014; Henn et al., 2020)*" (p. 777). Kumar et al. (2023) thus identified "*two overlapping, yet distinct definitions of behavioural spillovers based on whether the initial causal factor is an intervention or the primary behaviour itself*" (p. 777).

Figure 1 illustrates two spillover paths from an organizational intervention to private behaviours, which correspond to these two distinct types of definitions. The first path, A_1-A_2, assumes that behavioural spillover from an organizational intervention is taking place in a process requiring two steps. In a first step, the organizational intervention changes organizational behaviour, and thereafter, this behaviour change can spill over, for example to a positive environmental behaviour in private life. However, it is also possible that an organizational intervention – involving for example pro-environmental communication arguing for flying less – creates a direct spillover and influences the private traveling behaviour of employees, who do actually not change their organizational travel behaviour due to the intervention. The corresponding spillover path B can, for example, be mediated by changes of values, norms, knowledge and attitudes of organization members due to the intervention (Behn et al., 2025; Carrico, 2021).

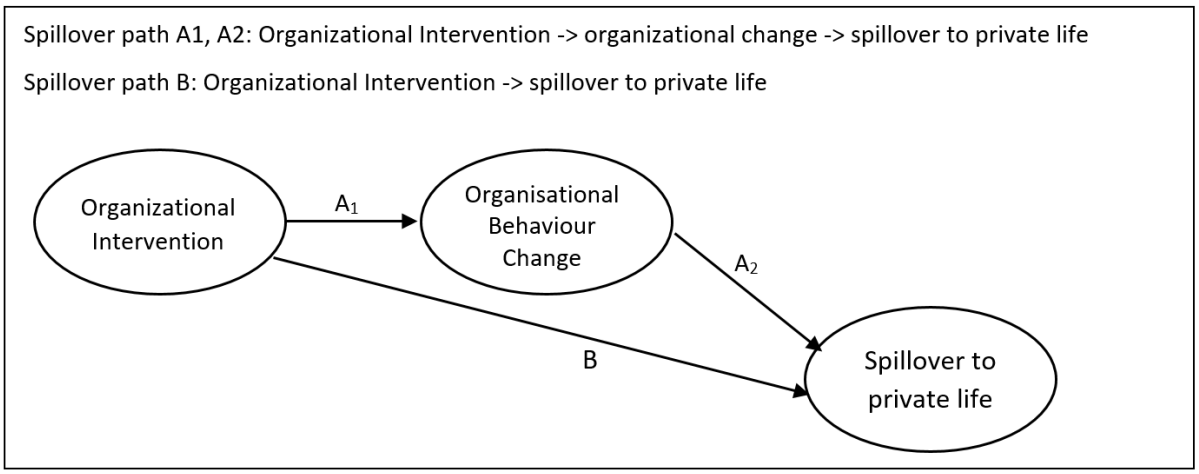

Figure 1: Interventions can create spillover to private sphere environmental behaviours via changes of organizational environmental behaviour (path A1-A2) or directly (path B), for example via communication and/or learning processes resulting in changes of knowledge, values, attitudes and norms, but not in overt behaviour change.

For example, employees who never take business flights, because their workplace is always at their home base, may acquire pro-environmental attitudes and hence, refrain from taking the plane for their future holiday travels, because of the flight reduction arguments communicated by the company. Accordingly, the second spillover path B, which spills over directly from the organizational intervention to private behaviour is also possible. This second path corresponds to the second type of definitions of spillover identified by Kumar et al. (2023).

Accordingly, an integrative definition would be that a spillover can consist of (i) influences of an intervention on the probability of behaviours that are not primarily targeted by the intervention **and/or** (ii) the influence of a spontaneous (naturally occurring) behaviour or a behaviour triggered by an intervention on the probability of subsequent behaviour.

To consider both spillover paths from an organizational intervention to private behaviour appears important since "*failure to account for all possible spillovers not only leaves out valuable information on dynamic interactions across domains but also results in biased estimates and misdirected policy recommendations*" (Kumar et al., 2023, p. 774). Spillover processes caused by either naturally occurring behaviours (e.g. Thøgersen & Ölander, 2003) or by behaviour changes following an intervention are in the foreground of many studies (Behn et al., 2025; Henn et al., 2020 Maki et al., 2019). However, organizational interventions as such can also influence private behaviour, and hence generate contextual spillover, via communication, learning, attitude change or normative processes, independent of the organizational behaviour change they achieve (Truelove et al., 2014; Henn et al., 2020). For example, Elf et al. (2019) could show that an intervention applying a wide range of behaviour change techniques achieved positive environmental behaviour change not only for behaviours "*strongly linked to the project (reducing food waste, purchasing labelled products) but also for behaviours that were not addressed in the intervention (walking or cycling instead of using a car)*" (p. 6) indicating a spillover effect from the intervention as such on non-targeted behaviours. However, in the same study "*correlations were computed between all behaviour change scores*", which resulted in higher and more "*significant correlations in the experimental group* [addressed by the intervention] *than in the control group, suggesting that behaviour changes for one behaviour were more likely to be associated with behaviour change for another behaviour in the experimental group"* (p. 6). This indicates in turn that behaviour changes triggered by the experimental intervention showed spillover in the form of triggering further behaviour changes. Accordingly, the study provided support for both paths shown in Figure 1. The two spillover definition types identified by Kumar et al. (2023) complement each other as both paths can operate in parallel and contribute to the total spillover. Therefore, it seems important for the design of interventions to apply an encompassing understanding of spillover, which acknowledges and accepts both types of definitions. Such an integrative understanding should also prevail in future research.

A historic social psychological study that used the '*Foot in the door*'-research paradigm (Freedman & Frazer, 1966) provided an example of very strong spillover effects that occurred after an intervention that triggered a primary behaviour change. This example hence fits to both types of definitions.

The '*Foot in the door*'-technique asks target persons to perform a first behaviour involving a small favour in order to increase the probability that he or she performs a second, much larger behavioural favour. In the classical experiment by Freedman and Frazer (1966), Californian households were asked to sign a petition in favour of defensive driving (experimental condition 1) or place a small card stating "*Be a safe driver!*" in the window or car (experimental condition 2). Two weeks later, the participants of both experimental conditions, as well as an equally large group of previously unsolicited participants (control condition) were asked if they would place a large billboard reading "*Drive Carefully!*" in their

front yard. The share of positive responses in the '*petition group*' was about 48%, in the "*Be a safe driver!*"-card condition 76% and in the control group about 20%. This means that a spillover effect from the behaviour to sign a petition on the behaviour to place a large billboard in the own garden increased the frequency of the latter behaviour by 140%. The preceding behaviour to place a small "*Be a Safe Driver!*" card increased the frequency even by 280%. Thus, if the preceding behaviour was more similar to the behaviour B (as placing a card seems more similar to placing a billboard than signing a petition) the spillover was twice as high. Already in this classical study, the similarity of behaviour A and the subsequent behaviour B was accordingly identified as a mediator of the strength of a possible spillover from A to B. The moderating effect of the similarity between two behaviours on the corresponding spillover, with stronger spillover between similar behaviours, is in line with the findings of a recent meta-analysis of spillover between *Positive Environmental Behaviours* by Maki et al. (2019).

The large positive spillover reported above for the '*Foot in the door*'-technique is usually explained by avoidance of cognitive dissonance and/or facilitation of a consistent self-perception based on the *Theory of Cognitive Dissonance* by Festinger (1957) and/or the *Self-Perception Theory* by Bem (1972). According to the latter theory, we infer our attitudes to considerable extent on the basis of our behaviours while the former theory assumes "*that perceived inconsistencies between behaviours and attitudes produce negative emotions (dissonance), which people try to reduce by changing their behaviours and/or their attitudes and self-perceptions*" (Mørk et al., 2017, p. 409). Thus, recognizing that oneself has just signed a petition for save driving, strengthens the attitudes in favour of driving carefully, thus promoting the readiness to take striking action for this goal.

A further account for potentially very large spillover effects from the performance of earlier behaviours on subsequent (similar or identical) ones is provided by research on the development and effects of **'habits'** (De Houwer, 2019; Klöckner, 2013; Linder et al., 2022; Wood & Neal, 2009). According to Gardner et al. (2011) habits are "*behavioural patterns learned through context dependent repetition: repeated performance in unvarying settings reinforces context-behaviour associations such that, subsequently, encountering the context is sufficient to automatically cue the habitual response*" (p. 175). According to Wood and Neal (2007), habits, are "*learned dispositions to repeat past responses*" (p. 843). These definitions clearly imply that **habits** can entail positive spillover effects from past behaviours to identical or similar behaviour in the future. The concept of habit refers to the frequent, partly automatic repetition of the same or highly similar behaviours at different points in time or in similar or even distinct contexts. The repeated previous performance of a then habitual behaviour makes the subsequent performance of this behaviour more probable. The concept of habits thus aligns exactly with the definition of a positive spillover.

The explanative value and strength of the effects of habits – and hence of the resulting spillover – is disputed. Ajzen (1991) did not include habits as explanatory variable in his highly influential *Theory of Planned Behaviour*. Still Ajzen acknowledged that under stable surrounding conditions "*past behaviour is the best predictor of future behaviour*" (p. 202) and that possibly "*repeated performance of a behaviour results in the establishment of a habit; behaviour at a later time then occurs at least in part habitually, without the mediation of attitudes, subjective norms, perceptions of control, or intentions*" (p. 203). Indeed, Friedrichsmeier et al. (2013) list various studies that have "*shown that including measures of habit or past behaviour improves the overall model fit*" (p. 1) of the Theory of Planned Behaviour and similar models such as the Norm Activation Model (Schwartz & Howard, 1981).

In fact, many specific positive environmental behaviours show considerable consistency over time, and can be considered habits, whereas spillover from one type of positive environmental behaviour to another type is less common (Puntiroli et al., 2022). The concept of habits can explain this as it points

to the importance of the similarity of behaviour A and a subsequent behaviour B as a moderating variable for the size of spillover.

Habits are considered to play a large role for mobility behaviour as transportation choices have a quite high consistency over time (e.g. Gärling et al., 2001; Havlíčková & Zámečník, 2020; Thøgersen, 2006; Verplanken et al., 1994). For example, in a study by Thøgersen and Ölander (2003) the choice of environmentally friendly modes of transport (bike, bus or train) at the time of a first survey explained 75% to 92% of the use of these transportation means one year later. Consistent with this, habitual car use has been identified as an obstacle to switch to other transportation modes in interventions aiming at pro-environmental changes of mobility behaviour (e.g. Aarts et al., 1998; Møller & Thøgersen, 2008). According to Aarts et al. (1997), habits can distort the use of information regarding transportation choices by favouring habitual modes of transport. Habits can accordingly explain substantial spillover effects when it comes to the performance of the same behaviour at different times or in different contexts. However, from a specific positive environmental behaviour in one environmental domain to a different positive environmental behaviour in another domain (e.g. from mobility to recycling) only a very small spillover based on habit formation can be expected (Thøgersen & Ölander, 2003; Thøgersen, 2006). The generalizability of habits from one type of behaviour to another is limited (Heijs, 2006). According to Friedrichsmeier et al. (2013), some scholars perceive habits as a "*strongly situation-specific behavioural response, which is learned by frequent enactment of the same behaviour in a confined context*" (p. 2), whereas others assume that "*habits are effective across a wide range of situations, possibly across travel mode choice situations in general, or the idea that habitual behaviour can also be learned from socialization*" (p. 2). The former notion suggests that habits are nearly exclusively effective in promoting spillover to exactly the same behaviour in the same context in the future, whereas the latter notion implies that habit-based spillover from one context to another (e.g. from work to private life) is easily possible when the two behaviours are similar to some extent (e.g. choice of mode of transport for long distance travel in private and business contexts). The specifics of spillover effects between similar and dissimilar behaviours within and between contexts have been addressed and distinguished by various classificatory approaches as described in the following Section 3.

Summary of key points "Definition of 'Spillover' and Empirical Roots":

- Spillover describes how one behaviour can increase or decrease the likelihood of another behaviour, and/or how an intervention can influence the probability of behaviours, which it does not directly address.
- Behavioural and contextual similarity significantly strengthen spillover, especially when habits are involved.
- Habit-based spillover tends to occur between the same or closely related actions; cross-behavioural domain transcending spillover effects are rare.

3. Classification schemes of spillover

3.1 Positive versus negative spillover

A fundamental classifying aspect of behavioural spillover is that they can be either **positive or negative.** When considering environmentally relevant behaviours, the corresponding direction of a spillover can be determined based on its consequences for sustainability or the achievement of goals of a corresponding campaign, intervention or program (e.g. promoting ecologically friendly products, recycling, healthy diets, reduction of emissions). According to Nilsson et al. (2016), a "***positive spillover*** *effect predicts that interventions targeting one specific behaviour have the capacity to promote non-*

targeted and/or future pro-environmental behaviours. However, the ***negative spillover*** *effect predicts that engaging in a first pro-environmental behaviour will prevent or decrease a second pro-environmental behaviour*" (p. 573). This means that a positive environmental behaviour (which may have occurred spontaneously or in the context of an intervention, campaign or program) increasing the probability of subsequent positive environmental behaviours entails a positive spillover. On the contrary, a negative spillover means that a positive environmental behaviour increases the probability of subsequent negative environmental behaviours or decreases the probability of subsequent positive environmental behaviours. These latter processes are usually discussed in the context of rebound effects or moral licensing (Nilsson et al., 2016; Reimers et al., 2022).

Summary of key points "Positive versus negative spillover":

- Positive spillover increases the likelihood of subsequent pro-environmental actions, while negative spillover reduces it or leads to environmentally harmful actions.
- Negative spillover often involves rebound effects and/or moral licensing, where one sustainable act justifies and/or facilitates less sustainable behaviour later.
- Behaviour framing and communication strongly influence whether spillover is positive or negative.

3.2 Cross-behavioural, temporal, and contextual spillover

An additional classification approach distinguishes between (1) behavioural, (2) temporal, and (3) contextual spillover (e.g. Behn et al., 2025; Nilsson et al., 2016). A corresponding overview is provided in Table 1. The distinction is reasonable as spillover effects may "*affect another behaviour, the same behaviour in the future, or the same behaviour in another context.*" (Nilsson et al., 2016, p. 575). Still, the terminology of this widely applied classification scheme seems unfortunate since temporal and contextual spillover (2, 3) are also behavioural in the sense of being related to behaviour. Conducting a different behaviour, conducting the same behaviour in the future and conducting the same behaviour in a different context in the future is behavioural and therefore, this study will use the terms (1) cross-behavioural, (2) temporal, and (3) contextual spillover, when applying this classification scheme.

Furthermore, when considering cross-behavioural spillover, it needs to be considered that a different subsequent behaviour B, influenced by a previous behaviour A, may be more or less similar and/or dissimilar to the preceding behaviour A. Thus, we provide two examples of different behaviours with rather *high similarity* (1.1) and *low similarity* (1.2) in Table 1. The similarity of a behaviour A to a subsequent behaviour B is a crucial factor determining the strength of possible spillover from A to B (Dreijerink et al., 2023). According to a meta-analysis of spillover effects by Maki et al. (2019), positive spillover from a positive environmental behaviour to other behaviours can be identified primarily in relation to similar positive environmental behaviours. The similarity between two behaviours is difficult to assess. One aspect of similarity of positive environmental behaviours is whether two behaviours are located within the same topical domain (e.g. mobility), another aspect is whether they have similar goals (e.g. transport from A to B, emission reduction, health).

The second type (2), temporal spillover, takes place between one behaviour and the identical behaviour (or a highly similar one) in the future. Here the time distance between behaviour A and the possible behaviour A at a later time plays an important role. In this regard, Behn et al. (2025) distinguished *immediate spillover* (within hours, minutes or right after the initial behaviour), *short-term spillover* (emerging within days, weeks, months), whilst *long-term spillover* manifests itself after more than three months or longer, up to several years). As is true for behavioural consistency and

stability of habits, a temporal spillover tends to be larger if the time distance Δt between behaviour A at time t and options for behaviour A at time $t+\Delta t$ is not too large.

The third category (3), contextual spillover may likewise tend to be larger if the contexts of the behaviours in question are not too different. Corresponding spillover from business life to private life is a prominent example which has been investigated in various previous studies (e.g. Andersson et al., 2012; Lee et al., 1995, Littleford et al., 2014; Nik Ramli & Naja, 2011, 2012; Tudor et al., 2007). In this project, contextual spillover from flight reduction measures addressing business flights on private flights are of particular interest. Therefore, the focus is on spillover of the same or a highly similar behaviour from one context (business life) to another context (private life).

Table 1: Three basic types of spillover effects: 1) cross-behavioural within the same or a different topical domain, 2) temporal, and 3) contextual spillover

Type of spillover	**Explanation**	**Example / further information**
1. Cross-behavioural spillover (with varying levels of similarity of different behaviours A and B)	Performing behaviour A promotes (or inhibits) a different behaviour B	The similarity between behaviour A and B can be high or low
Example 1.1: Cross-behavioural spillover to similar behaviour within the same topical domain	Behaviour A and B have considerable similarity (e.g. both are positive environmental behaviours in the same topical domain)	Using the night train instead of taking a business flight, may increase the probability of using the train instead of the car for short business trips (*spillover from flight reduction to car travel reduction)*
Example 1.2: Cross-behavioural spillover to dissimilar behaviour in different domain	Behaviour A and B have a low level of similarity (e.g. they belong to different topical domains)	Using the night train instead of taking a business flight, may increase the probability of recycling batteries (*spillover from flight reduction to sustainable waste disposal*)
2. Temporal spillover to the same behaviour in the future (with different time distances Δt between A at time t and at time $t+\Delta t$	Performing behaviour A at time t changes the probability of the same behaviour A in the future at time $t+\Delta t$. Immediate, short, and long-term spillover can be further distinguished depending on Δt.	Abstaining from a business flight (behaviour A) at time t changes the probability p(A) of abstaining from a business flight at a subsequent time $t+\Delta t$ (*spillover from business flight reduction to business flight reduction*)
3. Contextual spillover	Performing behaviour A changes the probability of performing the same behaviour in a different context (at a later time)	Abstaining from a business flight at time t changes the probability of abstaining from a private flight at a later time $t+\Delta t$ (*contextual spillover from business to private flight reduction*)

Summary of key points "Cross-behavioural, temporal, and contextual spillover"

- Cross-behavioural spillover links different actions, especially within the same domain or sharing the same purpose.
- Temporal spillover reflects the repetition of a behaviour over time, which is supported by action-based learning and habit formation.
- Contextual spillover transfers the same behaviour to a new setting, such as for example from work to private life.

3.3 Personal, interpersonal, organizational and societal spillover

Another classification of spillover can be accomplished based on the distinct sets of persons or social systems (e.g. organizations, groups, nations etc.) that are influenced by these effects.

The main body of research on spillover effects focusses on the effects of a first behaviour of a certain person and on the subsequent behaviour of the same person. The spillover effects prevailing in the literature are accordingly **(intra)personal** as they are considered to influence only the acting person.

In addition to such (intra)personal behavioural spillover, **interpersonal spillover** (Nash et al., 2019; Sorrell et al., 2020) is also possible. The behaviour of a person X can also influence the behaviour of persons Y, Z, etc. Such effects have been previously investigated for example under the perspective of the *Social Cognitive Theory* by Bandura (1986). A consumer's behaviour can accordingly also positively or negatively influence the probability of the subsequent behaviour of others for example by functioning as a role model. To also consider such interpersonal spillover in the context of flight reduction appears crucial as "*social innovation and (ecological) change can be attained through social influence processes*" (Hansmann et al., 2005, p. 367). A green transformation of society and, for example, its predominant mobility pattern is only possible through multi-level, socio-cultural processes promoting the diffusion of innovation and change of social practices (Keller et al., 2022; Nash et al., 2017; Svennevik, 2022).

To broaden the scope of spillover research and also investigate interpersonal spillover is in line with a review by Nash et al. (2017) claiming that "*behavioural models could be improved by shifting focus from individual actions toward more expansive and contextual behavioural perspectives*" (p. 2). For this purpose, the review by Nash et al. "*incorporates a social practice perspective to behavioural spillover"* and explores *"the potential of social norms for encouraging behavioural spillover, which has been relatively neglected in the literature*" (p. 3).

Research addressing these interpersonal influences, which may also constitute environmentally relevant spillover, investigates social psychological processes such as conformity, imitation, learning from role models, and the formation of social norms. Such interpersonal spillover effects are highly relevant for the transformation of predominant social practices and diffusion of innovation. A green transformation of organisations and society therefore needs to consider interpersonal behavioural spillover in addition to personal spillover. In the context of organizational learning, spillover across organisations is likewise possible and highly important as intervention programs implemented in certain organizations can potentially trigger similar programs in other organizations. Accordingly, researchers have also investigated inter-organizational spillover (for a review, see Shi et al., 2022). Apart from **inter-organizational** spillover, **intra-organizational** spillover is likewise possible - if for

example, a certain company department changing its operations serves as model influencing other subsections of the company. There is some overlap, as personal spillover can take place from business to leisure and vice versa and also within and across organizations. Spillover can also occur within or between societal groups or political entities (**societal spillover**).

Table 2 shows a corresponding classification of agents that can be the recipients or be affected by spillover effects. The table also takes into account that apart from spillover between organizations, spillover between further social aggregates such as groups or states are likewise possible.

Table 2: Four types of spillover effects can be distinguished with respect to the affected people or social systems: 1) Personal, 2) Interpersonal, 3) Organizations and their members in an (i) intra- and/or (ii) inter-organizational context, 4) Societal spillover

Type of spillover	Explanation	Example
1. **Personal spillover**	The influence of a behaviour A performed by person X on the probability of a subsequent behaviour B of the same person X.	That a person is traveling mostly by train for business purposes may promote (or reduce) the frequency of train travels of that person in private life.
2. **Interpersonal spillover**	The influence of a behaviour A performed by person X on the probability of a subsequent similar behaviour A' (or different behaviour B) of another person Y.	If one employee decides to participate in a remote meeting only virtually (no flight), other employees might follow the role model and also participate virtually.
3. **Organizational spillover**	Spillovers between (3.1) and/or within (3.2) organizations	
- Intra-Organizational spillover	The influence of a behaviour A implemented in department X of an organization on the probability of a subsequent behaviour of members/ subsections in the same organization.	The successful implementation of certain measures in section A of company A stimulates section B of the same company.
- Inter-Organizational spillover	The influence of a behaviour A implemented in organization X on the probability of a subsequent implementation in organization Y.	The successful implementation of certain measures in company A stimulates company B to introduce similar measures to reduce flight emissions.
4. **Societal spillover:** practices spread in or between societal groups or political entities	The influence of a behaviour A implemented in societal group or political entity X on the probability of a subsequent implementation in group or political entity Y.	A flight reduction achieved by one group or political entity (canton, state) may inspire and hence influence other groups or states.

Summary of key points "Personal, interpersonal and organizational spillover"

- Personal, interpersonal, organisational, and inter-group spillover describe how behaviours and norms spread across individuals and social systems.
- Personal spillover: Behaviour in one context influences the same person's future actions in another.
- Interpersonal spillover: One person's actions influence others' behaviours through norm setting, communication, or imitation and role model learning.
- Organisational spillover: Practices spread within an organisation (intra) or between organisations (inter).
- Societal spillover: Practices spread in or between societal groups or political entities

Therefore, spillover can be categorised by direction (positive/negative), behavioural relationship (cross-behavioural, temporal, contextual), and social scale (personal, organisational, societal).

4. Mechanisms underlying spillover effects

A multitude of theories and corresponding mechanisms (or causal chains) underlying spillover effects have been proposed and substantiated by previous research. These mechanisms may be separated quite consistently in those underlying positive spillover and negative spillover. Both types of spillover need to be taken into account, when designing effective pro-environmental interventions.

This section starts with an overview of the main mechanisms for positive spillover, thereafter considering negative spillover mechanisms and rebound effects, and finally, addressing implications for the design of interventions.

4.1 Mechanisms underlying positive spillover

4.1.1 Reduction of cognitive dissonance

The most prominent theory explaining positive spillover is the *Theory of Cognitive Dissonance* by Festinger (1957). This theory claims that people aim for consistency between their values, norms, cognitions, self-perceptions and actions. As a consequence, there exists a motivational and cognitive tendency in humans to reduce or avoid behavioural contradictions and discrepancies. Therefore, positive spillover effects ensuring consistency between a first behaviour and a subsequent behaviour can be expected on the basis of the Theory of Cognitive Dissonance (Nilsson et al., 2016). A mediating mechanism is for example, that the attractiveness of an alternative often increases after it has been chosen (Regan & Kilduff, 1988), to avoid cognitive dissonance between actions and evaluations. As a consequence, the consistent, repeated selection of the identical alternative has an increased probability.

According to the *Theory of Cognitive Dissonance*, someone who chooses to abstain from business flights for environmental reasons may subsequently also abstain from leisure flights in private life because this avoids a discrepancy between his or her environmental values and the subsequent behaviour. The reduction of cognitive dissonance can take place through behavioural consistency between different behaviours (behavioural spillover), between the same behaviours in different contexts (contextual spillover, e.g. business to private life as in the example) as well as between a behaviour and subsequent instances of the same behaviour (temporal spillover).

However, if behaviour changes are externally enforced then no such value changes and spillover effects can be expected (Festinger & Carlsmith, 1959). Business flights are often reduced as part of

cost-saving measures. For example, budget constraints can lead to fewer flights being approved within an organisation. Such external restrictions, in particular, when not even linked to pro-environmental concerns, will usually not alter private attitudes in the direction of reducing private flights for environmental aims.

4.1.2 Self-perception of positive environmental behaviours

Further theoretical mechanisms of positive spillover operating in the direction of consistency between past and future behaviour are explained by the *Theory of Self-Perception* by Bem (1972). According to the *Theory of Self-Perception*, people construct their behavioural values and norms and self-identity on the basis of perceptions and cognitions about the own behaviour. The performance and hence perception of the own environmentally friendly behaviour can accordingly lead to the formation of pro-environmental attitudes and a green or pro-environmental self-identity. The latter constructs can create environmental spillover as described in the following subsection.

4.1.3 Pro-environmental attitudes, values, norms and self-identity

Research on the prominent psychological constructs of **pro-environmental values** (e.g. Van der Werff et al., 2013, 2014), **self-identity** (Eby et al., 2019; Van der Werff et al., 2014), **attitudes** (Verplanken et al., 1994) and pro-environmental **social and personal norms** (Schwartz & Howard, 1981; Van der Werff & Steg, 2016) shows the strong positive influence of these concepts on a broad range of environmental behaviours. These constructs can therefore function as effective mediators of spillover.

There is considerable overlap between these concepts and therefore each of them has only a limited amount of unique explanatory power. Nevertheless, it is possible to distinguish them. According to Van der Werff et al. (2013), "*there is a conceptual difference between values and self-identity: **values are general and abstract principles that you strive for in life, while self-identity reflects how you see yourself***" (p. 56). Still, "*values may form important ingredients of a person's self-concept and thus contribute to a person's sense of identity*" (Verplanken & Holland, 2002, p. 434). Green self-identity and pro-environmental values are accordingly interrelated.

Both, pro-environmental self-identity and values are in turn closely connected to positive attitudes as it can be assumed that "*a person's self-identity would be reflected in that person's beliefs, values, and attitudes*" (Sparks & Shepherd, 1992, p. 390). A distinguishing aspect between attitudes and values is, that the latter are more fundamental (i.e. psychologically more deeply rooted) and central for the identity of a person. Environmental values are underlying environmental identities and thus promote positive attitudes towards a broad range of pro-environmental behaviours (Schultz & Zelezny, 1999).

Green-self-identity and values are more stable over time, and more difficult to change than attitudes (Gatersleben et al., 2014). For example, the attitude of a person towards going by bike to work may change from a sunny day to a day with rainy weather. However, the self-identity of seeing oneself as an environmentally friendly bicyclist, and the underlying value of protecting the environment by avoiding emissions are stable with respect to weather conditions.

The distinction between pro-environmental attitudes and behavioural norms is also important. Personal norms refer to behaviours which an individual approves or disapproves and considers morally and socially appropriate and acceptable for themselves (Schwartz, 1977; Schwartz & Howard, 1981). Personal norms and attitudes overlap considerably, as someone who has a positive attitude towards a certain pro-environmental behaviour, also tends to favour corresponding behavioural norms, and both, consequently, effectively promote positive environmental behaviour (Goldman et al., 2020; Mouro & Duarte, 2021; Stern, 2000).

Personal norms need, however, to be distinguished from social norms, and the latter can be further differentiated into injunctive (or prescriptive) and descriptive social norms (Cialdini et al. 1990; Jaich et al., 2023; Sabherwal & Sparkman, 2025):

- **Personal norms** define the behaviour, which someone expects from herself or himself, respectively.
- **Injunctive social norms** (sometimes also denoted as **prescriptive** social norms) define what others in the social environment approve or disapprove of
- **Descriptive social norms** refer to the actual behaviour of others in the social environment

So, injunctive norms define the socially approved behaviour, whereas descriptive norms describe the behaviour that is actually performed. Descriptive norms and prescriptive norms are consistent with each other, as long as people actually behave as it is socially expected from them. However, think for example of an Anti-littering sign reading "Keep the environment clean. Do not litter!" placed in the middle of a lawn severely polluted by littering. Here, the sign defines the injunctive social norm **not to litter**, whereas the pollution on the lawn shows that some people actually litter their waste (observable, descriptive norm). So here, injunctive and descriptive norm deviate from each other.

Injunctive and descriptive social norms can influence and shape personal norms. This can take place in educational setting, where social norms are communicated to pupils or students, but also at the workplace. Various studies have shown that injunctive pro-environmental norms of and within an organization, as well as positive environmental behaviours of co-workers (forming descriptive social norms) can influence members of an organization to adopt pro-environmental personal norms and corresponding pro-environmental behaviour (Jaich et al., 2023; Mouro & Duarte, 2021; Sabherwal & Sparkman, 2025). Thus, pro-environmental organisational environments and social norms can trigger spillover to the personal private life of employees by influencing their personal norms.

Further psychological concepts, which overlap to large extend with each other as well as with the concepts of pro-environmental attitudes, identity, and values are **environmental awareness** (e.g. Vasiljevic-Shikaleska et al., 2018), **environmental consciousness** (Sharma & Bansal, 2013), and **environmental concern** (Best & Mayerl, 2013; Nilsson & Küller, 2000). The three latter constructs attracted considerable research interest, and accordingly, promote a broad range of positive environmental behaviours. Hence, they can also be effective mediators of positive environmental spillover. They may be distinguished as 'awareness' points to the relationship between internal and external aspects, whereas 'consciousness' primarily refers to an internal, mental process or state. The term 'concern' implies that one is involved, affected and/or worried about the environment. So, the meanings of these terms have slightly different nuances.

In sum, it may be stated that the **development of positive environmental attitudes, values, awareness, consciousness, concern, norms and self-identity** can create spillover as all these constructs are operative not only in relation to one specific behaviour, but to a broad range of possible environmental behaviours (Brügger & Höchli, 2019; Eby et al., 2019). Positive spillover effects are therefore likely if the pro-environmental values and corresponding environmental attitudes (or environmental concern, norms, awareness or consciousness and green self-identities) are promoted by appropriate interventions (e.g. Behn et al., 2025). According to Thøgersen & Crompton (2009) an *„appeal to environmental imperatives is more likely to lead to spillover into other pro-environmental behaviours than an appeal to financial self-interest or social status*" (p. 141).

4.1.4 Action based learning, perceived self-efficacy and the formation of habits

Further processes that can generate positive spillover involve **action-based learning** (Thøgersen, 1999; Thøgersen & Noblet, 2012), **perceived self-efficacy** (Lanzini & Thøgersen, 2014) and the **formation of habits** (Zhou et al., 2017). **Action-based learning** approaches assume that the (successful) performance of a pro-environmental action increases corresponding action competencies, knowledge, **perceived self-efficacy** regarding the ability to perform the action, and corresponding positive attitudes based on positive feedback, experiences, and emotions (Lanzini & Thøgersen, 2014; Lauren et al., 2016). The successful performance of an action thus increases the probability of the performance of the same behaviour in the future, and hence behavioural consistency. The resulting possible repetition of a behaviour may ultimately lead to the formation of a habit that is connected to considerable behavioural stability and consistency over time. Accordingly, action-based learning and **habit formation** involve similar processes that can generate positive temporal and contextual spillover, and cross-behavioural spillover to similar or related behaviours by promoting behavioural consistency over time and varying contexts (Thøgersen & Ölander, 2003; Zhou et al., 2017). For example, people can form general habits promoting the consistent use of certain modes of transport in varying situational contexts (Verplanken et al., 1994; Aarts et al., 1997).

In the mobility sector, the promotion of positive environmental spillover through habits, therefore usually requires breaking existing, and building new, environmentally friendly habits. In many domains of business life, flying has become the habit. To change this, a new habit of "not flying", respectively of e.g. conducting meetings online or going by train, needs to be established. For the purpose of changing habits, specific psychological models and practical approaches have been developed.

According to Jackson (2005), in the context of habits "*behavioural change involves the 'unfreezing' of existing behavioural patterns and the discursive elaboration of new and preferable alternatives, before these become the basis of new behavioural patterns*" (p. 114). To achieve this, Dahlstrand and Biel (1997) recommend a four-steps proceeding. First, a person needs to recognize that the negative old habit needs to be changed. Second, the person needs to consider and try out alternative actions. Third, the person evaluates the new alternative action, and fourth and final, if the evaluation of the new behaviour is positive, it can become established as new positive habit.

In the mobility domain, practical approaches aiming to make people try out alternative modes of transportation include incentives, offering free-tickets and even the organization of competitions (e.g. bike-to-work). Small actions and incentives can pay-off on the long term, if e.g. a free train ticket might, after a positive evaluation or experience, encourage someone to shift from driving or flying short-distance to travelling by train.

<u>Summary of key points "Mechanisms Underlying Positive Spillover"</u>

- Positive spillover stems from consistency with pro-environmental values (cognitive dissonance), self-perception, and reinforcement of identity and positive norms.
- Organisational norms include descriptive (peer behaviour) and injunctive (approval) norms and both types of norms shape personal behaviour and can via spillover influence private life behaviour.
- Habit change requires unfreezing old routines, experimenting with alternatives, and reinforcing new behaviours.

4.2 Mechanisms underlying negative spillover

A broad range of mechanisms can underlie or cause negative spillover. The most prominent mechanisms have been investigated under the **term rebound effects** and in studies of **moral licensing**, which may also be denoted as a **mental rebound effect**.

4.2.1 Negative spillover effects and rebound effects

Reimers et al. (2022) defined rebound effects as the "gap between consumers' actual greenhouse gas emission savings and the emission savings that they could potentially realize using energy saving alternatives or through more sufficient consumption" (p. 3). A negative spillover means that a certain positive environmental behaviour A (e.g. saving emissions by going by bike instead of by car to the fitness studio), increases the probability or frequency of a subsequent environmentally harmful environmental behaviour B (e.g. traveling by car to work the next morning which is causing emissions). Such a negative spillover can cause or contribute to a rebound effect as defined above. So ultimately, negative behavioural spillover and rebound effects are closely related to each other as the former can cause the latter. The two concepts are thus overlapping to a considerable extent. It is therefore not surprising that the concepts of rebound effects and negative spillover effects are not consistently distinguished and sometimes even used interchangeably in the literature (e.g., Galizzi & Whitmarsh, 2019; Nash et al., 2017; Nilsson et al., 2016; Reimers et al., 2022; Truelove et al., 2014).

According to the definition above by Reimers et al. (2022), the focus of the term 'rebound effect' is rather on the size or measurement of secondary negative outcomes connected to an intervention measure or a positive environmental behaviour. On the contrary, analyses of negative spillover have a strong focus on the psychological, economic and logical or consequential mechanisms that influence secondary behaviours that run against the sustainability aim of an intervention or the initial positive environmental behaviour. However, studies on rebound effects are not solely interested in their environmental outcomes as suggested by the definition of Reimers et al. (2022), but instead also investigate the underlying mechanisms and processes (e.g., Hertwich, 2005; Font Vivanco et al., 2022; Ribera Jemio et al., 2024).

For example, Berkhout et al. (2000) explained rebound effects as follows: "Technological progress makes equipment more energy efficient. Less energy is needed to produce the same amount of product, using the same amount of equipment - ceteris paribus. However, not everything stays the same. Because the equipment has become more energy efficient, the cost per unit of services of the equipment falls. If a car for instance can drive more kilometers on a litre of gasoline, the fuel costs per kilometer fall, and so will the total costs per kilometer. A price decrease normally leads to increased consumption. […] The rebound effect can be expressed as a percentage of the energy efficiency improvement potential, predicted by the engineer. The energy efficiency improvement should be measured in physical units, rather than in monetary units, as is often incorrectly done."

Typical rebound effects covered in the literature are connected to efficient environmentally friendly technologies and/or corresponding energy-, economically and time-efficient positive environmental behaviours saving money or time. These savings are relative time or financial gains available for increased spending on traveling or consumption.

For example, using a fuel-efficient car may reduce travel costs, and the resulting financial savings may lead to increased spending for additional energy consuming activities (finance-based rebound effect). In a similar vein, using an energy efficient (and fast) train (e.g. 200 km/h) instead of traveling by car (e.g. 100 km/h) may save travel time; this additional free time might be used for (high) energy consuming activities, reducing or eliminating the efficiency gains (time-based rebound effect).

So rebound effects may be regarded as specific, technology-related examples of negative spillover. However, many studies on rebound effects also cover so-called mental rebound effects caused for example by moral licensing (Van der Loo et al., 2024). Accordingly, psychologically mediated negative spillover is not excluded from the literature on rebound effects. Therefore, both concepts will be used in an overlapping, and to some extent interchangeable manner in this review. This proceeding also seems reasonable in order to not exclude studies and findings, and corresponding recommendations for measures to reduce business flights, solely on the basis of the terminology they use. In sum, this review agrees with the viewpoint of Nash et al. (2017) that "while some approaches argue that rebound effects differ from behavioural spillover (e.g. Dolan & Galizzi, 2015), 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" (p. 10).

4.2.2 Under certain conditions, rebound effects can generate positive spillover!

The literature on rebound effects has a clear focus on negative secondary consequences of efficient (*fast and economic*), environmentally friendly technologies and behaviours. However, some ecologically positive behavioural decisions and/or technology choices may in fact lead to higher costs and time losses compared to environmentally unfriendly alternatives. Choosing the train instead of taking a plane for short and medium distance travels could be such a costly positive environmental behaviour as flights are often faster and cheaper (Garcia-Sierra et al., 2015; Hansmann & Binder, 2021). Accordingly, positive rebound effects could occur since train travellers may have less money and time they can use for emission-causing consumption and activities compared to people traveling by plane. Such possible positive spillover, which may also be considered positive rebound effects, need to be taken into account when designing a project aiming at the reduction of business flights and a corresponding contextual spillover to leisure flights. Such possible non-psychological time- or finance-based rebound effects also need to be considered in the context of measures reducing business flights.

4.2.3 Psychological mechanisms causing negative spillover

A psychological mechanism that can trigger such negative spillover effects is "*moral licencing*" (Reimers et al., 2022). For example, if people feel that they have 'done their bit' for reducing flights, because they abstain from business flights, they may feel to have the right (be licensed) to do more leisure flights (e.g. compared to people that do not change their business travel behaviour).

Moral licensing is presumably the most prominent and relevant psychological mechanism underlying negative spillover effects on the consumer level (e.g., De Witt Huberts et al., 2012; Merritt et al., 2010; Mullen & Monin, 2016; Sheeran & Webb, 2016). It entails that people perceiving their behaviour as environmentally friendly feel the moral right (moral license) to perform some environmentally less or unfriendly behaviours in other domains or even in the same context (self-licencing). Wikipedia (2025) gives the following examples: "*Savings through more efficient technologies can lead to additional consumption through moral licensing* (mental rebound effect)*. A Japanese study found that drivers who perceived themselves to have bought an eco-friendly car drove a good 1.6 times more kilometres in the first year after buying it than with their previous non-ecological car. Some of the potential savings are therefore offset by higher consumption. Similarly, households can leave energy-saving light bulbs burning for longer than conventional light bulbs and still believe they are doing something for the environment*" [translated from German Wikipedia "Moralische Lizenzierung"].

Another psychological mechanism that can create a mental rebound effect reducing the effectiveness of pro-environmental interventions is „reactance" (Kavvouris et al., 2020; Toussard & Meyer, 2025;

Yan et al., 2024). According to the *Reactance Theory* by Brehm (1966, 1972), people strive for behavioural autonomy and freedom. Thus, for example, the restriction of options for employees to select their travel mode autonomously (e.g. a no-flight policy for certain distances or a carbon cap) could trigger reactance motivation opposing such restrictions. A possible consequence could be that employees protest against the corporation policies, dislike or even undermine them or fly despite respective regulations. Reactance motivation may also lead to behavioural compensation for the experienced restrictions by having more leisure flights.

Summary key points "Mechanisms underlying negative spillover":

- Rebound effects and moral licensing reduce environmental gains by justifying and/or facilitating unsustainable behaviours.
- Reactance can arise when individuals feel their autonomy is constrained, triggering counteractions against imposed constraints.

5. Promoting contextual spillover from work to private life

5.1 Pro-environmental management practices, organizational culture, norms and values

There are many different behavioural contexts from which, and to which spillover can occur. Examples are spillover from educational settings to private or professional settings or spillover from private behaviour at home to behaviour as tourist in foreign countries (Xu et al., 2020). This section focuses on spillover between work and private life, as these attracted considerable research interest in the environmental behaviour domain.

According to Gadeikienė et al. (2019), the workplace is "*an inducing source, which can stimulate or draw-back sustainable behaviour both at workplace and in private life*" (p. 142). Since many years, studies have investigated the relationship between the values and norms of companies and their employees, and the resulting connections between behaviours at the workplace and in private life (e.g., Diskienė & Goštautas, 2013; Gelle-Jimenez & Jimenez, 2024; Near et al., 1980). In corresponding research not only spillover between behaviours, but also spillover of knowledge, skill, moods, values, attitudes and behavioural norms have been investigated (Edwards & Rothbard, 2000; Jaich et al., 2023). According to Poelmans et al. (2008), a value spillover takes place "*if the values lived out at work spill over to home*" (p. 144). A corresponding pro-environmental value change within an organization can thus mediate and enhance corresponding positive behavioural spillover from work to private life.

In a similar vein, Jaich et al. (2023) identified a spillover from injunctive and descriptive organizational social norms on private sphere positive environmental behaviours of employees at home. Accordingly, pro-environmental corporate management practices can set an injunctive norm for pro-environmental behaviour within the company as they imply that a company approves environmental protection. Consistent with this assumption, many studies "*revealed that organizational engagement in environmental protection positively affects employees' positive environmental behaviour at work (Rasmus and Steger, 2000; Paillé and Raineri, 2015; Raineri and Paillé, 2016; Fanghella et al., 2022)*" (Jaich et al., 2023, p. 520). The positive environmental behaviour of colleagues at work may in turn set a descriptive social norm of pro-environmental behaviour within a company. The resulting positive descriptive social norms and injunctive pro-environmental norms, may be internalized by employees and enhance sustainable behaviours at home. In the two studies reported by Jaich et al. (2023), perceived positive environmental behaviour of colleagues at work (descriptive organizational social norm) accounted for 11%, and 57%, respectively, of the variance of self-reported positive environmental behaviours of the study-participants at home.

Various studies report a corresponding positive spillover of environmental behaviours from work to private life and vice versa (Klade et al., 2013; Lee et al., 1995). For example, Tudor et al. (2007) found "*employees who practised recycling activities at home also being more likely to practise a similar behaviour at work"* (p. 409). Andersson et al. (2012) found a positive spillover to private sphere behaviour after an environmental management system promoting waste separation was introduced at the workplace. In a similar vein, Littleford et al. (2014) reported a contextual positive spillover from energy saving behaviours between work settings and home settings.

Some organizational factors, and in particular aspects of the organization-employee relationships have been found to moderate the size of spillover from company to work. A study by Paillé et al. (2019) found that support of superiors for environmental protection, perceived self-efficacy of workers on their job, and a positive emotional commitment of the employees to the organization increases positive spillover from intervention programs in an organization to private life (Paillé et al., 2019). A positive identification of employees with their company or organization also increased positive spill-over from an organizational intervention to private life according to a study by Rashid and Mohammad (2011).

Furthermore, various studies showed that interventions promoting positive environmental attitudes, environmental concern, and a green-self-identity of employees can increase spillover to a broad range of positive environmental behaviours (Behn et al., 2025). Pro-environmental interventions in the company should therefore be oriented explicitly toward environmental goals and emphasize their importance. Organizational interventions that are designed and communicated with some orientation towards environmental education to promote environmental attitudes of the employees, may thus foster positive spillover to the private sphere. In addition, a non-authoritative, participative development of organizational interventions in collaboration between management, employees, and scientists can be helpful to increase intrinsic motivation of the staff and prevent reactance. The emphasis of interventions on the intrinsic motivation to protect the environment is important to prevent moral licensing and hence to promote positive and avoid negative spillover.

Accordingly, it is important for promoting positive spillover of interventions to "*create an organizational culture which fosters consistent pro-environmental norms across organizational levels (e.g. leadership, co-workers) and practices (e.g. communication, policies)"* (Sabherwal & Sparkman, 2025, p. 4). Hence, organizational activities should consistently signal injunctive and descriptive pro-environmental norms through environmental policies, management practices, operations, and supportive statements.

A specific literature search for flight reduction programs in organizations and corresponding behaviour spillover from work to private life did not retrieve a single scientific publication. Therefore, conducting a study and project aiming to reduce flights within organizations, and promote and measure positive spillover from work to private life would be timely and important for filling a corresponding research gap.

<u>Summary key points "Promoting contextual spillover from work to private life":</u>

- Work–private life spillover involves transfer of behaviours, values, norms, and skills, within (pro-environmental) workplace contexts influencing private actions.
- Organizational values and management practices shape injunctive norms (approval) and descriptive norms (peer modelling) that employees may internalize and apply at home.
- Supportive leadership, perceived self-efficacy of employees, emotional commitment to, and identification with the organization strengthen spillover effects.

5.2 Participatory design of interventions

In some cases, behaviours that occur spontaneously produce positive or negative spillover effects. However, in many cases interventions (e.g., environmental education programs, policy changes, prohibitions, incentives) trigger behavioural changes and create possible spillover effects (Truelove et al., 2014; Henn et al., 2020; Xu et al., 2018). In the context of pro-environmental interventions behavioural spillovers can be "*understood as the effect of an intervention (rather than the primary behaviour) on subsequent behaviours not targeted by the intervention"* (Kumar et al., 2023, p. 777). Accordingly, pro-environmental interventions should be designed in ways that promote positive and avoid negative spillover. To understand and consider spillover effects of interventions, it is crucial to comprehensively evaluate their overall effects on environmental behaviours and the environment.

To prevent negative spillover due to reactance, pro-environmental interventions, such as for example flight reduction programs in companies can be developed in line with the Self Determination Theory by Ryan and Deci (2000). This theory assumes, and corresponding research has shown, that people want to act autonomously and proceed self-efficient within the context of positive social relationships (Deci & Ryan, 2000). According to this theory, intrinsic motivations for environmental interventions and behaviours can be increased if people have autonomy, perceive themselves as competent, and experience respect and positive feedback from others in social relationships in the context of learning and decision-making processes. Participatory processes, in which problems are defined, framed, and approached collectively in democratic, cooperative processes where all participants are acting and communicating on equal footing can thus promote positive and avoid negative spillover (Stauffacher et al., 2006). Participatory environmental planning and actions can lead to intrinsic and social motivation gains promoting pro-environmental attitudes and values and the development of green self-identities possibly resulting in further positive spillovers that can promote positive environmental behaviours (Hansmann, 2010). If scientists are involved in the development of interventions, the corresponding planning and design processes can be regarded as transdisciplinary collective problem-solving processes involving mutual learning between science and society. Such mutual learning processes can be implemented for example in transdisciplinary living labs.

According to Sabherwal and Sparkman (2025), institutions should encourage "*participation in climate-relevant decisions to make citizens* [employees] *feel empowered and build trust between stakeholders*" and "*instill a sense of working together with others to reduce feelings of social pressure and enhance motivation to act*" (p. 4).

Summary key points "Participatory design of interventions":

- Spillover is more likely when interventions engage participants meaningfully and support intrinsic motivation.
- According to the Self-Determination Theory, autonomy, competence, and supportive social environments foster long-term behavioural change.
- Co-creation processes for interventions build acceptance and ownership, enable learning, and expand spillover beyond the initial target.

6. Quantification of spillover effects

6.1 Spillover findings and measures of previous studies and meta-analyses

Quantifying spillover effects is challenging, because various study designs, measures and levels of analysis were used in this regard. A first difference exists between the analysis of spillovers from spontaneous behaviours, which are merely observed and measured over time, and spillovers of interventions that actively aim to trigger or change a certain behaviour and in addition have the potential to produce spillover. According to Kumar et al. (2023) there is "*a critical gap in the literature regarding the distinction between spillover effects caused by interventions as distinct from those caused by primary behaviours*" (p. 773).

An example for the analysis of non-interventional spillover is the study by Thøgersen and Ölander (2003; *mentioned previously in Section 2*), which found that the use of an environmentally friendly mode of transport at the time of a survey explained up to 92% of the variance of the corresponding behaviour one year later. Analyses, which do not involve any experimental or practical interventions, are however, often rather correlational and can therefore not be interpreted as spillover in the strict causal sense (Carrico, 2021). To speak of a causal spillover would require that going by bike to work in year one, causes a person to also go to work by bike in year two. However, in fact a lacking driver licence or lacking ownership or access to a car, and poor access to public transport near home may be the reason for going by bike in both years. So strictly speaking, only a high correlation was observed here, and not a real causal spillover from one behaviour to a future behaviour.

In the context of organizational change programs, spillover caused by interventions are in the foreground. An example of a concrete intervention producing a behavioural spillover, is the '*Foot in the door'*-technique experiment that was presented in Section 2. Here, in the control only 20% of households agreed to place a large "*Drive Carefully!*" billboard in their front-yard condition, whereas after an intervention asking for the placement of a small "*Be a safe driver!*"-card, 76% of households agreed to place the large billboard. Here a causal interpretation is possible, since there was a random assignment of households to either the control or the experimental condition.

In this example, the absolute percentage point difference, from the spillover effect was (76% - 20% =) 56%, but in relative terms there was an increase by (56% / 20% =) 280%. The increase in terms of absolute percentage points reflects the magnitude of changes in behaviour and accordingly seems more important for an objective impact assessment, here. However, in terms of the statistical significance (*p*) and effect size (*d*), the relative increase is likewise important. Statistically, as an increase from, for example, 1% to 6% is statistically much more significant (more exceptional, and hence less probable in random data) than an increase from 50% to 55%, even though the percentage point difference is 5% in both cases. For the emission reduction in absolute terms, it makes however, no difference whether out of a population of 100 persons, 55 instead of 50, or 6 instead of only 1 person, switch from plane to train for reaching a certain common destination. The emission reduction is in both cases five times the difference between the emissions of going by plane compared to going by train.

However, instead of percentage differences, effect size measures need to be used in meta-analyses that aggregate a large number of studies in order to calculate the strength, which certain interventions or influential factors have produced on average in these studies. A common effect size measure is Cohen's *d*, which is basically defined as the difference between two means (usually of the experimental minus control condition) divided by the standard deviation of the underlying data points. Specific percentage differences and correlations can, however, likewise be translated into effect sizes, so that

studies using a variety of different measures can be integrated in meta-analyses using one integrative measure.

According to a meta-analysis on spillover effects of pro-environmental behaviours by Maki et al. (2019), the average effect size of observed spillover in 25 studies was only slightly positive (Cohen's d_i = 0.17) with respect to *behavioural intentions* and even slightly negative with respect to actually measured secondary *environmental behaviours* (d_{bi} = -0.03). A similar, more recent meta-analysis by Geiger et al. (2021) obtained similar results with a small positive effect size for behavioural intentions (d = 0.15), and a negligible average effect size for environmental behaviours (d = 0.01).

Since presumably not all readers are familiar with Cohen's d, and because correlations (r) and the related determination coefficient (r^2) are much more common in statistical reporting, we (re-)translated some of these values into correlation coefficients (r) according to Poom & Wåhlberg (2022) and Saroglou (2002) using the formula:

$r \approx d/(d^2 + 4)^{0.5}$

Using this formula, the effect size of d = 0.17 for behavioural intentions reported above (cf. Maki et al., 2019) corresponds to a correlation of r = 0.085, respectively an explained variance of only r^2 = 0.7% and is accordingly negligible. And the effect size reported by Maki et al. for behaviours is even more negligible (r = -0.015 and $r^2 \approx$ 0.0%).

The square of a correlation is known as determination coefficient, r^2, and denotes the share of variance which two variables (respectively behaviours) have in common. If the first of two behaviours causes the second behaviour through a spillover, then a r^2 of 1 means that all variance in the secondary behaviour is caused by a spillover from the first behaviour. If the squared correlation is zero, there is no spillover.

The inconsistent and on average negligible spillover effects found by Maki et al. (2019) and Geiger et al. (2021) can be easily explained by the fact that some of their reviewed studies showed positive and some negative spillover. However, one factor that moderated the size of the spillover was the similarity between the investigated behaviours. For intentions regarding similar pro-environmental behaviours an effect size of d = 0.74 was calculated, corresponding to an explained variance of 12%.

When considering contextual spillover, in addition to similarities between the considered behaviours, the characteristics, interrelationships, similarities and differences between the two considered contexts may influence the size and potential of spillover. A study by Nik Ramli and Naja (2011) found that pro-environmental behaviours at work explained on average 14% of the variance in a set of different pro-environmental behaviours at home. According to Nik Ramli and Naja "*other studies related to work-family spillover also resulted with a r^2 of between 5% - 12%*" and hence showed even smaller spillover.

In sum, it needs to be acknowledged that many of the determining factors for the size of spillover are not yet known. However, the spillover effect in the experimental condition with the card display in the *'Foot in the door'*-experiment seems stronger than in other studies that can be interpreted in causal terms. To calculate a measure of explained variance for this intervention, the phi-coefficient φ representing the Pearson correlation coefficients (≈ r) for two binary variables (*intervention behaviour A: yes-no; performance of behaviour B: yes-no*) was calculated, which resulted in a measure of r^2 = 31.4% (r = 0.56).

<u>Summary key points "Spillover findings and measures of previous studies and meta-analyses":</u>

- Studies often rely on correlation-based measures, which can overestimate causal spillover by not accounting for underlying constraints or structural factors (e.g. shared third variables).
- Effect sizes are generally small but higher when behaviours are similar and contextually linked.
- Average effect sizes across studies are reduced by studies reporting negative spillover.
- Spillover from work to private behaviour explains a modest but relevant share (5–14%) of observed variance.

6.2 Spillover scenarios for organizational flight reduction measures

In summary, previous research shows that the direction and expected quantities of spillover strongly depend on the exact design of an intervention and on the behaviours and contexts that are investigated. An intervention therefore needs to be designed and implemented carefully in order to produce positive spillover and avoid negative spillover processes. In the context of organizational measures to reduce business flights, positive/negative spillover effects mean that business flight reduction measures would decrease/increase flights in the private sphere. However, when considering the overall impact of organizational flight reduction measures, one needs to consider that the total environmental impact of an intervention includes both its primary effects and the positive (or potentially negative) spillover. Therefore, spillover effects need to be taken into account appropriately but should not be overvalued compared to the primary goals.

In many instances, a successful intervention reaching its primary behavioural targets, but lacking further secondary spillover, may be overall more beneficial to the environment, compared to an ineffective intervention regarding the primary target, which nevertheless produces some positive spillover. So, a quantification of the effects of an intervention needs to consider (i) primarily targeted behaviours, (ii) positive spillover, and (ii) negative spillover in an accumulative way and must not concentrate solely on one of these aspects.

The twelve spillover scenarios S_{ij} presented in Table 3 therefore represent combinations of interventions with *low*, *substantial,* and *high* effectiveness in achieving the primary target to reduce business flights, and with *no*, *usual (to be expected)*, *high,* and *unexpectedly high positive spillover effects* on the private flight pattern.

Specifically, the scenarios S_{ij} *are* assuming

- *10%*, *50%*, *80%* reduction of business flights for i = 1, 2, 3, and
- *0%, 15%, 30%, 50%* spillover to private flights for j = 1, 2, 3, 4.

The reduction of business flight emissions ($\Delta_{business}$, in %) is calculated as the difference of the emissions after and before the intervention, relative to the total business emissions before the intervention:

$$\Delta_{business} = (B_{before} - B_{after}) / B_{before} * 100 \quad \text{(in \%)}$$

where B_{before} and B_{after} are the organisation's total emissions (in tCO_2eq) due to business flights before and after the intervention, respectively.

The spillover due to the reduction of private flights is calculated also relative to **business flight emissions** of the organisation before the intervention:

$$\Delta_{private} = (P_{before} - P_{after}) / B_{before} * 100 \quad \text{(in \%)}$$

where P_{before} and P_{after} are the total emissions (in tCO_2eq) due to private flights of the employees of the organisation before and after the intervention, respectively.

Therefore, to give two examples:

- "50% reduction of business flights" means $\Delta_{business}$ = 50%, which means that the employees of the organisation reduce their business flight activities such that the resulting total business flight emissions are reduced by 50%.
- "15% spillover to private flights" means $\Delta_{private}$ = 15%, which means that the same employees of the organisation reduce their private flight activities such that this reduction corresponds to 15% of their total business flight emissions (before the intervention).

The reduction of business flights ($\Delta_{business}$) is provided for each scenario by one of three effectiveness assumptions describing organizational intervention measures with l*ow* (10%), *substantial* (50%) and *high* (80%) effectiveness in reducing business flights. The size of the spillover effect ($\Delta_{private}$) of each scenario is defined by assumptions of either *no* (0%), *usual* (15%), *high* (30%), or *unexpectedly high* (50%) spillover of organizational intervention measures on private flights relative to business flights prior to the intervention. The rational of the four distinguished scenario spillover levels can be briefly explained as follows:

- The variant with 0% spillover represents a baseline or zero scenario. It can result from an intervention that enforces organizational behavioural change without pro-environmental background and that was designed through an authoritarian top-down approach without participation of employees.
- The 15% spillover was termed *usual* as it roughly corresponds to spillover between similar behaviours according to the meta-analysis by Maki et al. (2019) and to spillover between work and private sphere environmental behaviours reported by Nik Ramli and Naja (2011). So, this scenario reflects the level of spillover that may roughly be expected from a reasonable intervention with considerable focus on environmental issues. To achieve this, the intervention should also take a voluntary or incentive-based and participatory approach, that is not causing reactance due to restrictive and authoritative elements.
- The 30% spillover was termed *high* as it corresponds to the spillover of the effective 'Foot in the door'-technique. This may be regarded as an upper limit of the size of spillover that can be realistically expected from an organizational flight reduction program in terms of a possible reduction of private flights. However, such a strong spillover will presumably only result from an intervention that has a strong pro-environmental orientation and is designed within a participatory approach.
- The 50% spillover was termed *unexpectedly high*, since only a highly elaborated design and communication of an intervention can presumably reach such a strong level of spillover. A strong pro-environmental orientation and design of the intervention through a participatory approach is presumably also necessary to achieve this.

Mathematically, we now consider the total reduction of emissions from business and private flights, which are:

$$B_{before} - B_{after} + P_{before} - P_{after} \qquad \text{(in } tCO_2eq\text{)}$$

This reduction we again express in percentages of the total business flight emissions before the intervention, B_{before}, and therefore we get

$$\Delta_{total} = (\Delta_{business} * B_{before} + \Delta_{private} * B_{before}) / B_{before} = \Delta_{business} + \Delta_{private} \qquad \text{(in \%)}$$

Therefore, with our definitions of $\Delta_{business}$ and $\Delta_{private}$, we obtain a straightforward formula for calculating the total relative reduction, Δ_{total}, for each scenario S_{ij}.

However, we should keep in mind that we consider here reductions of both business and private flights relative to the original business flight emissions. As a consequence, Δ_{total} can reach large values for organisations with relatively few business flights but many private flights. To make a simple example, we assume an organisation with, per year, 100 business flights (for simplicity we assume here that all flights have the same emissions) and with 1000 private flights of the employees. Assuming further that they reduce their business flights from 100 to 80 (relative change of 20%) and their private flights from 1000 to 900 (relative change of 10%), we would get a reduction of business flight emissions of $\Delta_{business}$ = 20%, and a spillover of $\Delta_{private}$ = 100%, leading to Δ_{total} = 120%. In another company with more business flights (reduction from 1000 to 800) but the same private flight reduction behaviour, we would obtain $\Delta_{business}$ = 20%, a spillover of $\Delta_{private}$ = 10%, leading to Δ_{total} = 30%. This should be kept in mind when interpreting the calculations below.

Table 3 presents the total relative reduction, Δ_{total}, for all 12 scenarios, S_{ij}. Empirical studies are required to get concrete numbers and empirical data of the actual primary effects and spillover effects from actual flight reduction programs in organizations. Table 3 can only illustrate the potential range of corresponding measures in terms of its primary effects on organizational flight travel and spillover into the private sphere. The design and characteristics of interventions plays an important role as reflected in the development of the different spillover scenarios.

Notably, changes of private flight pattern of employees may also trigger connected changes of the flight pattern of family members. However, such secondary spillover from organizational behaviour to private behaviour of organisation members reaching further away to the behaviours of their family members at home, and possible their friends outside work have been barely addressed in the literature. They are accordingly not included in Table 3 and need to be investigated in future research. These secondary spillovers are considered outside of the system boundary applied in the scenarios presented here.

Table 3: Reduction of emissions from business flights, private flights and total flights according to the intervention scenario Sij, considering interventions with primary effectiveness ranging from 10% to 80% and spillover from 0% to 50%. See text for details.

Scenario - S_{ij}	**Primary Effect $\Delta_{business}$ (%)**	**Size of Spillover $\Delta_{private}$ (% in relation to pre-intervention business flights)**	**Total emission reduction (business + private): $\Delta_{total} = \Delta_{business} + \Delta_{private}$ (%)**
S1,1	10%	0%	10%
S1,2	10%	15%	25%
S1,3	10%	30%	40%
S1,4	10%	50%	60%
S2,1	50%	0%	50%
S2,2	50%	15%	65%
S2,3	50%	30%	80%
S2,4	50%	50%	100%
S3,1	80%	0%	80%
S3,2	80%	15%	95%
S3,3	80%	30%	120%

S4,4	80%	50%	130%

Table 3 shows that both the primary effectiveness and the spillover of interventions need to be considered in the design of organizational flight reduction programs. A strict authoritarian limitation of business flights within an organization may be very effective within the organization, but may possibly create no positive spillover, or eventually even negative spillover into private life based on reactance and compensation. On the contrary, a purely voluntary intervention approach backed by pro-environmental arguments may prove rather ineffective to reduce business flights within an organization due to time constraints and performance pressure but may produce considerable positive spillover as employees reduce their holiday flights as consequence of the pro-environmental communication. A focus on both, primary effects and spillover effects is required for the design of optimal interventions, as total emissions and their environmental effects should be in the foreground.

Summary key points" Spillover scenarios for organizational flight reduction measures":

- Spillover is difficult to measure due to methodological variations and challenges in proving causality.
- Stronger effects emerge between similar behaviours and similar contexts. Considering work-home transfers of abstaining from flights, we investigate similar behaviours, but, in a greatly different context – so medium size spillover can be expected.
- For the optimal design of effective flight reduction measures, both the primary effects and the spillover effects of an intervention need to be considered.

7. Outlook

Reducing greenhouse gas emissions from flights is critical for achieving net zero targets, with spillover effects playing a significant role in the overall impact of mitigation strategies. As highlighted in this study, understanding the mechanisms behind spillover is essential for designing interventions that maximize positive spillover while minimizing unintended negative spillover effects. Notably, different types of spillover are important for air travel reduction and enable scaling effects, including personal spillover from business to leisure flights, intra-organisational spillover (between different people within the same organisation, for example through change of norms and role models), inter-organizational spillover (between different organisations) and societal spillover (between societal groups or political entities). We will use these insights to design and set up a follow-up cooperation project where we accompany and support a few organisations to transform current travel practices towards "new pathways for international business and exchange relations".

Glossary of Definitions and Key Concepts

Spillover

Occurs when engaging in one behaviour changes the likelihood of performing another behaviour- either positively or negatively. The first behaviour can occur naturally or it can be triggered by an intervention. In addition, the term spillover can be applied if an intervention alters the probability of behaviours that it does not focus on.

Positive Spillover

A behavioural effect where one pro-environmental action increases the likelihood of subsequent pro-environmental behaviours (or decreases the likelihood of subsequent environmentally harmful behaviours).

Negative Spillover

A behavioural effect where an initial pro-environmental action reduces the likelihood of further pro-environmental actions (or increases the likelihood of environmentally harmful behaviours).

Cross-behavioural Spillover

Occurs when one behaviour influences a different subsequent behaviour, especially when both behaviours share a domain or purpose.

Temporal Spillover

Refers to repeating the same behaviour over time. It is strengthened by short time gaps and habit formation.

Contextual Spillover

The performance of the same or similar behaviour in a different context, such as transferring reduced flying practices from the workplace to private life.

Personal Spillover

When an individual's behaviour in one domain or context influences their own behaviour in another.

Interpersonal Spillover

Occurs when one person's behaviour influences the behaviour of others, for example through modelling or social norms.

Organisational Spillover

Describes how behaviours and practices spread within an organisation (intra-organisational) or between organisations (inter-organisational).

Societal Spillover

Describes how norms, behaviours, or practices spread in or between societal groups or political entities

Cognitive Dissonance

A psychological mechanism where people are motivated to align their behaviour with their attitudes and values to reduce discomfort caused by inconsistency.

Self-perception

A mechanism through which individuals develop their self-identity by interpreting their own past behaviours as evidence of their attitudes and values.

Identity / Green Identity

A person's self-understanding in relation to environmental responsibility. It is shaped through consistent actions and recognition of pro-environmental behaviours as well as by (environmental) education and for example personal experience with nature.

Values

General guiding principles that shape attitudes and behaviours across different contexts. Pro-environmental values support sustainability-related norms and actions.

Personal Norms

Self-expectations regarding appropriate behaviour. They reflect internal moral obligations and overlap with personal values.

Injunctive Social Norms

Describe what is socially approved or disapproved of by others. These norms communicate expected behaviour within a group or institution (and can also be denoted as: prescriptive norms).

Descriptive Social Norms

Refer to what people in a group or setting actually do, i.e., the observed common behaviours.

Habits

Context-dependent patterns of behaviour that are learned and repeated over time. Once established, habits promote consistent action and enable temporal and contextual spillover.

Action-based Learning

A learning process where individuals actively try out and evaluate new behaviours. Behaviour change involves recognising a negative old habit, testing alternatives, evaluating them, and establishing new routines.

Rebound Effect

It typically occurs when efficiency gains (e.g. time or money savings) of environmentally friendly behaviours increase consumption elsewhere, potentially reducing the net environmental benefit (e.g. when consumers are spending the gained money during the gained time for expensive environmentally harmful activities).

Positive Rebound

When more time or money spent on sustainable options reduces resources available for harmful consumption (e.g. taking longer train journeys leaves less time for other emissions-intensive activities).

Moral Licensing

A phenomenon where individuals feel justified in performing unsustainable behaviours after previously acting in an environmentally responsible way.

Reactance

A defensive reaction to perceived restrictions on one's freedom, which can lead to resistance or compensatory behaviour that undermines the intended effect of an intervention.

Self-Determination Theory (SDT)

A psychological theory explaining that intrinsic motivation increases when individuals experience autonomy (*compare 'Reactance'*), competence, and relatedness (social connection). These conditions help foster sustainable behaviour change and positive spillover.

References

Aarts, H., Verplanken, B., & Knippenberg, A.v. (1997). Habit and information use in travel mode choices. *Acta Psychologica, 96*, 1–14.

Aarts, H., Verplanken, B., & Knippenberg, A.v. (1998). Predicting behavior from actions in the past: repeated decision making or a matter of habit. *Journal of Applied Social Psychology*, *28*, 1355–1374.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Andersson, M., Eriksson, O., & Von Borgstede, C. (2012). The Effects of Environmental Management Systems on Source Separation in the Work and Home Settings. *Sustainability, 4*, 1292–1308.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Behn, O., Wichmann, J., Leyer, M., & Schilling, A. (2025). Spillover effects in environmental behaviors: a scoping review about its antecedents, behaviors, and consequences. *Current Psychology, 44*, 3665-3689.

Bem, D. J. (1972). Self-perception theory. In Advances in experimental social psychology (Vol. 6, pp. 1-62). Academic Press.

Bergero, F., Hafner, P., Owen, B., Schumann, U., & Würtenberger, L. (2023). Mitigating aviation emissions in line with the Paris Agreement. CE Delft.

Berkhout, P. H., Muskens, J. C., & Velthuijsen, J. W. (2000). Defining the rebound effect. *Energy policy, 28*(6-7), 425-432.

Best, H., & Mayerl, J. (2013). Values, beliefs, attitudes: An empirical study on the structure of environmental concern and recycling participation. Social Science Quarterly, 94(3), 691-714.

Brehm, J.W. (1966). A theory of psychological reactance. New York, USA: Academic Press.

Brehm, J.W. (1972). Responses to loss of freedom. A theory of psychological reactance. Morristown NJ, USA: General Learning Press.

Brügger, A., & Höchli, B. (2019). The role of attitude strength in behavioral spillover: Attitude matters-but not necessarily as a moderator. *Frontiers in Psychology, 10*, 1018.

Carrico, A. R. (2021). Climate change, behavior, and the possibility of spillover effects: Recent advances and future directions. Current Opinion in Behavioral Sciences, 42, 76-82.

Cialdini, R.B., Reno, R.R., & Kallgren C.A. (1990). A focus theory of normative conduct. Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology, 58*(6), 1015–1026.

Crowe Global. (2025, April). Post-COVID business travel: Realizing the value of in-person meetings. Retrieved August 7, 2025, from https://www.crowe.com/global/insights/post-covid-business-travel-realizing-the-value-of-in-person-meetings

Dahlstrand, U. & Biel, A. (1997). Pro-environmental habits: propensity levels in behavioural change. *Journal of Applied Social Psychology, 27*, 588-601.

Deci, E.L., & Ryan, R.M. (2000). The —what‖ and —why‖ of goal pursuits: Human needs and the self-determination of behavior. *Psychol. Inq., 11*, 227–268.

De Houwer, J. (2019). On how definitions of habits can complicate habit research. *Frontiers in Psychology, 10*, 2642.

Deloitte. (2024). Navigating toward a new normal: 2023 Deloitte corporate travel survey results. Deloitte Insights. Retrieved August 7, 2025, from https://www2.deloitte.com

Diskienė, D., & Goštautas, V. (2013). A fit between individual and organizational values and its implications for employees' job satisfaction and performance. Ekonomika 92(2): 93-107.

De Witt Huberts, J. C., Evers, C., & De Ridder, D. T. (2012). License to sin: Self-licensing as a mechanism underlying hedonic consumption. *European Journal of Social Psychology, 42*(4), 490-496.

Dolan P., & Galizzi M.M. (2015). Like ripples on a pond: behavioral spillovers and their implications for research and policy. *Journal of Economic Psychology, 47*, 1-6.

Dreijerink, L., Handgraaf, M., & Antonides, G. (2023). Does perceived similarity of pro-environmental behaviors lead to behavioral spillover?. Frontiers in Behavioral Economics, 2, 1226590.

Eby, B., Carrico, A. R., & Truelove, H. B. (2019). The influence of environmental identity labeling on the uptake of pro-environmental behaviors. *Climatic Change, 155*, 563–580.

Edwards, J. R., & Rothbard, N. P. (2000). Mechanisms linking work and family: Clarifying the relationship between work and family constructs. Academy of Management Review, 25, 178–199.

Elf, P., Gatersleben, B., & Christie, I. (2019). Facilitating positive spillover effects: New insights from a mixed-methods approach exploring factors enabling people to live more sustainable lifestyles. Frontiers in Psychology, 9, Article e2699. https://doi.org/10.3389/fpsyg.2018.02699.

Fanghella, V., D'Adda, G., & Tavoni, M. (2022). Evaluating the impact of technological renovation and competition on energy consumption in the workplace. *Journal of Environmental Economics and Management, 114*, 102662. https://doi.org/10.1016/j.jeem.2022.102662.

Festinger, L. (1957). A theory of cognitive dissonance. Evanston: Row, Patterson and Company.

Festinger, L., & Carlsmith, J. M. (1959). Cognitive consequences of forced compliance. *The journal of abnormal and social psychology, 58*(2), 203.

Font Vivanco, D., Freire-González, J., Galvin, R., Santarius, T., Walnum, H. J., Makov, T., & Sala, S. (2022). Rebound effect and sustainability science: A review. Journal of Industrial Ecology, 26(4), 1543-1563.

Freedman, J. L., & Frazer S. C. (1966) Compliance without pressure: the foot-in-the-door technique. *Journal of Personality and Social Psychology, 4*(2), 195-202.

Friedrichsmeier, T., Matthies, E., & Klöckner, C. A. (2013). Explaining stability in travel mode choice: An empirical comparison of two concepts of habit. *Transportation Research Part F: Traffic Psychology and Behaviour, 16*, 1-13.

Gadeikienė, A., Dovalienė, A., Grase, A., & Banytė, J. (2019). Sustainable consumption behaviour spill-over from workplace to private life: Conceptual framework. *Polish Journal of Management Studies*, *19*(2), 142-154.

Gärling, T., Boe, O., & Fujii, S. (2001). Empirical tests of a model of determinants of script based driving choice. *Transportation Research Part F: Traffic Psychology and Behaviour 4*, 89–102.

Galizzi, M. M., & Whitmarsh, L. (2019). How to measure behavioral spillovers: a methodological review and checklist. *Frontiers in Psychology, 10*, 342.

Garcia-Sierra, M., Van Den Bergh, J. C., & Miralles-Guasch, C. (2015). Behavioural economics, travel behaviour and environmental-transport policy. Transportation Research Part D: Transport and Environment, 41, 288-305.

Gardner, B., de Bruijn, G. J., & Lally, P. (2011). A systematic review and meta-analysis of applications of the self-report habit index to nutrition and physical activity behaviours. *Ann. Behav. Med. 42*, 174–187. doi: 10.1007/s12160-011-9282-0

Gatersleben, B., Murtagh, N., & Abrahamse, W. (2014) Values, identity and pro-environmental behaviour, Contemporary Social Science, 9:4, 374-392. https://doi.org/10.1080/21582041.2012.682086

Geiger, S. J., Brick, C., Nalborczyk, L., Bosshard, A., & Jostmann, N. B. (2021). More green than gray? Toward a sustainable overview of environmental spillover effects: A bayesian meta-analysis. *Journal of Environmental Psychology, 78*, 101694.

Gelle-Jimenez, M. H., & Jimenez, F. C. (2024). Understanding congruence of values: a phenomenographic data analysis. International Journal of Research in Business and Social Science, 13(5), 377-385.

Gössling, S., Hanna, P., Higham, J., Cohen, S., & Hopkins, D. (2019). Can we fly less? Evaluating the 'necessity' of air travel. *Journal of Air Transport Management, 81*, 101722.

Gössling, S., & Humpe, A. (2020). The global scale, distribution and growth of aviation: Implications for climate change. *Global Environmental Change, 65*, 102194.

Goldman, D., Hansmann, R., Činčera, J., Radović, V., Telešienė, A., Balžekienė A., & Vávra, J. (2020). Education for environmental citizenship and responsible environmental behavior (pp. 115-137). In A. Ch. Hadjichambis, P. Reis, D. Paraskeva-Hadjichambi, J. Činčera, J. Boeve-de Pauw, N. Gericke, M.-C. Knippels (Eds.), Conceptualizing Environmental Citizenship for 21st Century Education. Cham: Springer Nature. https://doi.org/10.1007/978-3-030-20249-1_8

Hansmann, R. (2010). Sustainability learning: An introduction to the concept and its motivational aspects. *Sustainability, 2*, 2873-2897.

Hansmann, R., & Binder, C. R. (2021). Reducing personal air-travel: Restrictions, options and the role of justifications. *Transportation Research D: Transport and Environment, 96*, 102859. https://doi.org/10.1016/j.trd.2021.102859.

Hansmann, R., Scholz, R. W., Francke C.-J. A. C., & Weymann, M. (2005). Enhancing environmental awareness: Ecological and economic effects of food consumption. Simulation and Gaming, 36(3), 364-382.

Havlíčková, D., & Zámečník, P. (2020). Considering habit in research on travel mode choice: A literature review with a two-level methodology. *Transactions on transport sciences, 11*(1), 18-32.

Heijs, W.J.M. (2006). Household energy consumption. In: Verbeek, PP., Slob, A. (eds) User Behavior and Technology Development., vol 20. Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-5196-8_15

Henn, L., Otto, S., & Kaiser, F. G. (2020). Positive spillover: the result of attitude change, Journal of *Environmental Psychology, 69*: 101429.

Hertwich, E. G. (2005). Consumption and the rebound effect: An industrial ecology perspective. *Journal of industrial ecology, 9*(1-2), 85-98.

International Civil Aviation Organization (ICAO). (2019). Environmental Report 2019. Retrieved August 24, 2025, from https://www2023.icao.int/environmental-protection/pages/envrep2019.aspx,

Jackson, T. (2005). Motivating Sustainable Consumption: A Review of Evidence on Consumer Behaviour and Behavioural Change (A report to the Sustainable Development Research Network). Surrey, UK: Centre for Environmental Strategy, University of Surrey.

Jaich, H., Jastram, S. M., & Blind, K. (2023). Spillover of social norms at work on employees' self-reported private sphere pro-environmental behaviour: a mixed method investigation. Schmalenbach Journal of Business Research, 75(4), 519-547.

Kavvouris, C., Chrysochou, P., & Thøgersen, J. (2020). "Be Careful What You Say": The role of psychological reactance on the impact of pro-environmental normative appeals. *Journal of Business Research, 113*, 257–265. https://doi.org/10.1016/j.jbusres.2019.10.018

Kumar, P., Caggiano, H., Cuite, C., Felder, F. A., & Shwom, R. (2023). Analyzing spillovers from food, energy and water conservation behaviors using insights from systems perspective*. Behavioural Public Policy, 7*(3), 773-807.

Keller, M., Sahakian, M., & Hirt, L. F. (2022). Connecting the multi-level-perspective and social practice approach for sustainable transitions. *Environmental Innovation and Societal Transitions, 44*, 14-28.

Klade, M., Mert, W., Seebacher, U., & Schultz, I. (2013). Sustainable behaviour at work and in private life: the contribution of enterprises. *International Journal of Innovation and Sustainable Development, 7*(4), 321-332.

Klöckner, C. A. (2013). A comprehensive model of the psychology of environmental behaviour – A meta-analysis. *Global environmental change, 23*(5), 1028-1038.

Lanzini, P., & Thøgersen, J. (2014). Behavioural spillover in the environmental domain: An intervention study. *Journal of Environmental Psychology*, *40*, 381-390.

Lauren, N., Fielding, K. S., Smith, L., & Louis, W. R. (2016). You did, so you can and you will: Self-efficacy as a mediator of spillover from easy to more difficult pro-environmental behaviour. Journal of Environmental Psychology, 48, 191-199.

Lee, Y., De Young, R., & Marans R. W. (1995). Factors Influencing Individual Recycling Behavior in Office Settings: A Study of Office Workers in Taiwan. *Environment and Behavior 27*(3), 380–403.

Linder, N., Giusti, M., Samuelsson, K., & Barthel, S. (2022). Pro-environmental habits: An underexplored research agenda in sustainability science. *Ambio,* 1-11.

Littleford, C., Ryley, T. J., & Firth S. K. (2014). Context, Control and the Spillover of Energy Use Behaviours between Office and Home Settings. *Journal of Environmental Psychology, 40*, 157–166.

Maki, A., Carrico, A. R., Raimi, K. T. Truelove, H. B., Araujo, B. & Yeung, K. L. (2019). Meta-analysis of pro-environmental behaviour spillover. Nature Sustainability 2, 307–315. DOI: 10.1038/s41893-019-0263-9

Merritt, A. C., Effron, D. A., & Monin, B. (2010). Moral self-licensing: When being good frees us to be bad. Soc. Personal. Psychol. Compass. 4, 344–357. doi: 10.1111/j.1751-9004.2010.00263.x

Mørk, T., Bech-Larsen, T., Grunert, K. G., & Tsalis, G. (2017). Determinants of citizen acceptance of environmental policy regulating consumption in public settings: Organic food in public institutions. J. Clean. Prod. 148, 407-414.

Møller, B., & Thøgersen, J. (2008). Car use habits: An obstacle to the use of public transportation? In Road pricing, the economy and the environment (pp. 301-313). Berlin, Heidelberg: Springer Berlin Heidelberg.

Morgan Stanley. (2023). Will business travel take off again? Trends shaping the future of corporate trips. Retrieved August 7, 2025, from https://www.morganstanley.com/ideas/business-travel-trends-2023-outlook

Mouro, C., & Duarte, A. P. (2021). Organisational climate and pro-environmental behaviours at work: the mediating role of personal norms. Frontiers in Psychology, 12, 635739.

Mullen, E., & Monin, B. (2016). Consistency versus licensing effects of past moral behavior. Annu. Rev. Psychol. 67, 363–385. doi: 10.1146/annurev-psych-010213-115120.

Nash, N., Whitmarsh, L., Capstick, S., Hargreaves, T., Poortinga, W., Thomas, G., Sautkina, E., & Xenias, D. (2017). Climate-relevant behavioral spillover and the potential contribution of social practice theory. Wiley Interdisciplinary Reviews - WIREs Climate Change 8 (6), e481. http://dx.doi.org/10.1002/wcc.48

Nash, N., Whitmarsh, L., Capstick, S., Thøgersen, J., Gouveia, V., de Carvalho Rodrigues Araújo, R., ... & Liu, Y. (2019). Reflecting on behavioral spillover in context: How do behavioral motivations and awareness catalyze other environmentally responsible actions in Brazil, China, and Denmark?. *Frontiers in Psychology, 10*, 788.

Near, J. P., Rice, R. W., & Hunt, R. G. (1980). The relationship between work and nonwork domains: A review of empirical research. *Academy of management review*, *5*(3), 415-429.

Nik Ramli, N. A. R., & Naja, M. (2011). Spillover of environmentally friendly behaviour phenomenon: The mediating effect of employee organizational identification. *OIDA International Journal of Sustainable Development 1*(12), 29–42.

Nik Ramli, N. A. R., & Naja, M. (2012). A Discussion of Underlying Theories Explaining the Spillover of Environmental Friendly Behavior Phenomenon. Social and Behavioral Sciences 50, 1061–1072.

Nilsson, A., Bergquist, M., & Schultz, W. P. (2016). Spillover effects in environmental behaviors, across time and context: a review and research agenda. Environmental Education Research, 23(4), 573–589. https://doi.org/10.1080/13504622.2016.1250148.

Nilsson, M., & Küller, R. (2000). Travel behaviour and environmental concern. Transportation Research Part D: Transport and Environment, 5(3), 211-234.

Paillé, P., & Raineri, N. (2015). Linking perceived corporate environmental policies and employees eco-initiatives: The influence of perceived organizational support and psychological contract breach. Journal of Business Research, 68(11), 2404–2411.

Paillé, P., Raineri, N., & Boiral, O. (2019). Environmental behavior on and off the job: A configurational approach. Journal of Business Ethics, 158, 253–268.

Poelmans, S., Stepanova, O., & Masuda, A. (2008). Positive spillover between personal and professional life: Definitions, antecedents, consequences, and strategies. In K. Korabik, D. S. Lero, & D. L. Whitehead (Eds.), Handbook of Work-Family Integration (pp. 141–156). San Diego, CA: Elsevier.

Poom, L., & Wåhlberg, A. (2022). Accuracy of conversion formula for effect sizes: A Monte Carlo simulation. Research Synthesis Methods, 13(4), 508-519. https://doi.org/10.1002/jrsm.1560

Puntiroli, M., Moussaoui, L. S., & Bezençon, V. (2022). Are consumers consistent in their sustainable behaviours? A longitudinal study on consistency and spillover. Journal of Business Research, 144, 322-335.

Raineri, N., & Paillé, P. (2016). Linking corporate policy and supervisory support with environmental citizenship behaviors: The role of employee environmental beliefs and commitment. Journal of Business Ethics, 137(1), 129–148.

Rashid, N. R. N., & Mohammad, N. (2011). Spill over of environmentally friendly behaviour phenomenon: The mediating effect of employee organizational identification. OIDA International *Journal of Sustainable Development, 2*(12), 29–42.

Rasmus, C.A., & Steger, U. (2000). The roles of supervisory support behaviors and environmental policy in employee “ecoinitiatives” at leading-edge companies. *Academy of Management Journal 43*(4), 605–626.

Regan, D. T., & Kilduff, M. (1988). Optimism about Elections: Dissonance Reduction at the Ballot Box. *Political Psychology, 9*(1), 101–107.

Reimers, H., Lasarov, W., & Hoffmann, S. (2022). Moral-psychological mechanisms of rebound effects from a consumer-centered perspective: A conceptualization and research directions. *Frontiers in Psychology*, *13*, 886384.

Ribera Jemio, P., Merino-Saum, A., Hansmann, R., & Binder, C.R. (2024). Is the Sharing Economy a sustainable mode of consumption? An empirical case study of sharing of household goods and environmental rebound effects in a university context, Cleaner and Responsible Consumption, 14, 100210. https://doi.org/10.1016/j.clrc.2024.100210.

Ryan, R.M., & Deci, E.L. (2000). Self-Determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am. Psychol., 55, 68–78.

Sabherwal, A., & Sparkman, G. (2025). A review of consistency in climate action: The role of social interactions and institutions in cultivating positive behavioral spillover. Current Opinion in Behavioral Sciences, 61, 101475.

Saroglou, V. (2002). Religion and the five factors of personality: A meta-analytic review. Personality and individual differences, 32(1), 15-25.

Schultz, P. W., & Zelezny, L. (1999). Values as predictors of environmental attitudes: Evidence for consistency across 14 countries. *Journal of environmental psychology*, *19*(3), 255-265.

Schwartz, S. H. (1977). Normative influences on altruism. In I. Berkowitz (ed.). Advances in Experimental Social Psychology (pp. 221–279). New York: Academic Press.

Schwartz, S. H., & Howard, J. A. (1981). A normative decision-making model of altruism. In J. P. Rushton & R. M. Sorrentino (Eds.), Altruism and helping behavior. Lawerence Erlbaum: Hillsdale, NJ.

Sharma, K., & Bansal, M. (2013). Environmental consciousness, its antecedents and behavioural outcomes. Journal of Indian Business Research, 5(3), 198-214.

Sheeran, P., & Webb, T. L. (2016). The Intention–Behavior Gap. *Social and Personality Psychology Compass 10*(9), 503–518. https://doi.org/10.1111/spc3.12265.

Shi, W., Wajda, D., & Aguilera, R. V. (2022). Interorganizational spillover: A review and a proposal for future research. *Journal of Management, 48*(1), 185-210.

Sorrell, S., Gatersleben, B., & Druckman, A. (2020). The limits of energy sufficiency: A review of the evidence for rebound effects and negative spillovers from behavioural change. Energy Research & Social Science, 64, 101439.

Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with "green consumerism". Social Psychology Quarterly, 55, 388-399.

Stauffacher, M., Walter, A., Lang, D., Wiek, A., Scholz, R.W. (2006). Learning to research environmental problems from a functional social-cultural constructivism perspective: The transdisciplinary case study approach. Int. J. Sustain. High. Educ., 7, 252–275.

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. The Journal of Social Issues, 56(3), 407–424. https://doi.org/10.1111/0022-4537.00175

Svennevik, E. M. (2022). Practices in transitions: Review, reflections, and research directions for a Practice Innovation System PIS approach. Environmental Innovation and Societal Transitions, 44, 163-184.

Swiss Federal Assembly. (2021). Geschäft 2021.4259 – Klimaverträgliche Geschäftsreisen der Bundesverwaltung Parlamentarische Initiative. Retrieved August 7, 2025, from https://www.parlament.ch/de/ratsbetrieb/suche-curia-vista/geschaeft?AffairId=20214259

Thøgersen, J. (1999). Spillover Processes in the Development of a Sustainable Consumption Pattern."Journal of Economic Psychology, 20, 53–81.

Thøgersen, J. (2006). Understanding repetitive travel mode choices in a stable context: A panel study approach. *Transportation Research Part A: Policy and Practice*, *40*(8), 621-638.

Thøgersen, J., & Crompton, T. (2009). Simple and painless? The limitations of spillover in environmental campaigning. *Journal of Consumer Policy*, *32*, 141-163.

Thøgersen, J., & Noblet, C. (2012). "Does Green Consumerism Increase the Acceptance of Wind Power?" Energy Policy 51: 854–862.

Thøgersen, J., & Ölander, F. (2003). Spillover of environment-friendly consumer behaviour. Journal of environmental psychology, 23(3), 225-236.

Truelove, H. B., Carrico, A. R., Weber, E. U., Raimi, K. T., & Vandenbergh, M. P. (2014). Positive and negative spillover of pro-environmental behavior: An integrative review and theoretical framework. Global Environmental Change, 29, 127–138. https://doi.org/10.1016/j.gloenvcha.2014.09.004.

Tudor, T., Barr, S., & Gilg A. (2007). A tale of two locational settings: Is there a link between pro-environmental behavior at work and at home? *Local Environment 12*(4), 409–421.

Toussard, L., & Meyer, T. (2025). Autonomous communication with normative information facilitates positive spillover: promoting pro-environmental behaviors in a local setting. *The Journal of Social Psychology*, *165*(3), 353-373

Van der Loo, I. G., & Pigosso, D. C. (2024). Explaining the rebound effects of sustainable design: a behavioural perspective. *Proceedings of the Design Society, 4*, 1497-1506.

Van der Werff, E., & Steg, L. (2016). The psychology of participation and interest in smart energy systems: Comparing the value-belief-norm theory and the value-identity-personal norm model. Energy research & social science, 22, 107-114.

Van der Werff, E., Steg, L., & Keizer, K. (2013). The value of environmental self-identity: The relationship between biospheric values, environmental self-identity and environmental preferences, intentions and behaviour. *Journal of Environmental Psychology, 34*, 55-63.

Van der Werff, E., Steg, L., & Keizer K. (2014). I Am What I Am, by Looking Past the Present: The Influence of Biospheric Values and Past Behavior on Environmental Self-identity. *Environment and Behavior, 46*, 626–657. https://doi.org/10.1177/0013916512475209.

Vasiljevic-Shikaleska, A., Trpovski, G., & Gjozinska, B. (2018). Environmental awareness and of pro-environmental consumer behavior. *Journal of Sustainable Development, 8*(20), 4-17.

Verplanken, B., Aarts, H., Knippenberg, A.v., Knippenberg, C.v. (1994). Attitude versus general habit: antecedents of travel mode choice. Journal of Applied Social Psychology 24, 285–300.

Verplanken, B., & Holland, R. W. (2002). Motivated decision making: Effects of activation and self-centrality of values on choices and behavior. Journal of Personality and Social Psychology, 82(3), 434-447.

Wikipedia “Moralische Lizenzierung” (2025). “Moralische Lizenzierung” accessed from Wikipedia on 29. June 2025 at https://de.wikipedia.org/wiki/Moralische_Lizenzierung].

Wood, W., & Neal, D. T. (2007). A new look at habits and the habit-goal interface. *Psychological Review, 114*(4), 843–863. https://doi.org/10.1037/0033-295X.114.4.843

Wood, W., & Neal, D. T. (2009). The habitual consumer. *J. Consum. Psychol. 19*, 579–592. doi: 10.1016/j.jcps.2009.08.003

Xu, F., Huang, L., & Whitmarsh, L. (2020). Home and away: Cross-contextual consistency in tourists’ pro-environmental behavior. Journal of Sustainable Tourism, 28(10), 1443-1459.

Xu, L., Zhang, X., & Ling, M. (2018). Pro-environmental spillover under environmental appeals and monetary incentives: Evidence from an intervention study on household waste separation. Journal of Environmental Psychology, 60, 27–33.

Yan, Z., Arpan, L. M., & Clayton, R. B. (2024). Assessing the role of self-efficacy in reducing psychological reactance to guilt appeals promoting sustainable behaviors. *Sustainability*, *16*(17), 7777.

Zhou, J., Liu, Q., Mao, R., & Yu, X. (2017). Habit spillovers or induced awareness: Willingness to pay for eco-labels of rice in China. Food Policy, 71, 62-73.