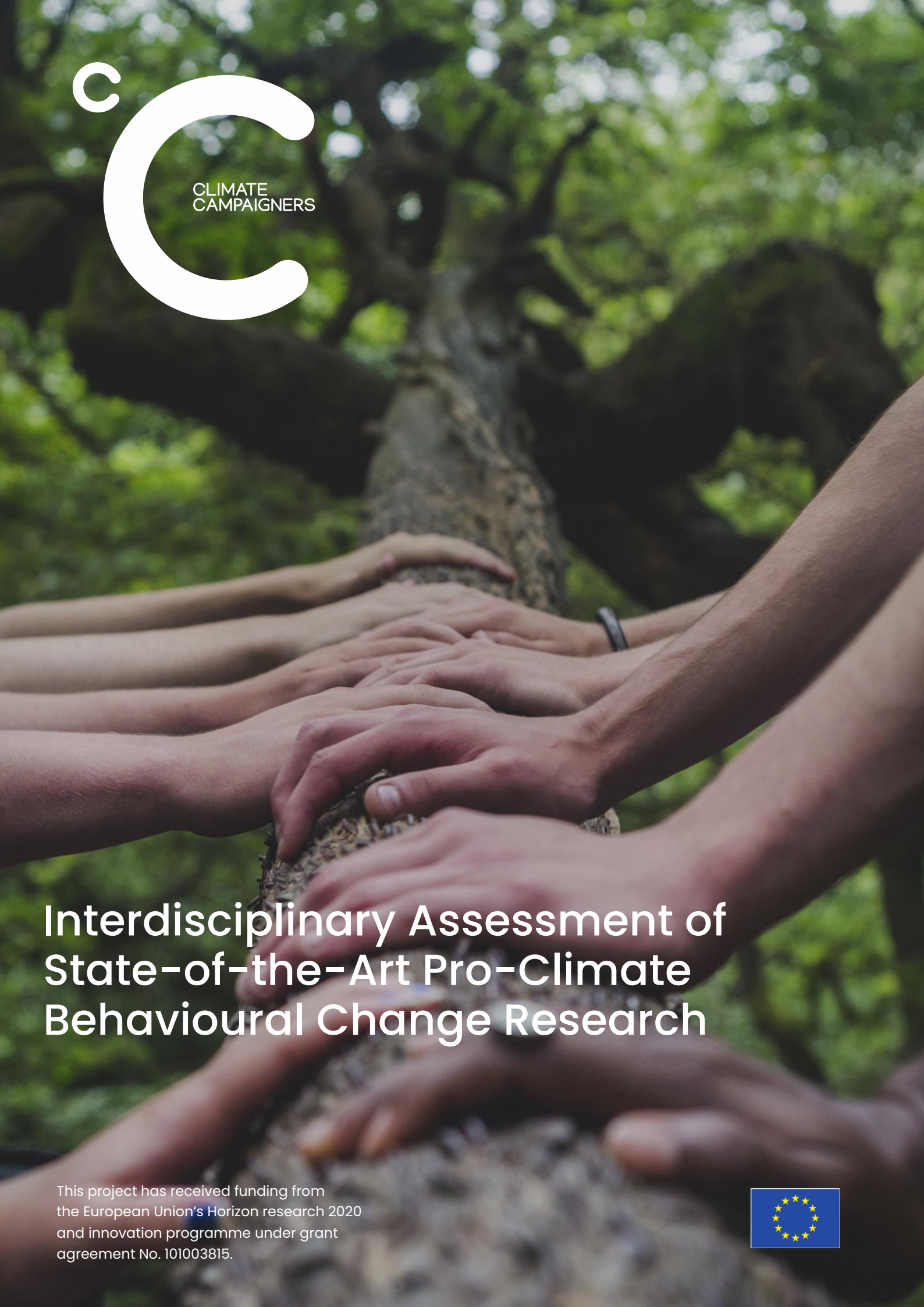

CLIMATE CAMPAIGNERS

Interdisciplinary Assessment of State-of-the-Art Pro-Climate Behavioural Change Research

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Disclaimer

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Executive Summary

This deliverable report summarises the findings of an interdisciplinary assessment of state-of-the-art pro-climate behavioural change research for the CAMPAIGNers project. The conclusions and recommendations will inform the design, delivery and framing of lifestyle challenges and the CAMPAIGNers mobile app which will be deployed across 16 cities in 15 countries to encourage over 100,000 urban residents to adopt more sustainable behaviours and lifestyles. This deliverable report consists of three discrete yet complementary reviews, each covering a specific perspective or body of knowledge.

Perspective one examines key concepts and theories related to pro-environmental lifestyles and behaviours across relevant social science disciplines and fields. It assesses how sustainable lifestyles and behaviour change can be framed or understood, and identifies potential levers for encouraging change. As part of this review of disciplines, an interdisciplinary review of lifestyle apps was also conducted.

Perspective two gathers insights from relevant academic studies, interventions, and reports across the identified disciplines along with non-academic studies and reports. Complementing perspective one, this review focused on eliciting practical guidance on pro-environmental behaviour change interventions.

Perspective three offers insights from intentional communities and grassroots approaches to sustainable lifestyles, based on a review of over 50 reports, articles and documents. This review proposes six principles for effective interventions.

Through these perspectives, this report concludes with recommendations for the CAMPAIGNers projects' challenge and mobilie app design and implementation. In addition to this primary objective, this report offers seeks to offer useful insights and best practices related on pro-environmental lifestyle and behaviour change through digital interfaces more generally.

1. Introduction

CAMPAIGNers, an international research project supported by EU Horizon 2020, focuses on mitigating climate change by motivating low-carbon lifestyles amongst urban residents in 15 major cities across five continents.

It is critically examining the potential for lifestyle transformation, and associated barriers and enablers, with a goal-setting network co-constructed with the active participation of residents and municipalities. The goal-setting network will consist of a mobile app that sets and tracks low-carbon and pro-environmental lifestyle challenges for urban residents.

Within the CAMPAIGNers project, work package three (WP3) focuses on reviewing and undertaking lifestyle transformation research to design and test lifestyle challenges for the project's mobile app-based goal-setting network. Task 3.1 of WP3 instigates this process by conducting an interdisciplinary review of state-of-the-art pro-climate behavioural change research.

This review and its findings are presented in this deliverable report (D3.1) and will inform the design, development, and framing of lifestyles at the heart of the goal-setting network.

The review consists of three distinct yet overlapping perspectives:

Perspective one (chapter 2) reviews relevant theories, disciplines, and conceptual approaches around pro-environmental behaviours and sustainable lifestyles across relevant fields, to highlight productive ways of understanding and informing sustainable lifestyles and behaviours.

Perspective two (chapter 3) assesses lifestyle and behaviour change interventions. The aim was to gather promising projects, interventions, and approaches to influencing behaviour change or lifestyles, particularly in urban contexts, including qualitative and quantitative studies.

Perspective three (chapter 4) analyses a comprehensive database of intentional communities and grassroots, community-led initiatives to outline prevailing lessons and successes for sustainable lifestyle transitions.

The following chapters summarise each perspective's findings and insights. The report concludes with a set of recommendations for the CAMPAIGNers project.

1.1 Approach

This report is based on an interdisciplinary review conducted collaboratively by members of the CAMPAIGNers consortium. The three perspectives which underpin this review were agreed upon in the CAMPAIGNers project design stage with the intention of bringing diverse, state-of-the-art knowledge on sustainable lifestyles and behaviour change into conversation to inform the design and delivery of the CAMAPAIGNers challenges and mobile app.

As a collaborative and interdisciplinary process, conducting a multi-faceted review involves multiple stages, actors, and considerations. This section outlines how this review was approached and conducted.

Task 3.1 commenced in June 2021, and is led by the National University of Ireland, Galway (NUIG), along with the participation of consortium members from the Norwegian University of Science and Technology (NTNU), the University of Cape Town (UCT), the European Network for Community-led Initiatives on Climate Change and Sustainability (ECOLISE), and other institutions. Their work consisted of several distinct yet overlapping activities.

A kick-off meeting was held between all WP3 members in August 2021 to determine leads for different research tasks and agree upon the parameters for the task. The topics and format of perspective one's reviews were agreed upon during this meeting, as were research parameters for perspective two's review task. A brief interdisciplinary review of lifestyle apps was also proposed at this meeting, and proposed as an addition to perspective one. It was also agreed that the review would be comprehensive based on researcher oversight and expertise rather than systematic. This distinction was made based on pragmatism, given the limited timeframe for informing CAMPAIGNers' lifestyle challenges and app development.

Research for perspective one consisted of summary reports of relevant themes, disciplines, and concepts. Consortium partners volunteered to complete briefs for their respective areas of expertise, which were subsequently reviewed to

identify key insights, areas of consensus, differences or contradictions, and gaps in knowledge. Information on the reports and analysis are presented in chapter two, with the complete reports available in appendix one.

Interventions and studies for perspective two were submitted to a shared spreadsheet, which gathered information on the interventions' objectives, approaches, and impact. All WP3 consortium partners were invited to submit, with most submissions provided by individuals who had contributed to perspective one. Proposed studies and interventions were reviewed by NUIG to assess their qualities, potential impact, commonalities, and elicit any insights for the CAMPAIGNers project.

In October 2021, a review meeting was held to present provisional analysis of perspectives one and two's reviews with consortium partners. This meeting was intended to share emerging insights, check the relevance of information presented, and discuss its potential applicability to the CAMPAIGNers project. Feedback from this meeting also informed the structure of this report and key messages.

Finally, perspective three was conducted by consortium member ECOLISE, based on their shared database on studies, reports, and associated information on intentional communities and grassroots initiatives related to sustainability and climate change. Following a preliminary review of this database, six principles were identified across multiple intentional communities and proposed for inclusion based on their relevance to informing CAMPAIGNers' lifestyle challenges. These principles have been described thematically, with illustrative reference to specific interventions.

With the three perspectives completed, provisional analysis was reviewed and updated prior to report writing over January and February 2022. A completed draft report was then shared with co-authors in February 2022 and two internal reviewers prior to submission in March 2022.

Additional particulars about each the review process and parameters of perspective are presented in the following chapters. To conclude, it should be noted that this report has endeavoured to balance clarity, detail, and transparency. In turn, this report has sought to provide a concise and actionable narrative, while including unabridged review documents in the appendices.

1. Perspective One: Theories Across Disciplines

This chapter summarises key perspectives across relevant social science disciplines and subfields. Represented disciplines include psychology, sociology, geography, and economics based on project consortium expertise. Specifically, this review has focused on frameworks and discussions across disciplines concerning pro-environmental behaviours and sustainable lifestyles.

Consortium partners agreed upon a series of relevant conceptual frameworks, sub-disciplines, and approaches in a kick-off meeting held online in August 2021. Selected areas included:

1. Theory of planned behaviour (TPB)
2. Norm-activation theory (NAT)
3. Comprehensive action determination model (CAD)
4. Protection motivation theory (PMT)
5. Stage model of self-regulated behaviour change (SM)
6. Social identity model of pro-environmental action (SIMPEA)
7. Behavioural economics (BE)
8. Degrowth/post-growth (DG)
9. Sustainability transitions (ST)
10. Systems of provision (SP)
11. Urban political ecology (UPE)
12. Social practice theory (SPT)

Scholars completed reviews for their respective areas of expertise over autumn 2021. Reviews summarised each area's background and application in research, outlining strengths, limitations, and insights that could inform lifestyle challenges. Once completed, reviews were shared with the task lead (NUIG), who then assessed the summary reviews to identify key lessons for encouraging sustainable behaviour and lifestyles changes from all submitted theories and models. Alongside this review, a parallel review of lifestyle apps was undertaken to complement disciplinary perspectives.

Given the breadth of disciplines and approaches, the analysis is not meant to be exhaustive. Instead, this review offers a comprehensive summary of relevant insights that respond to the CAMPAIGNers project's objectives and are based on the consortium's disciplinary expertise.

Following the preliminary review of the reports, the task lead (NUIG) presented provisional analysis to consortium members in October 2021. In this meeting, the task leads proposed analysis for this perspective could be productively summarised according to how behaviour and lifestyle change were primarily framed. In turn, key findings from the reviews are organised in this section according to two viewpoints: approaches focusing on the individual scale of action (individual focus) and approaches focusing on systemic factors and conditions (systemic focus).

Given this report's primary objective of providing actional guidance to CAMPAIGNers, the summaries and analysis in this chapter have been structured to ensure clarity, conciseness. All information and references underpinning this chapter can be found in the review summary documents, which are included in appendices one and two. For transparency, these documents have not been substantially edited from their submitted form.

The following section briefly introduce the theories across disciplines, before offering insights and lessons for understanding and informing sustainable lifestyles and behaviours. The review of lifestyle apps is discussed subsequently, given its specific parameters. The chapter then concludes by indicating some gaps identified across the reviews, which would merit further investigation.

1.1 Theories Across Disciplines

The theory of planned behaviour (TPB) is a popular theory in the tradition of social psychological action, which focuses on explaining people's deliberate decision-making for single behavioural choices. This theory has been applied to sustainable behaviours and lifestyles. It assumes people's choices are determined by three variables: attitudes towards this behaviour and its alternatives, subjective norms regarding the behaviour, and perceived behavioural control (PBC). A behaviour change, therefore, stems from changes in these predictors.

One of TPB's strengths is its simplicity, based on three levers for influencing changes to individual behaviours. However, this simplicity has also been criticised within environmental psychological research, as has the exclusive focus on deliberate decisions compared to habitual behaviours. Regardless, this model has been applied extensively in the environmental domain, leading to meta-analyses of such studies concerning organic food consumption (Scalco et al., 2017), socially responsible consumer actions (Han and Stoel, 2017), environmentally friendly behaviours (Morren and Grinstein, 2021), and experimentally induced changes to health-related behaviours (Sheeran et al., 2016).

Norm-activation theory (NAT), also referred to as the Norm-Activation Model, is a social psychological theory explaining altruistic behaviour. It is thereby explicitly restricted to situations with a moral undertone. While devised and initially applied in the 1970s, this theory has proven particularly popular in the field of environmental psychology since the 1990s.

NAT assumes that moral considerations can determine environmental behaviour if a moral obligation to act (personal norm) is activated in a given situation. Factors informing this personal norm can include: awareness of need, awareness of consequences, ascription of responsibility, response efficacy, ability to act, and denial of responsibility. Social norms and perceived behavioural control are also sometimes included as factors.

This theory is used to address individual actions, linking them to underlying value orientations. In turn, challenges for pro-environmental behaviour could activate personal norms by (a) highlighting the need to act or (b) the person's contribution to the problem. In turn, these challenges can (c) help someone to take responsibility, (d) provide them with practical solutions, (e) train them to implement them, and (f) help to prevent denial of responsibility. While NAT is explicitly focused on altruistic behaviour, it is respectively critiqued for only targeting a small range of drivers of environmental behaviour. NAT has informed intervention programmes and pilot studies, including an app to support more environmental transport (Park et al., 2017).

The **comprehensive action determination model (CADM)** is a social psychological behaviour

model that addresses the shortcomings of dominant behavioural models in environmental psychology. CADM brings together assumptions of other social psychological behavioural models and complements them by recognising the situational and habitual influences on behaviour.

As a combination of several theoretical families, CADM assumes that intentions determine environmental actions, perceived behavioural control, habits and routines, and activated personal norms and salient social norms. This offers many levers for promoting sustainable lifestyles at the individual scale, predicting that environmental behaviour can be changed. For instance, it is important to check if a behaviour is habitual and then deactivate/break these habits through situational changes or implementation intentions (Verplanken and Wood, 2006; Klöckner and Verplanken, 2018). Additionally, specific behaviours might be addressed through attitude change, reducing the perceived difficulty of the behaviour, making social norms more salient, or activating personal norms.

While developed specifically for environmental behaviours, CADM is mostly applied to individual actions over policy support or action. In turn, it has been critiqued for not covering all relevant factors, while others have suggested the model is unnecessarily complicated. Nevertheless, this model has been tested in relation to different behaviours (e.g., mobility, recycling, diet, clothing), including a field intervention for a recycling system at a university (Ofstad et al., 2017).

Protection motivation theory (PMT) predicts people's motivations for protecting themselves. Originating in health psychology in the 1970s (Rogers, 1975), it has been applied to environmental behaviour (Kothe et al., 2019). This theory focuses on individual behaviour, suggesting that the motivation to protect the environment is fuelled by two primary appraisals: the seriousness of the problem, or threat for the environment and the effectiveness of available coping strategies, or what can be done. Each area has further factors that can be assessed, including threat appraisals and coping options.

PMT states that protection motivation only forms if people have both a high threat appraisal ("This is a serious problem") and a high coping appraisal ("I can do something about

it"). This means people won't act if they are only fearful: they need to be provided with effective strategies to act.

Given this theory's origins within health psychology, PMT draws upon the narrative that problems, like diseases, can be "cured", which does not necessarily translate to environmental behaviours. PMT has been applied to a variety of environmental actions including reducing car use and meat consumption, purchasing electric vehicles, and energy savings, amongst other activities (Kothe et al., 2019). For instance, one study of 3,000 respondents investigated motivations for buying an electric car in the Netherlands (Bockarjova and Steg, 2014). Another study analysed 11 governmental campaigns to act on climate change, finding few had necessary components (Cismaru et al., 2011).

The **stage model of self-regulated behaviour change (SM)** moves away from predicting environmental behaviour to understanding the dynamics of behaviour change (Nielsen, 2017). It starts with a set of assumptions, including behaviour change being a multistage process (pre-decision, pre-action, action, post-action) with different variables as relevant predictors. Furthermore, transitioning between stages is informed by intentions, and people can move back and forth between stages.

With these assumptions in mind, SM suggests that behaviour change interventions should be tailored to where people are in their change processes. For example, it can be assumed that the main drivers in the pre-action stage include attitudes towards different alternative behaviours and perceived behavioural control (the ease of implementing these alternatives). Conversely, implementation during the action stage is informed by action planning, cognitive planning, and maintenance self-efficacy (the ability to sustain an effort over a longer timeframe).

Like other psychological models, SM addresses individual actions but also emphasises the staged process of changing actions and behaviours. This approach has been critiqued for being overcomplicated and focused on individual actions to the detriment of structural or societal impacts on behaviour.

SM has been widely employed to design and test interventions related to pro-environmental behaviour, such as travel mode choice

(Bamberg, 2013) or reducing beef consumption (Klöckner, 2017; Klöckner and Prugsamatz, 2017).

The **social identity model of pro-environmental action (SIMPEA)** was recently proposed within psychology and focuses on the social and collective aspects of environmental actions (Fritsche et al., 2018). SIMPEA assumes that confrontation with an environmental crisis leads to an appraisal process in the individual confronted with it. This triggers both individual and collective emotions and motivations to act. Framing an environmental crisis as a collective problem, SIMPEA suggests that people will probe relevant social groups for shared norms and goals concerning behaviours that could be a response to the crisis.

By emphasising the social and collective aspects of behaviour change, SIMPEA suggests that environmental action can be triggered by making it clear that significant problems like climate change are collective problems. In turn, pro-environmental social norms should be made salient and enhance collective efficacy beliefs by making changes that only materialise if many people act. Conversely, this theory can also explain inaction when pro-environmental social or group norms and goals are absent. Unlike the previous theories, some emergent critiques for SIMPEA include its relative disregard for individual dimensions. Furthermore, given its relative novelty, only a few empirical studies have incorporated SIMPEA to date.

Behavioural economics (BE) focuses on the behavioural dimensions influencing the market and consumer participation. Over the last 40 years, the discipline has developed and suggests that people's thinking is characterised by two systems: one being rational and reflective, and the other more intuitive and instantaneous. BE looks to optimise behaviours by understanding and testing interventions that "nudge" people to change. Key concepts include reference dependence (that utility does not arrive from levels of consumption, but changes in respect to a reference point), prospect theory (that people are less risk-taking when there is a potential gain, and more risk-taking in the face of a potential loss), social preferences (e.g., altruism and inequity aversion), and time preferences (people focus on the present, so immediate benefits are more influential).

BE has been applied to various behaviours and sectors, such as

energy savings, water consumption, recycling, and transport. Tested strategies to optimise behaviours include commitment contracts and goal setting, home energy reports, feedback mechanisms, social norms messaging, smart metres, and in-home displays, as well as digital and mail-in nudges. Through such interventions, BE emphasises the importance of encouraging behaviour change by showing people their progress towards a goal, avoiding choice overload, and narrowing the gap between intention and action.

Degrowth/post-growth (DG) are parallel concepts that have gained popularity amongst social scientists and social movements as frameworks for addressing the limits of economic growth in terms of wellbeing and ecological impact. Both approaches to a sustainable lifestyle are understood as not being shaped by economic growth imperatives, such as technological efficiency or improvements. Instead, DG perspectives argue that sustainable lifestyles will require radical change to social and economic organisation, including reconceptualising prosperity, work, and time organisation, decommodifying public goods and services, as well as limiting accumulation and overconsumption.

By focusing on systemic and societal features of sustainable lifestyles, DG perspectives highlight the role of actors across different spheres and sectors and highlight the importance of wider transformations. However, this perspective has also been critiques for being utopian, unrealistic, or unclear. Despite this, DG principles have been applied to various experiments and initiatives that encourage more sustainable lifestyles, including four-day work week experiments in Iceland (Haraldsson and Kellam, 2021) and universal basic income (UBI) pilot projects.[1]

Sustainability transitions (ST) emerged as a social science and environmental research field in the early 2000s. Theoretically, it is based on the idea that transition is not just a rational process, but reflexivity and complexity are core concepts to understand transitions. In turn, ST suggests that sustainable lifestyles are achieved by transforming socio-technical systems, which involve coevolutionary processes and

[1] https://www.pilotprojekt-grundeinkommen.de/projektaufbau

multiple actors. Furthermore, such processes are long-term and move between stability and change. Finally, ST also recognises that sustainability is a contested term, and that public policy plays a significant role in shaping such transitions.

ST focuses explicitly on sustainable lifestyles' multi-dimensional, multi-actor, and material aspects. In turn, ST has received criticism for being overly centred on technologies, leaving other dimensions underdeveloped or depoliticised (such as markets, user practices, policy and cultural discourses or governing institutions). While applied to various topics, most ST research has focused on the energy sector and new technologies. There has, for example, been some research on wind turbine development (Karnøe and Garud, 2012), showing how consumer choices and practices were intertwined with some other processes, such as public policies, the transformation of suppliers, and private buyers of wind turbines.

Systems of provision (SP) draws upon Marxist economic traditions to analyse the link between production, distribution, and consumption of goods and services. It focuses on the interaction between the social, cultural, and physical aspects of provisioning systems and physical aspects. Sustainable lifestyles are then understood as part of a broader understanding of the provisioning system. Behaviours are influenced by the provisioning systems and can also influence social and material aspects of these systems.

Systems of provisions represent an intermediate level between biophysical inputs (natural resources and planetary processes, such as the carbon cycle) and social outcomes (how we satisfy our needs and achieve wellbeing). Critiques have suggested that SP tries to describe a multi-layered reality yet is difficult to use in non-extensive research. Still, SP has been used in various research projects related to environmental crises, including the "Living Well Within Limits" (LiLi) project,[2] which investigated the relationship between energy use and human well-being.

Urban political ecology (UPE) is an interdisciplinary field that endeavours to account for the relations between society and the environment in urban contexts, focusing on the uneven material and political dimensions of urban processes under capitalism. This field

[2] https://lili.leeds.ac.uk/

is known for critically analysing flows, metabolisms, relations, and contestations surrounding urban resource distribution and access. UPE across various actors and processes, from the hyper-local to the planetary scales. For instance, many scholars have focused on infrastructure development and access, considering everyday access alongside broader political, material, and economic dynamics.

UPE encourages a critical reflection of sustainable behaviours and lifestyle choices' political, infrastructural, and material dimensions. It also emphasises how infrastructures are complex, political, and dynamic socio-technical processes that extend beyond official services or recognised practices. Furthermore, unevenness and splintering of infrastructures results in inequitable levels of consumption and service access, which means the distribution of responsibility for environmental impact and behaviour change should also be critically examined.

Finally, UPE encourages greater attention to the various intermediaries, improvisations, and incremental approaches people devise to access services and resources. Nevertheless, UPE has been criticised for being descriptive, explanatory, or overly focused on cities without regard for more comprehensive urban processes (Angelo and Wachsmuth, 2015). However, it has been applied in different contexts to understand the politics and implications of sustainable transitions, as seen with Silver's study of low-carbon restructuring of a waste system in Mbale, Uganda (2017).

Social practice theory (SPT) is a sociological field that has become widely used in sustainable consumption studies. SPT is viewed as a more holistic approach than behavioural theories. For instance, lifestyles are not seen as isolated individual choices, but as embedded within the social organisation of normality, where habits, routines and everyday behaviours are normalised and shaped by social and infrastructural factors.

Instead of educating or persuading individuals to make different decisions, SPT focuses on interventions that fall between agency and structure (middle level) for transforming practices to make them more sustainable (Southerton et al., 2004). SPT views individuals as practitioners or 'carriers' (Reckwitz, 2002) of social practices, consisting of three elements: materials,

meanings, and competencies (Shove et al., 2012; Shove and Spurling, 2013). SPT views social practices as interrelated and embedded in institutions, systems, and social contexts and, therefore, the constant change and adaptation locus.

One of the main criticisms of SPT is that there is no unified social practice theory nor a singular definition of practices. Furthermore, SPT has mainly been used in small scale studies and has fewer numerous empirical applications than other theories. Nevertheless, a growing body of literature seeks to understand social change by understanding social practice, including different changes in practices, such as recrafting, substituting, and changing how practices interlock. For instance, studies have looked at initiatives encouraging the wearing of the same pair of jeans over several weeks (Jack 2013) and contesting social norms in practices in the energy domain in households across Europe (Sahakian et al. 2021).

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Having introduced the subdisciplines, frameworks, and models that have been reviewed for this perspective, the following sections highlight insights across theories. In support of this, the following sections do not attempt to rank or reconcile all perspectives into a singular meta-theory. Instead, they adopt a narrative tone in the aim of highlighting the multitude of useful insights that appear across all reviewed disciplines.

As discussed in the approach, analysis for perspective one is loosely grouped into frameworks according are predominantly individual or systemic in their focus. The reviews and references underpinning this analysis are available in the summary reports found in appendix one.

1.2 Individual Focus

Just over half of the review reports for this perspective (seven of twelve) consider factors impacting sustainable behaviour change and lifestyles at the scale of the individual. These include key frameworks from social and environmental psychology (reviews one to six) and behaviour economics (review seven).

While accounting for social dynamics and broader contextual factors to varying extents, these perspectives generally focus on the individual as the precise scale for intervention. As such, these reviews offer useful insights for understanding

sustainable individual behaviours and lifestyles as well as encouraging pro-environmental changes at this scale.

Across the reviews, and particularly SM, behaviour change is not framed as a single action or moment. Instead, changing behaviours involves multiple stages, including pre-decision, pre-action, action, and post-action. Furthermore, behaviour change is not necessarily a linear process, within which individuals may move back and forth between different stages.

It has been argued within psychological debates that predictors need to be addressed to change individual behaviours, such as attitude, social norm, and perceived behavioural control. Furthermore, it is vital to ensure behavioural change processes can be personalised, recognising that individuals will be at different stages and operating in different contexts.

When individuals are changing behaviours, tracking and recognising progress made – especially at the early stages of working towards behaviour change – promotes motivation. It is recommended to minimise the time between motivation and first action, and also credit any progress made in completing a set of goals.

Habitual behaviours are a good place to start in lifestyle changes. Effective strategies can include changing the setting or environment where the habitual behaviour takes place before attempting to reduce the undesired behaviour; and targeting wider social norms and environmental values surrounding the habitual behaviour.

People's motivations for changing a specific behaviour (e.g., cost-savings or altruism), will also be activated by different variables, such as awareness and information, personal norms, values, and responsibility. Assessing the factors underpinning these motivations can suggest what information can help to encourage change processes.

It is also important to determine who is more likely to embrace pro-environmental behaviours. Participants who are more likely to accept challenges may also be more naive about their own goals, which increases their risk of disengagement when goals are not achieved. This potential risk suggests that participants should be guided towards setting realistic goals for greater success.

Additionally, too many options and alternatives can be disengaging for individuals. Limiting the number of choices presented to at a given time to five to six options or lines (or roughly the size of a phone screen) can help avoid disengagement.

Finally, more sustainable behaviours can be encouraged through efficient capital purchases. For example, individuals can be introduced to more efficient services or technologies, such as washing machines with lower water use.

From this review of insights related to individual dimensions of pro-environmental lifestyles, it is apparent that encouraging behaviour change is not a singular process nor a one-size-fits-all endeavour. Change needs to be understood as a dynamic process, informed by various personal, material, and social factors.

The following section, we expand upon some of the systemic dimensions highlighted in the review.

1.3 Systemic Focus

Environmental behaviours are individual, social, collective, spatial, and sociotechnical. Complementing the perspectives in the previous section, the remaining reviews (five of twelve) outlined perspectives that tend to emphasise systemic approaches to understanding behaviour and lifestyle changes. These frameworks cut across disciplines encompassed by environmental social sciences, including sociology and geography, and endeavour to account for the intersecting systems, politics, ecologies, and practices that underpin and inform behaviours or their potential to be changed.

A systemic focus also emphasises the importance of understanding the state's role and systems of the provision in supporting and scaling sustainable behaviours.

First, reviews emphasised the importance of public policy and infrastructures in enabling and shaping specific behaviours. For instance, political legislation or strategies can legitimise or discredit potential behaviours while infrastructures' form, quality, efficiency, and associated services can predetermine individuals' choices.

Several perspectives raised the importance of questioning what practices are included in sustainable lifestyles and behaviour change. Assumptions around behaviour change being solely associated with

consumer and technological choices ignore a wider range of behaviour changes based on lowered consumption, such as de-growth principles. Sustainable lifestyles encompass a wide range of behaviours, the adoption of which is informed by available infrastructures and political, socio-spatial, and economic context.

Sustainability transitions are also co-evolutionary and contested. Changes can take any number of possible pathways. For instance, reducing water usage in the shower could entail a more efficient showerhead, showering less often, for shorter periods, or incorporating alternative cleaning modes. Furthermore, encouraging transitions generally ebbs between moments of stability and change.

Finally, promoting behavioural change must recognise pre-existing inequalities and unevenness of lifestyles on a societal level. Inequalities and associated differences in consumption and lifestyle mean individuals have different environmental impacts. It is crucial to recognise the different levels of responsibility for, and ability to enact, related changes. In addition to considering how changes can be more equitable at an individual level, addressing broader political, social, and economic dynamics can also result in certain behaviours becoming more accessible or feasible for all. For instance, making public transportation free eliminates perceived costs associated with sustainable forms of transport. However, access to public transport may be uneven across a city region and therefore benefit those living in better-connected or central areas.

1.4 Lifestyle Apps

Alongside the reviews of cutting-edge disciplinary insights, a complementary assessment identified lessons based on environmental and lifestyle apps and related literature reviews. The full review is available in appendix two. This section outlines top-line findings of relevance to the CAMPAIGNers project.

This review highlighted the significant attrition rates related to behaviour change apps, with most apps seeing users drop off within the first 30 days of use. Several factors can curtail continued use, including:

- Users not seeing the purpose of the app, or finding it boring
- The app being a significant drain on battery use

- Excessive advertisements or notifications

The review also highlighted several features that can increase a lifestyle app's appeal and effectiveness. Ensuring user safety and data security, and conveying related measures to users, is critical when designing an app. Making information access seamless is also important.

Moving away from a one-size-fits-all approach is also widely recommended, particularly through personalisation of functionalities and the introduction of dynamic content. For instance, CAMPAIGNers may seek to find ways of recognising users' particular circumstances to determine what challenges and supporting information they receive.

Understanding users' motivations for using a lifestyle app is also paramount, and finding ways to recognise and respond to intrinsic (e.g., self-efficacy) and extrinsic motivators (e.g., social networks) can help foster continued use of an app.

Incorporating persuasive design principles and nudges in an app can encourage behaviour change in line with users' own starting points. Similarly, finding ways to connect an app's activities with offline experiences and communities can also encourage more sustained engagement. For instance, such experiences could include in-person events, organising challenges to be undertaken in public, or meet ups between participating individuals or groups, such as sports teams or civic organisations.

1.5 Opportunities for Further Learning

The reviews within this perspective have provided significant insights for CAMPAIGNers lifestyle challenges and mobile app. Reviewing their findings has also unearthed several questions and considerations that merit further reflection within and beyond the scope of the project.

While many reviews outlined how individual actions and behaviours were informed by wider systemic, social, ecological, material, political, and economic dimensions, yet most were proportionally more individualistic or systemic in their focus. While it is beyond this report's aims, there is scope for further reflection and investigation into the intersection of individual and systemic dimensions of pro-environmental lifestyles and behaviours.

Additionally, there appears to be a degree of consensus that pro-environmental behaviour change is a process. However, there is still some debate over the extent to which stages within this process differ across different contexts or circumstances. Identifying different types of change processes and assessing their particularities could contribute to this discussion.

The reviews also indicate that different approaches are required when encouraging changes to habitual and non-habitual behaviours. Given this importance, CAMPAIGNers should thus make this distinction within and amongst its proposed challenges.

Additionally, understanding participants' specific motivations for undertaking different challenges (e.g., financial, altruism, or social pressure) is importance. With this information, challenges can be designed to respond to these motivations, or varied if there is more than one primary motivation amongst participants.

Along with understanding different motivations, collecting background information on wider lifestyle norms, political frameworks, as well as infrastructure and service availability can help to tailor challenges to different contexts. CAMPAIGNers could work with local governments and other policy stakeholders to assess what kinds of transitions and systems of provision complement or support different pro-environmental behaviour change challenges. For instance: how might certain changes to public transport service costs, quality, and accessibility impact the successful uptake of a pro-environmental mobility challenge in different cities?

While the reviews have pointed to a plethora of ways behaviours and lifestyles can be shaped, influenced, and changed, they have also illustrated the importance of critically questioning what behaviours are currently deemed desirable and what might be omitted or overshadowed within current debates. For example, de-growth perspectives emphasise that pro-environmental behaviours and actions outside of consumer choice and technological intervention merit further consideration.

2. Perspective Two: Empirical Insights

The chapter outlines insights from an assessment of interventions, experiments, and studies related to lifestyle and behaviour change.

Consortium partners were invited to submit relevant reports, articles, and intervention summaries from their fields to a shared spreadsheet between August and October 2021. This exercise aimed to gather as many projects, interventions, and initiatives as possible. Insights from cases would help understand what had been effective (or not) at influencing sustainable behaviour and lifestyle changes. Consortium partners were encouraged, but not required, to focus on cases in urban contexts which also made use of digital interfaces.

The following sections summarise key insights related to different aspects of designing challenges and the associated CAMPAIGNers app while also highlighting gaps identified during the review. Prior to this, a summary of the results is presented in the next section. For clarity, we use the term "cases" to refer to submitted examples. While this review is not systemic, it offers a series of emergent insights from a broad range of disciplines and sectors.

2.1 Review of Submissions

Consortium partners submitted 65 cases for review. Cases covered an array of topics and behaviours, including sustainable food, meat consumption, water conservation, energy conservation, mobility/transport, waste prevention and recycling, eco-friendly products and technology, eco-upgrading home, and climate activism.

Cases focused on a variety of scales of intervention but were primarily focused on individuals (26), individuals in conjunction with households (11) or individuals in conjunction with another scale (10). Households also received some attention, with 13 cases reporting this as their primary scale of operation. Wider scales of intervention were less commonly reported: city-level (10), building (3), school/university (2), and global (1) scales of intervention were also reported.

The geographic distribution of cases was similarly diverse, although primarily situated in European countries and English-speaking countries, including Australia, Austria, Finland, Germany, Iceland, Ireland, Japan, Poland, Spain, Switzerland, the Netherlands, the UK, and the USA. This geographic representation is somewhat consistent with locations of consortium partners and cities associated with the CAMPAIGNers project. Several cases were multi-national or international in scope. Furthermore, wide range of methods and approaches for evaluation were reflected across the cases, ranging from statistical analysis and trials to pilot studies and literature reviews.

Though activities related to behaviour change were similarly diverse; several types of activities were consistently prevalent, including:

- Lowering consumption overall
- Changing technologies or products to a more efficient or less environmentally harmful alternative
- Reviewing and adapting existing habits
- Adopting new behaviours
- Investing in more sustainable services or infrastructures

Interventions encouraging such changes took place at individual and household scales of intervention. However, studies focused on these (and other) scales were responsive to contextual particularities that inform the influence behaviour change. For example, some interventions have been developed in response to a particular policy development while others built on or made use of existing infrastructures and services, or leveraged available spaces to support change. These interventions demonstrate how individual and household interventions can be grounded in and responsive to wider contexts and circumstantial differences.

Many cases also reported small effects within their studies. While smaller effects can be scaled, these studies also raised questions over how to ensure positive effects are sustained and don't result in unintended changes, consequences, or rebound effects. Additionally, cases highlight the importance of considering different stages of behaviour change interventions, including:

- Identifying and adapting challenges to participants'

motivations for behaviour change

- Gathering sufficient background information to assess changes
- Providing participants with options for concrete actions to change
- Gathering feedback during and following the intervention
- Supporting individual or online interventions with opportunities for real-life interaction with others

Furthermore, the cases highlight the importance of clearly defining any desired behaviours, so that changes can be accurately and effectively tracked and assessed.

However, even when clearly defined, some behaviour changes are easier to track than others, and this should be accounted for where possible in assessments. For instance, tracking mobility changes has different reporting and methodological requirements than tracking a reduction in meat consumption. As such, any behaviour change challenge should seek to balance the practicalities of accurate reporting and participant attrition risk.

Having summarised the submitted cases, the following section looks more closely at insights from cases recommended for consideration and with a confirmed positive impact.

2.2 Insights from Recommended Cases with Positive Impacts

31 of the 65 submitted cases were recommended for inclusion in this review and reported as having a positive impact on sustainable lifestyles or behaviours. Submissions ranged from systemic reviews to qualitative studies to non-academic summaries of interventions.

The submitted cases covered addressed a variety of sectors or behaviours including energy efficiency, alternatives, or consumption reduction (8), reviews of multiple sectors and practices (8), along with interventions or studies related to electricity consumption/efficiency (5), mobility (4), providing financial or political support (4), water (2), food (1), washing and eating (1), and general consumption behaviours (1). These interventions are introduced in the table below and followed by descriptive analysis.

Table 1: Recommended Cases with Confirmed Positive Impact on Sustainable Behaviours

Sector(s)	Behaviour/ Lifestyle targeted	Intervention Description	Sources
Consumption	Purchasing eco-friendly products and services	In two studies, the authors used a scenario in which participants could choose from a list of green amenities, either pre-selected (the default or opt-out condition) or not (opt-in condition).	Van Gestel, L. C., Adriaanse, M. A. and De Ridder, D. T. D. (2020). Do nudges make use of automatic processing? Unraveling the effects of a default nudge under type 1 and type 2 processing. Comprehensive Results in *Social Psychology*.
Electricity	Household electricity consumption	211 randomized controlled field trials, each trial similar to that described in Allcott, 2011 (see below).	Jachimowicz, J. M., Hauser, O. P., O'Brien, J. D., Sherman, E. and Galinsky, A. D. (2018). The critical role of second-order normative beliefs in predicting energy conservation. *Nature Human Behaviour*, 2, 757-764.
Electricity	Household electricity consumption	Participants were randomly assigned to treatment (i.e., receiving all intervention elements listed below) or control (not receiving any intervention). Treated participants received descriptive normative messages indicating how much electricity other similar households in their area consume, accompanied by injunctive normative messages indicating approval or disapproval of the target	Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics*, 95, 1082-1095.

		household's electricity consumption. Additional intervention elements included feedback on own consumption and electricity saving tips.	
Electricity	Purchasing electricity from renewable sources	Participants were given an option to opt into or out of a green energy subscription by checking versus unchecking a box. The green energy option was unmarked in the control treatment, allowing prospective customers to opt in actively. The green energy option was marked in the experimental default treatment, allowing prospective customers to opt-out.	Ebeling, F. and Lotz, S. (2015). Domestic uptake of green energy promoted by opt-out tariffs. *Nature Climate Change*, 5, 868-871.
Electricity	Individual electricity consumption	Participants were randomly assigned to one of three groups, two framing groups and a control group. They received electricity-saving tips, combined with monetary framing (savings in Euro) or environmental framing (savings in CO2), in the two treatment conditions, respectively, versus no information in the control group.	Steinhorst, J., Klöckner, C. A. and Matthies, E. (2015). Saving electricity – For the money or the environment? Risks of limiting pro-environmental spillover when using monetary framing. *Journal of Environmental Psychology*, 43, 125-135.
Electricity	Energy consumption	Website that allows participants to record consumption and receive feedback. Participants are randomised into being able to set goals, receive default suggestions about goals, and have no goals.	Loock, C-M., Staake, T. and Thiesse, F. (2013). Motivating energy-efficient behaviour with green IS: an investigation of goal setting and the role of defaults. *MIS quarterly*, 1313?1332.

Energy	Reduction of electricity consumption	Development of a mobile application to sensitize consumers to their energy consumption and motivate households to adopt and sustain behavioural changes through different incentives including dynamic prices, social comparison, and serious gaming	http://www.peakapp.eu
Energy	Energy efficiency through behavioural change and investment in more efficient capital	Goal-setting energy-saving nudge. Participants set goals to save energy. They can consult an online interface to track performance and compare themselves to other participants (although very few make use of this). Rewards are given based on savings compared to participant's pre-participation energy use (according to an algorithm never shared with them).	Harding, M. and Hsiaw, A. (2014). Goal setting and energy conservation. *Journal of Economic Behavior and Organization*, 107:209227.
Energy	Lower levels of energy consumption in targeted households	Households are mailed Home Energy Reports (HERs) with important characteristics: Households are shown their consumption clearly. This consumption is compared against plausibly comparable households nearby, and with an efficient goal. This feedback is augmented with tips for making small, medium, or significant investments to save energy. These tips were sometimes accompanied by vouchers for discounts on the suggested purchases at participating retailers. HERs were sent reasonably frequently (usually once monthly).	Allcott, A. (2011). Social norms and energy conservation. *Journal of public Economics*, 95(9-10):1082?1095. Allcott, H. and Rogers, T. (2014). The short-run and long-run effects of behavioural interventions: Experimental evidence from energy conservation. *American Economic Review*, 104(10):3003?37. Brandon, A., Ferraro, P.J., List, J.A., Metcalfe, R.D., Price, M.K. and Rundhammer, F. (2017). Do the effects of social nudges persist? theory and

			evidence from 38 natural field experiments. Technical report, *National Bureau of Economic Research*. Brandon, A., List, J.A., Metcalfe, R.D., Price, M.K. and Rundhammer, F. (2019). Testing for crowd out in social nudges: Evidence from a natural field experiment in the market for electricity. *Proceedings of the National Academy of Sciences*, 116(12):5293?5298.
Energy	Installation of residential solar panels	Municipalities were randomly assigned to receive self-interest messaging, prosocial messaging (with identity-based elements), or to a control group. Messages in the prosocial condition focused on community benefits, community identity, and social norms, with messages such as "The community is doing something together to have more clean energy" and "All of my friends and neighbours are doing it too."	Bollinger, B., Gillingham, K.T. and Ovaere, M. (2020). Field experimental evidence shows that self-interest attracts more sunlight. *Proceedings of the National Academy of Sciences*, 117, 20503-20510.
Energy	Household heating transition to air-source heat pumps	Slow change with the growth of hands-on knowledge resulted in improved training and standards for insulation, boosting reputation and increasing sales. Internet discussion forums also increased discussion, trust and collaboration amongst users and installers. Alongside regulation, recognition that individual households were	https://www.nesta.org.uk/feature/stories-change/peer-peer-support-and-rapid-transitions-how-finland-found-answer-heating-homes/

		substantial in changing to air pumps with limited or no government support.	
Energy	Focusing on the perception of indoor climate instead of energy efficiency	The intervention can essentially be categorized into information, including simplification and social norms. IT tools for various uses to generate behavioural change at various levels of social activity: a dashboard (for non-residential buildings), a game (for households), an office app, and expert tools. The tools used the collected consumption information from the sites to elaborate several behaviour typologies, based on which the researchers designed targeted solutions for the end-consumers. The game, for instance, provided incentives in the form of recognition, achievements, and suggestions to users.	https://www.mobistyle-project.eu
Energy	Purchasing of energy-efficient products	There were two consecutive random assignments of participants to treatment and control groups (i.e., it was a 2*2 factorial design with the following structure: monetary information: yes vs. no * rebate: yes vs. no). First random treatment assignment: In the monetary information treatment group, participants were shown annual energy costs for CFL versus incandescent light bulbs, given the customer's estimated daily usage, desired wattage, and desired number of bulbs. The treatment screen also displayed the energy costs and total user costs (energy plus bulbs) for CFLs versus incandescent over the expected life of a CFL. The control group did not receive this intervention. Second random treatment assignment: Participants in the rebate treatment, but not participants in the control, received a 20 per cent discount on all CFLs.	Allcott, H. and Taubinsky, D. (2015). Evaluating behaviourally motivated policy: Experimental evidence from the lightbulb market. *American Economic Review*, 105, 2501-2538.

Energy	Sufficiency, absolute reduction, and/or overall reduction in energy use	Two prototypes: ENERGISE Living Labs were designed to influence individual and collective practices concerning household energy use. Two challenges were introduced to 306 households in eight countries: lower indoor temperatures and reduce laundry cycles. Weekly surveys recorded the effects on the sample. Interventions consisted of participants setting their own targets, based on their current practices. The research team provided low-tech kits to encourage alternative practices – these included: a Clothes brush for spot cleaning and aprons to keep clothes cleaner for longer - reducing the need to wash and dry clothes. In addition, socks and hot drinks were included in every household pack to encourage heating the body inside or heating the entire house/ space. Finally, board games were provided to each family to encourage bringing residents together to heat one room instead of heating all the rooms every evening.	http://www.energise-project.eu/livinglabs
Food	Increased consumption of plant-based foods including fruit and vegetables; Reduced meat consumption; Shifts in palm oil consumption (i.e., not always or necessarily reductions), and; Reductions in sugar intake	Review of different interventions, summarizing over 100 articles on sustainable healthy eating theories and interventions.	Food Climate Research Network

Mobility	Car use	Analyse the effects of four orders of satisfiers: 1) socio-technical provisioning systems; 2) activities; 3) energy and material services, and; 4) specific product of technology	Brand-Correa, L.I. et al. (2020). Understanding (and tackling) need satisfier escalation. *Sustainability: Science, Practice and Policy*, 16(1), pp. 309–325.
Mobility	Personalised travel advice	TravelSmart, a community-based programme in Western Australia encouraged individuals to find alternatives to private car use by providing information and encouragement. Intervention involves contact with individuals who are infrequent public transport users but reported interest in adopting more environmentally friendly forms of travel. Combines provision of travel maps and public transport timetables with specific guidance on the routes that are relevant to the journeys that an individual takes; provision of travel maps and public transport timetables that are of direct relevance to individual's needs; information on walking and cycling routes in the area that are relevant to the journeys that an individual takes.	Southerton, D., Mcmeekin, A. and Evans, D. (2011). International Review of Behaviour Change Initiatives. (Scottish Government Report). *The Scottish Government*. http://www.scotland.gov.uk/Publications/2011/02/01104638/0
Mobility	Use of public transport	Fare-free public transport (sometimes focusing on younger people <25)	Grzelec, K. and Jagiełło, A. (2020). The Effects of the Selective Enlargement of Fare-Free Public Transport. *Sustainability*, 12(16), 6390.
Mobility	To reduce 25 per cent average mobility	PCT app was downloadable for all interested users. The app sets a weekly CO2 target for each user depending on	Many publications published and in progress, e.g.

	emissions in the city through CO2 price and personal carbon trade; information on own daily mobility emissions and personal weekly targets	their life situation. Then the app automatically recognized mobility modes and mobility distances and provided information for users almost in real-time about their mobility CO2 emissions. At the end of each week, extra emission allowances were sold and bought using virtual euros. If a user could net earn virtual euros within a month, it was possible to purchase products e.g., bus tickets, through the app.	Kuokkanen, A., Sihvonen, M., Uusitalo, V. et al. (2020). A proposal for a novel urban mobility policy: Personal carbon trade experiment in Lahti city, *Utilities Policy*, 62, 100997.
Multiple sectors	Pro-environmental behaviour changes	10 different field experiments. Designs varied across experiments, but generally speaking, the effect of commitment or goal setting on pro-environmental behaviour (s) was studied in all experiments included in this paper.	Nisa, C. F., Bélanger, J. J., Schumpe, B. M. and Faller, D. G. (2019). Meta-analysis of randomised controlled trials testing behavioural interventions to promote household action on climate change. *Nature Communications*, 10, 4545.
Multiple sectors	Behaviours such as energy and water conservation, sustainable transportation, and climate policy support	188 papers were included in the meta-analysis. Designs varied across studies but, generally speaking, the links of different identity variables (connectedness to nature, environmental self-identity, place identity, and social identity) to different pro-environmental behaviours were studied in all papers included in the meta-analysis.	Vesely, S., Masson, T., Chokrai, P., Becker, A., Fritsche, I., Klöckner, C. A., Tiberio, L., Carrus, G. and Panno, A. (2021). Climate change action as a project of identity: Eight meta-analyses. *Global Environmental Change*, 70, 102322.

Multiple sectors	Behaviour changes leading to energy and water conservation, recycling household waste, and the use of sustainable transportation modes	19 different experiments. Designs varied across experiments but, generally speaking, the effect of commitment or goal setting on pro-environmental behaviour(s) was studied in all experiments included in this paper.	Lokhorst, A. M., Werner, C., Staats, H., van Dijk, E. and Gale, J. L. (2013). Commitment and behavior change: A meta-analysis and critical review of commitment-making strategies in environmental research. *Environment and Behavior*, 45, 3-34.
Multiple sectors	Lifestyle and behaviour changes leading to energy conservation, recycling household waste, and the use of sustainable transportation modes.	25 experimental and quasi-experimental studies. Designs varied across studies but, generally speaking, the effect of incentives on pro-environmental behaviour(s) was studied in all studies included in this meta-analysis.	Maki, A., Burns, R. J., Ha, L. and Rothman, A. J. (2016). Paying people to protect the environment: A meta-analysis of financial incentive interventions to promote pro-environmental behaviors. *Journal of Environmental Psychology*, 47, 242-255.
Multiple sectors	Lifestyle and behaviour changes leading to energy and water conservation, littering prevention, reduced paper and plastic usage, sustainable transportation, and reduced red meat consumption	91 different field experiments. Designs varied across experiments but, generally speaking, the effect of social norms on pro-environmental behaviour(s) was studied in all experiments included in this paper.	Bergquist, M., Nilsson, A. and Schultz, W. P. (2019). A meta-analysis of field-experiments using social norms to promote pro-environmental behaviors. *Global Environmental Change*, 59, 101941.

Multiple sectors	Multiple interventions and activities	Defining with local communities how to stay in the doughnut	Raworth, K. (2017). *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*. Chelsea Green Publishing.
Multiple sectors	Reducing 10 per cent of greenhouse gas emissions	Personal Carbon Trading System based on a carbon card to track greenhouse gas emissions of purchases.	Webb, G., Hendry, A., Armstrong, B., McDermott, R., Swinburn, R. and Garry, E. (2014). Exploring the Effects of Personal Carbon Trading (PCT) System on Carbon Emission and Health Issues: A Preliminary Study on the Norfolk Island. *The International Technology Management Review*, 4(1), 1-11.
Multiple sectors	Collaborative process identifying, experimenting with, and promoting more sustainable household washing and eating practices.	Project worked with an array of actors from public, private, and civil society to identify existing and prototype innovations for sustainable household practices, taking everyday practices as starting point for behaviour change. Technological, regulatory, and informational innovations were acquired, tested, and evaluated using ethnographic processes in Irish households over an intense 5-week period. This built understanding of the variety of washing and eating practices carried out by individuals and the kinds of strategies that can be deployed to encourage more sustainable solutions. Also informing policymakers, education and NGO sectors, and commercial industries	Numerous publications from this study. Final project report: Davies, A. Fahy, F. Rau, H., Devaney, L., Doyle, R., Hynes, M., Lavelle M.J., and Manton R. (2017). CONSENSUS Phase II – Towards transformative action for sustainable consumption. *EPA*, Wexford. Available at: https://www.epa.ie/publicatio

	The 10 households participated in the experiment over five weeks with new challenges and goals set each week. The research involved multiple steps. In the case of the washing labs there were: Initial survey - House visits and interviews - WhatsApp interaction - Washing logs (recording shower time, litre use, motivations, and product assessments). Integrated interventions relating to governance, tools and education yielded changes in washing practice. In the area of reducing household water consumption, the CONSENSUS Washlab identified opportunities to reduce water use through innovation in hair and body care products 1. Combining steps (e.g., combined shampoo and conditioner products) 2. Displacing steps (e.g., moving washing steps outside the shower by using leave-in conditioner) 3. Using dry/ no water solutions (e.g., body gel cleaners, dry shampoo, and dry shaving). In addition, tips on planning showering and bathing events and connecting people to their water sources were employed and information was provided through an online water portal when combined with water reduction targets. The eating HomeLabs interventions included aquaponic grow-your-own starter kits, organic food box delivery schemes, food audits and pods for the fridge to keep food fresh for longer. Chef visits inspired new eating practices by reviewing food acquisition, storage, and preparation techniques. Information about regulatory requirements for food safety and food waste reduction ensured households experienced regulatory drivers that supported the end	ns/research/socio-economics/research-205.php Eating homelab study: http://www.consensus.ie/wp/wp-content/uploads/2015/02/Eating-HomeLab_High-Level-Findings1.pdf

		goals of reducing waste and increasing resource efficiency.	
Support	Product/ practice efficiency	Creating an indicator of the climate change mitigation potential. Focus on carbon handprint, such as avoiding material use, replacing, repairing, lengthening the lifetime of a product, etc.	Pajula, T., Vatanen, S., Behm, K., Grönman, K., Lakanen, L., Kasurinen, H. and Soukka, R. (2021). Carbon handprint guide: V. 2.0 Applicable for environmental handprint. *VTT Technical Research Centre of Finland*.
Support	Financial support of environmental organisations	In the Anonymous treatment, participants were informed that their donation decision would be "completely private and anonymous and it will not be revealed to others". On the other hand, in the Observable treatment, participants were informed that, after the session, their decision will be "revealed to other participants in this session" along with their first name and the place where they sit.	Vesely, S. and Klöckner, C. A. (2018). How anonymity and norms influence costly support for environmental causes. *Journal of Environmental Psychology*, 58, 27-30.
Support	Financial support for renewable energy development	In the Anonymous treatment, participants were informed that their donation decision would be "completely private and anonymous and it will not be revealed to others". In the Observable treatment, participants were informed that, at the conclusion of the session, their decision will be "revealed to other participants in this session" along with their first name and the place where they sit.	Vesely, S., Klöckner, C. A., Carrus, G., Chokrai, P., Fritsche, I., Masson, T., Panno, A., Tiberio, L. and Udall, A. M. (2021). Donations to renewable energy projects: The role of social norms and donor anonymity. Manuscript under review.

Support	Changes in support for climate change mitigation policies	Respondents were randomly assigned to one of four conditions. In the three-item condition, subjects were instructed to check energy-saving actions they previously completed from a list of three items. In the 10-item condition, subjects were instructed to check energy-saving actions they previously completed from a list of ten items. Subjects in the placebo condition and in the control conditions were not asked to complete the checklist task (the latter two conditions differed in other respects).	Werfel, S. H. (2017). Household behaviour crowds out support for climate change policy when sufficient progress is perceived. *Nature Climate Change*, 7, 512-515.
Water	Reducing household water consumption by 10 per cent	Social marketing for campaign by Durham Water (Canada), employed to bring about reduction in residential water use. Four test groups were chosen to pilot this intervention: One control group (no intervention); the second received an information brochure; the third had access to master gardener volunteers who could provide landscape assessments for homeowners; and the fourth was selected for a community-based social marketing approach.	https://www.research.manchester.ac.uk/portal/files/40834866/FULL_TEXT.PDF https://toolsofchange.com/English/CaseStudies/default.asp?ID=156
Water	Water consumption	In 2007, a water utility in metropolitan Atlanta, Georgia implemented a natural field experiment that randomized households into four treatments: a control group, a group that received technical advice, a group that received both technical advice and an appeal to prosocial preferences, and a group that received both technical advice and an appeal to prosocial preferences that included a social comparison	Ferraro, P. J. and Price, M. (2013). Using non-pecuniary strategies to influence behavior: evidence from a large-scale field experiment. *The Review of Economics and Statistics*, 95(1), 64–73. Bernedo, M., Ferraro, P.J. and Price, M. (2014). The persistent impacts of norm-based

messaging and their implications for water conservation. *Journal of Consumer Policy*, 37(3), pp.437-452.

The submitted cases presented above offer a variety of useful features and considerations relevant to CAMPAIGNers aims and objectives. Analysis below discusses these insights in a narrative manner, akin to that used in the previous chapter.

First, many successful cases either deployed, tested, or integrated multiple strategies within an intervention, suggesting that **interventions that integrated multiple approaches and stages** would benefit further consideration. Some cases consisted of sustained programmes of various interventions with smaller groups, while other studies combined different combinations of interventions to test their effectiveness independently and together. Such schemes often included an element of education and information-sharing to change behaviours, specific tools, materials, or technologies, and guidance and support. For instance, one randomised experiment tested the impact of technical advice, pro-social preferences, and social comparison interventions on water consumption.

By combining multiple strategies or approaches, integrated interventions often sought to inform participants of possible actions, equip them with the tools needed to successfully adapt their behaviour, and motivate them to commence and stick with their chosen behaviour change. When undertaking a more integrated approach, however, it is also important to assess how practices are interconnected and anticipate any potential rebound effects resulting from individual changes (Sorrell et al., 2020; Geiger et al., 2021).

Multiple submissions also highlighted the importance of supporting participants to set **clear targets and goals.** As also highlighted in the previous chapter, guiding participants to set clear goals that are also realistic supports their likelihood of success.

Incremental targets can equally help people recognise their progress by achieving multiple goals. A promising approach may be inviting participants towards feasible goals and targets in line with their circumstances and experiences to illustrate possible pathways for reducing their environmental impact.

Alongside clear goals and limited choices, one study emphasised the benefits of creating an **opt-out rather than an opt-in** mechanism. For instance, this could mean enrolling participants into

recommended set of goals and allowing them opt-out of those they do not want to pursue.

Once a behaviour change intention is set, it is also vital to scaffold stated intentions with different kinds of support. For instance, **providing timely information** on participants' existing behaviours (including baseline data) provides a basis for comparison against updated information as a change process is underway. Information can be gathered and shared through a myriad of automated and manual ways, including:

- Washing logs to track water usage
- Tracking the emissions of purchases through a carbon card
- Gathering mobility data through GPS on an app
- Website forms for recording consumption patterns, which can be compared to goals

How information on behaviour and promoted changes is presented is equally important. **Ensuring that information is presented clear and usable ways** can help to keep participants interested. For instance, one case outlined a community-based programme encouraging alternatives to car use, which offered personalised guidance on travel options based on people's routes, using travel maps, public transport timetables, and information on cycling and walking routes.

Effective interfaces not only help personalise the information provided to participants. They can also be used to create opportunities for reflection and feedback. Several cases included **feedback mechanisms at multiple stages during and following interventions** in the form of interviews, surveys, and reflective meetings.

Personalisation is another feature of many submitted cases which can take several forms. Behaviour typologies or personas can be devised based on different users' habits in an intervention, leading to different phrasing of challenges, challenge topics, or complementary information.

Similarly, **reporting back personal information** on consumption patterns or environmental impact is helpful. This approach is particularly impactful when this information is reported in comparison to others (e.g., to equivalent households, neighbours, or overall user averages) and accompanied with personalised

guidance and incentives for improvement. Here, personalisation is integrated with reporting social norms or pro-social behaviours to motivate additional change.

Making challenges social also appears to improve the likelihood or extent of behaviour change. For instance, **fostering social accountability and comparison with others** was emphasised in several cases as a useful mechanism for encouraging long term changes. In one case, people were more likely to undertake or increase a behaviour if they knew their actions would be shared with others than those whose actions were kept anonymous.

Many cases equally **provided support** to facilitate chosen behaviour changes. Material supports included kits, tools, and box schemes to provide the necessary materials for new behaviour. One case provided participants a low-tech kit to encourage alternative behaviours for lower energy use, including a clothing brush to reduce washing, socks, board games, and hot drinks to increase warmth while reducing heating.

Alternatively, other cases offered compensation or reimbursement for preferred habits, such as bus tickets. One case noted that **providing financial rebates** was more effective than simply sharing information on personal cost savings. In contrast, others offered **social support** in the form of demonstrations from chefs or teaching and guidance on reducing water use through house visits and on-call local experts.

Identifying appropriate support depends on the promoted behaviour change in question. This leads to another point from multiple cases: the importance of **clearly specifying desirable behaviours** is essential.

For example, several interventions provided ideas for **combining and displacing activities**. For example, when looking to reduce water consumption, cases not only looked to reduce washing and showering but also offered alternative behaviours for cleaning without water. This approach does not negate the potential benefits of encouraging technologies to manage consumption or purchasing more energy-efficient products. Rather, such interventions complement more substantial efforts to rethink social practices of energy use and adaptations to existing materials, such as repairing or extending product lifetimes.

At the same time, **looking beyond everyday behaviours** emerged as

an important lesson for several cases. In these cases, cases noted the importance of understanding product lifecycles and efficiencies, as amendments that affect these things in design and production can be equally or more effective in supporting more sustainable lifestyles at the individual scale.

Successful changes in behaviour or lifestyle tend to result in small changes individual's environmental impact rather than substantial transformations. Consequently, several cases highlighted the importance of **persistence and scaling** when looking to realise more substantial transformations.

Persistence means individuals maintain and sustain pro-environmental behaviours so that small reductions accrue over time. Likewise, scaling small changes can add up to more substantial effects as more people undertake them. Both factors are important to recognise and track within a behaviour change process and beyond the specified timeframe of any single intervention. Failing to balance persistence and scaling risks changes proving to be temporary, either prompting people to revert to original habits, or resulting in rebound effects.

Finally, it is important to **contextualise behaviour changes** to understand what can be possible. Challenges must suit a participant's circumstances - individually, socially, and materially. Encouraging changes will only be feasible if they apply to the individual's circumstances and surrounding context. For example, this may include reflecting on:

- Ecological ceilings and conditions
- Sociodemographic characteristics
- Sociotechnical provisioning systems
- Political and market conditions
- Personal preference, such as time, convenience, cost, and taste
- Availability and accessibility of key infrastructures (e.g. public transport), and how they differ within and across cities

2.3 Limitations

Despite being recommended by consortium members and noted for successful impact on behaviour change, the nominated cases also reported several limitations.

One recurrent limitation was the small sample sizes of studies. Some nominators cautioned against quantitative findings based on small samples because statistically detecting subtle effects becomes more complex, and false positives become more likely (e.g., Goldberg, 2019). For instance, systematic quantitative tests of interventions integrating multiple strategies are mostly missing in existing research.

However, others noted that smaller sample sizes had allowed for more intensive and sustained interventions than would have been possible with a larger sample. The CAMPAIGNers project provides an opportunity to overcome this limitation by testing interventions on a wider scale and in more intensive and sustained ways.

While not necessarily a research limitation, multiple cases noted the challenge of maintaining user engagement, particularly on apps or when continued data collection is required. These observations echo the review of lifestyle apps outlined in section 2.4. For instance, one case describing a mobile app targeting mobility habits noted that one-third of participants did not engage in the app due to increased battery consumption. Additionally, other case reiterated the importance of avoiding overly intrusive or frequent communication via an app to avoid disengagement.

Another point of consideration for CAMPAIGNers is participants' recruitment and the likelihood of realising sustained pro-environmental behaviour change. Determining whether the project will focus solely on self-selecting participants, who may already be motivated to pursue behaviour change, has two implications. On the one hand, exclusively relying on self-selecting participants omits the ability to apply findings to the wider population, including people unwilling to engage in such programmes.

Furthermore, one study cautioned that participants with high motivations and naivety surrounding their goals might be less likely to realise their intended lifestyle changes. This echoes similar cautions amongst cases in which studies assessing intentions or preferences do not necessarily reflect actual changes to actions and behaviours – also known as the attitude-behaviour gap.

Additional limitations for data collection and analysis might include:

- Conflating correlation with causation
- The absence of appropriate comparison groups, making it difficult to disentangle the impact of different dimensions (elements) of complex interventions
- Difficulties ensuring accurate and consistent reporting from the appropriate scale and actor (e.g., individual reporting on behalf of a household)
- Difficulties tracking behaviours over longer periods to see whether changes are sustained
- Clarifying and measuring the actual impact of specific behaviour changes individually, and when scaled

Looking beyond the particulars of research and assessment, these interventions also highlighted the importance of understanding the myriad of factors that contribute to a successful intervention. Here, it is crucial to account for political and socio-economic context, infrastructural lock-in, cultural and historical legacies, and material and spatial circumstances. For instance, if encouraging air pumps in a Northern European country, one must understand and contend with pronounced Northern European winters, inefficient housing stock, existing fuel alternatives, and the costs of scaling this intervention.

2.4 Opportunities for Further Learning

While this review has provided significant insights into behaviour change interventions, it has also highlighted several areas meriting further investigation within or beyond the CAMPAIGNers project.

First, while context is acknowledged, potential interventions would benefit from carefully assessing motivations, existing habits, context, and available alternatives. What works in one location may work in another but should be adequately adapted and account for contextual differences. Additionally, while some cases raised the issue of rebound effects and challenges of sustaining behaviour change, there is limited guidance on how to mitigate such risks.

The submitted cases also suggest a challenge's potential environmental impact needs to be weighed against its ease and likelihood of being completed. In other words, a higher impact challenge may be more

difficult to achieve or make habitual, and therefore have no pro-environmental impact. It would be prudent for CAMPAIGNers to limit or avoid high difficulty-low environmental impact challenges.

Identifying levers to encourage or facilitate challenges beyond individual behaviours is also encouraged. For instance, CAMPAIGNers should consider what service transitions, social norms, and incentives would help to increase the likelihood of completing challenges or their overarching environmental impact.

In this vein, it is worthwhile questioning where app-based digital technologies can increase the likelihood of sustained pro-environmental behaviour changes and where they are not necessarily poised to increase the likelihood of change or environmental impact. For example, apps can be useful for tracking behaviour in more accurate ways than self-reporting or fostering engagement and providing real-time feedback to a vast population.

As discussed earlier, mobile apps have high attrition rates. The devices and servers necessary for their operation also carry additional environmental impacts, which are not normally accounted for in calculating the impact of the behaviour change interventions they support.

Many of these challenges have already been recognised by the project consortium, who are considering ways of addressing and responding. More broadly, these reflections point to number of opportunities for further learning and investigation within and beyond the CAMPAIGNers project.

The following chapter moves away from specific behaviour change interventions to highlight lessons gathered from across international communities committed to sustainable lifestyles and behaviours.

3. Perspective Three: Learning from Intentional and Bottom-up Community Interventions

Intentional and bottom-up community interventions offer a unique perspective for CAMPAIGNers, in that communities and residents have instigated actions and changes to lifestyles from the grassroots level. Thus, while diverse, community interventions can highlight additional lessons that may not be apparent in research or policy-led behaviour change initiatives. Furthermore, many intentional groups organised around sustainability have incorporated resourceful, creative, self-starting, and radical approaches to pursuing more sustainable lifestyles - such as DIY, self-sustainability, eco-construction, permaculture, communitarianism, and permaculture.

While such initiatives are grounded in their immediate locality, many practices and approaches have been adapted and replicated across different groups and networks, scaling organically across various locales. Here, a "wicked problem" is that bottom-up initiatives can and do come into conflict with government institutions in the way they implement low-carbon lifestyles. Laws and regulations, especially if inflexible or bureaucratically burdensome, sometimes stand in the way of intentional communities lowering their carbon footprint. Organisations representing local initiatives may have grievances over bureaucrats and policymakers slowing down or hindering their sustainable projects.

As mentioned earlier this report, when behaviours are sustained and consolidated within communities and spread over time, cumulative results often exceed individual elements in isolation (Daly, 2017; Fazey et al., 2018; Hausknost et al., 2018; Schäfer et al., 2018). Thus, focusing on the interconnectedness of lifestyle and behaviours within communities is perhaps more challenging than assessing an individual habit or specific behaviour change. However, this perspective can offer especially valuable insights into sustaining and maturing interlocked low-carbon lifestyles over time.

This chapter outlines the key insights from a meta-assessment and literature review of more than 50 articles, books and papers related to lifestyle and habit change from the perspective of intentional communities and community-led actions for sustainable transformation.

ECOLISE undertook this review based on an existing database of research and insights from partners and research resources, including the ECOLISE Projects Wiki,[3] Transformative Social Innovation Theory (TRANSIT),[4] TESS project,[5] COMETS project,[6] and 52 Climate Actions.[7] A pattern language approach was used to identify six principles to encompass the interconnectedness of climate approaches in intentional communities and show how they are (or can be made) actionable. Each principle's name is therefore intentionally prescriptive.

Complementing the perspectives outlined in previous chapters, this review highlights useful dynamics and approaches for encouraging and diffusing pro-environmental lifestyles. The six principles are summarised in the following sections, and consist of the following:

1. Start with what is available
2. Share resources
3. Change together in communities of practice
4. Stack functions
5. Create positive impact (eco-efficacy plus eco-efficiency)
6. Encourage localisation of circular economy

As much as these principles, together, apply to systemic solutions, they are also be applied to common sustainability areas and criteria (such as energy, transport, housing, and food) and help to reveal how different elements can be applied individually or combined productively. The principles are presented below to highlight promising practices and approaches relevant to the CAMPAIGNers project.

[3] https://wiki.communitiesforfuture.org/wiki/ECOLISE_projects

[4] http://www.transitsocialinnovation.eu/

[5] http://www.tess-project.eu/

[6] http://www.comets-project.eu/

[7] https://www.52climateactions.com/

3.1 Start with What is Available

Intentional communities tend to be under-resourced, and thus forced to make the best use of what they already have - and use it frugally. Some organisations, and even governments, consciously choose the path of voluntary simplicity, building resilience, durability, and antifragility.

Starting with what is available has occurred in various contexts to date. Generally, invoking this approach requires some mapping to identify potential resources or spaces that are un- or under-utilised or mismanaged. Commonly identified resources include land, buildings, vehicles, and even waste. Alongside mapping resources, it can also be good practice to map existing initiatives performing well and invest in upscaling. This principle also promotes trusting citizens' ingenuity by providing information to enable communities to self-organise and mobilise existing resources to achieve their goals.

For instance, many European cities recognise the benefit of opening common spaces for citizens to create community gardens, such as Incredible Edible (Morley et al., 2017), co-working spaces, art centres, playgrounds, farmers' markets, amongst others.

Additionally, initiatives have sought to make use of available spaces, materials, or resources. For instance, ecovillage initiatives in some countries (for example, Spain) work with local authorities to regenerate hundreds of deserted villages (Renau, 2018). Similarly, investments in wind energy in the United Kingdom or solar energy in Montenegro and on Greek islands also use existing natural resources.

Using what is already available looks to challenge ideas of scarcity or competition with multinationals, and instead points to existing resources and looks for ways to integrate them back into sustainable practices and lifestyles. However, this approach may point to activities that are not directly relatable to low-carbon lifestyles or are difficult to assess in comparative life-cycle analysis.

Overall, starting with what is available is a broad principle rather than a single activity. While tracking this approach can be difficult given its breadth and diversity, this principle has been present within replicated

community engagement models such as the Transition Town Network.[8]

3.2 Share Available Resources

The principle of sharing builds on starting with what's already there and adding innovative ways of managing these resources. Sharing is an easily applicable principle across various contexts, from bicycle- and car-sharing, to business ownership (cooperatives), cohousing, coworking spaces, entrepreneurs and banks offering micro-loans, ethical banking, non-profit provision of various resources, foodbanks, and so forth.

Sharing is as old as human culture. Sharing goods and innovations is ancient and has remained an essential part of society. Particularly in times of crisis (such as economic collapse, natural hazard, or war), parallel economies based on trust and sharing commonly form in all parts of the world. Proactively encouraging and implementing such practices can create resilience and enhance adaptive capacities.

Sharing available resources has been implemented across a variety of behaviours and sectors. For example, options for transport include adding one's car to a car-pooling scheme, joining a ride-sharing scheme (driving others and/or taking rides with others), or picking up passengers. For accommodation, individuals have offered unused rooms in homes for (non- or low profit) rent or affiliated with a dispersed hotel.

This principle has also been implemented concerning agriculture and food, with groups sharing a piece of land to turn it into a garden to grow food (Dhakal and Ruth, 2017, p. 44), or by organising shared meals within communities (Ibid, p. 46). Furthermore, sharing materials or everyday items is also commonly practised through initiatives like clothing exchanges, tool rental, and community sheds. Finally, sharing knowledge and innovation has also been viewed as a key aspect of this principle, and at the heart of many peer-to-peer (P2P) and knowledge commons schemes. For instance, energy cooperatives utilise shared data and information on solar-electricity production via decentralised systems to support overall system resilience (Ibid, p. 7).

Typically, formalized examples of sharing available resources are

[8] https://transitionnetwork.org/stories/

instigated by visionary individuals within communities who also have sufficient entrepreneurial skills to boost sharing schemes. Such efforts are driven by various circumstances and motivations, including economic imperatives, crisis, scarcity, pragmatism, shared culture, community, solidarity, and even profit.

While a relatively straightforward principle, sharing is not without its challenges. In times of abundance, sharing tends to be less prominent and harder to proactively implement amongst well-off populations. Equally, sharing initiatives may encounter resistance if they encumber revenue streams. For example, car sharing could lead to lower parking revenue in cities, or food sharing and self-sufficiency could reduce revenue for food distributors and retailers.

3.3 Change Together in Communities of Practice

The critical aspect of low-carbon lifestyles in intentional communities is social cohesion and support when implementing new practices. Changing together is more effective and long-lasting than changing individually. When communities or people come together around a shared issue or objective, such groups are seen as the backbone of all intentional communities and associated sustainable networks and movements. Such communities of practice manifest as interest groups, hubs, circles, clubs, cooperatives, and unions.

A fundamental element within intentional communities, communities of practice typically cluster different practices depending on their location (e.g., urban, rural, dense, scattered) and people's interests. In some instances, people may congregate around single areas of interest such as urban gardening, zero waste, car-pooling, energy cooperatives, and eco-construction. Other times, people living in a certain area may decide to implement different clusters of sustainable practices, depending on available resources and interests. For example, ecovillages stack functions of many lifestyles and professional sustainable practices (the focus of the following principle).

With these diverse origins, communities of practice have been known to assemble around virtually all aspects of sustainable lifestyles and behaviours, including providing organic food, food waste reduction,

dietary change, transport, electricity generation, recycling and more. Establishing a community of practice similarly is difficult to define and appears contingent upon the needs, interests, and circumstances of the people involved. Nevertheless, good examples of successful communities of practice emerging in ecovillages orientated around changing together, such as Schloss Tempelhof in Germany (Kunze, 2015). A sense of belonging, purpose, and connection appears to be a necessary basis for establishing a community of interest. Sometimes, such communities emerge in response to social alienation and the absence of community in other areas of life.

Change through communities of interest can be challenging, particularly amidst a strong emphasis on nuclear family-centred lifestyles in cities. Social isolation, such as prolonged lockdowns, can also create additional barriers to establishing and maintaining communities of interest. Additionally, examples of communities of interest emphasise how working at the community level to address the climate crisis can be done with a narrower range of activities while also contributing to increased resilience (Webb et al., 2021).

3.4 Stack Functions

Stacking functions is a well-known permaculture principle: "To maximise the efficiency of a design, every element (component) is selected and located with the intention that it serves as many functions as possible".[9] The principle was formed in the late 1970s and developed through the 1980s by permaculturists, on the observation that a monoculture field has one species of plants that serve a single function (a yield of a crop). In contrast, in a polyculture garden, plants support each other and create stacked functions extending beyond food.

Permaculture network has popularised the principle of "stacking functions" from the core permaculture philosophy among its practitioners. Today, the principle has a broader sense, extending from gardening and rural household planning. It is informed by Christopher Alexander, the author of *A Pattern Language: Towns, Building, Construction* (1977), who noticed how modern society is characterised by

[9] https://deepgreenpermaculture.com/permaculture/permaculture-design-principles/2-each-element-performs-many-functions/

brutal fragmentation spatially, socially, and in terms of lifestyle. This principle has since broadened and been applied to smart urbanisation by bundling diverse spatial functions, like building schools next to parks and sports or recreational areas with safe bicycle and pedestrian pathways to nearby housing developments.

Stacked functions are often consciously introduced to emulate how natural ecosystems function or for practical reasons, like saving time or increasing efficiency. However, initiating stacking can be challenging when wider urban designs and lifestyle norms encourage or reinforce specialisation or separation, making it difficult and time-consuming for people to move between functions. Furthermore, while stacking might facilitate ease and efficiency, it can be difficult to assess environmental impact, given the overlapping of multiple interventions and activities.

A common practice in intentional communities is to have multi-purpose shared spaces (both indoors and outdoors) or share kitchens, conduct specialised workshops, and communal workspaces. Multi-purpose spaces rationalise the material use of resources and save energy and strengthen community and inter-generational relations. Other examples of stacking spaces include repurposing public spaces, integrating edible landscapes in parks, planning green roofs, positioning solar panels, redesigning city centres to pedestrian areas, and sheep grazing around social panel facilities.

Stacking can also be applied to individual lifestyle and habit change examples by combining challenges. For instance, a single challenge might ask individuals to work with their friends and neighbours to produce less (organic) waste and, in turn, make local compost to use in their gardens, which becomes a more social space. Hence, people begin to spend quality time working together and improving social relations.

Most contemporary environmentally oriented intentional communities learn to stack functions from community networks. For instance, urban community gardens expand their intentionally stacked functions by not only growing local vegetables and fruits, but also using their space for other functions, such as gathering and celebration, absorbing organic waste (composting), increasing green spaces and biodiversity, and improving citizens' health.

As shown in the case of Tempelhof, stacking climate solutions supports the development of more robust, resilient models of social organisation resistant to both financial and climate crises (Kunze, 2015). According to Huber and Schuster, Tempelhof had to be of such a magnitude and incorporate such complexity "in order to include all aspects of a holistic socio-economic experiment" (2015).

3.5 Create Positive Impact (Eco-efficacy plus Eco-efficiency)

Efficacy is about intelligently designing, optimising, and adapting the solution to fit the problem and focusing on its positive impact. The sequence is: create the best mechanism, tool, or application (efficacy) and then use it efficiently.

An analogy to describe the problem of focusing only on efficiency is that bailing out the Titanic would be more efficient with a tablespoon than with a teaspoon. Eco-efficacy focuses on positive impact instead of solely diminishing the negative impact. The idea to do more good, not just less bad, changes the nature of the incentive.

Eco-efficacy is pursued as a way of alleviating environmental and health harms through intelligent design. Many intentional communities are applying approaches that imply efficacy preceding efficiency in the design of their housing, farming practices, choice of appliances, or transport. For example, permaculture practitioners use zoning to rationalise the positioning of elements in their household, workshop, and garden to maximise energy efficiency.

Additionally, effectiveness implies mindful consumption, and that is a soft solution that can be incentivised with education and positive feedback. For instance, using a tea kettle is more efficient than boiling water on an electric or gas stove but can be further optimised by only boiling as much water as is needed.

The principle of combining efficacy, efficiency, and effectiveness has been particularly central to applying cradle-to-cradle design and zero waste networks' activities. For instance, the cradle-to-crade paradigm would look to first retrofit and insulate buildings (improve their effectiveness) and then install efficient heating and/or cooling systems (Braungart et al., 2007). A similar example would be creating better products and packaging to

make them repairable and easily recyclable, as illustrated through the case of coffee capsules.[10] Right to repair movements have also fought for users' right to repair devices, legislation to outlaw planned obsolescence and an end to material and legal obstacles to fixing products.[11]

Despite its widespread application, promoting combining eco-efficacy with efficiency and effectiveness can be challenging. For one, positive motivation is not prevalent within climate change narratives making the arguments for greater efficacy and efficiency somewhat out of place. Additionally, initial investments associated with more efficient and effective materials, infrastructures, or practices can be an economic barrier to making changes, thereby reinforcing the status quo.

3.6 Encourage Localisation of Circular Economy

The extractive globalised economy is likely to gradually self-destruct if it doesn't prevent externalities from leaking and ultimately flooding it. A circular economy begins with the intention of replenishing the resource in a closed cycle. This approach involves a reverse assessment of cumulative resource use and infrastructure impacts, rather than starting from a point of taking resources and infrastructure for granted, as some conventional circular economy approaches do.

Many intentional and traditional communities have been opposing extractive industrial development and are therefore seeking ways to create new forms, or preserve old forms, of low-carbon lifestyles. These lifestyles blend human life and work with respect to the natural environment. Complimenting local efforts, policy at all scales is increasingly supporting the move towards a circular economy, as evidenced by the European Commission's new circular economy action plan.[12]

A simple example of a deeper, more localised circular economy is a composting toilet, which is nested in a holistic spatial design, especially in urban areas where human waste and other organic waste need to reach

[10] https://zerowasteeurope.eu/2011/05/coffee-capsules-and-zero-waste/
[11] https://www.ifixit.com/Right-to-Repair/Intro
[12] https://ec.europa.eu/environment/strategy/circular-economy-action-plan_en

the waste management system for safe composting without getting mixed up with hazardous chemicals and plastic. The challenge is to achieve the situation where the "output ('waste') from one metabolic urban conversion equals input for another" (Wielemaker et al., 2018). In some areas, composted waste can seamlessly complete the cycle of organic matter to bring it back to the farmland. The stress here is on smaller scale circular ecological and economic process, completed locally, not as parts of global "sustainable" cycles.

Due to the growing popularity of circular economy principles and approaches, interpretations of this principle have broadened and loosened in recent years. In turn, there are instances where this principle's conceptual integrity has been weakened or over-simplified when it applied in practice. For instance, the full lifecycle of products might not be considered, design problems such as planned obsolescence might be ignored, or certain unsustainable practices (such as waste incineration) might be included within circular models. Additionally, loosely defined circular economy models can privilege or reinforce centralised solutions and unsustainable consumption, to the detriment of local, small scale, or de-growth approaches.

4. Conclusion

This report has provided a review of state-of-the-art research related to sustainable lifestyles and behaviour change to support the CAMPAIGNers project and inform the design and delivery of its lifestyle challenges and mobile app. The report divides these insights into three overarching perspectives:

Perspective one outlines and analyses theories and models relevant to sustainable lifestyles and behaviours from a variety of social science disciplines.

Perspective two offers insights from empirical research which has engaged with encouraging more sustainable behaviours and lifestyles.

Perspective three shares learning from intentional and bottom-up community interventions in the form of six principles for sustainability challenges.

Together, these perspectives summarize cutting edge conceptual and empirical social science research and embedded experiences of intentional communities. It does not attempt to reconcile differences or disagreements, but rather illustrate a diversity of perspectives, ways of understanding, and approaches to enacting change. This concluding section highlights and organises key insights from this review by offering a set of recommendations for effective sustainability challenge design and app development within the CAMPAIGNers project.

For clarity, recommendations have been organised according to different aspects of challenge development, app design, user recruitment, and risk mitigation.

4.1 Recommendations for CAMPAIGNers

4.1.1 Challenge Design,

- Identify participants' prevailing motivations for adopting different behaviours and frame challenges according to these motivations (e.g., cost savings, altruism, social norms)
- Ensure promoted behaviours and challenges are relevant and feasible within the existing context by gathering information on policy,

infrastructure, spatial dynamics, and socio-economic dynamics

- Distinguish between habitual and non-habitual behaviours so that habitual behaviours are first addressed or prioritised by challenges
- Target behaviours and activities that can be changed or leveraged using existing resources
- Alternatively, create challenges that encourage the adoption of less resource-intensive or more efficient technologies to reduce environmental impact without requiring changes to behaviours
- Include challenges that are not only related to individual or personal consumption, but also wider aspects of social and political agency – such as getting involved in communities of interest and civil society responses to climate change, or petitioning officials

4.1.2 Challenge Implementation

- Stage challenges according to degrees of difficulty, so people can realise the impact and progress incrementally
- Many challenges may have small effects on individual environmental impact; increase impact by encouraging sufficient people to undertake it, or to continue for a sustained period
- Determine potential unintended consequences and rebound effects of any challenges and associated behaviours
- Where possible, devise and promote challenges that can have multiple positive impacts, stack functions, or transcend individual sectors

4.1.3 App Design

- Eliminate common features that encourage attrition, including:
    - high battery use
    - excessive notifications or advertisements

    - a boring or unengaging interface
    - not clarifying the app's purpose
- Include personalised features in the app, along with dynamic information
- Incorporate persuasive design principles and nudges to encourage users to start their behaviour change processes

4.1.4 Recruitment and User Experience

- Maintain engagement by personalising challenges and app
- Create opportunities for online and real-life social encounters between users, to maintain motivation and encourage sustained participation
- Create an opt-out system for challenges to increase the likelihood of participation
- Limit the number of choices presented at a given time to five to six options or lines (or roughly the size of a phone screen)
- Target individuals who are more realistic about their outcomes and distinguish them from users already engaging in sustainable behaviours who might be more enthusiastic or naïve about outcomes
- Provide realistic goals to minimise the likelihood of disappointment and dropout
- Create feedback loops and mark progress early in challenges to encourage continued progress
- Leverage social norms and motivation through existing social groups to inspire behaviour change - e.g., by getting social clubs, workplaces, and existing communities of practice to participate in the challenges
- Share information with and between users to encourage social comparison and positive social norms around challenges

4.1.5 Assessment and Risk Mitigation

- Ensure user safety and data security, and communicate this information to users

- Make challenges straightforward to ensure assessment and progress can be accurately tracked
- Create reporting methods within the app that balance accuracy with ease
- Where feasible, incorporate passive data tracking (such as mobility tracking) to reduce the amount of self-reporting

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Shove, E., Pantzar, M. & Watson, M. (2012). *The Dynamics of Social Practice: Everyday Life and How It Changes*. SAGE.

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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.

Southerton, D., Chappells, H. & van Vliet, B. (2004). *Sustainable Consumption: The Implications of Changing Infrastructures of Provision*. Edward Elgar Publishing.

Verplanken, B. & Wood, W. (2006). Interventions to break and create consumer habits. *Journal of Public Policy & Marketing*, *25*(1), 90-103.

Webb, J., Stone, L., Murphy, L. & Hunter, J. (2021). *How Communities Can Thrive in a Climate Changing World*. Institute for Public Policy Research, London.

Wielemaker, R.C., Weijma, J. & Zeeman, G. (2018). Harvest to harvest: Recovering nutrients with New Sanitation systems for reuse in Urban Agriculture. *Resources, Conservation and Recycling*, 128, 426–437.

6. Appendix One: Summary Reviews for Perspective One

This appendix consists of all summary reviews submitted for perspective one. The approach and framing for this review exercise are outlined in (chapters one and two of this report.

Consortium partners drafted short summaries to outline the current state-of-the-art for selected subdiscipline, theory, or model. In several instances, reviewers elected to undertake a more extensive review to ensure necessary background information was included.

Summary reviews responded of the following questions:

- What is this theory/frame?
- Where does it originate? (e.g., sector/discipline)
- How does it understand sustainable lifestyles and/or behaviour change?
- What scale of action does it address?
- What lessons does it offer for sustainable lifestyles and/or behaviour change?
- How does this theory/framework relate to the environment and/or climate change?
- What are the main criticisms of this approach?
- 1-2 one paragraph summaries of applications of this approach
- List 5-10 key literature

6.1 Theory of planned behaviour (TPB) –Ajzen (1991)

Where does it originate? (e.g., sector/discipline)

The Theory of Planned Behaviour stands in the tradition of social psychological action models and is the clearly most successful theory in this domain. It is relatively simple with only four variables included and aims at explaining deliberate decisions people make about behaviours they take. It evolved from its predecessor, the Theory of Reasoned Action. It has been applied to behaviours in many domains, such as health, consumption, environment, etc.

How does it understand sustainable lifestyles and/or behaviour change?

As indicated in the previous section, the theory has not been developed specifically for sustainable behaviour. However, it has also been applied numerous times to this domain, either in its pure form or supplemented with additional variables. As this theory addresses single behavioural choices of individuals, it does not refer to lifestyles (which are the overarching patterns of behavioural choices) directly but can clarify choices within a certain lifestyle.

The theory assumes that people's (in our case environmental) choices are determined by their **intentions** to perform a behaviour. An intention is defined as the willingness to try to perform a behaviour. The intention in turn is determined by three variables: **Attitudes** towards this behaviour and its alternatives, **subjective norms** regarding the behaviour, and **perceived behavioural control** (PBC) regarding the behaviour. Attitudes are in simple words a person's assessment of how good or bad the behaviour would be for them, or in more precise terms the generalised subjective evaluation of the benefits and costs of the behaviour in comparison to behavioural alternatives from the person's perspective. Subjective norms represent the social pressure the person experiences, in psychological terms, the social costs and benefits of performing the behaviour. Perceived behavioural control is a representation of the behavioural difficulty, in other words, how capable a person feels to implement the behaviour and how much control they experience about the behaviour.

Perceived behavioural control also has a direct impact on behaviour (bypassing and moderating the effect of intentions), because for behaviours which are very simple or very difficult to perform, intentions have been shown to be less relevant predictors (simple because almost everyone implements simple behaviours and almost anyone difficult behaviours).

Change of behaviours within this theoretical framework originate from changes in the predictors. If attitudes become more positive towards environmental behaviours, subjective norms become more supportive and/or behaviour becomes easier to implement, the theory predicts that intentions become stronger and subsequent behaviour more likely.

What scale of action does it address?

The TPB has been developed to predict deliberate actions on a single action level. These are usually individual actions (although collective actions might be analysed through the theoretical lens of the theory as well). Applications to environmental behaviours have been mostly on the level of curtailment behaviours (e.g., switching off the light, participation in recycling schemes, mobility choices, energy saving behaviours) or – usually smaller – investments (e.g., energy saving appliances).

What lessons does it offer for sustainable lifestyles and/or behaviour change?

One advantage of the TPB is its simplicity. It offers three levers for influencing people's behaviours: attitudes, subjective norms, or perceived behavioural control. Changes to more sustainable lifestyles within this theoretical framework would be initiated by changing the pattern of individual decisions. Strategies would be a combination of influencing attitudes (here one can draw on the literature on attitude change and persuasion), subjective norms (increasing social pressure by making social norms in favour of the behaviour more salient), and perceived behavioural control (by removing barriers or providing strategies and skills for overcoming barriers). Attitude change might for example happen by providing people with additional positive anticipated outcomes of a behaviour (referred to as **beliefs** in the theoretical framework) or arguing against negative anticipated outcomes. As attitudes are generated from the set of activated

beliefs in a decision situation, they can vary from situation to situation even if the person does not establish new beliefs or removes existing beliefs. Therefore, another strategy to create more positive attitudes is to trigger the relevant positive beliefs in a given situation (for example, by **framing** or **priming** procedures). Attitudes have also been shown to change, when people are in situations of **cognitive dissonance**, namely when they hold several cognitions at the same time which do not match. At the same time, thinking that a weekend in New York would be nice and that avoiding flying is positive leads to an aversive mental state of cognitive dissonance, which people can resolve by changing/adjusting the involved cognitions. Interestingly, the vast majority of papers using the TPB in the environmental domain focuses on describing behavioural predictors, rather than using the TPB to derive and test interventions.

How does this theory/framework relate to the environment and/or climate change?

As long as the behaviours analysed are within the realm of the TPB (deliberate actions on an individual level), environmental and climate actions can and have been analysed through this theoretical lens. Climate change and environmental problems in this theoretical approach are understood as the sum of individual choices.

What are the main criticisms of this approach?

The TPB has been criticised within the environmental psychological research tradition as being too simplistic and only applicable to deliberate decisions, whereas habitual behaviours are not well covered by the theoretical structure. Furthermore, the theory has also received criticism for not covering the moral dimensions of environmental behaviour well enough. Both aspects have been addressed by extensions of the theory with additional constructs (habits, personal norms, values).

From other disciplines, the TPB has been criticised in line with many psychological theories as being too much focused on individual decisions, treating the social and structural context of the behaviours merely as externalities.

1-2 one paragraph summaries of applications of this approach

The TPB has been applied in the environmental domain literally hundreds of times, so it is impossible to give a short summary of the whole field in this section. Therefore, two examples of applications and a meta-analysis are presented briefly here:

De Leeuw et al. (2015) strictly followed the variables and structure of the TPB to identify the relevant beliefs (which are the "building blocks" of attitudes, subjective norms, and PBC) of 602 high school students in Luxembourg (age 12-16). In a qualitative pilot study with 92 students from the same cohort, they first derived a list of potential beliefs in the three categories. "*Specifically, they were asked to list (a) the advantages and disadvantages of performing these behaviors in the next year, (b) the persons or groups of people who would approve or disapprove of their performing these behaviors in the next year, and (c) the factors that could facilitate or interfere with their performing these behaviors in the next year.*" (De Leeuw et al., 2015, p.130-131). From this list of beliefs, the most frequent 12 behavioural beliefs (forming the attitude), 12 control beliefs (forming PBC), and a list of the nine most likely social influences (parents, peers, teachers, etc.) were measured in a quantitative survey early in the school year, whereas the self-reported environmental behaviour was measured later in the school year by a second survey. Overall, they find strong support for the TPB structure in their empirical analysis and identify the following behavioural beliefs as particularly relevant for forming the attitude: "I would save energy", "I would help keeping our planet clean", and "I would help protect our natural environment". The following control beliefs contributed most to perceived behavioural control: "if the printer I'm regularly using prints on both sides of a sheet of paper", "if we have recycling bins at home", "if I can afford buying ecological products", "if there were interesting movies, documentaries and articles about the natural environment, suitable for teenagers my age", and "if stickers, boards and voice guides specified which behaviors to perform and how". The most relevant social influences came from their mother and father, the family in general, and to a lesser degree celebrities committed to protect the environment.

In a field experiment, Kormos et al. (2014) manipulated social norms to reduce car use for commuting (no standard, low standard, high standard) and found that

the degree of descriptive social norms (how much others reduced their car use) impacted the degree to which people themselves reduced car use.

Since there are so many published papers using the TPB, meta-analyses are also common. In the following, two examples are given. Scalco et al. (2017) for example meta-analysed data from 17 studies on organic food consumption using TPB variables and found very good support for the theoretical structure, with attitudes and subjective norms having the strongest impact on intentions to buy organic food. Han and Stoel (2017) meta-analysed 33 independent datasets about intentions of socially responsible consumer actions (mostly related to the environment) with the TPB framework and found in line with Scalco et al. (2017) that the attitudes were the strongest predictor of intentions, followed by subjective norms. From an intervention perspective, the meta-analysis by Sheeran et al. (2016) analysed if experimentally induced changes in attitudes, subjective norms, and perceived behavioural control lead to changes in intentions and health-related behaviour. Based on 204 studies, they conclude that changes in the predictors in the TPB lead to changes in intentions with medium effect sizes, and changes in behaviour with small to medium effect sizes.

List 5-10 key literature (taken from spreadsheet)

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211.

Ajzen, I. & Schmidt, P. (2020). Changing behavior using the theory of planned behavior. *The handbook of behavior change*, 17-31.

De Leeuw, A., Valois, P., Ajzen, I. & Schmidt, P. (2015). Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions. *Journal of Environmental Psychology*, *42*, 128-138.

Han, T. I. & Stoel, L. (2017). Explaining socially responsible consumer behavior: A meta-analytic review of theory of planned behavior. *Journal of International Consumer Marketing*, *29*(2), 91-103.

Kaiser, F. G. & Gutscher, H. (2003). The proposition of a general version of the theory of planned behavior: Predicting ecological behavior. *Journal of Applied Social Psychology*, *33*(3), 586-603.

Kormos, C., Gifford, R. & Brown, E. (2015). The influence of descriptive social norm information on sustainable transportation behavior: A field experiment. *Environment and Behavior*, *47*(5), 479-501.

Scalco, A., Noventa, S., Sartori, R. & Ceschi, A. (2017). Predicting organic food consumption: A meta-analytic structural equation model based on the theory of planned behavior. *Appetite*, *112*, 235-248.

Sheeran, P., Maki, A., Montanaro, E., Avishai-Yitshak, A., Bryan, A., Klein, W. M. ... & Rothman, A. J. (2016). The impact of changing attitudes, norms, and self-efficacy on health-related intentions and behavior: A meta-analysis. *Health Psychology*, *35*(11), 1178.

Si, H., Shi, J. G., Tang, D., Wen, S., Miao, W. & Duan, K. (2019). Application of the theory of planned behavior in environmental science: a comprehensive bibliometric analysis. *International Journal of Environmental Research and Public Health*, *16*(15), 2788.

Yuriev, A., Dahmen, M., Paillé, P., Boiral, O. & Guillaumie, L. (2020). Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. *Resources, Conservation and Recycling*, *155*, 104660.

6.2 Norm-Activation Theory (NAT) – e.g., Schwartz (1977); also referred to as Norm-Activation Model

Where does it originate? (e.g., sector/discipline)

The NAT is a social psychological theory originally developed for explaining **altruistic behaviour** (or its absence) in situations where people need help of other people (e.g., in cases of emergencies). The theory was developed based on research that Shalom Schwartz was conducting in the 1970s with some collaborators. In the papers published by the original group, the theory was never formalized to the degree it was in the later applications within environmental psychology. Already shortly after its publication, it was applied to the environmental domain by van Liere and Dunlap (1978) and the way central variables from the NAT are now used in environmental psychology were coined. A related theory is the Value-Belief-Norm Theory proposed by Stern (2000), which combines many of the NAT variables in an activation chain.

How does it understand sustainable lifestyles and/or behaviour change?

As the NAT was initially developed for altruistic behaviour, its application is explicitly restricted to situations which have a moral undertone, thus, where value orientations people have can become relevant. Transferred to environmental topics, this means that the NAT also here tries to address the moral dimension in environmental behaviour. The basic assumption in the NAT applied to environmental behaviour is that moral considerations can determine environmental behaviour, but only if the feeling of moral obligation to act, which is referred to as a personal norm, is activated in a given situation (hence, the name of the theory: Norm-activation theory). The NAT has become rather popular in environmental psychology since the 1990s, highlighting the influence of values and norms which has been argued to be missing in the Theory of Planned Behaviour (see also there). Sustainable lifestyles are understood in this theoretical framework understood as lifestyles where decisions are made with activated personal norms (given that the person holds values that tell them to behave environmentally friendly).

Which factors exactly contribute to activating the personal norm in a decisional situation varies a bit from paper to paper, but the following are named often: (1) awareness of need (AN) – hence the necessity of realizing that there is a need to act (an environmental problem that threatens something the person values); (2) awareness of consequences (AC) – hence the necessity to realize that a person's own behaviour contributes to this problem; (3) ascription of responsibility (AR) – hence the person accepting responsibility for the choices damaging the environment; (4) response efficacy – hence knowing efficient alternatives of the damaging behaviour; (5) ability to act – having the skills, resources, knowledge to implement the efficient alternatives; and (6) denial of responsibility (which is a mechanism used, if people feel morally obliged initially, but do not find an efficient solution that they can implement). Sometimes social norms (a variable comparable to subjective norms in the Theory of Planned Behaviour, see there) and perceived behavioural control (see Theory of Planned Behaviour) have also been included in the factors activating personal norms. Often it is assumed that several, or all, of the factors named above need to be in place for personal norms to be activated.

What scale of action does it address?

The NAT is a theory that in general addresses individual actions such as waste sorting, energy efficiency investments, dietary choices, purchases, etc. However, as it links these choices to underlying value orientations, it is to a certain degree suited to explain sustainable lifestyles, namely when people (a) have values that tell them to behave environmentally friendly, and (b) manage to establish constellations of norm-activating factors in their everyday life that make sure that personal norms that link their values to concrete actions are activated as often as possible.

What lessons does it offer for sustainable lifestyles and/or behaviour change?

NAT offers a number of rather specific advice how to change behaviour: First of all, as personal norms are considered the manifestation of value orientations in a given decisional situation, general environmental values need to be in place to have the chance to activate personal norms. However, value surveys show that these are well established in many countries. Second (and here it becomes

interesting from the perspective of challenges in CAMPAIGNers) when the values are in place, the role of the challenge through the app would be to activate the respective personal norms at the right point in time by highlighting (a) the need to act, (b) the person's contribution to the problem, (c) help them to take responsibility, (d) provide them with effective solutions, (e) train them to implement them, and (f) help to prevent denial of responsibility. Tools for these interventions have been developed in several intervention papers. Especially, commitment has been linked to activating and strengthening personal norms (e.g., Matthies et al., 2006).

How does this theory/framework relate to the environment and/or climate change?

The NAT applied to environmental behaviour or climate change-related actions interprets environmental behaviour and climate actions as altruistic behaviour (as opposed to for example self-serving behaviour). This excludes all other constellations of why environmental or climate behaviour might be conducted by people (e.g., economic or social influence). It has not been developed initially for environmental behaviour, which explains this restricted perspective. However, within this perspective, it offers a good understanding of why some people show environmental behaviour even if they do not benefit from in directly or indirectly in the first place.

What are the main criticisms of this approach?

The main criticism of this theory is that it is only explaining a (potentially small) fraction of drivers of environmental behaviours. Furthermore, it was shown empirically, that personal norms (the feelings of moral obligation to act) are still relatively distant from behaviour and other variables might still interfere, even if personal norms have been activated.

1-2 one paragraph summaries of applications of this approach

The NAT has been used as a theoretical framework for designing intervention programs in a number of papers. Matthies et al. (2006), for example, have combined a plea for commitment (addressing personal norms) with a temporal

free ticket for public transportation to defreeze transportation habits. They found that a combination of free ticket for the first for two weeks to reduce habitual influence then followed by two weeks with commitment was effective to stimulate participants to try alternative travel modes to their car. This was reflected in changes in the effect of (among other variables) personal norms.

In an interesting pilot study on the effects of an app (EcoTrips) designed to stimulate use of more environmental transport modes in the US, Park et al. (2017) made use of the NAT in the design of the app (among other theoretical input). They found that the app was able to change people's awareness of consequences. The app was characterized by a high degree of flexibility when tailoring the feedback metrics (CO_2, calories, …) and personalizing the messages, which the participants identified as an important feature for the effect of the app.

List 5-10 key literature

Matthies, E., Klöckner, C. A. & Preißner, C. L. (2006). Applying a modified moral decision making model to change habitual car use: how can commitment be effective?. *Applied Psychology*, 55(1), 91-106.

Park, H., Sanguinetti, A. & Castillo-Cortes, G. (2017). EcoTrips: Leveraging Co-benefits and Metaphorical Metrics in a Mobile App to Promote Walking and Biking for Short Trips. In *Design, User Experience, and Usability: Designing Pleasurable Experiences*. Location: Springer. UC Davis. Retrieved from https://escholarship.org/uc/item/4wc8g5sm

Schwartz, S. H. (1977). Normative influences on altruism. In *Advances in experimental social psychology* (Vol. 10, pp. 221-279). Academic Press.

Stern, P. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407-424.

Van Liere, K. D. & Dunlap, R. E. (1978). Moral Norms and Environmental Behavior: An Application of Schwartz's Norm-Activation Model to Yard Burning. *Journal of Applied Social Psychology*, 8(2), 174-188.

6.3 Comprehensive Action Determination Model (CADM) – Klöckner & Blöbaum (2010)

Where does it originate? (e.g., sector/discipline)

The CADM is one of several attempts to address the shortcomings of the dominant behavioural models in environmental psychology such as the Theory of Planned Behaviour (see for a description there), the Norm-Activation Theory (see for a description there), and the Value-Belief-Norm theory by combining their main assumptions and complementing with specific assumptions about situational and habitual influence on behaviour. As such, it is a model in the tradition of social psychological behaviour models.

How does it understand sustainable lifestyles and/or behaviour change?

As indicated above, the CADM is a combination of several theoretical families which are popular in social psychology inspired environmental psychology. For a deeper introduction of the different variables, please consider the summaries for TPB and NAT. CADM assumes that environmental actions are determined by intentions (as in TPB), perceived behavioural control (PBC) and habits and routines (if the behaviour is repeated often). In line with TPB, intentions are assumed to be predicted by PBC, attitudes, and social norms (which are equivalent to subjective norms in TPB). However, in addition, the CADM assumes that intentions are also formed by taking into account activated personal norms (thus, covering the moral dimension of the behaviour). These personal norms are assumed to be activated as described in the NAT (see there), but also by salient social norms. As in Stern's Value-Belief-Norm theory, it further assumes that personal norms link to basic and environmental value orientations and environmental worldviews (as captured by the New Environmental Paradigm, NEP).

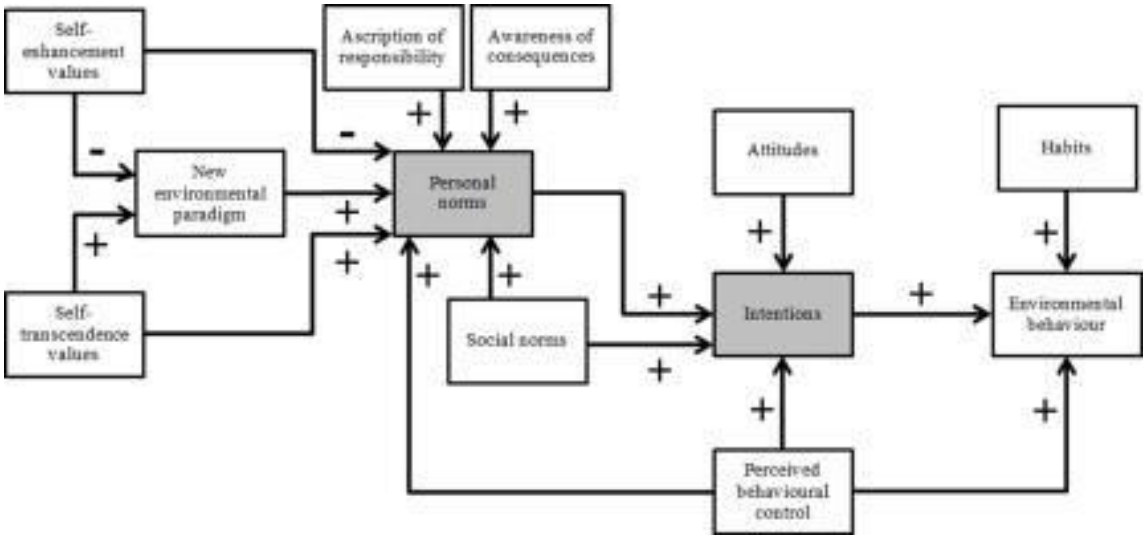


Fig 1: The comprehensive action determination model. (Klöckner, 2013, graphical abstract)

From the perspective of promoting sustainable lifestyles and behaviour change, the model offers many levers: Since the underlying value orientations are assumed to be rather stable and relevant across different behavioural domains. However, these values only manifest, if the corresponding personal norms are activated consistently across situations (see NAT review for further discussion). Increasing PBC and attitudes are interventions closer to behaviour, but also more specific to behaviours, thus less likely to lead to change of lifestyles, rather than individual behaviours. For repeated behaviours, deactivating anti-environmental habits first. Situational change or planting implementation intentions (see Klöckner & Verplanken, 2018, for a discussion).

What scale of action does it address?

In line with TPB, the CADM mostly applies to analysing individual environmental actions. Collective action and more comprehensive lifestyles are addressed rather indirectly, by being represented in the value orientations or the consistency of behavioural choices across domains (lifestyles; see also the discussion of behavioural spill-over in this report) and the social norms (for collective actions).

What lessons does it offer for sustainable lifestyles and/or behaviour change?

The model makes a number of predictions about how environmentally relevant behaviour might be changed. First, it needs to be checked if the behaviour is

habitualised, which then requires to break or deactivate these habits first, for example by situational changes, addressing people who are in the middle of live changes, or by implementation intentions (Verplanken & Wood, 2006; Klöckner & Verplanken, 2018). Then, for specific behaviours, attitude change might be tried (see TPB), (perceived) difficulty of the behaviour can be reduced, social norms can be made more salient, or personal norms activated (see NAT). In the longer run, change of environmental values might be the target, having more comprehensive lifestyle change in mind.

How does this theory/framework relate to the environment and/or climate change?

The theory has been developed specifically for environmental behaviour including climate action. It does, however, mostly apply to individual actions and does not cover policy support of political action. Environmental and climate change issues are, according to this theory, rather the outcome of the sum of individual choices, including choices by policy makers or leaders in the industry.

What are the main criticisms of this approach?

The model has been criticized from two ends: On the one hand, some researchers considered it unnecessarily complicated with too many factors involved and advocated either for very simple general models or for rather defining conditions under which the building blocks of the CADM should be applied (e.g., NAT for normative situations, TPB for more rational choices, habit theories for habitual behaviour). On the other hand, the model has been criticized for still not covering "all" relevant factors, such as, for example, environmental identity or social identity factors. Some attempts have been made to integrate these factors, but to our knowledge none of them are published yet (however, see the description of the SIMPEA for identity factors and environmental behaviour). A study by Balunde et al. (2020) tested identity theories and CADM against each other, though, and concludes that both theories have different applications.

1-2 one paragraph summaries of applications of this approach

The CADM has generated some interest in the environmental psychology community and applications in many behavioural subdomains have been tested (e.g., mobility behaviour, recycling, dietary behaviour, clothes). In a meta-analysis across the different domains, Klöckner (2013) finds good support for the model's theoretical structure.

In a study on a field intervention implementing a new recycling system at a university, Ofstad et al. (2017) used the CADM as a framework model and found that new recycling bins and a psychologically informed information campaign lead to increased participation in waste separation by students and university employees, mediated by an increased behavioural control, deactivated recycling habits (as compared to before the intervention), and highlighting social norms to participate in the behaviour. Attitudes and personal norms were basically unchanged in the intervention.

List 5-10 key literature (taken from spreadsheet)

Balundė, A., Jovarauskaitė, L. & Poškus, M. S. (2020). Exploring Adolescents' Waste Prevention via Value-Identity-Personal norm and Comprehensive Action Determination Models. Journal of Environmental Psychology, 72, 101526.

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

Klöckner, C. A. & Blöbaum, A. (2010). A comprehensive action determination model: Toward a broader understanding of ecological behaviour using the example of travel mode choice. *Journal of Environmental Psychology*, 30(4), 574-586.

Klöckner, C. A. & Verplanken, B. (2018). Yesterday's habits preventing change for tomorrow? About the influence of automaticity on environmental behaviour. *Environmental psychology: An introduction*, 238-250.

Ofstad, S. P., Tobolova, M., Nayum, A. & Klöckner, C. A. (2017). Understanding the mechanisms behind changing people's recycling behavior at work by applying a comprehensive action determination model. *Sustainability*, *9*(2), 204.

Verplanken, B. & Wood, W. (2006). Interventions to break and create consumer habits. *Journal of Public Policy & Marketing*, *25*(1), 90-103.

6.4 Protection Motivation Theory (PMT) – Rogers (1975)

Where does it originate? (e.g., sector/discipline)

The protection motivation theory is a theory originating in health psychology, trying to predict people's motivation to protect themselves from diseases. It has been developed over several decades and evolved from a relatively simple theory to a more complex theory over the years (Rogers, 1975; Rogers & Prentice-Dunn, 1997; Floyd et al., 2000). While not initially developed for environmentally relevant behaviour, it has been applied to this domain more and more often in recent years (see Kothe et al., 2019). As it focusses originally on individual health protection behaviour, its application to the environmental domain are also within individual behaviour change.

How does it understand sustainable lifestyles and/or behaviour change?

In its more complex version, the PMT can be depicted as in figure one below. According to the theory (applied to environmental behaviour), the motivation to protect the environment is fuelled by two main appraisals: (a) how big is the threat for the environment ("Is it a serious problem?") and (b) how effective are the coping strategies at hand ("Can I do something about it?").

The seriousness of the threat is assessed by taking the following aspects into account: (I) How severe are the effects of the environmental problem (e.g., climate change). The more severe the outcomes are perceived, the higher the threat. (II) How vulnerable am I (or the environment) from the threat? If climate change is a problem with potentially serious effects, will it affect me or nature close to me, that I care for? (III) Are there intrinsic (=internal) or extrinsic (=external) rewards for keeping up the damaging behaviour? If climate change is a big problem with potentially big consequences near me, should I reduce flying and driving the car, even if I then cannot reach the nice holiday destination in the Caribbean (intrinsic reward) or even if I then need much longer for my trip to work (extrinsic reward)? If strong intrinsic or extrinsic rewards are in place for performing the damaging behaviour, the perceived threat will be reduced (which the model refers to as a maladaptive response).

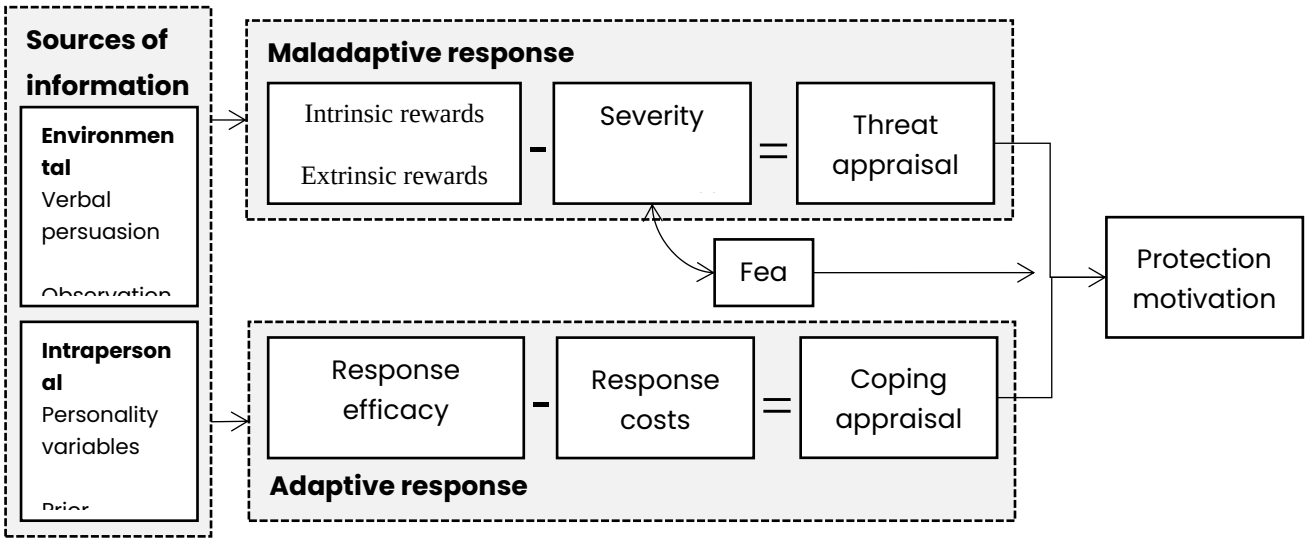


Fig 1:The protection motivation theory adapted from Floyd et al. (2000), page 410.

In parallel to the threat appraisal, coping options are also assessed. Here, the efficacy of the potential actions ("Does it help if I use the bicycle instead of the car for my trips to work?") and the self-efficacy ("Can I manage to perform the behaviour that would help the environment?", "Can I bicycle? Is it easy enough?") are evaluated. If both are high, the coping appraisal is high. However, high costs for the behaviour reduce the coping appraisal.

PMT states that protection motivation only forms if people have both a high threat appraisal ("This is a serious problem") and a high coping appraisal ("I can do something about it"). If that is the case, an adaptive response forms and action is taken. Higher levels of fear appear to have an additional independent effect on protection motivation (which is in parallel to the threat appraisal).

Influences on the different factors discussed so far comes from persuasion (others trying to influence me), observing behaviour by others (see also injunctive and descriptive norms in the introduction of the CADM). Also, prior experience with the threat (e.g., through being witness to a climate change-related flooding event) and personality variables have an impact on both threat and coping appraisal.

What scale of action does it address?

PMT was developed to predict individual protective actions in the health domain (e.g., condom use, quitting smoking, cancer screening, wearing face masks

during the pandemic). Thus, it understands environmental protective actions also as responses to a threat. It addresses individual environmental actions on such as reducing car use, reducing meat consumption, purchasing electric cars, energy saving, etc. (see Kothe et al., 2019, for a good summary of behaviours that have been covered by studies using the PMT). The types of behaviours span from everyday actions to large investments.

What lessons does it offer for sustainable lifestyles and/or behaviour change?

The PMT is interesting and relevant for the CAMPAIGNers project as it can be applied to designing communication campaigns: It predicts that if people are supposed to develop a motivation to protect the environment from harm, they need to develop a good understanding of the severity of the threat the environment is facing and be provided with effective coping strategies. Only inducing fear is not enough to create action, according to PMT. Mechanisms to increase the threat appraisal are making the severity and (personal) vulnerability salient (climate change is serious and will hurt you personally), but also to reduce intrinsic and extrinsic rewards for climate damaging behaviours. To increase the coping appraisal, it is necessary to communicate which actions have a large impact, make the actions as easy to implement as possible, and reduce their perceived costs. All these changes can be achieved by persuasion (e.g., communication campaigns), models that perform the behaviours (observational learning), and building on prior experiences.

How does this theory/framework relate to the environment and/or climate change?

The theory has not been developed for environmental issues or climate change. However, it builds on the narrative that these problems are like diseases that can be cured (a narrative one might agree with, or not).

What are the main criticisms of this approach?

As the application of PMT to environmental issues is relatively new, not much criticism has been raised. However, as already indicated, PMT treats

environmental problems through a health psychological lens and is strongly individualistic.

1-2 one paragraph summaries of applications of this approach

A large study with almost 3,000 respondents on the purchase of electric vehicles in the Netherlands, Bockarjova & Steg (2014) used a comprehensive framework of PMT variables to analyse what impacts the motivation to buy an electric car as a measure of saving the climate and supporting policies to strengthen electric mobility. They found that all PMT factors impacted intentions to buy electric cars and support for policies, as predicted. Interestingly, for intentions to buy, costs were by far the strongest influence (negative), whereas for policy support, response efficacy was the strongest predictor. In a recently published study on environmental behaviour of Iranian students using the PMT as a framework (Shafiei & Maleksaeidi, 2020), similar findings were reported. Here self-efficacy was the most important predictor of environmental behaviour, and intrinsic or extrinsic rewards were a major barrier together with response costs.

Cismaru et al. (2011) analysed 11 governmental campaigns to act on climate change with the PMT as a lens of analysis and found that very few of them address all necessary components. Often, the response efficacy component is neglected, which – according to PMT – leads to a higher chance of maladaptive responses.

List 5-10 key literature

Bockarjova, M, & Steg, L. (2014). Can Protection Motivation Theory predict pro-environmental behavior? Explaining the adoption of electric vehicles in the Netherlands. *Global Environmental Change*, 28, 276-288.

Cismaru, M., Cismaru, R., Ono, T. & Nelson, K. (2011). "Act on climate change": an application of protection motivation theory. *Social Marketing Quarterly*, 17(3), 62-84.

Floyd, D. L., Prentice-Dunn, S. & Rogers, R. W. (2000). A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology*, 30(2), 407-429.

Kothe, E. J., Ling, M., North, M., Klas, A., Mullan, B. A. & Novoradovskaya, L. (2019). Protection motivation theory and pro-environmental behaviour: A systematic mapping review. *Australian Journal of Psychology,* 71(4), 411-432.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology*, 91(1), 93-114.

Rogers, R. W. & Prentice-Dunn, S. (1997). Protection motivation theory. In D. S. Gochman (Ed.), *Handbook of health behavior research 1: Personal and social determinants* (pp. 113–132). Plenum Press.

Shafiei, A. & Maleksaeidi, H. (2020). Pro-environmental behavior of university students: Application of protection motivation theory. *Global Ecology and Conservation*, 22, e00908.

6.5 Stage Model of Self-Regulated Behaviour Change (SSBC) – Bamberg (2013)

Where does it originate? (e.g., sector/discipline)

The stage model is a relatively new addition to the canon of environmental psychological theory. However, it has roots back in stage models in other domains of psychology (such as health), for example the Model of Action Phases (e.g., Keller et al., 2020) or Prochaska's Transtheoretical Model (e.g., Prochaska et al., 2015). The main achievement of this model is to move away the focus from predicting environmental behaviour to understanding the dynamics of behaviour change (Nielsen, 2017).

How does it understand sustainable lifestyles and/or behaviour change?

The stage model of self-regulated behaviour change has a number of basic assumptions: (1) behaviour change is not a one-step process but requires progressing through a number of stages of change (pre-decision, pre-action, action, post-action). (2) In each of the stages, people need to find the answers to specific questions: Why do I need to do something? (pre-decision); What do I want to do? (pre-action); How do I implement this behaviour? (action), and; How do I stabilise this new behaviour? (post-action). (3) The transition from one stage to the next is characterized by forming a specific type of intention: Forming a goal intention to do "something" is the first step from pre-decision to pre-action; forming a behavioural intention selecting the specific behavioural alternative is the next transition from pre-action to action; forming an implementation intention (making a specific plan for when and how to implement the behaviour) is the final transition from action to post-action. (4) For each of these intention types, different variables are relevant as predictors. (5) People can jump back and forth between stages. (6) Promoting progress between the stages of change requires knowledge about where people are in the change process and tailored intervention types.

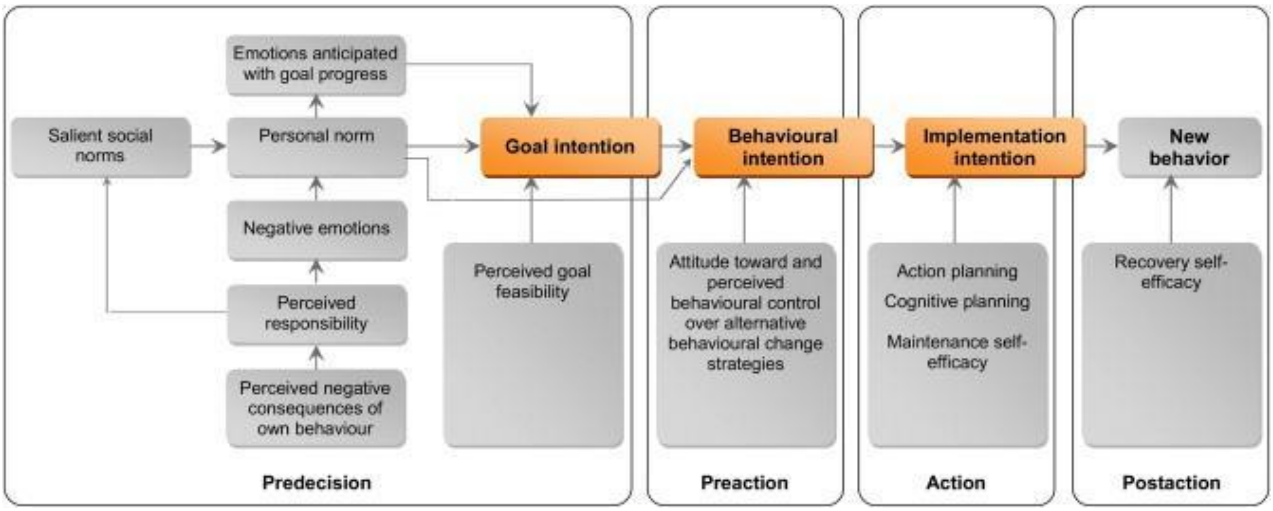


Fig 1: The stage model of self-regulated behavioural change. (Bamberg, 2013, page 153)

For forming the goal intention, mostly variables from the Norm-Activation Theory are relevant (see also there for a deeper description of the variables). If a person perceives negative consequences of their own behaviour and takes responsibility for them, they will experience negative emotions, which then trigger personal norms (hence a feeling of moral obligation). Also, salient social norms make it more likely that personal norms are triggered. If personal norms are activated, a person might anticipate positive emotions when a change process is imagined to be completed. Personal norms, anticipated positive emotions, and a general feeling of the feasibility of a change together then form the goal intention.

In the pre-action stage, attitudes towards different alternative behaviours and perceived behavioural control (the ease of implementing these alternatives) are the main drivers, hence variables from the Theory of Planned Behaviour (see there). Also, the personal ability to come up with behavioural change strategies is relevant here. In the action stage, abilities of action planning, cognitive planning, and maintenance self-efficacy (the ability to sustain an effort over longer time) help in the concrete implementation steps. Finally, when the new behaviour has been trialled, the ability to bounce back from relapses (recovery self-efficacy) decides about stabilizing the new behaviour over time.

What scale of action does it address?

The theory addresses specific individual actions. Throughout the progression through the stages, people plan behaviour change more and more specifically, thus moving from “something has to be done about climate change” to “next

time when I enter the supermarket, I will buy a meat replacement product". The type of behaviours analysed through the lens of this theory varies between everyday actions like dietary choices (Klöckner, 2017) and big investments, like electric cars (Klöckner, 2014).

What lessons does it offer for sustainable lifestyles and/or behaviour change?

The most important lesson this model teaches for behaviour change is that people are in different stages of making change and that this stage of change needs to be taken into account when intervention strategies are designed. Bamberg and Schulte (2020) identify different intervention strategies to promote progression between the stages. For people in the pre-decisional stage, making social and personal norms salient, enhancing problem awareness and a focus on one's own contribution to it, and support in goal setting and goal commitment are recommended. In the pre-decisional stage, providing information about pros and cons of different behavioural alternatives as well as interventions strengthening behavioural control are recommended. In the actional stage, support for behaviour planning is the key, whereas in the post-actional stage behavioural feedback and measures to prevent relapse are most important. Changes in the situational context to make the behaviour easier, and social support for the change should promote progression towards change in all stages.

How does this theory/framework relate to the environment and/or climate change?

The theory has been developed specifically for environmental behaviour, including climate action. It describes in detail how processes of behaviour change might unfold over time when people try to deliberately change their behaviour. According to this theory, climate action is the sum of smaller individual actions.

What are the main criticisms of this approach?

The model has been criticized for its over-complexity. Furthermore, as with many psychological models, it has a strong focus on individual action and sets only

limited focus on structural and societal impacts on behaviour (although some variables in the model represent these aspects).

1-2 one paragraph summaries of applications of this approach

More than most of the other models in environmental psychology, this model has been used to derive and test intervention strategies. In an interesting handbook chapter, Bamberg & Schulte (2020) use the SSBC to analyse web-based tools to affect environmental behaviour (in their case mobility behaviour through the BLAZE app). They found that web-based interventions can only be effective if they use theory to design communication strategies. They concluded that the SSBC is a valid theoretical framework to design these interventions (e.g., by tailoring the interventions to the stage people are in).

In an intervention study aiming to reduce beef consumption in Norway, Klöckner (2017) and Klöckner and Prugsamatz (2017) used the SSBC as a framework model to design an intervention homepage diagnosing the stage of change people were in and then providing tailored interventions for that stage. They could show that tailored information was significantly more successful in progressing people through the stages of change as compared to mismatched information, information addressing all stages, and no information. However, the results with respect to actual beef consumption reduction were ambiguous.

List 5-10 key literature

Bamberg, S. (2013). Changing environmentally harmful behaviors: A stage model of self-regulated behavioral change. *Journal of Environmental Psychology*, 34, 151-159.

Bamberg, S. & Schulte, M. (2020). Designing theory-based interventions to change behaviour effectively. In *Research Handbook on Communicating Climate Change*. Edward Elgar Publishing.

Keller, L., Gollwitzer, P. M. & Sheeran, P. (2020). Changing behavior using the model of action phases. *The Handbook of Behavior Change*, 2, 77-88.

Klöckner, C. A. (2014). The dynamics of purchasing an electric vehicle–A prospective longitudinal study of the decision-making process. *Transportation Research Part F: Traffic Psychology and Behaviour*, 24, 103-116.

Klöckner, C. A. (2017). A stage model as an analysis framework for studying voluntary change in food choices–The case of beef consumption reduction in Norway. *Appetite*, 108, 434-449.

Klöckner, C. A. & Ofstad, S. P. (2017). Tailored information helps people progress towards reducing their beef consumption. *Journal of Environmental Psychology*, 50, 24-36.

Nielsen, K. S. (2017). From prediction to process: A self-regulation account of environmental behavior change. *Journal of Environmental Psychology*, 51, 189-198.

Prochaska, J. O., Redding, C. A. & Evers, K. E. (2015). The transtheoretical model and stages of change. *Health Behavior: Theory, Research, and Practice*, 97.

6.6 Social Identity Model of Pro-Environmental Action (SIMPEA) – Fritsche et al. (2018)

Where does it originate? (e.g., sector/discipline)

The latest addition to the model families analysed in these summary review reports is the Social Identity Model of Pro-Environmental Action (SIMPEA), which was proposed by Fritsche et al., 2018. Unlike the other models (TPB, NAT, SSBC, CADM, PMT), this model has a clear focus on the social and collective aspects of environmental actions. It has its roots in Social Identity theory and describes how environmental crises might be understood as collective challenges which require collective actions, which then again are rooted in identification processes with social groups and the local norms and goals.

How does it understand sustainable lifestyles and/or behaviour change?

SIMPEA assumes that (to start at one point of the circular relations depicted in figure 1) confrontation with an environmental crisis leads to an appraisal process in the individual confronted with it. This then triggers potentially personal (or individual) emotions and motivations to act (as described in the other theories introduced on the previous fact sheets), but also collective emotions and motivations ("this is a crisis that affects 'us' as a group"). If the person frames the crisis as a collective problem, they will probe the relevant social groups for shared norms and goals with respect to behaviours that could be a response to the crisis. If the social groups the person identifies with (the citizens of the same town, the sports club, the company, etc.) hold strong pro-environmental norms ("we citizens of Freiburg are environmentalists"), it is more likely that the person will follow these group norms and take action, both because they will feel obliged, but also because they will develop a stronger collective feeling of efficacy ("Together we can solve this issue").

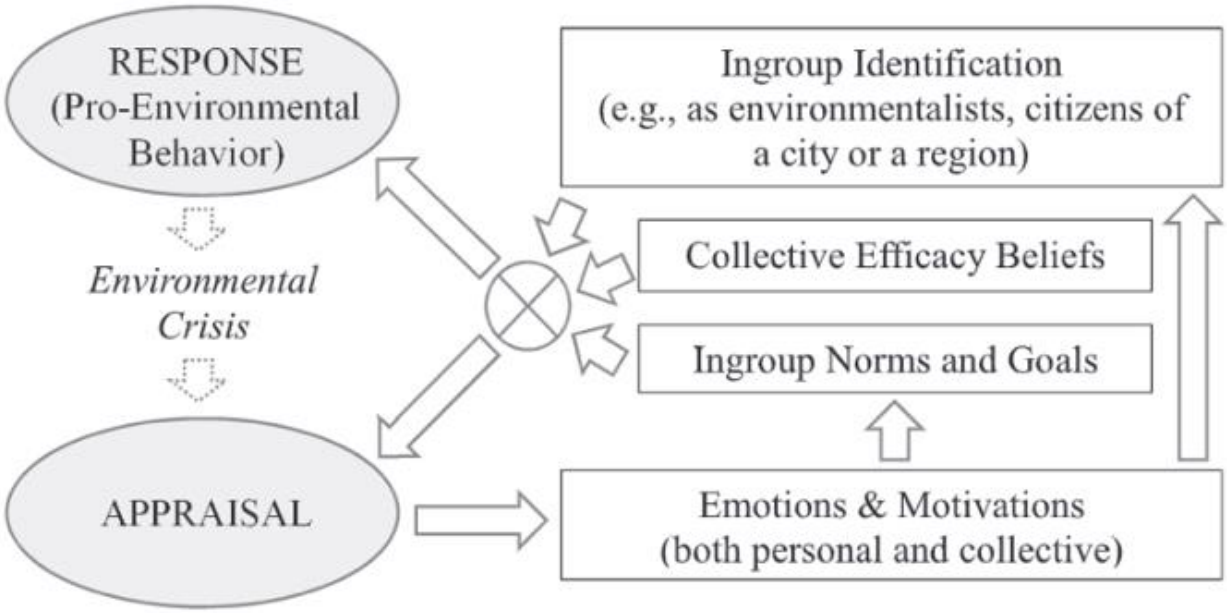


Fig 1: Social Identity Model of Pro-Environmental Action (SIMPEA). (Fritsche et al., 2018, page 246)

What scale of action does it address?

Actions addressed in the SIMPEA approach are genuinely social. All types of behaviours that can be performed by people together or where people can at least perceive others doing them as well. Furthermore, it addresses environmental problems which are collective in nature.

What lessons does it offer for sustainable lifestyles and/or behaviour change?

The theory predicts that people are more willing to take environmental actions if they frame environmental challenges as collective challenges and at the same time identify with social groups that have clear pro-environmental norms and goals. Therefore, from this theory's perspective, environmental action can be triggered through several levers: (a) it should be made clear that big environmental problems, like climate change, are collective problems. (b) Existing pro-environmental norms and goals in social groups many people identify with should be made salient, especially in social groups where these norms are potentially kept unknown (e.g., nobody ever talks about environmental issues in the sports club, but when people finally do, they find out that others share

their pro-environmental motivations). (c) Enhance collective efficacy beliefs by making substantial effects that only materialize if many people act tangible.

How does this theory/framework relate to the environment and/or climate change?

This theory does explicitly address big environmental challenges that can only be solved by collective action, such as climate change. Thus, it is a theory that is well suited for these approaches. It might also be useful to explain inaction, as ingroup norms and goals might be absent in relevant social groups many people identify with.

What are the main criticisms of this approach?

The approach is relatively new and has not been criticised in depth yet. However, one might raise the issue that the SIMPEA model emphasises the collective dimension of environmental action at the cost of the individual dimension (which is not really captured by the model). Furthermore, the model still lacks strong empirical support, as so far only few studies have used it empirically.

1-2 one paragraph summaries of applications of this approach

As indicated above, the SIMPEA has not yet been tested empirically to a larger extent. The different building blocks of the model are based on established knowledge from social psychology and identity research, though. Vesely et al. (2021), for example, show that identification with social groups known to support pro-environmental behaviour correlates with pro-environmental intentions and behaviours of people. An application of a framing experiment, varying if an environmental action was framed as an individual or collective action in the ECHOES project, showed some first results indicating that collective framing increased social identification and collective efficacy (Carrus et al., 2020). Further experiments in the same project demonstrated that strong social norms had an effect on people's willingness to donate for an environmental cause, especially when the behaviour was observable.

List 5-10 key literature (taken from spreadsheet)

Barth, M., Masson, T., Fritsche, I., Fielding, K. & Smith, J. R. (2021). Collective responses to global challenges: The social psychology of pro-environmental action. Journal of *Environmental Psychology*, 74, 101562.

Carrus, G., Chokrai, P., Fritsche, I., Klöckner, C. A., Masson, T. & Panno, A. (2020). Psychological factors in energy decisions: Results from experimental studies and a multinational survey. *ECHOES report*, (D4), 2.

Fritsche, I., Barth, M., Jugert, P., Masson, T. & Reese, G. (2018). A social identity model of pro-environmental action (SIMPEA). *Psychological Review*, *125*(2), 245.

Masson, T. & Fritsche, I. (2021). We need climate change mitigation and climate change mitigation needs the 'We': a state-of-the-art review of social identity effects motivating climate change action. *Current Opinion in Behavioral Sciences*, *42*, 89-96.

Vesely, S., Masson, T., Chokrai, P., Becker, A. M., Fritsche, I., Klöckner, C. A. ... & Panno, A. (2021). Climate change action as a project of identity: Eight meta-analyses. *Global Environmental Change*, *70*, 102322.

6.7 Behavioural economics

1. Introduction and health warning.

The field of behavioural economics and energy consumption is vast. The non-energy studies which are likely to have relevance to this field will be vaster still. As a result, this review should be considered an extremely narrow and incomplete treatment of the subject material out there. However, we think that what we have prepared here will allow CAMPAIGNers (especially WP3.1) a firm footing from which to proceed. Given that changing behaviour is complex and that attempting to do so through nudging is still a young and developing literature, there is a lot that the field does not know, and many reasons to proceed with caution. With this in mind, we have sought to craft this summary review report to focus upon what we think are the most important elements for CAMPAIGNers to consider as we enter the design phase of the challenges. We begin by considering some necessary theory, very briefly. Without at least an impressionistic understanding of this, it is impossible to proceed. We do this in sections two and three below. We briefly consider why price interventions alone are not enough to change energy consumption behaviour in section 4. We then proceed to consider applications to energy in section five and six - the bulk of this report. We have had a lot of fun developing the report and are likely to develop this further - perhaps into a review article - so please check back with us if you would like an update[13] Finally, this report was written, in haste, as an input for a work package in the CAMPAIGNers project to serve as a very brief literature review. As a result, we ask the reader to forgive the loose writing, incomplete coverage of the area in general and other shortcomings.

2. Markets and classic microeconomic theory: understanding the ideal which behavioural economics seeks to explain departures from.

Since this is an interdisciplinary group and we are not all going to be familiar with each other's specialisations, we are including a very brief summary of how an

13 Grant Smith (UCT) will be marshalling this process - he can be reached at grant.smith@uct.ac.za

efficient market works and why prices play a central role in allocating demand and supply across an economy. To appreciate much of what follows in this summary, both in the section on prices, as well as in the later section on nudges, it is necessary to have a working understanding of how markets work. Among other things, this will help non-economists get at least an intuitive sense of why getting prices right, and people's perceptions of prices remains important. This brief explanation will also help the reader to contextualise the role behavioural economics sees for things like nudges, and how they are understood to potentially help markets achieve more socially efficient outcomes. Finally, we are just going to focus on providing an intuitive explanation of efficient markets in this section. The reason for this is simple. Efficient markets, if they exist, bring about the maximum social well-being, and as such, they are, if you will, an economic ideal. However, like all ideals they are very seldom achieved, leading to lower social well-being than theoretically possible. One of the tools to mitigate against these departures is behavioural economics. To understand in what way the application of behavioural economics hopes to mitigate these departures, we must understand the nature of these departures from the ideal, and to understand what these departures from the ideal are, we must first understand the ideal: an efficient market. We turn to that, now.

Prices play a central role in allocating resources. In economic theory, an efficient market will see prices for goods, such as electricity, or other forms of energy, settle at the total social marginal cost of producing that good (we will explain what is meant by social marginal cost presently). The reasons for this can be summarised as follows.

On the supply side, the costs of producing a good should, first, capture all internal factors used in production and how the costs of their use vary in relation to the amount of the good produced. This is known as private marginal cost. Under-accounting for private marginal costs risks the firm under-pricing their output and suffering losses which drive them out of business. However, in an efficient market the principle of marginal cost pricing extends beyond just accounting for private marginal cost. In an efficient market the externalities of production are accounted for, too. As production levels vary, so the level of externality imposed upon society may vary, too. Externalities impose costs upon society (for example, to clean up pollution generated by production). Accounting for how both externalities and private costs vary with levels of production measures what is

known as social marginal cost (SMC). Under-accounting for SMC and selling a good for less than its SMC means that society will, somewhere, suffer a loss that cannot be covered and be worse off than before.

Turning to the demand side now. Prices are, in essence, exchange rates between one type of good and all others. As an intuitive explanation of this, consider the following: when we purchase a pair of shoes, we do not have that money available in our budget to purchase other goods, let's say, three shirts. The price of shoes relative to shirts, then, is an exchange rate - it tells us how many shirts we must forgo, or exchange, to buy a pair of shoes. We will circle back to this point before the end of our brief explanation. This principle extends through the economy across all markets, applying to all goods and services, with the result that the price of a good reflects its rate of exchange to all other goods: to consume more of some things, we must give up consumption of other things. At the level of the individual consumer, classic microeconomic theory says that consumers will condition their degree of consumption of a good primarily upon three things: their preferences for that good relative to others, the cost of the good, and their budget. Let's consider preferences first. Consumers are typically understood to have preferences that are driven by the amount of happiness, or utility, that they gain from consuming one good relative to another. Furthermore, the extra utility that they gain from consuming an extra unit of that good (the marginal utility of consumption) is commonly understood to decline with each additional unit of consumption, implying that it will achieve a maximum at some level of consumption, and decline thereafter.[14] This also implies that when a consumer can gain a larger amount of marginal utility from consuming an extra unit of some other good, they should substitute towards that good. Factoring in their marginal utility for the marginal unit of different goods in this way allows consumers, in classic microeconomic theory, to form different combinations of goods (in their imagination, if not in reality) that yield the same amount of overall utility. For example, one pair of shoes and two shirts may yield the same amount of happiness to a person as six pairs of shirts. For “normal” goods, microeconomic theory makes the prediction that more consumption, overall, will yield more utility to the consumer, at least until a theoretical bliss point is reached, beyond which

[14] Microeconomics actually allows for much more flexible assumptions about preferences and utility than what we are laying out, briefly, here, but, for all practical purposes, assumes that declining marginal utility holds in nearly all cases.

overall utility will decline.[15] For example, two pairs of shoes and four shirts will yield more total utility to the same consumer than one pair of shoes and two shirts, or six shirts. Let's consider the budget set, next. Consumers will try to achieve the greatest amount of utility by consuming the combination of goods that maximises their happiness. However, consumers are constrained by the budget they have available to fund their consumption. They therefore pick the bundle of goods that makes them the happiest they can possibly be, given their budget set and the cost of the goods. This brings us to the final element that enters a consumer's consumption decision: the cost of the good. The cost of a good is the sum of two things: the prices of the good itself and the cost of forgone alternatives in consumption, or opportunity cost.

Put another way, consumers select a bundle of goods to consume that yields the optimum amount of happiness, given their preferences, the prices of the goods, and the budget set available to them. For goods that are consumed over time, or at some later point in time, or have an uncertain probability of consumption (such as crops, or other investment goods), the consumer incorporates these sorts of factors, too.

At this point, it is worthwhile to note that for consumers to solve this optimisation problem, in this way, they require information about all the goods that they can possibly include in their consumption bundle, they also need accurate assessments of how consumption of different amounts of each will affect their level of happiness, as well as being able to forecast where needed, and factor in the uncertainty of outcomes where that is needed too. Taking all these things into account, consumers then need to have the ability to make any required trade-offs subject to the different prices of the goods and their budget constraint.

If this sounds like a tall order for the cognitive abilities for a person, you are right, it is. There are a number of reasons why the overwhelming majority of people (if any) do not make consumption decisions in this way, exactly. In the bulk of this document, we will have a lot more to say about this in the realm of energy consumption. However, for the moment, it is important to note two things. First, making decisions in the way that classic microeconomics describes, is probably the best way to make decisions that involve trade-offs: making decisions this way

[15] Again, microeconomic theory allows for all sorts of goods to be modelled, including goods where less consumption can lead to greater happiness. For the sake of time and space though, we are forgoing discussion of those topics.

would almost certainly make everyone a lot better off. The trouble is that people, typically, are not futuristic super-computers and so struggle to implement these processes. Second, classic microeconomics does not make the claim that the process described above is how people actually make decisions, but, rather, that it provides a close enough, logically consistent, model to predict what they do, with sufficient accuracy. We will also have a little bit more to say about this, presently. For the moment, let us wrap up our introduction to efficient markets.

If we assume that suppliers and consumers behave in the ways that classic microeconomics describes them behaving, then the following situation will unfold in a market. Consumers will buy a good until the extra amount of utility they get from consuming an extra unit of the good (their marginal utility of consumption, or MU) equals (and is not less than) the extra cost they incur by choosing to consume that extra unit of that good (their marginal cost of consumption, MC). If they cease their consumption at a point just before MU = MC, then they are forgoing additional happiness that is within their power to achieve; they are worse off than they need to be. For example: if I cook most of my meal on an electric stove, and need 1kWh of electricity to boil some extra vegetables that I want, and can afford that electricity, but I decide not to, choosing instead to use a paraffin fire, which pollutes my household air and has a smell I do not like, to boil those eggs, then I am worse off than I need to be. Classic microeconomics assumes that consumers never[16] make the mistake of ceasing consumption before MU = MC, or continuing consumption until MU < MC. As prices increase, marginal costs increase, too, and so the amount of consumption of a good will decline, since MU = MC at a lower quantity of consumption for all consumers; the reverse being true for lower prices. Suppliers condition the quantity they produce and supply to the market upon a similar logic of marginal returns and marginal costs. Suppliers will increase the quantity they produce until the additional revenue they can earn from the additional product they produce (the marginal revenue, or MR) equals the additional cost of producing that additional unit (the marginal cost, or MC). Like consumers, costs for producers include the costs of forgone alternatives in production (opportunity costs). If producers cease production at a quantity where an additional unit of production could be sold for additional revenue that was not less than the marginal cost to produce it, then they would be worse off than they could be. As prices for a good increase, suppliers will increase supply,

[16] Or do so too seldom for this to be a material consideration

since the quantity at which MR = MC will increase, with the reverse true for falling prices.

Let us bring all of this together, now. Let us say that producers produce a quantity of a good (q_1) and, after accounting for all internal costs and externalities they charge a price (p_1) for per good that is equal to the SMC. However, at price p_1 the total demanded by consumers as a whole (behaving as described above) is q_2 with $q_2 < q_1$. To get rid of their stock, the producers reduce the price of the good, but they also reduce their amount of production since at the lower price per unit the relative returns to investment in other markets have risen. This process continues until a price (p^*) is reached at which consumers demand a total quantity of q^* which is also the same amount that producers are prepared to produce at that price. In this way supply is brought into equilibrium with demand, and the market clears. Most importantly, the market clears at a price where the degree of resource use (to produce a good), and the marginal social costs of their use, exactly matches the amount of that good which consumers demand in preference to other goods. If all markets are efficient, then this process will play out across all markets and an optimal allocation of resources is achieved - meaning that it would be impossible to find another allocation of goods (and resource use) that would make society better off. Importantly, if markets worked in this way, especially with goods appropriately priced according to their social marginal cost of production, it is unlikely that we would face a situation of over extraction, pollution, and environmental degradation.

Of course, this situation is largely only idealistic. However, it is the ideal to which economic theory points us, and to which it orients policy. To understand behavioural economics, it is essential to understand this ideal. In practice, markets are not working this way. Part of the reason for this are behavioural errors that the human actors in these markets make, we turn to those now, and then review some strategies that have been adopted to correct for these errors.

3. Behavioural Economics.

Markets, almost universally, do not achieve the ideal described in section (2). There are a number of reasons for this, with different reasons coming to bear with different force depending on context. One set of reasons have to do with market structure, in particular greater concentrations of market power (few producers,

or few consumers) tend to lead to progressively sub-optimal outcomes. Underlying income distributions, as well as unhelpful structural alignments between markets (such as between the market for education and the labour market) will also affect the ability of consumers to participate upon an equal footing, with important implications for well-being. Another set of reasons can be gathered under the label "behavioural". Given the centrality of people on both sides of the market (producers and consumers), it makes sense that if people depart from the rational, optimising model assumed by classical microeconomics, then markets are unlikely to function as they ideally should. The discipline of behavioural economics arose from researchers finding more and more ways in which people's behaviour systematically departs from the rational, optimising agent of classical microeconomics, especially over the last years (Kahneman et al., 2003). We now offer a very brief review of some key ideas in behavioural economics. These are important to grasp, to some degree, to appreciate how specific interventions that attempt to change behaviour work.

3.1 One person, two minds.

In simplicity, most behavioural economists now accept that our thinking can be characterised by two different systems (see Kahneman, 2003; Thaler and Sunstein, 2008; and Thaler and Sunstein, 2021; Bank, 2014; Thaler, 2018).[17] These systems are referred to simply as system I and system II (following Stanovich and West, 2000). To be clear, behavioural economists are not seeking to make any claims to insight about the underlying biology of how thought or consciousness arise and operate, it is merely a useful summary model of the way in which we think. We describe both systems now.

System II. One way to think is to be rational and reflective. This is the manner in which we think to solve complicated math problems, such as dividing the bill after dinner, or perhaps calculating a mortgage application. We move slowly and methodically through the process, checking each step and making sure that we do not make an error. We consider all the information available and reach our conclusions by integrating all of it in the relevant manner. Thinking in this manner almost always leads to accurate conclusions. This sort of thinking is very useful. This is the sort of thinking which has taken us to the moon and invented the micro-processor. However, this type of thinking is also quite taxing; it takes a relatively

[17] Although not universally. See for instance Gigerenzer, 1991; Mega et al., 2015

large amount of our mental energy. It is also slow - as anyone who has ever had to balance a budget will tell you. This is the type of thinking that System II does.

System I. Another way in which we "think" is to **not** reflect and think slowly, but to rather follow more intuitive and instantly available heuristics instead, almost always without seeming to "think" in a meaningful way. This is System I in action. There appear to be numerous specific biases, including socially oriented biases - such as following the crowd, or responding to our ranked place in that crowd. The point is, is that we often, automatically follow these biases, rather than thinking in a reflective way

3.2 Moving between two minds: attention and scarcity.

So, what determines when we use System I or II? It seems that two related factors come to bear with particular force here, and both relate to the fact that our cognitive resources appear to be limited. Following Mullainathan and Shar (2013), we refer to the first as "scarcity". Scarcity refers to the fact that when our mental resources are appropriated by one thing (for example, the fact that we are hungry) then we have less to give to thinking about other things (for example, planning our energy consumption), and we are more likely to follow biases - rather than thinking - about those other things, perhaps with sub-optimal outcomes. Another way of expressing this idea is to say that when we give attention to something we seem to engage the systematic, reflective, system II, but when we do not engage our attention, we are subject to biases, and often sub-optimal outcomes (see for example Taubinsky and Rees-Jones, 2018).

3.3 Some important concepts.

Without wishing to launch into an entire course on behavioural economics, and at the risk of being far too summary (which this will unavoidably be), it is probably important to briefly note three further concepts from behavioural economics which are likely to be important for this project.

3.3.1 Reference dependence

It may sound strange to non-economists, but reference dependence is an important contribution of behavioural economics. Economists model people as - in simplicity - consuming things which make them happier. Consistent with our discipline's preference for more surgical language (and to remain consistent with the language of Jeremy Bentham - one of the forefathers of this line of thought),

we refer to this as seeking to maximise our "utility" rather than happiness (the concepts are also arguably slightly different). Additionally, we have modelled people as achieving utility in a manner that depends on levels of consumption - so the more/less of something you consume the more utility you will realise. One of the results of behavioural economics is the fact that a lot of utility seems to arise not from levels of consumption, but rather from changes, or differences, in levels with respect to a reference point. So, for example, if Grant starts the year earning 20 000 euros and ends the year earning 15 000 euros, he will be unhappier than Bert, who began the year earning 5 000 euros and finished the year earning 10 000 euros. This arises because of different reference points (their initial earnings). Reference dependency is likely to be important throughout CAMPAIGNers.

3.3.2 Prospect Theory

Prospect theory arises from the work of Daniel Kahneman and Amos Tversky (Kahneman and Tversky, 1979). It is widely considered to be one of the foundational concepts in behavioural economics. Prospect theory understands utility to be reference dependant, at least when it comes to taking a decision that involves risk. The core result is that people are less risk-taking when there is a prospect of a gain, but more risk-taking when there is a prospect of a loss. In particular, we seem to be more likely to take a more risky than less risky decision when seeking to prevent a loss. For CAMPAIGNers, this suggests that the way in which we frame energy savings, or losses, will need to be thought through.

3.3.3 Time

Finally, it seems that people focus upon the present, to the degree that we might even reverse our preferences. There has been a lot of work in economics on how time interacts with our preferences, as well as system I and II in order to generate behaviour. For CAMPAIGNers the important thing for us to consider is that the immediate costs and benefits of whatever we choose to make immediate to the participant, or not, since what is immediate is likely to be the most potent influence.

4. Energy Prices.

There is evidence that electricity prices contribute significantly to sub-optimal environmental and economic outcomes. First, the prices themselves are often not

set in a manner that reflects the true Social Marginal Cost (SMC) of producing and consuming the energy. In a review of energy prices in the USA, Borenstein and Bushnell (2021) find large variation in how prices are set with respect to the SMC of different energy sources, with the result that demand for greener energy forms is muted or exaggerated accordingly. Clearly how prices are set is important, not least because consumers respond to them. But how do consumers respond to prices? This question is especially important for energy because energy prices are often set up as complicated price schedules, with the marginal price of energy often varying in relation to cumulative consumption. Apart from concerns about the fact that this means that prices depart from being equal to SMC for much of the time, this also requires a lot of cognitive energy on the part of the consumer to figure out these price schedules in order to optimise their consumption over them - making sub-optimal consumption potentially more likely.

With respect to considering the whole price schedule and perceiving the several different marginal prices over those schedules, indications from the literature are that, for many consumers, the complexity of an inclining block tariff may materially obscure the true price (De Bartolome, 1995; Fujii and Hawley, 1988; Carter and Milon, 2005; Liebman, 1998). Where consumers respond to marginal price but cannot accurately forecast or track their own consumption, they may respond by incorporating uncertainty around this consumption into their demand and respond to an expected marginal price (Saez, 1999; Borenstein, 2009). Where customers respond to expected marginal price, we would still expect to see bunching of consumption around the kink points of an inclining block tariff, however this is not often observed (Ito, 2014; Borenstein, 2009). Where cognitive costs of understanding the inclining block tariff and perceiving its several different marginal prices are too high, we would expect to see consumers respond to an alternative, less complex, perceived price, such as average price, and this is something that is often observed (Ito, 2014; Liebman, 2004). Furthermore, the bill, which reports consumption, arrives after a significant delay and can be difficult to understand (Slabbert, 2010), rendering optimal consumption behaviour less likely still.

Characteristics of the household itself may also mitigate against optimising behaviour. First, households composed of more than one person may struggle to coordinate (Jenkins and Osberg, 2004) which may mitigate against achieving an

optimal household consumption level, with larger households presumably struggling more than smaller households. Second, households will have different levels of income and wealth, with the result that the bill for consuming services may represent a larger share of income for poorer households than richer households. With this in mind, richer households may, rationally, pay less attention to achieving optimal consumption than poorer households. Ma et al. (2014) analyses responses of 248 households in Beijing to an experimental study and finds that low-income households seem to respond to marginal price, middle income households respond to average price, while upper income households are price insensitive. Still in the context of inclining block tariffs, Ito (2014) finds that consumers respond to average price in Orange County, California, one of the wealthiest areas on earth, while Szabó (2015) finds that households in a poor township outside Tshwane, South Africa seem to respond meaningfully to marginal price. Finally, a growing literature in behavioural economics suggests that poorer households are subject to stress and heavier cognitive demands in many areas of life (Mullainathan and Shafir, 2013). As a result, poorer households are likely to face a "cognitive tax", especially in domains where they are not focused on as a priority. It may be that utility consumption and pricing is one such domain and, as a result, we may expect poorer household to be less attentive to marginal price than richer households.

5. Changing behaviour

5.1 Challenges: commitment contracts and goal setting

CAMPAIGNers hope to make use of challenges to get people to adopt more climate friendly energy consumption habits. These challenges are arguably forms of what are known as commitment contracts in the literature. "Commitment contracts" are contracts where you declare to yourself, and, potentially, others that you are going to achieve some sort of goal. This goal could be losing weight, reading a book, or anything really. The work that is most associated with commitment contracts in economics is that of Dean Karlan and his website.[18] The website grew out of his bet he made with a fellow student while in graduate school in order to keep their weight below an unhealthy level. The form of the bet was that each agreed to pay the other half of their annual earnings (a low absolute amount, given that they were in graduate school at the

[18] www.stickk.com

time) if their weight exceeded their contracted level, as assessed by surprise check-ins.[19] The bet paid off, so to speak, and Karlan kept his weight at a healthy level - as did his graduate school colleague, with one exception, which saw the forfeit paid immediately - for many years beyond graduate school, until eventually they cancelled the contract by mutual consent.

A commitment contract can have varying levels of intensity. You can make a commitment contract with yourself, perhaps by putting a deadline in your calendar, which you will feel bad - in your own eyes - to miss. More common though, is to commit to another person to achieve a goal. Here the intuition is that, negatively, you do not want to have to tell the other person that you did not make your goal, and positively, that other person can provide encouragement and celebrate your success with you when that comes. Finally, there are several ways in which commitment contracts can also involve material losses (or, conceivably, gains). A person can decide to essentially bet on the likelihood of their achieving the goal in question by agreeing to pay their counterpart a fee if they fail to meet their goal. One of the well-known versions of this is a person can agree that the forfeited money goes to an anti-charity, which is a cause, or group, that the person actively dislikes. For example, a politically liberal person could decide that if they do not achieve their goal, that the forfeited money would be donated to a socially conservative political party.

Whatever the level of intensity in terms of costs, commitment contracts involve setting a goal, that is shared with another person, with the hopes of achieving that goal. This is very much the general form of what CAMPAIGNers hopes to do. In the energy saving literature, in behavioural economics, there is precedent for this (see for example Van Houwelingen and Van Raaij, 1989). While goal setting generally seems to produce movement in the desired direction, this is not always the case. Löschel et al. (2020) investigate the scalability of an energy saving mobile application in Germany. They found that there was low demand for energy saving applications in Germany which resulted in low uptake of the application. Worryingly, they found that nudging resulted in a decrease in the likelihood of using the app and that goal setting had no effect. As with many other types of nudges, the success or failure of the nudge depends upon how the nudge is designed to interact with a heterogenous population. With this in mind, we review

[19] https://www.stickk.com/founders#karlan

what we think is a particularly helpful paper that focuses upon an important determinant of the effectiveness of goal setting: naivety.

5.1.1 Naivety

In a 2014 paper Harding and Hsiaw (2014) review a goal-setting program run by the "Citizens Utility Board" of Northern Illinois, USA.[20] Here residents, primarily in Chicago, are invited to set goals for the amount of energy that they hope to save. Participants are rewarded with points for their energy savings relative to their pre-program consumption (as calculated by an algorithm which is never explained to the participants) and are also compared to other participants. Harding and Hsiaw do not find evidence that suggests that either the points or the social comparisons were systematically related to observed energy savings at all. However, the program did generate a roughly 4 per cent average decline in consumption among participants. There was a large degree of heterogeneity among participants in terms of savings. The participants most responsible for savings were those participants who set realistic goals for their consumption (defined, according to engineering estimates, as between 0 to 15 per cent of pre-program use). This is consistent with a reference dependent model of utility where the goal set by the participant upfront becomes the reference point, and achieving or outperforming the reference point (so, saving more energy than the goal amount, in this case) delivers more utility to the participant. In this model, participants who set unrealistic goals mainly do not achieve them and experience, as a result, negative utility, with arguably potentially declining sensitivity to the magnitude of under-performance (as argued by Harding and Hsiaw), with the result that they become less motivated to engage further with the program.

In this program, what seems to have been important was the degree of naivety among participants. Naive participants form expectations of their future behaviour that overestimates their ability to achieve the reference point that they endogenously determine (the energy savings goal that they specify), whereas less naive participants are more accurate in this regard. Awkwardly, the program was more likely to draw respondents who seemed to be more likely to demand commitment devices in other domains too (in particular, Harding and Hsiaw note

[20] CUB was set up in 1983 by the Illinois General Assembly as a nonprofit, nonpartisan organization designed to represent the interests of residential utility consumers. Harding and Hsiaw, 2014, 211.

that they were more likely to participate in diet programs) but were also more likely to behave naively (non-diet program participants were more likely to pick more realistic energy savings goals).

For CAMPAIGNers, it is worthwhile to understand that we may well be recruiting people who have a bias toward demanding commitment contracts, with a significant number likely to be meaningfully naive. The program, and its participants, will benefit from the CAMPAIGNers app helping to guide them toward forming realistic energy saving goals, or accepting challenges in a realistic way. One easy way for us to do this is to work with estimates of possible savings in the relevant domains (in home energy, transport, etc.) by locale to set challenges that are realistically achievable.

5.2 Home Energy Reports

Arguably the most well-known set of interventions aimed at reducing residential consumption are the Home Energy Reports (HERs) compiled by OPower. Households receiving HERs receive reports in the mail (more recently, these reports have also been delivered electronically, too) as part of the bill for their own consumption. These reports include information about how to reduce that consumption, cues to buy more efficient appliances (including discounts in some cases). Households also receive feedback that compares their consumption to that of their neighbours' (a descriptive social norm) and indicates the social desirability of that relative consumption (an injunctive norm). An example of the HER social norms strategy is shown in figure (1). In one of the earliest peer-reviewed studies of this program, Allcott (2011) analyses several randomised control trials (RCTS) of the OPower HERs and estimates that receiving a HER leads to an average reduction in consumption that ranges between 1.4 - 3 per cent of pre-program energy use, with an unweighted average treatment effect of 2 per cent. These effects seem to show remarkable persistence, too. Revisiting the OPower program some years later, Allcott and Rogers (2014) find program effects persisting two to three years after HERs are discontinued.

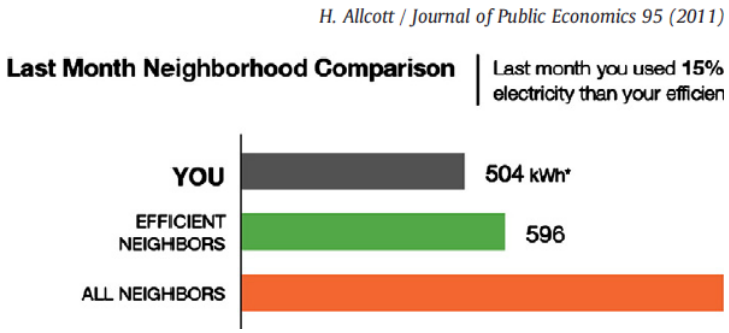


Figure one, from Allcott (2011).

So, through what mechanisms do these HERs work? This question has animated the literature on HERs. One candidate of interest is the use of social norms strategies. The social comparison module in the HERs is largely inspired by Schultz et al. (2007) and Nolan et al. (2008) who test social norms strategies among a small sample in southern California. For setups close to those used by OPower, those studies found average effects of five and ten per cent savings after one month. However, there was significant variation in terms of consumption outcomes which, combined, with the small sample sizes in both cases meant that neither studies' results were distinguishable from a zero effect. Since OPower rolled out its HERs in an RCT fashion in nearly all instances, and over a very large number of households (now numbered in the millions), it was ripe for a credible estimation of effect size. When Allcott (2011) tries to separate out the effect of receiving feedback that your household is over/under consuming by comparing households just above and below the relevant consumption thresholds for receiving different social norms feedback, he finds no evidence of any effect. Subsequent studies such as Allcott and Rogers (2014), Brandon et al. (2017) also fail to identify social norms as specific paths of influence. Part of the reason for this might be due to the fact that the social norms feedback is always bundled with the other elements of the HERs (such as general information, and cues to buy more efficient appliances). What does seem to have happened is that the HERs seem to have motivated households to expand their stock of energy efficient capital, either through purchasing more efficient appliances, or improving insulation and other elements of their dwelling's structure. Brandon et al. (2017) focus upon the energy records of dwellings that had had households who received HERs but were then sold some time later and did not receive HERs thereafter. Comparing the energy consumption records for these dwellings with

dwellings that had never received HERs, but were also sold, they find that a large share of energy savings among HER receiving dwellings persist - even after sale. Revisiting the households from Allcott (2011), Allcott and Rogers (2014) find results consistent with investment in more efficient capital as driving significant a share of energy savings. It seems then, that a meaningful channel through which the HERs work is to motivate households to invest in capital that is more energy efficient. Finally, one of the most interesting results from Allcott and Rogers (2014) is the pattern of persistence. Households receiving HERs show dramatic initial reductions in energy consumption, which then decay almost as quickly. However, as households continue to receive HERs this volatility gradually dissipates and households settle at a lower level of energy consumption, which appears to be stable even after HERs are discontinued (after two years of being sent - mainly quarterly), decaying between 10 to 20 per cent per year Allcott and Rogers (2014). We explore persistence a little further, below. Finally, Brandon et al. (2019) find evidence that HERs also reduce intra-day peak consumption.

The Household Energy Report, then, seems to work to prompt energy savings. However, it seems to work by bundling several strategies, whose effects are difficult to separate out. We look at the literature and recent developments in these and related strategies, now.

5.3 Feedback Mechanisms

A review by Fischer (2007) evaluates what types of feedback mechanisms are the most effective in reducing household energy consumption. This review finds that feedback mechanisms result in household energy savings ranging from 1.1 per cent to just over 20 per cent, with the magnitude of the savings depending on the type of feedback. For example: in a large-scale field experiment Tiefenbeck et al. (2018) show that real-time feedback on resource consumption of an energy intensive activity (showering) resulted in a 22 per cent reduction in energy consumption for this specific activity. This translated into a five per cent reduction of the household's energy consumption.

In its basic form, interventions that use feedback technologies are generally in the form of enhanced monthly bills communicating additional information and/or social comparisons. In these interventions household energy consumption is processed in some way making them indirect feedback mechanisms. More complex feedback technologies give direct feedback, or real time information access, via computer, mobile phone and or in home displays.

Several studies that provide systematic reviews on energy conservation interventions shows that direct feedback results in higher rates of energy saving than indirect feedback (Fischer, 2008; Darby et al., 2006; Andor and Fels, 2018). Feedback likely improves awareness among household members about which house behaviours result in greater energy consumption.

5.4 Social Norms – some other studies and reviews.

Social norms messaging refers to interventions that provide households with their consumption in comparison to similar households, or close neighbours or the national average (Andor and Fels, 2018). These social comparisons go hand in hand with feedback on a household's actual consumption behaviour. This is often in the form of a descriptive norms message comparing the energy consumption of a household to the average level of consumption.

Literature on the effectiveness of social norms messages is somewhat mixed with earlier studies showing that social norms campaigns intended to reduce consumption can produce an unintentional 'boomerang effect' (Schultz et al., 2007, Fischer, 2007). This happens when the reduction in consumption by those consuming above the average is offset by an increase in consumption by those consuming below the average due to the use of descriptive normative information that serves as a point of comparison. None of the 12 studies that use descriptive norms messaging reviewed by Fischer (2007) resulted in a reduction in energy consumption. Fischer attributes this to the 'boomerang effect' of social comparison messages. In a more recent review of literature the effect of behavioural interventions on energy consumption, Andor and Fels (2018) find that social comparisons are the most effective in reducing energy consumption. Of the 24 studies analysed they found that all had at least one social comparison treatment that was effective with the reduction in energy consumption of between 1.2 per cent and 30 per cent. They find that higher quality studies with larger sample sizes generally reported lower reductions in energy consumption.

5.5 Persistence

While various studies highlight the importance of non-monetary interventions in achieving reduced energy consumption, there is some debate over the persistence of these interventions over time. Several studies that we are aware of find that the treatment effect of non-price interventions diminishes over time (Ito et al., 2018, Ferraro and Price, 2013, Houde et al., 2013). However, Allcott (2011) finds

that the Opower home energy reports have either a constant or increasing effect as they are repeated over a two-year period. This may be the result of the Opower reports using social comparison messages. Ito et al. (2018) compared the effect of "moralsuasion" and economic incentives on households' energy consumption behaviour investigating habituation and habit formation. They find that moralsuasion messages resulted in an initial reduction of eight per cent, however, this effect diminished quickly over repeated interventions over time. Economic incentives resulted in a larger decrease in energy consumption of between 14 per cent and 17 per cent. The effect of these economic incentives did not diminish over time. They found evidence of habit formation as a result of the economic incentive treatment as households continued to consume less after the treatment was discontinued. This was not the case for the moralsuasion messages. Houde et al. (2013) found that providing real time feedback on energy to households in the form of a web interface resulted in a 5.7 per cent reduction in household energy consumption. However, this change was not persistent over time. This intervention was implemented for an eight-month period. By the end of these eight months household energy consumption between the treatment and control group had converged. These studies however did not incorporate social comparison messages in their intervention. When looking at the persistence of behavioural messages to reduce water consumption, Ferraro et al. (2011) found that only those messages that contained social comparisons resulted in a lasting decrease in water consumption. Wemyss et al. (2019) look into the long-term effects of a mobile app in reducing household energy consumption. This study used the "Social Power" app which combined constant energy consumption feedback and social comparison through a neighbourhood energy saving competition. They found that while the application initially led to a significant decrease in energy consumption, this decrease was not maintained and one year after the intervention there was no difference in energy consumption between the treatment and control groups.

Considering these results together with those reviewed in the Home Energy Report section, it seems that two factors emerge as likely to increase persistence. First, if households can be nudged to invest in capital that is more energy efficient (like solar panels), then they lock in future behaviour and are more efficient - conditional upon them directing the discarded capital to effective recyclers so that the old capital (e.g., an old fridge) re-enters the economy in useful form and is not discarded. Second, social norms seem to somehow be associated with

generating longer run changes, in general. CAMPAIGNers should thus endeavour to link people to more efficient capital purchases, link people to effective recyclers, and employ social norms in a comparative manner.

5.5.1 Non-Residential Energy Consumption

There is a large and growing body of literature that evaluates the effect of behavioural nudges on household energy consumption, however, the effectiveness of such intervention in a non-residential setting is under-researched. A reason for this lack of research in the commercial sector could be the result of the difference in the relationship between reducing consumption and financial saving in a non-residential setting. The fact that the financial costs of energy consumption fall on the organization rather than individuals make if more difficult to incentives saving behaviour (Klege et al., 2018). Non-monetary interventions that appeal to pro-social behaviour in these settings are important as price mechanisms would not influence the decision-making behaviour of individuals that do not bear the cost of consumption.

A field experiment by Handgraaf et al. (2013) compares the effect of monetary incentives and social incentives on energy conservation behaviour over 13 weeks in a Dutch firm. Employees of this firm either receive monetary reward or social rewards which are either made public or private. This study found that social incentives outperform monetary incentives when trying to reduce energy consumption in the workplace. Klege et al. (2018) makes use of a randomized control trial to investigate the effect of behavioural nudges in reducing energy consumption in a large provincial office building in Cape Town. The floors of the building were randomly assigned into one of two treatment arms or the control arm with seven floors in each group. The first treatment received general energy conservation information emails and participated in weekly inter-floor competitions. The second treatment combined the first treatment with additionally assigning a weekly 'energy advocate'. This experiment resulted in a significant decline in energy consumption with the first treatment reducing their consumption by nine per cent and the second treatment reducing consumption by 14 per cent. University residences are another setting in which the cost of energy consumption falls on the organization rather than directly on the consumers (students) (Delmas and Lessem, 2014). Although the cost of electricity consumption could be implicitly factored into their fees students in residents generally do not directly pay for their own consumption (Klege et al., 2018). A study

by Petersen et al. (2007) finds that a combination of feedback, education, and social incentives result in an average decrease in electricity consumption of 32 per cent among students residing in 28 dormitories at Oberlin College. This intervention was framed as an energy and water saving competition between dormitories that only lasted for two weeks. Delmas and Lessem (2014) evaluated the effect of public and private feedback on the energy consumption of residence halls at the University of California – Los Angeles. They collected information from 66 rooms over an academic year and found that while private feedback had no effect on energy consumption a combination of private and public feedback lead to a 20 per cent reduction in electricity consumption.

One interesting aspect of all four of the above-mentioned non-residential conservation interventions is that they all used some form of public image reward to motivate reductions in consumption. Klege et al. (2018) and Petersen et al. (2007) show that consumption feedback; and education in combination with extrinsic motivation, through conservation competitions; can significantly reduce energy consumption in a non-residential setting. Handgraaf et al. (2013) and Delmas and Lessem (2014) compare the use of public and private feedback interventions and find that while private feedback had little to no effect on energy conservation in these contexts, public feedback resulted in a significant reduction in consumption.

5.6 Recycling

In a field experiment, Schultz (1999) used door hangers delivered to 605 households with messages providing feedback, information, and social norms on recycling behaviour to nudge household to increase their recycling. They found that the feedback messages on recycling behaviour as well as the descriptive norms messages lead to a significant increase in the frequency and amount of recycling of households.

A study by Chong et al. (2015) evaluates the effect of pro-recycling messages on the recycling behaviour of 6718 families through a nongovernmental recycling organization in Peru. They crafted nine different pro-recycling messages including providing pro-social recycling messages and social norms messages. This study found that none of the nine pro-recycling messages had an effect on household recycling behaviour. However, alongside these pro-recycling messages, they conducted three separate randomly assigned interventions aiming to reduce the barriers to recycling participation. They found that providing

households with recycling bins significantly increased the frequency and amount of recycling.

5.7 Water Consumption

Feedback on household water consumption is generally provided as indirect feedback through monthly water bills. This means that mail-based nudges are often a simple and cost-effective way to influence the behaviour of a large number of households. Various studies have use mailed feedback in large field experiments to evaluate the effect of behavioural interventions on reducing household water consumption (Datta et al., 2015; Ferraro et al., 2011; Ferraro and Price, 2013; Brick et al., 2017). Other water consumption feedback mechanisms include smart water meters (Erickson et al., 2012; Fielding et al., 2013), and In-home display mechanisms (Kappel and Grechenig, 2009; Willis et al., 2010; Tiefenbeck et al., 2018).

5.7.1 Mail in nudges

Ferraro and Price (2013) conduct a randomized experiment that sent mail-based messages to over 100,000 people. They find that social-norms comparison messages had a greater influence than pro-social messages or technical advice alone. They found that combining a social comparison message with technical advice led to a reduction in water consumption of 4.8 per cent. When looking at the persistence of these nudges over time Ferraro et al. (2011) find that while pro-social appeals messages affect short term water consumption. Only those messages which combined pro-social preferences and social comparisons resulted in a lasting decrease in water consumption with the effects of social comparison messages being detected more than two years after the first messages were sent.

Brick et al. (2017) studied the effect of various types of mail based behavioural nudges on water consumption in Cape Town during a severe drought. Eight behavioural treatment messages were sent through monthly inserts in the water utility bills of over 400,000 households. The first group of four nudges tried to correct for information failures around the price and consumption of water by providing water saving tips and tariff graphs. The second group of four nudges use social incentives to promote water saving. The monthly inserts were sent over a period of six months and resulted in an average water saving of between 0.6 per cent and 1.3 per cent.

5.7.2 Smart Water Meters

Smart water-meters are devices that provide real-time feedback on household water consumption which can be presented to households either through online platforms or through in-home water consumption displays (Sonderlund et al., 2014). Various studies have looked into the effect of smart water meters on water consumption and have combined the effect of smart water meters with informational nudges. A study by Erickson et al. (2012) assesses the effectiveness of a web-based water consumption feedback portal in reducing household water consumption over a 15-month period. This online portal recorded data from smart meters installed in 303 households and presented the households overall water usage in the form of graphs while also comparing their consumption to their neighbours. This study found that the online portal resulted in a 6.6 per cent reduction in water consumption compared to households with smart meters that did not have access to the portal. The sample for this study, however, was not random and a majority of the households that participated were already engaged in water saving activities, with the result that this study and its results may be subject to selection bias. Fielding et al. (2013) recruited 221 households to participate in a randomized control trail which evaluated the impact of three behavioural nudges on residential water consumption through the use of smart water meters in Queensland, Australia. The first intervention provided households with water saving information, the second combined social comparison and water saving information, and the third intervention provided tailored feedback with a breakdown of water usage. They found that the interventions lead to an average reduction in water consumption of 7.9 per cent, however, this reduction in consumption eventually dissipated after interventions were ended.

5.7.3 In-Home displays

In home water consumption displays are devices that are connected to smart water meters which provide households with real-time feedback on their water usage and costs (Sonderlund et al., 2014). Several studies have used in home displays to specifically track water and energy use generated by showering in households (Willis et al., 2010; Tiefenbeck et al., 2018; Kuznetsov and Paulos, 2010; Kappel and Grechenig, 2009). A study by Willis et al. (2010) installed alarming visual displays in 44 households that were locked at 40 litres of water. They found a significant reduction of 27 per cent in shower event volumes. A more recent and larger field experiment run by Tiefenbeck et al. (2018), installed smart shower meter displays that were mounted on the shower hose of 700 households in

Switzerland over a two-month period. These meters displayed energy and water usage while a person was showering. This potentially prompted individuals to take direct action and correct behaviour while engaging in the activity of showering. These in-home shower displays reduced water consumption by 20 litres per day.

5.8 Digital nudges

Weinmann et al. (2016) describes a digital nudge as "the use of user-interface design elements to guide people's behaviour in digital choice environments". These digital choice environments offer great promise for offering customized information, continuous feedback, support over time. They also have obvious potential to scale up with relative ease. Green information systems are digital nudges that aim to influence pro-environmental behaviours. Loock et al. (2013) evaluate the effect of Velix, a web portal designed to motivate households to reduce their energy consumption. This web portal combines feedback, goal setting and defaults to influence energy consumption behaviour. Using a sample of 1791 electricity consumers, they find that goal setting through this web portal has a significant effect on energy conservation, and that the use of a default saving goal has an impact on goal selection. Wemyss et al. (2019) look into the long-term effects of a mobile app in reducing household energy consumption. This study used the "Social Power" app which combined constant energy consumption feedback and social comparison through a neighbourhood energy saving competition. They found that while the application initially led to a significant decrease in energy consumption, this decrease was not maintained and one year after the intervention there was no difference in energy consumption between the treatment and control groups.

5.9 Transport

The mobility sector plays an important role in achieving ambitious goals for climate neutrality since the sector, as a whole, contributes about 25 per cent of total emissions. (EEA, 2018). Low-carbon mobility plans encompass a multitude of different policies and goals, but usually try to stimulate a decrease in conventional fuel use by increasing green public transportation options, occupancy of vehicles, shares of alternative fuelled vehicles, and active transport commuters (i.e., walking, cycling, etc). One major hurdle for the sector is the "first and last mile problem" which refers to the inefficiencies and challenges faced in getting a person or parcel the first and/or last leg of its journey (i.e., getting from

one's home to the metro and then from the metro's stop to work) (Tight et al., 2016; Chen and Wang, 2018; Lui et al., 2012). The first and last mile problem can be a major deterrent to choosing public transit over a private car and thereby contributes to urban congestion, increased demand for built environment, and air pollution (Chen and Wang, 2018).

5.9.1 Increasing fuel efficiency

Monetary and non-monetary incentives have been used to encourage personal transport choices that have less of a negative impact upon the natural environment. Lai (2015) focused on increasing fuel efficiency of public busses and found that offering monthly monetary incentives based on the litres of fuel saved increased fuel efficiency by 10 per cent. Non-monetary incentives to personal vehicle operators, such as real-time feedback on fuel economy and dynamic advice to drivers[21], can decrease the fuel consumption rate by 2.7 per cent and result in 10-20 per cent in fuel savings, respectively (Kurani et al., 2013; Barth and Boriboonsomsin, 2009).

5.9.2 Combating the first and last mile problem

Though beyond the scope of the CAMPAIGNers project, improved urban planning that facilitates the ease of active transport and public transit ridership can greatly disincentivize personal vehicle ownership (Mohiuddin, 2021). Emerging mobility services, however, such as ride-hailing services and ride-share services offered by companies such as Uber and Lyft as well as various bike and scooter share services all offer a platform to facilitate behavioural interventions of the sorts described in this brief review.

E-commerce is another sector where there is likely to be scope to reduce the inefficiencies incurred in getting a parcel over the last mile to the consumer. One group who could impact upon this through changed behaviour are the consumers themselves. Consumers already often have options that could decrease the environmental cost of e-commerce such as crowd-shipping, selecting alternative places of delivery (parcel lockers and pick up points), and use of green delivery vehicles (for a comprehensive review see Mucowska, 2021). This opens the scope for behavioural interventions to nudge more consumers to adopting these options.

[21] e.g. do not accelerate too quickly, reduce speeds, etc.

5.9.3 Efforts to get people to change modes

Redman et al. (2013) completed a literature review of quality attributes of transport modes that attract car users, identifying physical and perceived qualities that seem important. Physical qualities that they identified include: reliability, frequency, speed, accessibility, price, information provision, ease of transfers/interchanges, vehicle condition. Perceived qualities that they identified include: comfort, safety, convenience, and aesthetics. Roseneld et al. (2020) demonstrates that there is not a clear method to increase the modal share of non-personal vehicle use, however, informational provision and financial benefits are the two common approaches to motivate change. Additionally, according to Arney (2010), individuals desire to be liked, to conform, or to impress others can easily supersede a desire to spend less money.

Overall, mode change remains a very challenging area for behavioural science to affect. In a recent review of five field experiments to shift commute behaviour Kristal and Whillans (2020) find that traditional nudges (which included devising travel plans - essentially a more intensive form of goal setting - as well as free bus passes for a trial period) had no effect upon mode used in the commute. Their recommendation was that nudges in this space should seek to target purchases of more energy efficient capital (such as electric cars), or work schedules (such as working from home some of the week), rather than to modify the details of daily commuting (for example, car-pooling).

6 ...and some further considerations for app design.

Here are some further thoughts from the Behavioural science literature that may have bearing on app design. These thoughts arise from an email exchange involving myself (Grant), Frances (NUIG), and Felix (SBK) in the early afternoon of 20 October 2021.

6.1 Showing people progress towards their goal

Showing people their own progress towards an achievable goal, has been found to increase the rate at which people achieve those goals. Beginning with Clark Hull (Hull, 1938)[22] and replicated in more recent studies (see Kivetz et al., 2006, Cheema and Bagchi, 2011), the goal gradient hypothesis describes how people

[22] Hull was extending earlier work in which he found animals - albino rats in a maze - displaying this type of behaviour Hull (1932)

exhibit progressively increasing effort to attain a goal the closer they can see they are to it. In this process, it is important that people are able to clearly see[23] their degree of completeness and that the goal not be too far off (Cheema and Bagchi, 2011). Barasz et al. (2017) demonstrate how presenting a number of activities - such as a collection of book titles to read - as a set leads to significantly higher levels of completion and overall activity than if the options are just presented separately. Over five experiments, they demonstrate that this framing leverages our general innate motivation to act until we have eliminated incompleteness and the set is complete. Importantly individuals are able to see their progress towards completing the set, what they have done so far and what remains. It is important to note that these sets can be made of disparate goods or activities that otherwise might not be judged as sets. So, for instance: taking out the recycling, buying a more efficient fridge - and sending your old fridge to a credible recycler - eating vegetables one more evening of the week - whatever is deemed important to achieving the desired outcome, could be presented as a set.

Crediting people with an initial amount of progress towards completing a set has been shown to increase effort. Nunes and Dreze (2006) conduct a randomised trial of loyalty card design among customers of a car wash. A random 150 customers where given a loyalty card that required ten stamps (one stamp per visit to the car wash) overall to earn a free car wash, however this group was credited with two stamps when issued with their card (as a result of their first visit), meaning that they needed 10 further visits to claim a free car wash. A further randomly selected 150 customers were issued a loyalty card requiring eight visits to earn a free car wash. A greater portion (34 per cent) of the group who received their loyalty card with two stamps already affixed completed the task and earned their free car wash than for the group who just received their loyalty card (19 per cent of this group completed).

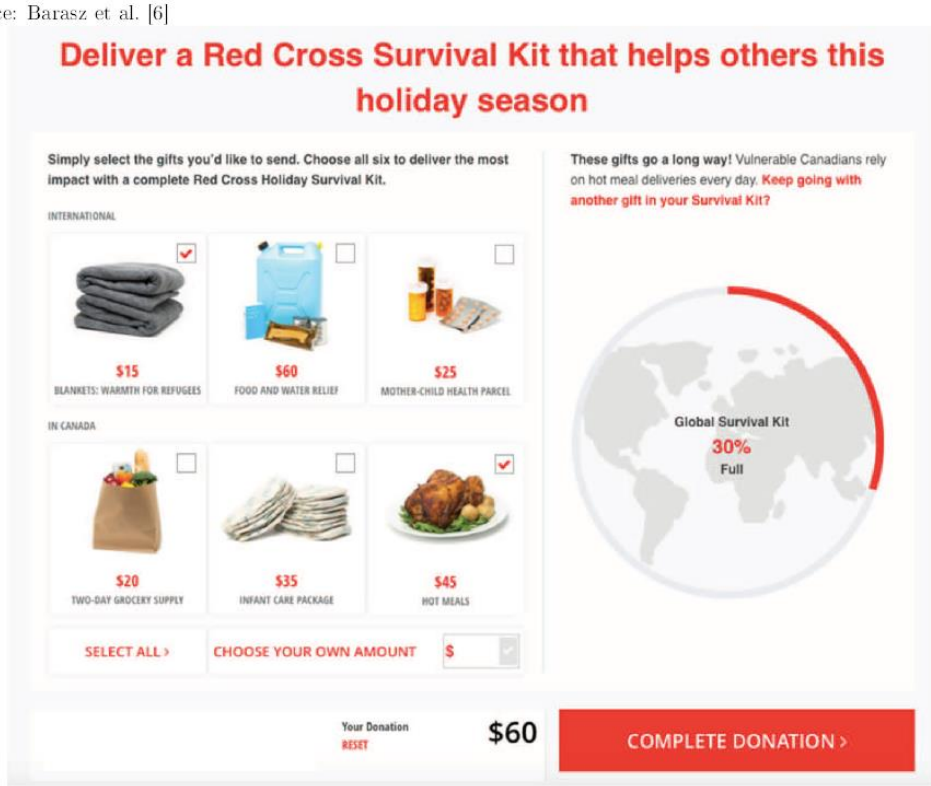
6.2 Choice overload

Arising from the work of Iyengar and Lepper (2000) there is awareness now that there is a limit to the number of total choices, we can offer people before we begin to drive their disengagement and potentially decrease their well-being by

[23]All of the research we are aware of in this area uses visual representations of completeness; but presumably being clearly able to judge degree of completeness through any sense is sufficient.

holding them in a sub-optimal position. In their seminal study Iyengar and Lepper (2000) find that offering students more bottles of jam to purchase serves to drive down the absolute number of jam bottles purchased. This type of trial has been reproduced, now, across many different domains (so, we're not relying on results about students buying jam, now), including in the electricity market, where Jilke et al. (2016) find that offering a customer more utility companies to choose from increases the likelihood that they take no action and remain with their existing utility company. For CAMPAIGNers, this means that we both need to offer participants alternatives to their existing lifestyle (if it is somehow plausibly sub-optimal), but not too many so that we overload them with choices and so, perversely, increase the chance that they make no change at all. While there is no golden rule about the number of choices that is optimal, I, personally, suspect that it is a number that can be seen with only minimal eye-movement, so that would be what you can see on one hand (5 fingers), or on one mobile phone screen - without scrolling.

Figure 2: Pseudo-set of activities: an example.
Presenting potential donors to the Red Cross with goods framed as a set (survival kit) and displaying their progress to completion significantly increased donations.
Source: Barasz et al. [6]



6.3 Intention-action gap.

Sheeran and Webb (2016) provide a helpful overview of work in the intention-action gap. The intention action gap refers to what happens when I get motivated to do something now, but then time passes, and I forget and/or it feels less urgent with the result that I end up doing nothing instead of what I had initially intended to do. The more time there is between our point of motivating the participant in a certain direction and them needing to take action, the greater the risk of our participants taking no action.

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6.8 Degrowth and post-growth theories

Where does it originate? (e.g., sector/discipline)

Degrowth was firstly theorised in France (Décroissance), by the philosopher André Gorz in the 1960s and then was used by social scientists and social movements at the beginning of the 2000s. It was translated into English in 2008 and has gained a lot of popularity since then amongst social scientists and economists.

Post-Growth is a parallel concept that also addresses the limits to growth. It was developed based on the findings that beyond a certain point (often cited as $25,000 GDP/capita), economic growth does not increase human well-being. It was also developed since the beginning of the 2000s and became very popular in the last years amongst social scientists and economists.

How does it understand sustainable lifestyles and/or behaviour change?

In both these approaches, a sustainable lifestyle is understood as a lifestyle that is not shaped by economic growth imperatives. The focus is put on practices and lifestyles that do not rely on the market economy. Decoupling environmental pressures and economic growth is seen as impossible. Therefore, sustainable lifestyle cannot be achieved through better technologies but must imply a radical change in our economic and social organisation. Many authors focus on the importance of several elements to foster sustainable lifestyles:

- *work and time organisation* (work time reduction, revalorisation of paid and unpaid care work, decent and fulfilling work, etc.)
- *money and exchange practises* (alternative currencies, local consumption, sharing and exchange opportunities, cooperative business and banks, ethical finance, etc.)
- *reconceptualisation of prosperity and happiness in everyday life* (engaging in sensual, bodily, intellectual pleasures, valorisation of sufficiency practices, developing practices that foster physical and mental health, etc.)

- *limitation of accumulation and overconsumption* (cutting advertising, ending planned obsolescence, shifting from ownership to usership, avoiding food waste, etc.)
- *reduction of inequality* (maximum wages and redistribution, wealth or solidarity taxes, and universal basic incomes or universal basic services)
- *social and political participation of citizens* (citizen assemblies, representation and inclusion of all citizens, future generations commissioners, etc.)
- *decommodification of public goods and services* (housing and rent controls, healthcare, education, access to the internet and to information, public transport, energy and water supplies, libraries, parks, and sports facilities, etc.), this also raises the idea of *restoring commons* at a local and global scale

What scale of action does it address?

The scale of action is primarily focused on social organisation, highlighting the role of all relevant actors at different levels, including local authorities, states, international regulations, economical actors, communities, households, individuals, and so forth.

What lessons does it offer for sustainable lifestyles and/or behaviour change?

The main lesson of these approaches is the need to address sustainable lifestyles and behaviour change as a global shift out of an existing model. Interesting inputs and specific drivers are:

- the role of public policies in limiting overconsumption, ensuring access to public goods and services, fostering citizens social and political participation
- the need to reduce inequality (of wages, of wealth, of access to opportunities) to foster sustainable lifestyles

- the importance of time organisation and the link between "having more time outside of paid work" with "reducing the ecological impact" through fostering practices with low- or no ecological impacts
- Seeing green technologies as necessary but not as a solution or a main driver for behavioural change and sustainable lifestyles

How does this theory/framework relate to the environment and/or climate change?

The starting point of this framework is that economic growth (beyond a certain point that has been reached in all "developed" countries) is not compatible with environmental sustainability, human well-being and fosters inequality.

What are the main criticisms of this approach?

The main criticism of these approaches is that they are often seen as a utopian and/or unrealistic concepts. Some criticisms also draw on the idea that degrowth is similar to an economic recession and will impoverish citizens instead of making them thrive.

Both approaches have also been criticised for their lack of clarity and conceptual definitions, as well as for their focus on big ideas that are difficult to implement in specific policies.

1-2 one paragraph summaries of applications of this approach

There are many applications of this approach and most of them address a specific element. To cite just a few of them: Four-day work week experiments in Iceland (Haraldsson and Kellam 2021), Universal basic income pilot projects,[24] the Transition Town movement, Vienna's low-cost housing policy, and fare-free public transport cities (Grzelec and Jagiełło, 2020)

[24] For example https://www.pilotprojekt-grundeinkommen.de/projektaufbau

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6.9 Sustainability Transitions

Where does it originate? (e.g., sector/discipline)

The sustainability transitions field emerged as a specific research field at the beginning of the 2000s, firstly in Germany, UK, and the Netherlands. It then gained popularity on an international level. It is mainly developed by researchers from the social and environmental sciences. Theoretically, it is based on the idea that transition is not just a rational process, but that reflexivity and complexity are core concepts to understand transitions.

How does it understand sustainable lifestyles and/or behaviour change?

Sustainable lifestyles are achieved through the transformation of socio-technical systems. This transformation has seven main characteristics: 1) it is made of *coevolutionary processes*, involving changes in a range of elements and dimensions; 2) change is enacted by *multiple actors* and social groups; 3) the focus is put on the dialectic relation between *stability* (including locked-in patterns and dependency paths) and *change*; 4) transitions are *long-term processes;* 5) *future is open-ended,* there are multiple transition pathways and no one can predict the future; 6) sustainability is a *contested concept*, it is not a shared concept and our understanding depends on values and interests; 7) p*ublic policy must play a central role* in shaping the directionality of transitions as sustainability is seen as a public good.

What scale of action does it address?

The level of analysis is primarily situated at the meso-level, focusing on what is called socio-technical systems.

What lessons does it offer for sustainable lifestyles and/or behaviour change?

The main interest of this theory is to frame sustainable lifestyles as being part of complex, multi-dimensional and multi-actor systems. It also highlights the

importance of technologies and infrastructures, as well as public policies, vested interests, and issues of power in transition.

How does this theory/framework relate to the environment and/or climate change?

This field of research focuses specifically on sustainability in which environment and climate change play a central role, even if sustainability is understood as being a normative concept subject to change depending on values and interests.

What are the main criticisms of this approach?

There are three main criticisms of this approach. The first is that change is often cantered on technologies, leaving aside some more social innovations, and that the co-evolution of different dimensions (such as markets, user practices, policy and cultural discourses or governing institutions) are insufficiently developed in most research in this field. The second criticism is that power issues are sometimes overlooked. The third is its influence and interrelation with governance framing and political choices, especially in the Netherlands.

1-2 one paragraph summaries of applications of this approach

This approach has been applied to different topics, but the majority of applied research focus on the energy sector and the new technologies involved. There has, for example, been some research on wind turbines development (Karnøe and Garud, 2012) showing how consumer choices and practices were intertwined with some other processes, such as public policies, transformation of suppliers, private buyers of wind turbines, and so forth. Some other research focuses on niche and grassroots innovations in the renewable energy sector and car sharing for example (…) assessing how they can scale up and be seen as successful innovations. They focus on the interrelation of dimensions such as the structural conditions and resources of origin, the motivations of social actors involved, the learning processes and outcomes, the competences and activities of those actors, the processes of institution-building, and the relationships to mainstream market actors.

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6.10 Systems of provision

Where does it originate? (e.g., sector/discipline)

The systems of provision approach draws in the tradition of Marxist economics. It was first theorized by Ben Fine (2002) and aims to analyse the link between production, distribution, and consumption of goods and services. It focuses on the interaction between social/cultural aspects of provisioning systems and physical aspects.

How does it understand sustainable lifestyles and/or behaviour change?

Sustainable lifestyles are then understood as part of a broader understanding of provisioning system. Behaviours are influenced by the provisioning systems and can also influence social and material aspects of this system. Sustainable lifestyles are dependent on the systems of provision within which they are entrenched. This means one must consider material aspects (such as infrastructures, technology, supply chains, and so forth) and social aspects (such as state, markets, institutions, communities, distribution, norms, and culture).

What scale of action does it address?

The level of analysis is primarily situated at the structural level, trying to understand how individual behaviours are part of broader systems.

What lessons does it offer for sustainable lifestyles and/or behaviour change?

This approach shows the importance of considering sustainable lifestyles entrenched in production, distribution, and consumption systems. It highlights the role played by other actors (institutions, communities, companies) and infrastructures.

How does this theory/framework relate to the environment and/or climate change?

This approach has been used in much research concerning the environmental crisis. Systems of provisions are seen as an intermediate level between biophysical inputs (natural resources and planetary processes such as the carbon cycle, for example) and social outcomes (how we satisfy our needs and have access to wellbeing).

What are the main criticisms of this approach?

One of the main criticisms of this approach is that it tries to describe a multi-layered reality and is difficult to use in non-extensive research.

1-2 one paragraph summaries of applications of this approach

One of the ground-breaking applications of this approach is the project "Living Well Within Limits" (LiLi) conducted by Julia Steinberger (University of Lausanne) and her team at Leeds University. In this project, they question the link between energy use and human well-being (how much energy is necessary to achieve well-being, what is the influence of systems of provision on the level of resources used to achieve well-being, how can resources best be used to achieve well-being).[25]

List 5-10 key literature

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[25] https://lili.leeds.ac.uk/

Fine, B. (2002). *The World of Consumption: The Material and Cultural Revisited* (2nd ed.). Routledge.

Fine, B., Bayliss, K. & Robertson, M. (2018). The Systems of Provision Approach to Understanding Consumption, in Kravets, O. et al. (eds.) *The SAGE Handbook of Consumer Culture*. SAGE Publications, 27–42.

Gideon, J. & Fine, B. (2020). *A Guide to the Systems of Provision Approach: Who Gets What, How and Why*. Palgrave Macmillan.

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6.11 Urban Political Ecology (UPE)

Where does it originate? (e.g., sector/discipline)

UPE is an interdisciplinary field that stems from several disciplines and theoretical frameworks, integrating Marxist, post-structuralist thinking and, more recently incorporating feminist, abolitionist, postcolonial, and more-than-human lenses. This field endeavours to account for the relations between society and environment within urban contexts, with a particular focus on the uneven material and political dimensions of urban processes under capitalist relations.

Scholars of UPE have shown particular interest in critically analysing flows, relations and contestations surrounding urban resource distribution and access. Key concepts associated with this field include socionatures (Angelo & Wachsmuth, 2015; Heynen, 2014) urban metabolisms (Heynen et al., 2006; Gandy, 2004) and splintering (Castán Broto & Bulkeley, 2013)

How does it understand sustainable lifestyles and/or behaviour change?

This approach is more preoccupied with systemic, spatial, political, and ecological relations and dynamics across diverse scales. As such, UPE studies tend to focus on multiple scales of analysis rather than personal behaviours or habits. However, many studies have located individual practices and strategies for a living are embedded within and produced through broader infrastructural, political, economic, and social imperatives.

Furthermore, many studies seek to make visible the challenges and realities of accessing infrastructures and services, to highlight uneven and splintering realities of social reproduction and development in urban contexts.

What scale of action does it address?

UPE studies are focused on studying the urban but can vary in scales of engagement and study, often adopting a multi-scalar perspective ranging from the hyperlocal to the global. Some studies will focus on wider assemblages/networks beyond cities (e.g., Angelo & Wachsmuth, 2015). Others

focus on smaller scales, such as neighbourhood or household, or conduct detailed studies which focus on individuals or specific localities or sectors (e.g., Silver, 2017).

Unlike many other frameworks and conceptual approaches which have been reviewed for the purposes of CAMPAIGNers, UPE is less oriented towards experiments, interventions, or even individual behaviours. Instead, such research will often focus on a particular urban process, service, or infrastructure and seek to untangle its varying actors and relations, interests, and imperatives, materialities, and ecologies.

What lessons does it offer for sustainable lifestyles and/or behaviour change?

While focused on the more systemic and political dimensions of urban resource flows, UPE offers some important lessons for considering sustainable lifestyles and behaviour change. First, UPE encourages a critical reflection of the political, infrastructural, and material dimensions of sustainable behaviours and lifestyle choices. For instance, what is available, why are certain behaviours more feasible than others, and how do existing spatial organisation and services predetermine and inform what behaviours and lifestyles are possible?

Secondly, UPE research emphasizes how uneven and splintered infrastructures are continuously in the making, contested, and often result in informal or adaptive behaviours which may fall outside of official services or recognised practices. This has two implications - first, recognising how different options may not be available to all residents or are exclusionary due to cost or other barriers. Furthermore, this unevenness and splintering will result in different patterns and levels of consumption and service use, which means responsibility for environmental impact and responsibility for behaviour change should also be critically examined - e.g., higher-income households maybe have higher waste volumes and consume a greater proportion of water and electricity.

Finally, it is important to pay attention to the various intermediaries, improvisations, and incremental approaches people devise to gain access to services and resources. These tactics, practices, and labour can be difficult to discern beyond official plans and practices but are critical infrastructural

processes that underpin individual consumption patterns, everyday life, and urban spaces and processes more broadly.

How does this theory/framework relate to the environment and/or climate change?

In focusing on urban socionatures and metabolisms, UPE scholars do address the environmental dimensions of urban life and infrastructures. Increasingly, studies have also highlighted the politics of sustainable urbanisms and critically analysed efforts to govern sustainable cities and urban processes (Rice, 2014).

Furthermore, UPE studies highlight the uneven and racialised nature of resource access and consumption which has intensified in the context of climate change and environmental degradation. In particular, such studies point to exclusions from formal or market-led infrastructures and services and disproportionate burdens placed on lower-income or marginalised residents through heterogeneous, adaptive, or improvised infrastructures and consumption.

What are the main criticisms of this approach?

Critics have suggested that this field can be descriptive, explanatory, or critical, without much consideration for the implications of this analysis. Also, studies have suggested that the emphasis on the urban often falls into methodological city-ism, where urban processes and infrastructures beyond the city are disregarded or understudied (e.g., Angelo & Wachsmuth, 2015). Indeed, this critique is rather useful for considering sustainable urban lifestyles and behaviours, as it encourages research to looks at the spatial and environmental implications of consumption processes beyond the city.

While UPE has engaged with different aspects of everyday lives to bridge the 'grounded-planetary' dichotomy (Tzaninis et al. 2020), further insights into practices and lifestyles could be developed. There is potential to bring approaches such as social practice theory into conversation with urban political ecology, with a view to devising an understanding of sustainable lifestyles and behaviours which accounts for inequalities, power relations, market and political imperatives, and infrastructural predispositions that precede any and all individual behaviours and service configurations.

1-2 one paragraph summaries of applications of this approach

Silver (2017) applied at UPE perspective to study the low-carbon restructuring of a waste system in Mbale, Uganda. By studying socio-material processes and their outcomes, this study highlighted how powerful transnational actors use localities to experiment with low-carbon transformations and dominate their surrounding governance. In turn, the risk of failure around such pilots was relegated to the local level, which resulted in new socio-environmental inequalities for marginalised groups.

List 5-10 key literature

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Heynen, N. (2014). Urban Political Ecology I: The Urban Century. *Progress in Human Geography,* 38(4), 598–604.

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Lawhon, M. & Murphy, J.T. (2012). Socio-Technical Regimes and Sustainability Transitions: Insights from Political Ecology. *Progress in Human Geography,* 36(3), 354–78.

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Rice, J.L. (2014). An Urban Political Ecology of Climate Change Governance. *Geography Compass*, 8(6), 381–94.

Silver, J. (2017). The Climate Crisis, Carbon Capital and Urbanisation: An Urban Political Ecology of Low-Carbon Restructuring in Mbale. *Environment and Planning A*: *Economy and Space,* 49(7),1477–99.

Tzaninis, Y., Mandler, T., Kaika, M. & Keil, R. (2020). Moving Urban Political Ecology beyond the "Urbanization of Nature". *Progress in Human Geography*, 0309132520903350.

6.12 Social Practice Theory

Where does it originate? (e.g., sector/discipline)

Taking inspiration in the works of sociologists like Giddens (1984) and Bourdieu (1977, 1990), the Social Practice Theory (SPT) has been developed in the last decades by social scientists like Theodore Schatzki (Schatzki, 1996) and Andreas Reckwitz (Reckwitz, 2002), Elisabeth Shove (2010, and see Shove and Pantzar, 2005) and Alan Warde (2005).

It was developed as an alternative and a criticism to other social theories focusing either on individuals and their interests or on the society and social norms. In SPT, the focus is not on individuals but on practices. Individuals are seen as practitioners or 'carriers' (Reckwitz, 2002) of social practices, carrying out the various activities and tasks that the practice requires.

Social practices are understood to consist of three elements: materials (tools, technology, infrastructure), meanings (values, symbolism, identity), and competences (knowledge and skills) (Shove et al., 2012; Shove & Spurling, 2013). Social practices are interrelated and embedded in institutions, systems, and social contexts. There are the locus of constant change and adaptation. Different studies show how practices have changed in the past, towards the normalization of some forms of energy use and their prioritisation over others.

The SPT is now widely used in the field of sustainable consumption studies. It is seen as a more holistic approach than behavioural theories.

How does it understand sustainable lifestyles and/or behaviour change?

Lifestyles must be understood within the social organisation of normality. This means that some habits, routines, and everyday practices of consumption (for example, around washing, showering and laundry, as well as travel and heating) are normalised and shaped by social and infrastructural factors.

Sustainable lifestyles are thus not an individual choice or behaviour, but interrelated practices that are embedded in a social, material, and institutional system. To promote sustainable lifestyles (as the CAMPAIGNERS project is aiming

to do), it is necessary to address the systemic conditions and drivers of practices and attempt to reshape systems in a more sustainable manner.

Social practice theory, in this view, raises a series of radically different questions about how to foster more sustainable lifestyles. The focus is no longer on individuals' attitudes, behaviours, and choices, but instead on how practices form, how they are reproduced, maintained, stabilized, challenged and ultimately killed-off; on how practices recruit practitioners to maintain and strengthen them through continued performance, and on how such practitioners may be encouraged to defect to more sustainable practices.

Bringing about pro-environmental patterns of consumption, therefore, does not depend upon educating or persuading individuals to make different decisions, but instead on transforming practices to make them more sustainable (cf. Southerton et al., 2004). As Warde (2005, p.140) notes, "the principal implication of a theory of practice is that the sources of change behaviour lie in the development of practices themselves".

What scale of action does it address?

SPT focuses on a middle level between agency and structure. The practice itself, rather than the individuals who perform them or the social structures that surround them, is the core unit of analysis.

For example, it is not about getting people to use an ecological laundry liquid, it's about considering that washing clothes is embedded in a set of social practices, configured by materials (tools, technology, infrastructure), meanings (values, symbolism, identity) and competencies (knowledge and skills). It also involves considering the space and time constraints as well as the social norms of cleanliness and style.

What lessons does it offer for sustainable lifestyles and/or behaviour change?

SPT scholars like Elisabeth Shove believe that the dominant A(ction), B(ehaviour), C(hoice) paradigm has been so successfully sustained in governance and policy discourses because it serves the needs and interests of policymakers to put

responsibility for action (and inaction) primarily at the door of individuals, rather than questioning the institutions and systems that sustain it.

Instead, improving the sustainability of mobility, diets, and energy use in society requires directing attention to the multiple and interrelated social practices embodied by these actions. This means that to foster change, we need to understand the social context in which (un)sustainable actions occur.

How does this theory/framework relate to the environment and/or climate change?

Social practice theory has been used in consumption studies for decades. Specific research using SPT and focusing on sustainability and environmental change agenda grew after 2000. It was developed in that field to overcome the limitations of environmental behavioural change agenda and to fulfil a need to understand the social context in which unsustainable actions occur.

Sociology has a role to play in unpicking the contextual conditions driving variations in GHG emissions between and within countries (macro), corporations/social actors (meso), and individuals (micro), to gain a better understanding of what drives some actors to act differently under similar social, political, and economic institutional conditions. Further, sociological approaches are useful for exploring intersectionality, that is, how the interplay between social and political identities, such as gender, class, disability, race, sexual orientation affect climate justice and climate change.

What are the main criticisms of this approach?

One of the main criticisms is that there is no unified social practice theory. One area of disagreement, for example, centres on defining exactly what a practice is. Here, some theorists focus on the various components or elements that make up a practice (e.g., Reckwitz, 2002; Shove and Pantzar, 2005), others on the connections between these elements (e.g., Schatzki, 2002; Warde, 2005), and still others on the position of practices as a bridge between individuals' lifestyles and broader socio-technical systems of provision (e.g., Spaargaren and Van Vliet, 2000).

SPT has also mainly been used in small case study and has, so far, less numerous empirical applications than other theories (i.e., behavioural change theories). As it is a developing and systemic approach, it has also been criticised for not being able to shape a precise design of target interventions.

It has also been noted that SPT is a conceptual frame that does not sufficiently consider power and hierarchy relations.

1-2 one paragraph summaries of applications of this approach

A growing body of literature seeks to understand social change by understanding social practices. Some of these reflections focus on time use, life events and spatial arrangements to understand how practices can change or stabilize, while others emphasize the repeated performance of practices as a source of stability. Three types of changes in practices can be distinguished: 1) re-crafting practices, 2) substituting practices and 3) changing how practices interlock. These forms of practice-centred change have been experimented through various change initiatives, for example reducing washing among a group of students in Australia, encouraging the wearing of the same pair of jeans over several weeks (Jack 2013); initiatives aimed at contesting social norms in practices in different consumption domains in Switzerland (Sahakian and Bertho 2018); a practice-based Living Lab towards disrupting household food habits in Ireland (Devaney and Davies 2018); and engaging with social practices to discuss future imaginaries of energy consumption towards envisioning change, also in Australia (Strengers et al 2019).

Recently it has also been applied more specifically to the energy sector in the ENERGISE project. Following a review of different ways of engaging households, two challenges were introduced to 306 households in eight European countries: to lower indoor temperatures and to reduce laundry cycles. The project focused on the re-crafting of 'practice elements' and had a "Living Lab" approach, trying to work collaboratively with people to transform aspects of their everyday life, as opposed to focusing solely on changing consumption through technology, or social engineering and 'choice architecture'.

List 5-10 key literature

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Hargreaves, T. (2011). Practice-ing behaviour change: Applying social practice theory to pro-environmental behaviour change. *Journal of Consumer Culture,* 11(1), 79–99.

Jack, T. (2013). Nobody was dirty: Intervening in inconspicuous consumption of laundry routines. *Journal of Consumer Culture*, 13(3), 406–421.

Reckwitz, A. (2002). Toward a Theory of Social Practices: A Development in Culturalist Theorizing. *European Journal of Social Theory,* 5(2), 243–263.

Sahakian, M. & Bertho, B. (2018). Exploring emotions and norms around Swiss household energy usage: When methods inform understandings of the social. *Energy Research & Social Science,* 45, 81–90.

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Schatzki, T.R. (1996). *Social Practices: A Wittgensteinian Approach to Human Activity and the Social*. Cambridge University Press.

Shove, E. (2010). Beyond the ABC: Climate Change Policy and Theories of Social Change. *Environment and Planning A: Economy and Space,* 42(6), 1273–1285.

Strengers, Y., Pink, S. & Nicholls, L. (2019). Smart energy futures and social practice imaginaries: Forecasting scenarios for pet care in Australian homes. *Energy Research & Social Science,* 48, 108–115.

Warde, A. (2005). Consumption and Theories of Practice. *Journal of Consumer Culture,* 5(2), 131–153.

7. Appendix Two: A Review of Lifestyle Apps

7.1 Introduction

As mobile smartphone and device ownership and use surges globally, simultaneously the widespread embrace of such portable technology has been accompanied by the pervasive emergence of an 'apps culture' (Purcell et al. 2010). The mobile phone has morphed, over time, from a purely voice device to a multi-channel device to an internet-accessing always-on mini-computer. In response, a large market of mobile software applications (or apps for short) has developed. An app is a digital computer program designed to carry out a specific task other than one relating to the basic operation of the computer or mobile device itself. With the phenomenal growth of the smartphone market, mobile apps have become particularly ubiquitous in emerging markets as well as in most developed countries across the world. The global mobile internet population in 2021 stands at 4.28 billion and mobile internet traffic as a share of total online traffic at 55.6 per cent (Statista 2021). The number of mobile apps available to users at any time was just under six million and the projected worldwide mobile app revenue by 2023 is set to rise to 935.2 billion USD, up from 461.7 billion USD in 2019. eMarketer predicted that adult smartphone users in the US will spend about four hours per day using mobile internet, and 88 per cent of that time will be spent in mobile app use rather than a simple web browser (Wurmser 2020). European mobile device consumers spent an estimated 14.8 billion USD across the App Store and Google Play during 2020, representing a 31 per cent year-over-year increase in gross revenue from 2019, based on user spending for in-app purchases, subscriptions, and premium apps (Sensor Tower 2021). All indications are that this flourishing environment for mobile app consumption will continue to grow and develop, creating a crowded marketplace in the attention economy. How can mobile apps or digital information communication technology be best used to aid and support pro-environmental behaviours in the 21st century? This review will look at the existing literature in the areas of eHealth, pro-environmental change brought about by such technology, and look more broadly at if and how technology can be leveraged to change behaviours in a positive manner.

There are three types of apps currently in wide use - desktop, mobile and web. Mobile apps often stand in contrast to desktop applications which are designed to run on desktop computers, and web applications which run in mobile web browsers rather than directly on the mobile device itself. Mobile apps are pieces of software that frequently come pre-installed on portable devices such as smartphones, tablets or watches, or software that you can install effortlessly on such devices. Apps are broadly classified into three categories: native apps, hybrid, and web apps. Native applications are designed specifically for a mobile operating system, typically iOS (iPhone) or Android device. These can be downloaded from the App Store (in the case of iOS) or Google Playstore (for Android devices) and are available free or a minimum charge to the end user. Web apps behave similarly to native apps but are written in HTML5 or CSS and typically run through a web browser. These are not standalone apps in the sense of having to download and install code into your device, they are responsive websites that adapt its user interface to the device the user is using at any given time. Hybrid apps are built using web technologies such as JavaScript, CSS, and HTML 5 and function like web apps disguised in a native container. They traditionally have a home screen app icon, responsive design, fast performance, and can function offline, but are really web apps made to look like a native version.

Mobile apps are designed, developed, and utilised to accomplish many different purposes and functions. Gaming apps are the most popular category and a recent study found that 33 per cent of all apps downloaded, 74 per cent of all customers spend, and 10 per cent of all the time spend on mobile devices were on gaming apps (Sydow 2019). Business or productivity apps – used for tasks such as to track work progress, send communications, book tickets – are designed to boost productivity and minimise expenses allowing users perform a wide range of duties and errands. Educational apps allow users to gain new information or insights into a wide range of subjects and topics, such as learning a new language, and they give the users the flexibility to learn at a time of their own choosing and at their own pace. Lifestyle apps are a broad category of personal lifestyle choices spanning practices such online shopping, fashion, workouts, dating or diet apps, and mobile commercial apps provide users with convenient access to products and services while allowing seamless payment and delivery methods for an optimal online shopping experience. Entertainment apps facilitate the streaming of video content, allow online contact and

interaction, and include the popular social media providers such as Facebook or Instagram. Utility apps are software applications that allow users to track their activities, scan barcodes or monitor the user's health, and travel apps help users arrange their travel activities through such popular providers such as Google Maps, Airbnb, and Uber.

Of particular concern to mobile app designers and developers is the attrition rate, i.e., the percentage of users who download an app but then quickly delete it. The worldwide retention rate for lifestyle apps on day one is 20.9 per cent but falls to just 4.5 per cent on day 30, while the retention rate for educational apps on day one is 18.8 per cent falling to just 2.5 per cent by day 30 (Statista 2021). Based on Quettra's data, the average app loses 77 per cent of its daily users within the first three days after an install, within 30 days it has lost 90 per cent, within 90 days it has lost over 95 per cent (Chen 2015). Therefore, the average app loses its entire user base within a few months. In a study to explore the factors that lead towards the decision to uninstall mobile applications and cause smaller life cycles, the role of satisfaction was deemed important and in the case of negative disconfirmation when an application does not perform as expected, it ultimately leads to discontinuation of use (Vagrani et al. 2017). Consuming a lot of resources in terms of memory, processing time and power were also prominent factors that lead to discontinuation. In a recent survey of over 2,000 mobile app users who were asked their main reason for uninstalling mobile apps the top reasons were: they no longer use the app (39.9 per cent), limited storage space (18.7 per cent), too much advertising (16.2 per cent), excessive notifications (12.6 per cent), confusion (5.4 per cent), technical issues (5.4 per cent), other (1.6 per cent) (Karnes 2021). Earlier research found that the most important reason for a user to uninstall an application from smartphone was finding it "useless; other important factors were crashes, high memory allocation, instability and inconsistency, poor UI, intrusive advertisements, lack of improvement, and it was a 'boring app'" (Ickin et al. 2017). The following sections will focus more on lifestyle apps in the areas of health and pro-environmental behaviours to synthesise some of the key literature in this area to provide guidance and direction for pro-environmental behavioural change app development into the future.

7.2 mHealth: Mobile Apps and the Potential for Better Health Outcomes

With the expansive development of digital technology and growth in worldwide connectivity, the improvements in mobile technologies in healthcare have increased rapidly in the past decade. This has opened new opportunities, possibilities, and innovative ways to improve health and healthcare delivery. Mobile health (mHealth) refers to any use of mobile apps and wearable devices for health reasons (Silva et al. 2015), and these enable delivery of health-related services and applications through general-purpose mobile devices such as smartphones or tablet devices (Davis et al. 2016). Understanding methods to assess apps is key to improving the standard and quality of health apps on the market, towards the goal of delivering services that are built on the pillars of evidence-base, reliability, long-term effectiveness, and user-oriented quality (Paglialonga et al. 2018). Bates et al. (2018) argue that four major policy issues need to be addressed with respect to medical apps. First, the safety of apps must be established so the public is adequately protected, and a directory of evidence is needed to allow patients and clinicians to assess which apps make a difference. Third, apps must be able to connect with electronic health records (EHRs) to allow seamless and secure transfer of information and, fourth, policies should encourage the market to develop apps that will improve care and value. Understanding users' opinions is critical to this if we aim to design effective apps that will be adopted and used broadly.

A recent qualitative study of 106 mental health apps employed thematic analysis on 13,549 reviews to identify key themes and features of such apps (Alqahtani and Orji 2020). Specifically, this study generated insights into the strengths and weaknesses of available mental health apps by uncovering the features and qualities of the apps that users liked, disliked, and suggested improvements. Findings reveal several aspects of app design that developers should consider improving user experience, usability, adherence, and hence overall effectiveness. Developers should focus on the usability of the apps and conduct usability evaluations of both their initial and updated versions, providing users with a variety of rich content, personalisation functionalities, and allowing them to use the app without too many restrictions. Moreover, increasing the app credibility by offering security features to protect user's data, and providing regular updates and new features will increase users' trust and decrease the high attrition rates

currently experienced by mental health apps. In a systematic review of the influences on the uptake of, and engagement with, health and well-being smartphone apps, Szinay et al. (2020) found that across a wide range of populations and behaviours, 26 factors relating to capability, opportunity, and motivation appear to influence uptake. One of its core findings suggest that attention should be perhaps shifted mainly to the support and guidance offered to new and existing users of health and well-being apps. Another recent review indicates there is potential for mobile digital mental health apps to be used in the multidisciplinary clinical setting but not as a replacement for face-to-face and traditional treatment modalities such as traditional mental health care, rather as an adjunct for some service users and as an alternative option for ongoing care (Chan and Honey 2021). A previous review also found that patients reviewing mHealth apps viewed that as a useful complementary tool but that some major problems arise in their optimal use, including the need for more closely tailored designs, the cost of these apps, the validity of the information delivered, and security and privacy issues (Vo et al. 2019).

mHealth app content that involved clinician input at the design stage and included internal drivers such as motivation, self-efficacy and illness understanding and external drivers such as illness information, social networking and user compatibility tended to do better in facilitating behaviour change than those that do not (Fitzgerald and McClelland 2017). Of these factors, motivation is considered to be the most important. A further study highlighted conflicting views about how the cost of an mHealth app affects its trustworthiness (van Haasteren et al. 2019). While some participants interpreted paid apps to mean that they were of better quality, others did not subscribe to this view. The basis for the latter argument was that the cost of an app is meaningless in relation to its trustworthiness, a difference in opinion similar to findings of other studies. But the large variation in available mobile health apps - their target patient group, health behaviours, and behavioural change strategies - has resulted in a large but inconsistent body of literature. In their review, Milne-Ives et al. (2020) found there was no strong evidence in support of the effectiveness of mobile apps in improving health behaviours or outcomes because few studies found significant differences between the app and control groups. Schoeppe et al. (2017) suggests that future app development should identify factors that promote users' app engagement, be tailored to specific population groups, and be more informed by health behaviour theories, while Neilsen (2007) suggests the effective

incorporation of behaviour change techniques in an app facilitates overall increased engagement and effectiveness.

7.3 Promoting Pro-Environmental Change through Technology

As smartphone and other internet-connected mobile devices increased in popularity, so too did the development of mobile applications (also known as *eco-apps*) designed in attempts to promote environmentally friendly behaviours. Researchers in Human-Computer-Interaction (HCI) have suggested that there are new and developing opportunities for technology to assist in the efforts to combat climate change and in encouraging pro-environmental behaviours by employing behavioural psychology to promote environmentally conscious behaviours in individuals. But He et al. (2010) cautioned against a 'one size fits all' approach and providing the same feedback to differently motivated individuals at different stages of readiness, willingness, and readiness to change. In her analysis for improving mobile phone interventions for understanding and acting on environmental problems, Typhina (2017) offers four recommendations as points of discussion and exploration to reconceptualise the structural potential of eco-apps as modes for addressing environmental concerns. Developers and designers should include and support diverse stakeholders in the development of eco-apps, but also incorporate diverse stakeholders as users of eco-apps. Also, record lived experience and live new experiences through eco-apps, but attempts should also be made to supplement and support offline relationships through eco-apps.

Nkwo et al. (2020) found that amongst the 148 mobile apps they evaluated, a total of seventy-one (71) socially oriented strategies from the social support category of the Persuasive System Design (PSD) framework were implemented. Such findings show that, in general, socially oriented strategies are effective at promoting sustainable and pro-environmental behaviours; in contrast to passive participation, they are purposely designed to stimulate active participation of users to achieve communal objectives.

Studies have found that adults and children who spent extended amounts of time on smartphones in a day are also more likely to exhibit a disconnect with nature and exhibit stronger negative pro-environmental behaviours (Kesebir and

Kesebir 2017, Richardson et al. 2018, Kellert et al. 2017, Wang et al. 2021). Since people tend to form the habit of 'not being without their phone' they become more likely to use these devices in an uncontrolled manner and consequently spend less time on other activities, including those that involve nature contact. This suggests that mobile phone overuse, nature-deficit disorder, and public health are intertwined issues that should be studied simultaneously in future research to unveil the complex relations among them (Wang et al. 2021).

7.4 Technology to Aid Behaviour Change

Technology-based approaches to behaviour change interventions have particular promise given the widespread adoption and acceptance of mobile devices, and that such devices can offer tools that track physical activity, capture other important personal data, date-stamp and timestamp such activity, and provide encouragement and useful feedback that provides motivation, increased confidence, and social support. Human behaviour refers to physical and emotional activities and behavioural theories that aim to understand why individuals engage or fail to engage in such activities. There are five common theories that have potential implications for technology-based behaviour change: *Self-Determination Theory* (SDT), *Social Cognitive Theory* (SCT), the *Health Belief Model* (HBM), the *Theory of Planned Behaviour*, and the *Transtheoretical Model* (also referred to as the stages of change model) (Sabharwal et al. 2020).

Thaler and Sunstein (2008) had earlier introduced the notion of nudging to suggest that our knowledge about systematic biases in decision making can be leveraged to support people in making optimal decisions. Nudges, in the broadest of terms, are behavioural change techniques or methods that are designed to guide people to make better choices by exploiting insights from psychological research. Recent approaches to understanding the concept of 'digital nudging' in examining the effectiveness of user-interface elements to guide people's behaviour in digital choice settings has focused on nudging pro-environmental behaviours through anchoring and adjustment, overlooking the import nudging mechanisms of priming and status quo bias. In Thaler and Sunstein's terminology, an 'anchor' refers to a person's perceived reference point in relation to a question for which the answer is not known and is to be deduced. In simple terms an anchor is a clue, or cue, or a pointer, or a starting point, which

can be adjusted to help us to estimate an answer. A randomised, laboratory experiment with 120 participants found that groups nudged with a status quo bias acted more pro-environmentally while priming's ineffectiveness in motivating was also noted. In suggesting what designers should consider when designing new types of nudges, Caraban et al. (2019) outlined design considerations for 23 technology-mediated nudging mechanisms, grouped in six categories and leveraging 15 different cognitive biases, while discussing the factors shaping nudges' effectiveness and their ethical implications.

Michie et al. (2013) set out to develop an extensive, consensually agreed hierarchically structured taxonomy of behaviour change techniques (BCTs) used in behaviour change interventions resulting in 93 BCTs clustered into 16 groups. In seasoning for such a taxonomy that suggest that a well-specified intervention is essential before evaluation of effectiveness is worth undertaking and that an under-specified intervention cannot be delivered with fidelity and, if evaluated, could not be replicated.

Consolvo et al. (2009) derived eight guidelines for designing technologies for lifestyle change. Such technologies, they argue, need to be *abstract* and *reflective*, *unobtrusive*, *public*, *aesthetic*, *positive*, *controllable*, *comprehensible to users*, and include *historical data*.

7.5 A Review of Current Pro-Environmental Behaviour Apps

As part of a review of the current pro-environmental behavioural change app environment, students at the National University of Ireland Galway (NUIG) in Ireland were invited to volunteer to download an eco-app to their smartphone or mobile device and after interacting and using this app for a number of days submit a review of the application. The review was to be presented in the form of eight questions (one of which was the student's number which will not be included in the findings) submitted to an online portal. No specific direction as to what app to download was given to students, apart from the fact it 'should be focussed on sustainability behaviours, climate change or environmental concerns' and to be frank and truthful as to the positive and negative aspects of the app uncovered. By offering as little direction as possible as to the actual eco-app to download, it was felt that students had the freedom to explore this pro-

environmental behavioural change app environment on their own terms and discover such software as they deem fits the criteria. The results of this voluntary eco-app review are provided chronologically as they were received and available in the appendix of this review.

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7.7 Appendix

7.7.1 Review Structure

The direction and questions for the eco-app review undertaken NUIG students were as follows:

The app should be focussed on sustainability behaviours, climate change or environmental concerns, and please be as frank and truthful as possible about the positive and negative aspects of the app. The questions you will be asked are:

1. What is the name of the app you downloaded for review?

2. How much does the app cost to download?

3. Can it be downloaded to the iPhone (ISO) and/or an Android phone?

4. What exactly does the app claim to do or what service does it provide? (two or three sentences)

5. What did you find good or interesting about the app? (two or three sentences)

6. What did you find frustrating or what was poor about the app? (two or three sentences)

7. Would you keep this app on your smartphone and use it in the future?

8. Your student number.

7.7.2 The Review Data

Participant #	1
What is the name of the app you downloaded for review?	Treeapp
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	Treeapp is a smartphone application that allows anyone to plant a tree for free every day in under a minute
What did you find good or interesting about the app?	You can track your carbon footprint and the positive impact it has for the environment
What did you find frustrating or what was poor about the app?	There's nothing poor about this app it's an amazing way to help our planet
Would you keep this app on your smartphone and use it in the future?	Yes

Participant #	2

What is the name of the app you downloaded for review?	Ecosia
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	This app claims to plant trees for every search/click you make through their search engine. They use the profit generated from search ads to plant the trees
What did you find good or interesting about the app?	As a student constantly searching and looking up things, this is a simple change I could make that could contribute a huge amount by practically doing…nothing! The app allows you to see how many trees you've planted or in other words, how many searches you have clicked. You can use it globally which I enjoy, so in other words, it's accessible to anyone with technology worldwide. The app has a purpose and provides and educates people about why and how they're making a change and for what reasons.
What did you find frustrating or what was poor about the app?	With an app so basic yet effective, it is hard to fault it or find any negatives. It's very simple and it does what it says it does. However, the only con with this app is if you use it too much or spam the search engine constantly it can interfere with their data. Other than that, it's pretty faultless, so I'll definitely continue to use it as a legitimate green search engine for the ongoing future
Would you keep this app on your smartphone and use it in the future?	Yes

Participant #	3

What is the name of the app you downloaded for review?	Good on you - Ethical Fashion App
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	With the app you can look up a brand (of over 3000 brands, e.g., H&M, Levi's, and Zara) and the app immediately tells you how ethically responsible it is. It does this with the use of a five-star rating system
What did you find good or interesting about the app?	One the main screen there are blog articles. Each blog article has links to related brands. E.g., a block article about vegan shoes for work recommends different shoe models from ethical brands and provides links with them. There is also the possibility to search products directly in a search bar
What did you find frustrating or what was poor about the app?	The filter settings do not work. When I set filters the app crashes and redirects me to the blog articles on the main page. I researched the problems and this problem seems to happen a lot
Would you keep this app on your smartphone and use it in the future?	Yes

Participant #	4
What is the name of the app you downloaded for review?	Oroeco
How much does the app cost to download?	Free

Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	The apps tracks and outlines the impacts of one's personal behaviour and patterns, regarding the effects on climate change and sustainability. It has interactive ways to nudge people using it in the right direction to create better choices. It highlights how to save money and energy and inspire a cleaner and green way to live
What did you find good or interesting about the app?	I found it interesting to have a focus on all my behaviour in buying products, food, and travel modes. It definitely encouraged awareness of taking stock of personal choices and the effects
What did you find frustrating or what was poor about the app?	I found some parts very frustrating when I was trying to create a profile
Would you keep this app on your smartphone and use it in the future?	I'm undecided

Participant #	5
What is the name of the app you downloaded for review?	CodeCheck
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	Scan barcodes of food and cosmetics and check whether it contains allergens, unhealthy ingredients, and environmentally damaging ingredients
What did you find good or interesting about the app?	It is very easy to use and works quite fast. It has a nice interface and is a cooperation between

	different environmental groups. (Greenpeace, WWF, Food Standards Agency, a few German agencies etc.)
What did you find frustrating or what was poor about the app?	The climate score does not exist for many foods I scanned, which is the main reason I downloaded the app
Would you keep this app on your smartphone and use it in the future?	I'm undecided

Participant #	6
What is the name of the app you downloaded for review?	JouleBug
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	Keeps score of the users eco-credibility
What did you find good or interesting about the app?	I found it interesting when they compared the eco-activity the app was encouraging you to do with other eco-friendly activities
What did you find frustrating or what was poor about the app?	Some of the eco-activities were very basic. For example, opening a window on a hot day or hanging out clothes to dry on the line are things people do without thinking
Would you keep this app on your smartphone and use it in the future?	No

Participant #	7

What is the name of the app you downloaded for review?	Good on You
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	It provides information on how ethical clothing brands are. It provides ratings on a scale from 1 to 5 on how good the brand is
What did you find good or interesting about the app?	I was able to see which brands I buy from are more sustainable and ethical and which ones I should stay away from
What did you find frustrating or what was poor about the app?	I think it could have maybe included a map feature for the area you are in and click on different stores and check sustainability that way rather than having to look up individual stores
Would you keep this app on your smartphone and use it in the future?	I'm undecided

Participant #	8
What is the name of the app you downloaded for review?	Giki Badges
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	Giki scans grocery products and determines whether they are ethical, healthy, and sustainable. The app aids people in grasping the true impact they and their choices have on the environment

	around them. The app also connects you with more credible brands that share a common belief in supporting nature
What did you find good or interesting about the app?	I found it extremely interesting to see how my own food rated on the badge system. It made me realize how simple it is to swap my choices for more sustainable products and the impact every change makes. It helps me so much on my product choice and living as healthily and sustainable as possible
What did you find frustrating or what was poor about the app?	As much as I admire this app unfortunately it too has its downfalls. For example, there were many different barcodes I scanned that were not on the app. I would have also enjoyed if they displayed what aspects of the ingredients were good/bad for you and how. The main negative aspect was how I struggled to find some of my products on the app
Would you keep this app on your smartphone and use it in the future?	Yes

Participant #	9
What is the name of the app you downloaded for review?	Ecosia
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	Ecosia is a German search engine that donates 80% of its profits to non-profit associations that work on the reforestation program, which is mainly present in southern countries. Ecosia plants trees in Burkina Faso, Peru, Tanzania, Madagascar and twelve other countries

What did you find good or interesting about the app?	- Ecosia makes it easy to work for the environment - We can easily see our contribution to the environment in the number of trees planted (45 internet searches = 1 tree planted) - We can easily follow news about the action that Ecosia lead around the world
What did you find frustrating or what was poor about the app?	- The search engine does not offer as many search results as Google (Ecosia is powered by Bing) - Compared to Safari, Ecosia is less powerful. It needs a good internet connection to it
Would you keep this app on your smartphone and use it in the future?	Yes

Participant #	10
What is the name of the app you downloaded for review?	Ecosia
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	It uses the benefits made by our research on the internet to plant trees. They plant them in the areas where reforestation is needed
What did you find good or interesting about the app?	It doesn't change anything for the users because it's just a place where we can research all we want, such as Google. But it changes everything for the planet and for the ecosystem
What did you find frustrating or what was poor about the app?	I have not find yet something's not good about this app

Would you keep this app on your smartphone and use it in the future?	Yes

Participant #	11
What is the name of the app you downloaded for review?	Refill
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	The app provides the user with locations that provide refilling options for water, coffee and even food. The idea behind the app is to reduce single use plastic in drink bottles and coffee cups by giving users the information needed to find refill stations near their location. The user must turn on their mobile device location and they are taken to a map where they can see nearby stations. some of these stations are free water refill, some offer a reduced price for on the go coffee if you bring your own travel mug and some show users where they can buy dry foods by weight by bringing their own containers
What did you find good or interesting about the app?	I liked how simplistic the idea behind the app is. I found the app to be very effective and clear about the services of each location. I think the app will motivate users to live a low plastic waste life as it makes it very easy to do so and the convenience of the app will make users feel they are make a positive change no matter how small
What did you find frustrating or what was poor about the app?	The app is difficult to use in rural locations due to lack of services provided. Also for the services to be added to the app the location must make

	themselves known to the app themselves. As the app is reliant on location users must have their location services turned on their mobile devices and some users may not feel comfortable with this. This may also be a strain on the battery life of some devices
Would you keep this app on your smartphone and use it in the future?	Yes

Participant #	12
What is the name of the app you downloaded for review?	Too Good to Go
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	So the app offer you to buy produce and food from both restaurants and supermarket that otherwise would be thrown out. However, this is a Danish app I used to use largely. It does not exists in Galway unfortunately. but it is expanding to many countries, in order to stop food waste
What did you find good or interesting about the app?	it's a win-win, the consumer gets cheap food, while the restaurant or supermarket avoid throwing out food, while still earning a bit of money
What did you find frustrating or what was poor about the app?	It does not offer anything in Galway
Would you keep this app on your smartphone and use it in the future?	Yes

Participant #	13

What is the name of the app you downloaded for review?	Brightly: Eco Community
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Just Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	The app claims to be a community or blog-type of app that should be used to share and read articles about sustainability, green energy, eco-friendly lifestyles and climate change, and to talk about those topics with sustainability enthusiasts. It covers multiple aspects of a sustainable lifestyle, such as fashion, food, and home
What did you find good or interesting about the app?	a. It is an easy-to-use app: the whole app is well-organized and user-friendly, which I really appreciate, as new apps can be difficult to understand at times which makes the process more frustrating. b. The app has multiple topics that relate to sustainability so that I can choose to focus on one aspect, for example, sustainable fashion. c. The app has a linked shop where you can directly buy sustainable products which I think is smart
What did you find frustrating or what was poor about the app?	a. The app can get boring after using it for a while (there only really are three options: engaging in conversations with others in groups, reading blogs or visiting the shop). b. It misses interactivity or direct activism (call-to-actions) in my opinion. c. Updates on the blogposts on the app are app are not very frequent

Would you keep this app on your smartphone and use it in the future?	I'm undecided

Participant #	14
What is the name of the app you downloaded for review?	Depop
How much does the app cost to download?	Free
Can it be downloaded to the iPhone (ISO) and/or an Android phone?	Both iSO (iPhone) and Android
What exactly does the app claim to do or what service does it provide? (two or three sentences)	This app isn't typically advertised as a green app however it does promote sustainable fashion and encourages me to shop more ethically friendly options rather than fast fashion. This app acts as a market place where consumers can buy and sell clothes and other belongings therefore for me should be viewed as a green app
What did you find good or interesting about the app?	This app provides an environment for people to shop sustainably which in turn decreases the amount of people buying into fast fashion and unethically produced clothing. This supports a current issue that is important to me and this free widely available app makes it very accessible for people to support the slow fashion industry. Its also a trust worthy app with payments through PayPal and also a feature which allows buyers and sellers to leave reviews on each other
What did you find frustrating or what was poor about the app?	Sometimes sellers can be untrustworthy in terms of shipping times or even being untruthful about the condition of the item. Most sellers don't accept returns either so this can be frustrating if you were expecting an item of better quality

Would you keep this app on your smartphone and use it in the future?	Yes

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