Creating sustainable innovation through design for behaviour change: full project report

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Creating Sustainable Innovation through Design for Behaviour Change

Full Project Report

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Full Project Report

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Full Project Report

Executive Summary

Design is a significant driver of behavioural change, enabling, encouraging or discouraging particular practices from taking place. Already, approaches derived from the concept have enabled us to recycle, heat more efficiently, increase our exercise patterns and change the way we think about interaction, along with many more examples besides. Despite design's clear influence on human behaviour, the understanding of design for behaviour change is still fragmented and limited frameworks exist for its effective implementation in professional and public contexts.

In response, this project has surveyed current approaches of design for behaviour change and their use by private and public stakeholders. The aim was to elicit the challenges for professional stakeholders in understanding, accessing and implementing behaviour change through design. The further aim was to develop a cross-sectional overview or 'map' of current approaches, their purpose and their application as a first step to facilitate easier access and understanding. The project focused on small and medium size enterprises (SMEs), which constitute 99% of European businesses.

The project comprised of three parts: a cross-sectional literature review, a broad online survey and two follow-up focus groups with private and public stakeholders. The literature review provides a cross-sectional overview of current design for behaviour change approaches from key areas of ecological sustainability, health and well-being, safety and social design. It has surveyed current design for behaviour change approaches, how they are delineated from established behaviour change approaches in the social and behavioural sciences, and how they have influenced examples in the four key areas included in the review. The online survey has complemented the literature review by finding out about current understandings and uses of design for behaviour change in the private and public sector. It has provided insights into which theories are being used by non-academic stakeholders, what obstacles there are to access and implementation, as well as additional examples. The focus groups have added to the findings of the online survey elaborating on the understanding of design for behaviour change and its ethical implications as well as on ways to address obstacles and challenges to its implementation.

The complete results of the investigation are presented in this Full Project Report. It details the background of design for behaviour change and the methodological approach of the investigation. It then presents the findings of the 'theory review', which is divided into behavioural science approaches to behaviour change, design approaches and examples, and the relationship of which is visualised graphically. The theory review is followed by the 'access and innovation review' which provides a discussion of the understandings, access, obstacles and future potential elicited through the online survey and focus groups. The report concludes with reflections on the uptake of current design for behaviour change approaches by private and public stakeholders with a set of recommendations for the way forward.

The contribution of the project comprises firstly the broad overview of the diverse design for behaviour change approaches, their derivation, relation and application, supported by relevant examples within the different areas. Secondly, it offers insights into the understanding of design for behaviour change by SMEs and the perceived benefits and obstacles to its implementation. The findings highlight the currently still rather eclectic approach to design for behaviour change and the need for more systematic development, evidence based testing and more systematic and detailed representation of evidence based examples. In summary, the project outcomes offer a first step towards better access to design for behaviour change approaches through the positioning, explanation and visual mapping of the diverse approaches; through pointing out areas for development of research and examples to make design for behaviour change more accessible and useful to SMEs; and through providing a platform and forum for access and discussion.

The project findings have been disseminated through an international conference presentation (Helsinki, August 2014), through a summary report (September 2014), the full project report (October 2014), two journal articles (forthcoming), and a Wikipedia page (forthcoming). The project has further established a platform and forum for access to, and development and engagement with design for behaviour change through its website as well as through establishing a new Special Interest Group on Design for Behaviour Change under the auspices of the Design Research Society.

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1. Introduction

1.1   Funding scheme and response

The 'Creating Sustainable Innovation through Design for Behaviour Change' project was born in response to the 'Design in Innovation: Research Development Funding' call of the Arts and Humanities Research Council (AHRC) in August 2013 (AHRC 2013). The 'Design in Innovation' funding scheme is part of the AHRC's Delivery Plan (2011-15), which identified the discipline of design as a strategic priority. It responded to a scoping study (2012) by the AHRC in partnership with the Design Council, which investigated the role of Design Research in UK universities and its connections with businesses and policymakers. The Design Council report highlighted the importance of small and medium size enterprises (SMEs) for design innovation as well as shortcomings in the accessibility of research knowledge in the context of innovation.

In line with the Design Council report, the 'Design in Innovation' call focused on the role of design in service innovation and in the innovation ecosystem as well as on evidence of its impact in these contexts. The scheme invited short, 6-months collaborative research development projects for research networks and workshops, including scoping studies or small research projects. Innovative and creative projects addressing new areas at the cross-section of design and innovation were favoured. The results from these projects are envisaged to help the AHRC to scope further targeted calls for funding relating to design.

In response to the 'Design in Innovation' call, the project presented here focused on the role of design for behaviour change as a driver for sustainable innovation. Design has always been linked to change, and Herbert Simon's observation in 1969 that designers are "devising courses of action to change existing situations into preferred ones" summarises this aptly. However, since then the understanding of design has further developed and two changes have been significant as drivers for the present work. Firstly, situations are no longer viewed as neutral and object-centred. Instead, it is acknowledged that design inevitably has an impact on human behaviour and that this is dependent on many variables including context, motivation, etc. Therefore, in design, and more specifically design for behaviour change there has been a recent focus on service design, which is also reflected in this project. Secondly, there is a recognition, both, that designers need to take responsibility for the ensuing actions, but also that usually there are many people involved in any one situation and therefore the question arises as to *whose* preferences are to be addressed.

This becomes quite clear when working with a range of stakeholders – from industry, academy and government, private and public sectors, commercial, social, charitable and not-for-profit organisations – that views of what behaviour change means, and whose behaviour is to be changed diverge quite strongly. They include anything from what might be termed 'behaviour management' and micro-behaviours to large-scale ideas of ethical changes, from influencing customer buying behaviour to life style changes.

Within this array of views, we want to position design for behaviour change as an approach to ethical change that makes innovation sustainable not just for the individual, but for us as well as for future generations. Our project has therefore focused on how design for behaviour change can drive sustainable innovation, in particular for SMEs which constitute 99% of businesses in Europe (EC 2014).

1.2   Aims and objectives

The aim of this project was to develop a better understanding of design for behaviour change, of its access and implementation and of its role in driving sustainable innovation, with relevance to service providers in the key areas of ecological sustainability, health and well-being, safety and social design.

In order to address this aim, the project has adopted the following strategic objectives:

1) To bring together a significant inter-disciplinary and multi-institutional network of academic partners and non-academic stakeholders with an interest in sustainable innovation through design for behaviour change. To provide a holistic perspective and strategic capability through this network to carry the work forward beyond the duration of this funding application through public and private sector engagement and policy development.
2) To develop a holistic overview of design for behaviour change based on a) a desk-based survey of current literature, including examples and approaches to design for behaviour change, to identify current and potential approaches and applications; b) a broad online-survey among relevant public and private stakeholders to ascertain current understandings, needs and opportunities.
3) To explore and formulate effective strategies of collaboration and implementation to address the needs and opportunities for sustainable innovation in service and business communities through a number of face-to-face focus group events with academic and non-academic stakeholders.
4) To create a project resource and interactive platform to raise public awareness and create a public debate about sustainable innovation through design for behaviour change engaging a diverse set of audiences.

The contributions and benefits of the project include:

1) A cross-sectional overview of the subject, including current approaches and examples from within four areas of design for behaviour change (ecological sustainability, health, safety, social design), their derivation and relationships as well as the applications and benefits, challenges and obstacles to the implementation of design for behaviour change.
2) Better access to design for behaviour change and its implementation through the positioning, explanation and visual mapping of the diverse approaches and examples, and through pointing out areas for development of research and examples.
3) A set of insights and recommendations for the development of the field of design for behaviour change and its role in promoting sustainable innovation.
4) Providing a resource and forum as a community and contact point for all stakeholders interested in design for behaviour change to raise awareness, and enable on-going debate, development and promotion.

1.3   Approach

The core aim of the project was to provide a cross-sectional overview of design for behaviour change, of its understanding, access and implementation covering views from both academic and non-academic stakeholders. To achieve this aim, the main project activities were threefold: they comprised a cross-sectional literature review, a broad online survey and two targeted follow-up focus groups with private and public sector stakeholders.

The cross-sectional literature review has provided a broad overview of current design for behaviour change approaches and examples from the key areas of ecological sustainability, health and well-being, safety and social design. The online survey has elicited current understandings and uses of design for behaviour change and its role for sustainable innovation in the private and public sector. The focus groups have elaborated on the understanding of design for behaviour change and its ethical implications, as well as on ways to address obstacles and challenges to its implementation. All three data sets were the triangulated to derive an understanding of the current situation, and to enable drawing up recommendations for future research and development to enable a cross-sectional approach to design for behaviour change. The stages of the project approach and their integration are schematically represented in Figure 1.

Detailed literature review of Design for Behaviour Change in relation to business (SME).

Focus group with Design for Behaviour Change practitioners aiming to contextualise and supplement online survey.

Understanding future research area.

Online survey discovering understanding of, use of and thoughts on Design for Behaviour change by business (SME).

Triangulation of results and final report.

Figure 1: Roadmap of project

To enable such a broad overview, the project brought together a team of 7 researchers and 4 advisors from 7 universities from key design departments in the UK and the Netherlands. Its breadth and expertise allowed the team to cover the four core subject areas from different perspectives, including both design and behavioural science approaches. In addition, participants from a broad base of private and public organisations, which were invited to engage with the project through the online survey and focus groups, contributed their diverse expertise of design for behaviour change approaches and examples within professional practice in the public and private sectors. Thus, knowledge gathered from academic research and current professional knowledge and views of design for behaviour change are synthesised and complement each other in this report.

1.4   Format and scope of the Summary Report

This report presents the full findings of the project. Together with the summary report and other outputs, this full project report is available from the project website: www.behaviourchange.eu

The full report details the background of design for behaviour change and the methodological approach of the investigation. It further presents an overview over the theoretical approaches and examples in the 'theory review', which is drawn from the literature review, online survey

and focus group results. It is divided into behavioural science approaches, design approaches and examples of behaviour change, which the review relates through graphical illustrations. This is followed by the 'access and implementation review', which discusses the understandings, access, challenges, obstacles and future potential of design for behaviour change. Results were elicited through the online survey and focus groups, and informed by the literature review.

The report concludes with reflections on the current role of design for behaviour change for sustainable innovation by private and public stakeholders. It offers a set of recommendations for the way forward to improving understanding and access to knowledge about design for behaviour change approaches and practices.

2. Design for Behaviour Change and its Background

Herbert Simon's early understanding of design acknowledged its capacity to create change in "*devising courses of action to change existing situations into preferred ones*" (1969, p.129). Today, it is widely recognised that design in its various guises of objects, services, interiors, architecture and environments can play an important role in influencing human behaviour (e.g. Brown and Wyatt 2010, Consolvo, McDonald and Landay 2009, Fry 2008, Lockton, Harrison and Stanton 2010: 382, Niedderer 2013), and that design can create both desirable as well as undesirable change, both intentionally and unintentionally.

Unintentional changes of behaviour through design, and their consequences, are very common. For example, the impact of cars has been profound with respect to social mobility, transforming cities and increasing resource demand and pollution. While social mobility is generally regarded as positive in this context, the impact which associated road building has had on cities has often been detrimental to living conditions. Even more so, resource use and pollution is requiring a rethinking of both human behaviour and the technology used, promoting schemes for less travel or alternative transport such as trains and bike riding. Similarly, mobile phones and computers have transformed the speed, social code and mediums used to communicate. Here also, while the increased ability to communicate is generally seen as positive, it is acknowledged that they cause an increase in stress levels (Ilstedt 2003) with a wide range of health impacts. It has further blurred social understandings of public and private spheres to various effects such as causing a nuisance (e.g. talking on your mobile phone in public), safety hazards (e.g. texting while driving) or abuse (various internet threats) (Niedderer 2014).

In these examples, as in many others, we can see that designs have been created with a particular, often narrow focus, which one might regard as the supportive function of design to enhance human abilities within existing behaviours, e.g. of travel and of communication over distance. In these kinds of examples, there is no explicit intention apparent to change behaviour, and no foresight or consideration as to what the consequences or 'side effects' of any design might be, while inadvertently they have created large scale behavioural change, with both positive and negative consequences.

Design also has a history of attempting intentionally to create positive change. For example IDEO's 'Coasting bike platform' sought to address the fact that a large segment of the US adult population were no longer riding. Despite the population's fond memories of cycling, they were put off by the 'lycra-clad' bike brigade and the complexity of modern bikes. The

resulting new design took cycling back to basics focusing on the simplicity of cycling to encourage a large part of the population to take to cycling again (Moggridge, 2008a). Although change is only implicit also in this case study, and no explicit reference to behavioural change theory was acknowledged, IDEO's design process clearly identified barriers to cycling in complexity, safety and sales, which were addressed through the design to facilitate behavioural change. This can be considered as intentional change aligning to Simon's early understanding of design changing existing situations into preferred ones. This example highlights a general dilemma in the area of design, which is that considerations about behaviour change, even where they are intentional, often remain implicit.

While it can be argued that designers have always attempted to utilise design to lead to "preferable outcomes", in response to current recognitions of the important role of design, Jelsma (2006) calls for designers to take moral responsibility for the actions which take place as a result of humans interactions with artefacts. He posits that, whether intentional or not, "artefacts have a co-responsibility for the way action develops and for what results. If we waste energy or produce waste in routine actions such as in the household practices, that has to do with the way artefacts guide us" (Jelsma 2006, p.222).

Importantly, design for behaviour change acknowledges this responsibility and seeks to integrate this thinking into the design process to enable consideration for the actions and services associated with any design and their contexts, and the consequences of these actions. It thus seeks to put higher on the agenda ethical behaviour and goals in general. In order to do so, design for behaviour change draws on a range of explicit theories, approaches and tools which have been developed in an attempt to encourage pro-environmental and social actions and lifestyles from designers as well as user.

Design work leading to the development of design for behaviour change was initially conducted under the mantel of design psychology or behavioural design, a term first coined by Don Norman in the 1980s with respect to product design (Norman, 1988). Norman's 'psychology of everyday things' of the 1980s introduced to designers key concepts from ecological psychology and human factors research, such as affordances, constraint feedback and mapping, which have provided guiding principles to design of the intuitive use of artefacts. This work has been influential, despite not engaging in the specific language of behavioural change. Over time, models have progressed to be more explicit in influencing behaviour, such as emotion design (e.g. Desmet, Overbeeke and Tax 2001) and persuasive technology (Fogg 2003). Most recently, a number of theories have developed that explicitly address design for behaviour change, such as the Loughborough model (e.g. Lilley 2009), Design with Intent (Lockton, Harrison and Stanton 2010) or mindful design approaches (Niedderer 2014), among others.

With the emergence of the notion of behaviour change, a much more explicit discussion has also begun about the deliberate influence of design; of the areas in which it is, could or should be applied; whether its influence should be implicit or explicit, voluntary or prescriptive; of the ethical consequences of one or the other in various contexts; and also of the approaches that are available and emerging to offer guidance and support. However, in a review of this area, Boks (2012) has identified that a lack of common terminology, formalized research protocols and target behaviour selection are still key issues for this approach. In response to the emergent literature and findings, this project has sought to provide an overview of the current positions on design for behaviour change, its foundations and relevant examples as well as current views on access, implementation and its ethical implications, which are presented in the following.

3. Methodology

3.1 Overall approach

The core aim of the project was to provide an overview of design for behaviour change and its implementation across the four key areas - ecological sustainability, health and well-being, safety and social design. The project therefore sought to gather knowledge generated through academic research, such as theoretical models and examples that demonstrate their application, as well as knowledge by professional stakeholders about the access to, understanding and implementation of design for behaviour change.

This has led to the threefold approach that included a cross-sectional review of predominantly academic literature, as well as an online survey and two follow-up focus groups with private and public stakeholders. The three parts of the methodology have complemented each other and together they have allowed building up a broader picture, which is presented in this project report. In the following, the purpose and conduct of the literature review, the online survey and the focus groups is explained before the integrated results are presented in sections 4 and 5.

3.2 Literature review

Although the influence of design on human behaviour has been recognised for some time, design for behaviour change has only been recognised formally over the last decade and is still immature, without a coherent set of approaches or framework to guide access for interested stakeholders. The aim of the literature review therefore was to develop a relational overview or 'map' of design for behaviour change approaches and their relationships to provide a first step and guide towards a better understanding, access and evidence base for the successful implementation of design for behaviour change across the different fields of its application, and towards stimulating lasting behaviour change.

To this purpose, the literature review has explored the relatively new body of work with the explicit focus on designing for behavioural change, while acknowledging that the scope of how design can be applied to change behaviour is broad and extremely multidisciplinary. More precisely, the literature review has surveyed current approaches to design for behaviour change to provide a broad cross-sectional overview covering the key areas of ecological sustainability, health and well-being, safety and social design. This includes current approaches to behavioural change from the social and behavioural sciences and how these have informed relevant design approaches, as well as a collection of design examples from the four focus areas and which are related to the relevant design approaches.

The review covered the three areas as follows:

1. Key theories and models of behaviour change from the social and behavioural sciences were reviewed including their areas of application to provide the foundations for the subsequent discussion of design for behaviour change models.

2. Behaviour change approaches in design, covering established and emerging models and toolkits and their delineation from models in the social and behavioural sciences. The identified approaches were analysed thematically to map out the different perspectives, including common, dominant and emerging approaches as well as the absence of approaches.

3. A selection of examples from the four design areas - sustainability, design for health, social design and safety (including crime prevention) - which were identified as current key areas through a preliminary review of the literature prior to the project. These examples are related where possible to supporting and relevant theories of design for behaviour change.

The approach to the three levels of the analysis, and that joins them, follows Clark (2009) who has identified a common divide in approaches to understanding behaviour, which falls into those primarily addressing the individual and those addressing the context. This 'agency structure' divide from behavioural change theory has provided a useful starting point for the analysis because design can be seen to interact at the level of both the individual (via human-artefact interactions) and broader social structures and systems (within which individuals act). Indeed, the ambition of designers may need to progress from product improvement and re-design to systems innovation if it is to address more complex ecological and social challenges. As an example, Brezet (1997) proposed that, for eco-design to achieve large-scale reductions in resource use, a move from product improvement and re-design to systems innovation would be required.

The majority of theories, approaches and examples for the literature review have been drawn from the cross-sectional survey of academic literature on design for behaviour change. Based on the broad expertise of the research team, a cross-section of the most relevant prominent as well as novel and emerging theories and examples from the four subject areas have been identified. The review is does not comprehensive and does not seek to cover all theories and all sectors. This was outside the scope of this short project. Instead, it seeks to offer a useful and robust guide to designing for behavioural change through an overview of its foundations, and a discussion of its strengths and weaknesses, both in the available material and in its application.

These findings of the academic literature review are importantly complemented through theories, models and examples identified through the online survey and focus groups with public and private stakeholders. These are integrated with the literature review, and their professional use is indicated where appropriate. Thus, under the name of the 'Theory Review', in section 4 the results of the literature review are presented, integrated with the approaches and examples elicited from the online survey and focus groups.

3.3   Online survey

The online survey has complemented the literature review by finding out about current understandings and uses of design for behaviour change and its role for sustainable innovation in the private and public sector. Its aim was to provide insights into which theories and approaches are being used by non-academic stakeholders, what obstacles there are to access and implementation, as well as to gather additional, current examples.

The online survey was conducted via SurveyMonkey and announced through the Design Council's Newsletter, which reaches a large national and international audience of around 32,000 subscribers. The survey was open from 22 May-31 August 2014. During this time, the survey was completed by 131 respondents, of which 77 respondents completed the entire survey. Fifty-four respondents completed the survey partially. This offers a statistically significant number of responses.

Of the 131 respondents, roughly one third were Micro businesses (Mi: 1-10 employees); Small and Medium size enterprises (SE: 11-49 employees, ME: 50-249 employees); and large organisations (LO: >250 employees). Furthermore, 55% of respondents worked in private/commercial organisations, followed by 31% in the public and education sector. Charities were represented with 7%, and social enterprises (including non-for-profit and community interest companies) 5%. Two per cent were from other organisations such as professional bodies.   The survey thus provided an even spread of target group(s) for comparison, both in terms of size as well as the nature of the organisations.

The survey had 23 questions in five sections, which were designed to elicit the nature and demography of the respondent organisation, the understanding and views on innovation, the understanding, views and uses of design for behaviour change, and means and obstacles to access information on design for behaviour change. The final question offered participation in the focus groups, and/or to receive a copy of the report:

S1: About your organisation and you (Q1-8)
S2: Innovation (Q9-12)
S3: Facilitating behaviour change (Q13-19)
S4: Access and barriers to knowledge (Q20-22)
S5: Finishing off (Q23)

The full set of questions can be found in Appendix 1. One lesson learned from the survey about its design was that some of the questions in the first section could usefully have been moved to the end of the survey. As it was, the first section was relatively long and put some people off completing the survey in its entirety: several respondents dropped out after question 6 (although some entered information in the later parts of the survey again).

The quantitative analysis of the data was provided through SurveyMonkey. It provided an overview over the whole set of respondents as well as a number of filters for more detailed analysis. Due to the focus of the project on SMEs, the filter was used in particular to compare data between Micro, Small, Medium and Large Organisations. The qualitative data of the open responses were checked and evaluated manually to provide for further evaluation and interpretation of the quantitative data. At times, this also allowed for calibration of the system data analysis. For example, where respondents had chosen to give an answer under 'other', which could be attributed to one of the specified answers, the data and percentages were manually adjusted accordingly to give a clearer picture. This applied particularly to question 1, where respondents were asked to classify their organisation into e.g. "public sector" or "private/commercial organisation", etc. and with which some respondents appeared to have difficulties. For example, two respondents answered "self-employed" instead of classifying themselves as "Private / Commercial Organisation", and their answers were manually moved into this category.

The results of the survey are discussed in section 5 "Access and implementation review", complemented by details from the focus groups, participants of which were drawn from the online survey. Collating the results of the survey and focus groups allows for a richer interpretation of both results, which were therefore integrated.

3.4   Focus Groups

The aim of the focus groups was to form discussion with non-academic professionals to elicit key data concerning understanding, challenges and opportunities of adopting and implementing design for behaviour change strategies. Particularly, this focused on use by small to medium size enterprises (SMEs) and how the concept can help drive innovation.

3.4.1   Setting and sample

Two focus groups were conducted each at separate academic institutions: one on 10th July 2014 at the Royal College of Art (RCA) in London, and one on 16th July 2014 at the University of Warwick, Coventry, lasting approximately three hours each.

A broad sample of participants was aimed for in order to reduce selection bias and increase transferability of results from samples to populations (Freeman, 2006). Participants were recruited through the online survey with respondents being given the opportunity to sign up for one of the two focus groups. In addition, researchers send invitations to potentially interested contacts, who were also asked to complete the survey if interested.

Overall, 30 respondents indicated their interest in participating in the focus groups with 23 respondents volunteering for the focus group in London, and 7 for the focus group in Coventry. Of these 14 and 7 participants were invited respectively. In total 16 participants attended the two focus groups: 10 attended the first focus group at the Royal College of Art, London (out of 12 who signed up), with six attending the second focus group held at the University of Warwick, Coventry (out of seven who signed up). A full break down of the participant business background is shown in Table 1. The majority of participants from SMEs, although five participants from large organisations were also included, which were from the public sector (2), charities (1), professional bodies (1) and a commercial organisation (1). This provided a good spread of views from different sectors and across different size organisations, while keeping the focus on SMEs. Please note that in accordance with research ethics approval specific details such as age, gender were not obtained.

Table 1: Business background of focus group participants

Business type	Number of participant from business type	
	FG1	FG2
Private/commercial organisation	5	4
Social enterprise	1	-
Charity	3	-
Public Sector	1	1
Professional body/ chartered society	-	1

3.4.2 Focus group methodology

Krueger (1994) defines a focus group as a carefully planned discussion designed to obtain perception on a defined area of interest in a permissive, non-threatening environment where group members influence each other by responding to ideas and comments in the discussion. Using an innovative combination of Krueger and Casey's focus group methodology (2000) and of co-creation and participatory design workshop methodologies (Sanders, Brandt and Binder 2010), the focus groups were designed to elicit deeper insights about the participant's understanding and use of design for behaviour change. Especially, they were designed to include a number of interactive elements to facilitate engagement and make participants feel comfortable and able to draw on their experiential knowledge in the area.

A framework concerning the areas of discussions and prompts was developed to guide the focus groups (Table 2), and which was informed by the preliminary assessment of results of the online survey. This resulted in a structure of three interactive sessions, with sub-tasks within each, to enable participants to become immersed in the discussion and draw upon their experiences. The sessions included an introduction of the participants to each other, a session to elicit participant's understanding of design for behaviour change and the benefits, challenges and obstacles to its implementation and included a brief design exercise, and a final session exploring ways forward. The focus groups were each of approximately 3 hours duration, and the programme structure can be found in Appendix 2.

Table 2: Focus group outline and topic guide

Section	Content	Broad Purpose
Introduction	About the project / survey results so far/ Purpose of the FG group	*Setting the scene*
Introductions from participants	Introducing each other, their interest in behaviour change in design, and any examples or case studies – what design techniques or principles have you used?	*Getting to know each other/s concerns*
Your take on design for behaviour change and its challenges	Discussion of participants' approaches to this area, and the problems encountered in accessing and implementing it, including design exercise	*Gathering insights and discussing*
What's the way forward? What would be helpful to you? What do you want to do, that you can't?	Arrive, collaboratively, at a set or list of features / criteria for making behaviour change research more accessible or usable too Small to Medium size Enterprises in the context of innovation—issues potentially including evidence, language, examples, methods, theories	*Structuring / Developing solutions*

The introduction provided a presentation of the outline of the project along with on overview of the preliminary results of the online survey. This was followed by an exercise for participants to get to know each other, where participants talked in pairs, and presented to the group each others name, professional role, and interest in design for behaviour change including one key example. The second session sought to elicit the understandings of and create discussion about the nature and issues surrounding design for behaviour change from

the perspective of the participants. The session started with a short design exercise (improving the building planning application process), which was used to facilitate intuitive interactions between participants to enable them to question their own experiences and views on behaviour change as a precursor to the main discussion about design for behaviour change. Participants where then asked to very briefly give a personal definition or view of what they understood design for behaviour change to be, which was followed by a discussion of its benefits, challenges and obstacles to implementation. The final section sought to elicit what participants felt might be the way forward to improve the use of design for behaviour change within professional practice. This session was structured into small group discussions, and a reporting phase which led to an open unstructured discussion of the issues brought forward.

3.4.3   Procedure and analysis

Once the project and current finding from the online survey had been presented the aims of the session were given along with written informed consent obtained from the participants. At this point dictaphones were turned on as participants had consented to the session being recorded. Each focus group was facilitated by members of the project team with the principal investigator (Niedderer) being present at both. Five facilitators were present at the first focus group with four facilitating the second. The three stages of the focus group were facilitated by different members of the project team which was decided upon prior to the focus group starting. Detailed notes were made by all project members and were included in the analysis. The sessions, although having a formal structure, were encouraged to have a flowing discussion both within and between participants and researchers. At the end of the session participants were thanked, and feedback sheets and claim forms for a remuneration fee for participants were collected. Notes from the discussions as well as research notes by the researchers were collected.

Both focus groups were recorded on a dictaphone and transcribed verbatim. Researchers' and discussion notes were written up and included in the analysis to help contextualise the narrative of the transcripts. They were analysed by Mackrill and Niedderer using thematic analysis to extract key themes and categories within the data (Strauss & Corbin, 1998). Mackrill used NVIVO 10 software, and Niedderer coded the data by hand. Both coded the transcripts using a mixture of inductive and deductive coding approaches. Deductive coding was carried out using the focus group outline to form the main themes of the analysis with inductive coding drawing out nuances held within these themes. The two sets of analyses were triangulated to form the final analysis.

The focus groups produced an engaging dialogue between the participants and the researchers. Three main themes emerged from the data (based on the focus group outline) which covered "knowing design for behaviour change use and concerns", "current take on design for behaviour change, benefits, challenges and obstacles" and "design for behaviour change: the way forward". A full break down of the coding schedule is shown in Tables 3, 4, and 5.

The results of the focus groups are discussed in section 5 "Access and implementation review", together with the discussion of the online survey results. The results of the survey and focus groups were collated to allow for a richer interpretation of both results.

Table 3: Themes extracted for 'knowing each other's concerns'.

1.Knowing DfBC use and concerns	
Case study examples	
	Adoption of positive behaviours
	Crowd sourcing and charitable giving
	Environment design
	Health (all types occupational, physical etc.)
	Misc. Comments
	Output of work activity
	Product innovation
	Service design
	Social design
	Waste management
Design Principles and Techniques used	
	Co-production
	Double diamond
	Ethnography
	General iterative approach
	Government toolkits
	Habit testing
	Nudge theory
	Philosophical approach
	Psychology principles
	User centred design

Table 4: Themes extracted for 'your take on design for behaviour change'

2. Your take on DfBC	
DfBC benefits	
	Corporate benefits (brand identify etc.)
	Customer focus
	Efficiency
	General benefits
	Health
	Increase in (design) knowledge + thinking
	Increase in design usage
	Innovation
	Monetary
DfBC challenges	
	Buy-in (legitimacy)
	Change management
	Demographic challenges
	Ethical + legislation sensitivities
	Future proof
	Intangible
	Investment and cost
	Presenting information
	Scale of change

	Time

DfBC obstacles	
	Definition
	Examples
	Lack of evidence
	Lack of metrics
	Language
	People's perceptions
	Mini exercise - how would you address the problem
	Misc. comment
	Position of understanding of DfBC

Table 5: Themes extracted for understanding 'the way forward'

3.DfBC - What is the way forward?	
	Misc. comment
What do you want to do that you can't	
	Access to academic journals
	Access to general DfBC information
	Evaluation of DfBC
	Problem of Design as a concept
	Understanding why it fails
What is the way forward	
	Building a framework to explore DfBC
	General guidance about DfBC use
	Promote information on DfBC
	Understanding what element of behaviour is targeted
What would be most helpful for you	
	Evidence
	Practitioner based information resource

3.5   Dissemination and continuation

The project has used a number of different formats to publish and disseminate the project results. Results are published in the form of: a conference-paper presented at the NordDesign 2014 conference in Helsinki, Finland; the summary report presented at the final results workshop in September 2014; this present final full project report; two journal articles (forthcoming at the time of publication of this report); and a project video; all of which are or will be available from the project website www.behaviourchange.eu.

In addition, a new Wikipedia page on design for behaviour change will enable public engagement in building the definition and overview of design for behaviour change and associated theories and practices. On-going information, public interaction and discussion is achieved through the use of social media and with a Special Interest Group (SIG) on Design for Behaviour Change, which has been formed as part of the Design Research Society SIG programme. This new SIG has a discussion list on LinkedIn and a twitter address: @behaviourchangeu.

4. Results of Theory Review

4.1 Introduction

The theory review brings together the findings from the literature review and integrates it with models and examples used by professionals elicited through the online survey and focus groups. It explores the relatively new body of work focused on design for behaviour change across the areas of ecological sustainability, health and well-being, safety, and social design whilst acknowledging that the scope of how design can be applied to change behaviour is broad and extremely multidisciplinary. It seeks to provide a coherent relational overview or 'map' of design for behaviour change approaches and examples, and their relationships, as a first step and guide towards a better understanding, and easier access to design for behaviour change across the different fields of its application.

The theory review is presented in three sections: in section 4.2, the origins of behaviour change theories from the behavioural and social sciences are introduced; section 4.3 introduces behaviour change approaches in design, covering established and emerging models and toolkits, and their delineation from behavioural sciences; section 4.4 presents select examples of design for behavioural change from each key area reflected on the models discussed in the previous sections. The conclusion summarises the findings of the theory review, and draws out insights about important relationships and uses as well as gaps in the availability of theories, tools and examples.

The approach to the three levels of the analysis across the three sections follows Clark's identification of a common divide in approaches to understanding behaviour, which falls into those primarily addressing the individual and those addressing the context (Clark 2009). This divide in behaviour change theory can be seen to date back to Lewin's (1935) early understanding of behaviour, that a person's behaviour (B) is a function of his or her own personality, or other 'internal' factors (P) and the physical and social environment (E) $B = f(P, E)$. On this basis, Clark (2009) has proposed the division of approaches into those that primarily address the *cognition* of the individual, and those which address the *context* outside the individual. This divide can be further illustrated through Simon's metaphor of a pair of scissors (1990). Both 'blades' shape behaviour, but a model or technique will often concentrate on either individual cognition (mind, individualistic rational choice models) or context (environment, social structuralism theories). This 'agency divide' provides an initial framework to position the behaviour change strategies that we argue have been adopted and adapted in a design context. Importantly, there is a space that is a kind of 'middle ground' where models combine elements of individual and contextual agency to elicit change, and which we have added to the model (Figure 2). Further, the 'scissor' model is used to elucidate the relationships and 'continuum' between the different theories and levels.

Figure 2: Agency divide

4.2   An overview of behaviour change models in the behavioural sciences

The behavioural sciences broadly encompass the study of human behaviour, drawing on insights from economics, psychology and neuroscience. For example, Darnton's (2008) review of behaviour change models and their uses outlines 60 social-psychological models of behaviour, distinguishing between models of behaviour and theories of change.

Some behavioural models are mutually incompatible (Gintis 2007) using different foundational beliefs as their basis. For example, many recent findings in the behavioural sciences challenge established views that people solely make decisions with rational, self-interest and always respond well to financial incentives or environmental arguments. In fact, people are often influenced by variables that are not related to either, and are uncertain about the consequences of their actions (despite clear evidence) and regularly discount future costs (Brekke & Johansson-Stenman, 2008).

The review of behavioural change theories quickly identifies the above mentioned divide between the individualistic rational choice model and social structuralist theories (e.g. Jackson 2005). In other words, there is a divide between a focus on agency versus that on structure. The individualistic rational choice model of behavioural change has been dominant, and places agency with an individual to act. By contrast, the social structuralist theorists suggest that the individual person is not the appropriate level for analysis. Instead, they suggest that behaviours in many instances can be viewed as consequences of societal norms and expectations that are held in place by the systems of provision and social structures that the individual lives within.

Figure 3: Mapping behaviour change theories from Individual (cognitive) to environment (context).

In addition, a third model is emerging, which mediates the middle ground between individual action and structure in order to reconcile the first two, including for example social practice theory. Other categorisations are also emerging, making the picture yet more complex. They include for example models of internal and external locus control (Rotter 1990), which relate to perceptions of internal and external influences and empowerment, often expressed as motivation, and prescriptive or seductive influences in design literature, or the attribution of models to a particular (subject) areas of application.

The divide between cognition (person, individualistic rational choice models) and context (environment, systems, social structuralist theories) has been used to map out change strategies in Figure 3 to help conceptualize the variety of theories and the conceptual split between agency versus structure models. The left hand side of Figure 3 shows strategies aimed predominately at influencing individual behaviour, whereas the right hand side lists strategies that may shift the environment and as a result influence behaviour in some way. An additional way of observing this is to see those models on the left as cognitive and those on the right as context based interventions.

This section provides an overview and discussion of the most prominent models of behaviour change theory. These range from the more traditional theories through to more recent models that can be seen to influence the developing domain of design for behaviour change.

4.2.1   Individualistic rational choice models

The individualistic rational choice model of behaviour change has been dominant in the behavioural sciences, and places agency with an individual to act. The model is founded on three broad principles: choice is rational; the individual is the appropriate choice of analysis; behaviours are self-interested (Jackson, 2005). Theories aligned to the rational choice model are outlined below.

4.2.1.1   Theory of planned behaviour

The Theory of Planned Behaviour (TPB) describes a group of cognitive theories which understand behaviour as an external expression of internal beliefs and attitudes. The TPB is one of the most widely cited and applied behaviour theories. The TPB (Ajzen 1985, 1991; Ajzen and Madden 1986) evolved from the theory of reasoned action (Fishbein and Ajzen 1975) which proposed that intention to act was the best predictor of behaviour.

Intention is determined by appraisal (of the pros and cons, risks and benefits and alignment or divergence with social norms) of the intended behaviour (Munro et al 2007). Intention is itself an outcome of the combination of attitudes towards behaviour. That is, the positive or negative evaluation of the behaviour and its expected outcomes and subjective norms. These are the social pressures exerted on an individual resulting from their perceptions of what others think they should do and their inclination to comply with such social pressures. The theory of reasoned action suggests that intention to act is the best predictor of behaviour.

The degree of perceived control over the outcome is also thought to be a factor in determining intention. This is closely related to the concept of self-efficacy (Bandura 1986, 1997, Terry et al. 1993). Self-efficacy means that achievement of a goal is determined by the level of confidence in our capability and capacity to achieve the necessary performance and

/or access the resources to support goal achievement. In addition to self-efficacy expectancy theory, Vroom et al (1983) argue that motivation to act is similarly influenced, but also by the value placed on the outcome. TPB added a third set of factors as affecting intention (and behaviour): perceived behavioural control. This is the perceived ease or difficulty with which the individual will be able to perform or carry out the behaviour, and is very similar to notions of self-efficacy (Bandura 1986, 1997; Terry et al. 1993).

Widely used in health, the TPB is useful for predicting behaviour and for retrospective analysis of behaviour change (Armitage and Conner 2000, 2001; Taylor et al. 2007). It is suggested the TPB can predict 20-30% of the variance in behaviour brought about via interventions. The TPB is not considered useful for planning and designing interventions to prompt behaviour change (Hardeman et al 2002; Taylor et al. 2007; Webb et al. 2010). However, it may be useful in the design process for identifying particular influences on behaviour that could be targeted for change.

4.2.1.2   Health belief model

The health belief model (HBM) (Rosenstock 1966; Becker 1974; Sharma and Romas, 2012) argues that behaviour is determined by a number of beliefs about threats to individual well-being and the effectiveness and outcomes of particular actions or behaviours. This cognitive model is grounded in an assumption that a purposeful (even though speedy and possibly unconscious) appraisal of perceived threat or risk versus perceived benefits and barriers determines action or non-action. The model also acknowledges the impact of self-efficacy (Bandura 1997) as a determinant of action, i.e. the capacity/capability to achieve the new behaviour. The HBM suggests that a variety of internal and external cues, which affect the perception of threat, may trigger actual behaviour change. Internal cues may include emotions, e.g. anxiety or experiences, e.g. feeling unwell. External cues may include environmental prompts or media campaigns. These internal or external cues affect the perception of threat and can trigger or maintain behaviour. Barriers can include physical or psychological discomfort arising from the new behaviour and the time taken to feel the benefit.

An individual is thought to be unlikely to make changes if the perceived threat is insignificant or they do not feel vulnerable to it. Similar non-response effects have been noted if the 'cost' is high but perceived benefits are low. e.g. if the remedy carries unpleasant side effects or disrupts habitual behaviours more than experienced by living with the problem. Perceived barriers are said to be the strongest predictor of the decision to act or not. Although widely used in health, the HBM has been applied to the other types of behaviour, such as recycling (Lindsay and Strathman 1997). It is most suited to explaining or predicting patterns of behaviour but has low predictive power. In common with other cognitive models, HBM does not include social or economic or unconscious (e.g. habitual) determinants of behaviour, which are generally considered to be at least as important as the personal cognitive factors covered by the model (Jackson 2005).

4.2.1.3   Stages of Change (Transtheoretical model)

The Stages of Change (SoC) model is also known as the Transtheoretical model (Prochaska 1979; Prochaska and DiClemente 1983; Prochaska et al 1992). First applied to smoking cessation (Sutton et al 2000) and now commonly applied to other addictive behaviours e.g. the design of energy feedback (see Ai He et al., 2010). This is also a cognitive model, which

posits that individuals contemplating a behaviour change go through a five step cycle of preparation. The five categories represent different milestones, or 'levels of motivational readiness' (Heimlich and Ardoin 2008), along a continuum of behaviour change; These stages are (i) pre-contemplation, (ii) contemplation, (iii) preparation, (iv) action, and (v) maintenance (Figure 4).

Each stage represents different stages of motivation and readiness to make the change. Individuals may move back and forth between stages in a cyclical (not linear) manner, sometime over many years. The transition between stages is determined by two key factors (i) self-efficacy (Bandura 1997) and (ii) decisional balance, i.e. the outcome of individual appraisal of the pros and cons of a behaviour (Heimlich and Ardoin 2008; Armitage et al 2004).

Figure 4: Stages of Change Model depicting the five 'milestones' of change.

The rationale behind using a staged model is that individuals at the same stage should face similar problems and barriers, and thus can be helped by the same type of intervention (Nisbet and Gick 2008). Whilst practitioners acknowledge many hundreds of different interventions, the SoC model identifies ten types ('processes'), which are most widely used and investigated (Prochaska, Redding and Evers 2002: 101):

Consciousness raising	Finding and learning new facts, ideas, and tips that support the healthy behaviour change
Dramatic relief	Experiencing the negative emotions (fear, anxiety, worry) that go along with unhealthy behavioural risks
Self-re-evaluation	Realizing that the behavior change is an important part of one's identity as a person
Environmental re-evaluation	Realizing the negative impact of the unhealthy behavior or the positive impact of the healthy behavior on one's proximal social and physical environment
Social liberation	Making a firm commitment to change
Helping relationships	Seeking and using social support for the healthy behavior change
Counterconditioning	Substituting healthier alternative behaviors and cognitions for the unhealthy behavior
Reinforcement management	Increasing the rewards for the positive behavior change and decreasing the rewards for the unhealthy behavior
Stimulus control	Removing reminders or cues to engage in the unhealthy behavior and adding cues for or reminders to engage in the healthy behavior
Social liberation	Realizing that the social norms are changing in the direction of supporting the healthy behavior change

A recent meta-analyses by Noar et al. (2007) of 57 studies demonstrated greater effects in programs that are tailored on each of the Trans-theoretical Model constructs. Specifically, programs that tailor on stage do better than those that do not; programs that tailor on Pros and Cons do better than those that do not; programs that tailor on self-efficacy do better than those that do not, and programs that tailor on processes of change do better than those that do not.

The model has been criticised however. Criticism has been argued for the lack of clarity in defining the concepts. Further, it is unclear if individuals must move between all the stages for change to become sustainable and it is unclear how individuals change or why some change more than others (Littell and Girvin 2002).

In an example of application, the TTM was recently used to derive a new framework to design for healthy behaviour by Ludden and Hekkert (2014). These authors state that designers need to consider the different stages that people go through to durably change their behaviour. Furthermore, they provide examples of how design interventions aimed at adopting a healthier lifestyle correspond to different stages of change. This will be discussed in more detail in section 3.

4.2.1.4 *Behavioural economics*

Behavioural economics is a field that integrates the "neoclassical" model of behaviour of psychological realism into economic theory to provide a better understanding of social and economic phenomena (Camerer, 1999). One of the assumptions of economic theory is that people behave with a rational self-interest, for example, if you show someone how many calories are in their food, then they will make healthier choices. Psychology systematically shows that this assumption is false and provides more realistic theories about human behaviour that can be incorporated into economics, for example, people often suffer from a lack of self-control, which means calorie information may not lead to better decisions. Behavioural economics unifies psychology and economics, providing a set of principles that can lead to the design of better products and services. Essentially the approach is about understanding and overcoming (or exploiting) cognitive biases through restructuring choice environments.

Lee et al (2011) use theory from behavioural economics (also described in Darnton, 2008) to persuade people to make healthy choices. Behavioural economics studies are concerned with decision-making that ranges from small to large decisions that people make throughout the day, such as whether or not to buy a certain item, whether to go by bike or take the car, and if they should eat a not-so healthy but delicious muffin. Behavioural economics deals with how such everyday decisions can be influenced. For example, Lee et al. (2011) tested several interventions to promote healthy snacking in the workplace. These interventions aimed to present choices in a way that leverages people's decision processes and induces them to make self-beneficial choices. One of the interventions they designed was a robot that would present two types of snacks, whereby it was made easier to pick a healthy snack (apple) than it was to pick a less healthy snack (cookie). There have been further attempts to integrate behavioural economics principles with design, most notably Pfarr et al's (2010) *Brains, Behavior & Design Toolkit*, developed at the IIT Institute of Design, Chicago.

Because of the focus on individual decision making, we have grouped behavioural economics under 'individual rational choice models' rather than under structural models, although if one took the focus on the external structuring to facilitate decision making one might count it under contextually driven models. In this way behavioural economics could be positioned on either side of the 'fence', without being seen to belong to the middle-ground. In acknowledgement of this dilemma, we have positioned the closely related model of choice architecture under structurally driven models.

4.2.1.5 Further individualistic driven models

Additional individualistic agency-oriented models exits, the detailed discussion of which is however beyond the scope of this review. These include: the Elaboration Likelihood Model (ELM) (Petty and Cacioppo 1986 a,b) including their prior developed models of Central Route Persuasion and Peripheral Route Persuasion, which proposes that individual decision making can be both rational (following rational arguments "central route") and non-rational (following other factors, e.g. trust in person trying to persuade, etc. "peripheral route"); the Heuristic-Systematic Model (HSM) (Eagly and Chaiken 1993) which - similar to ELM - proposes that people respond to persuasive messaging with a combination of systemic (analytical) or heuristic (synthetic) processing; the Resistance and Persuasion Model (Knowles and Linn, 2004) which examines resistance to understand how it can be reduced, overcome, or used to enable persuasion; and the Self-Determination Theory (SDT) which examines the motivation behind the choices that people make and the level to which an individual's behaviour is self-motivated and self-determined.

4.2.1.6 Individually driven approaches used by public and private sector stakeholders

A number of further approaches were mentioned by survey respondents. Detailed below, these varied in the depth and the rationale behind them:

The National Institute for Clinical Excellence (NICE) guide on 'behaviour change: the principals of effective intervention' was used. This provides a set of generic principles that can be used as the basis for planning, delivering and evaluating public health activities aimed at changing health-related behaviours. The guidance is for those who have a direct or indirect role in, and responsibility for, helping people change their health-related knowledge, attitudes and behaviour. The guide helps deliver general advice on intervention design to ensure they are robust in nature to maximise chances for success.

In terms of theoretical underpinning, the guide is influenced by many theories, concepts and accounts of behaviour and behaviour change based on social and behavioural sciences focused on changing the individual. Theories include: resilience, coping, self-efficacy, planned behaviour, structure and agency, 'habitus' and social capital. The authors suggest that change tends to be effective using a combination of awareness-raising, compulsion and enforcement, providing legislative or environmental 'structure' to the decisions people make about their behaviour. They also note that change depends on social and material circumstances. Overall, the guide points out key factors to consider in achieving behaviour change. It lacks however the detail and creative ways of engaging users in thinking about the issues in comparison, e.g. design for behaviour change guides, e.g. Design with Intent and MINDSPACE (cf. section 4.3).

Also, the National Social Marketing Centre (NSMC) toolkits were listed (The NSMC 2010). NSMC is the "centre of excellence" for social marketing and behaviour change in the UK. They produce several guidance documents of behaviour change based on a customer centric and planning approach including:

- Planning guide and toolkit – focusing on their perceptive behind social marketing (see below) along with the planning process.
- Value for Money tools - calculate the cost-effectiveness of social marketing and behaviour change programmes in five key health areas: smoking, breastfeeding, alcohol, obesity and bowel cancer.
- Social marketing case studies –portfolio of established evidence based project completed by NSMC
- Starter for Ten - a set of flexible teaching and course materials for use in undergraduate and master's programmes.
- NSMC work across sectors including business, NHS and focus on health and wellbeing.

The Social marketing perspective is defined as an approach used to develop activities aimed at changing or maintaining people's behaviour for the benefit of individuals and society. NSMC state that this is a six stage approach of starting, scoping, developing, initiating, evaluating and following up. It is suggested this is about understanding the person (people, communities, citizens etc.) along with looking at what people do, why they do it, influences and influencers and incentives and barriers. NSMC position social marketing in line with behavioural economics which recognises that we don't always behave rationally. Instead, our behaviour is governed by instinct, emotion, past events and the people around us.

Finally, the Department for Health (2014) Change4Life scheme was also mentioned. Change4Life aims to inspire people, including the NHS, local authorities, businesses, charities, schools, families, community leaders to play a part in improving health and well-being by encouraging healthy eating and exercise. It is an initiative to be "food smart" aiming to inform people about the dangers of an unhealthy diet and provide them with healthier alternative foods. Aiming to address the broad demographic of an entire population, it approach seeks to communicate at multiple levels, including for example meal cards which provide ideas for improving diet for adults while also showing cartoon characters aimed at children. The website provides ideas to make changes around:

- Eat well
- Move more
- Drink less
- Be healthier
- Quit smoking
- Parenting

The scale of change is also considered by encouraging routine behaviour, while the programme is aimed at the general public. At the same time, it provides a useful information resource about strategies to encourage behaviour change, which can be used by designers. The scheme is very similar to that of social marketing defined as an approach used to develop activities aimed at changing or maintaining people's behaviour for the benefit of individuals and society as a whole. The approach is also very similar to that of the NSMC described above and has been developed in collaboration with NSMC amongst others.

4.2.2   Context driven models

In contrast to the above approaches, social structuralist theories suggest that the person is not the appropriate level for analysis. Instead, behaviours in many instances can be viewed as consequences of societal norms and expectations that are held in place by the systems of provision and social structures that the individual lives within – contextual elements.

4.2.2.1   Choice Architecture Model

Closely related to Behavioural Economics, but more focused on systems change that leads to individual's decision, the 'nudge' approach, it is based on the potential effect of "defaults"; the selection made in the absence of alternatives. The design of a product or service can shape the choice architecture of a person's decision, while always allowing them to depart from it (Sunstein & Reisch, 2013). Defaults can therefore be very powerful – in many cases it is possible to 'design out' the problem for most users rather than actively changing any behaviour, for example setting the default printer setting to double sided. Kesan and Shah (2006) note the legal and societal power of technology defaults such as home pages, bundled software and privacy settings as effectively creating *de facto* norms, but ones which are rarely questioned or discussed.

Choice architecture illustrates one of the challenges to behaviour change raised in ethics - in particular in programs, implemented by government as they may impinge on people's rights, control or responsibility. The riposte is that most of these programs aim to make people better off, based on their own judgment, while providing the freedom to opt out if they choose. This is known as "libertarian paternalism", as coined by Richard Thaler and Cass Sunstein (2003). Ipsos Mori (2012) investigated public opinion on behaviour change campaigns related to smoking, unhealthy foods, savings, and living in an environmentally sustainable way. They found majority support for all types of intervention, decreasing with "force". Therefore choice architecture models in creating default behaviours may have an important role to play within design.

4.2.2.2   Christmas' change model

Christmas' model (Christmas, 2009) is structured around Nine Big Questions, designed to support and structure the process of gathering evidence, listening to viewpoints, and making judgments about behaviour change policies and interventions. In a sense this is similar to the SoC model in creating generative tools to interpret in order to develop behaviour change intervention through structural change. According to the model, behaviour change is typically best served by a mixture of 'tailored interventions', delivered over a long period of time and modified in response to measurement of impact.

The questions in the model are proposed to be as important as the answers:

> *Q1 – Who changes what?* Christmas argues that institutions cannot change people's behaviour but that the people within an institution are responsible for changing *their own* behaviour. What institutions *can* do is help people to change, encourage them, cajole them, reward them or threaten them, that it can 'market' new behaviours to them.

> *Q2 – Why do people change their behaviour?* People change their behaviour in response to other changes. These take various forms in the world around them, in their understanding of the world, or in themselves – which make a new behaviour seem more advantageous, more prevalent and more focused on the individual.

Q3 – Why do people not change their behaviour? The mere fact that a new behaviour seems more advantageous or focused on the individual may not in itself be sufficient for change. The *process* of changing can create additional barriers to change and there can be significant reluctance depending on effort and motivation. Therefore, it is important to remember that changing even simple behaviours can take time and it may be necessary to identify ways in which individuals can be supported within the change process.

Q4 – Why do people do what they do to start with? A first step in the process might involve the development of a picture of their current behaviour in terms of context, meaning and influence. This might help to identify where and why individuals may or may not be open to change in the first place.

Q5 – How does change happen in social networks? Interaction between individuals in social networks can lead to harmonised actions amongst groups of people including both resistance to change and 'tipping points' (when change happens very rapidly). The study of social networks is a relatively new field, and care is needed to avoid stereotyping of behaviour within the network.

Q6 – How do people differ? People differ in many ways. According to Christmas, 'segmentation' is a suite of techniques used to identify the differences that really make a difference, and divide a population into clusters of people with shared attributes. Segmentations allow policymakers to establish both who needs to change and what might make them more likely to change. Segmentation is a useful strategy across the whole field of behaviour change.

Q7 – Who is best placed to promote change? Before attempting to promote change, it is worth engaging with stakeholders who may be able to advocate new behaviours which may offer the change behaviour greater credibility within the community. However, individual citizens can also play a critical role as promoters of change and citizen-led change can deliver impressive results.

Q8 – How can governments unlock change? Sometimes the motivation for change already exists in the system, but is held back by the challenges associated with a new behaviour or the process of change. Governments can do a number of critical things to make new behaviours more do-able for those who already want to adopt them, including providing infrastructure to support the new behaviour, providing information, including personalised information and feedback and creating new connections and groups. Behaviour change is best served by a mix of interventions, delivered over a long period of time and modified in response to measurement of the desired impact.

Q9 - How can authorities give a push? Only after tackling all of the previous questions should one consider whether and how to provide an additional push for change. Too often this is the *first* question that gets asked.

The model thus proposes an external agency approach. It makes clear that only after tackling all of the previous questions should one consider the last; whether and how to provide an additional push for change. Too often this is the *first* question that gets asked. Overall Christmas' model has been applied particularly to climate change and in particular the public response to such perceived changes and includes one-off behaviours that are relatively easy to target such as insulating lofts or installing new boilers However, the model could also be applied to other daily behaviours relating to diet, travel and domestic energy use that are harder to change.

4.2.3   Approaches that tread the middle ground

There are a number of models which propose to mediate the middle ground between the individual agency and contextual approaches. They seek to overcome the perceived limitations of the individual sides of the model by integrating them.

4.2.3.1   Social practice theory

Social Practice Theory (SPT) recognises that human habits and behaviours are themselves arrangements of various inter-connected 'elements', such as physical and mental activities, norms, meanings, technology use and knowledge. The dynamic inter-relationship between factors helps shape actions or 'behaviour' as part of their everyday lives (Reckwitz 2002). The approach particularly emphasises the socio-technical infrastructures within which practices occur. According to Shove (2010) and Chatterton (2011) three elements are implicated in the final behaviour:

- **Materials:** The physical objects that facilitate activities to be performed in specific ways
- **Meanings:**   symbols, images, interpretations or concepts associated with activities that determine how and when they might be performed
- **Procedures:** Skills, knowledge or competencies that permit, or lead to activities being undertaken in certain ways

The 'Beyond Behavioural Change' approach from RMIT (Strengers 2010) further refines and redefines the components that make up a 'social practice', and adds a fourth to include:

1. Skills and competencies about *how we do* something (practical knowledge),
2. Meanings and understandings about what we *ought to* do (common understandings) and
3. Rules, what *we must do*.
4. Material Artefacts that enable *us to do* something

SPT has been applied to understanding sustainable behaviours, in particular in the fields of energy use, transport and waste (Chatterton 2011). It is seen to have relevance because the 'Green' agenda acknowledges the need to consider both individual and their environment in promoting sustainable behaviour change, relating to the social structures described above. It de-centres individuals from analyses, and turns attention instead towards the social and collective organization of practices – broad cultural entities that shape individuals' perceptions, interpretations and actions within the world (Hargreaves, 2011).

One major premise of Social practice theory applied in this context is that consumption occurs through everyday practices (Warde, 2005). Shove's (2003) work asserts that the great majority of our resources are consumed in maintaining standards of comfort, cleanliness and convenience in our everyday life (2003, p. 395). The notion that reducing consumption could potentially be achieved through understanding and modifying everyday practices is accepted within contemporary design for sustainability discourse.

For example, everyday practices such as cooking and eating have been formed over time through the interrelationship of all the above elements. Our built environment and material artefacts (things) play a significant role in assisting the facilitation of our everyday practices. Social practice theory reveals how change through time is dynamic. Social practice theory is beginning to engage in how practices may be influenced and changed, design may assist to

change unsustainable practices (Shove and Pantzar 2006) via redirection (Fry 2009), or amplifying past and present sustainable practices (Clune 2010b).

4.2.3.2   Mindfulness

Mindfulness Theories (Ie, Nguyen, Langer 2014) focus on behaviour change of the individual through consciously considering social, cultural and environmental contexts to create awareness resulting in responsible choice and behaviour. Mindfulness theories from both Eastern and Western approaches focus on change through some kind of intervention to raise awareness of an individuals' situation, context and other variables. This intervention may vary according to the approach: Eastern approaches tend to focus on meditation to achieve insight that enable change, while Western approaches tend to use a number of self evaluation tools or awareness raising measures from psychology and education to help individuals raise awareness of the constraints on them or their situation. The aim is to enable the perception of empowerment (internal locus control, Rotter 1990) as a precursor to enabling an individual to act and make changes to their situation. Langer (1989, 2010) has provided many examples of mindful change from a Western perspective.

Once again, mindfulness theories could be categorised differently, e.g. as an individual agency model, but we argue it sits in the middle-ground, because it is directed towards understanding and changing one's situation and wider context rather than (or in order to change) one's self.

Niedderer (2007, 2013, 2014) has adopted Langer's approach and suggests that – because a stimulus is required to raise mindful consciousness – design can be used as such a stimulus to instil mindful awareness, choice and behaviour.

4.2.3.3   Behavioural wheel

Michie, van Stralen and West (2011) developed a behaviour change wheel to help identify and develop behaviour change primarily for health reasons. From triangulating literature and interview data they propose a model formed of three key components. Firstly at the hub of the wheel, three conditions are proposed to elicit behaviour change; capability, opportunity and motivation for change. Then nine interventions exist which enable those interventions to occur including; education, persuasion, incentive, coercion, training, enablement, modelling, environmental restructuring and restrictions. On the outer sections there are policy characteristics which could enable the interventions to occur; environmental/social planning, communication/marketing, legislation, service provision, regulation, fiscal measures and guidelines. The wheel usefully characterizes the interventions and policies that may need to exist for affect behaviour change which now need to be fully validated using this systems based approach (Michie et al., 2011).

4.2.4   Summary

The models that are available to describe and analyse behaviour change notions are numerous. This discussion has selected a small number of the most used and relevant models and grouped these into the three approaches: individualist-rational, contextual, and the 'middle-ground' for theories which integrate elements of individual rational and contextual influence or reflection. Figure 5 positions the selected change approaches across the individual-context divide.

Figure 5: Classification of selected behaviour change theories according to the agency divide.

One conclusion from this review is that there appears to be a dominance of models of behaviour change that focus on individual cognitive processes and decisions. This is also confirmed by Southerton et al's review of international behavioural change campaigns (Southerton et al 2011), which has suggested a 'disproportionate focus' on the individual, with a recommendation to go beyond the individual to include mechanisms which intervene in the social and material contexts. The focus on the individual may have methodological reasons as the influence of social factors is difficult to measure. However, at the same time, they may underestimate the impact of social contexts. In turn, while more difficult to implement and assess, theories and approaches that promote a holistic systems-based approach are likely to understand these contextual factors more clearly and therefore yield more successful behaviour changes. Interventions that seek to follow a holistic approach need to address both the individual as a decision-maker and the wider social context in which they live. There appears to be a recent move towards an increased use of holistic approaches, which is encouraging.

The discussion illustrates the breadth of theories from the behavioural sciences, articulating both their potential for application in design as well as the sphere where designers may potentially intervene. Several of the behaviour change theories, including the Stages of Change Model, the Theory of Planned Behaviour, the Health-Belief Model, the Behavioural Wheel model, Social Practice Theory and Choice architecture were mentioned by a small number of predominantly international designers. Additional mention was made of Motivational Interviewing and Self-Determination Theory. Successful design needs to be aware of these hidden or tacit influences if it is to be used effectively to promote sustainable behaviour change, and there seems to be an increasing awareness and interest among designers. Current and emergent approaches from design that build on some of these behaviour change theories are discussed in the next section.

4.3   Design for behaviour change approaches

If, in design for behaviour change, we understand design as a social process, we can see that at its heart are people. Therefore, at the most elementary level design for behaviour change attempts to understand people, why they behave the way they do, and to use design to encourage them to 'do', or 'not do' something. Behavioural science can help designers understand why the people they are trying to help behave the way they do – from the influence of memories and experiences, to how attitudes are formed and when preferences translate into actions. This follows and extends the idea of behavioural design, a term first coined by Don Norman in the 1980s (Norman, 1988) with respect to product design.

The scope of how design can be applied to change behaviour is broad and extremely multidisciplinary. The interest and investigation into behavioural change has originated from, and has been a foremost prerogative of the behavioural and social sciences. This broad area, through both research and practice, has generated and contributed a large number of insights and frameworks, which seek to explain human behaviour in different ways and through different models. Design therefore draws regularly on behaviour change models from the behavioural sciences, which makes it necessary to look at themes from behavioural sciences and their application in design in order to set a scene for design for behaviour change in an applied sense.

Just as there are many different models of behaviour change in the behavioural sciences, so there are many different approaches to behaviour change in design. Thus there is no accepted unified model of human behaviour in design. Also, generally there are no 'look-up tables' for behaviour change, although a number of practical guides have been developed in different domains, e.g. Grout (2007) in medical design; Crowe (2000) in architectural design against crime; Nodder (2013), Wendel (2013) and Anderson (2011) in user experience design, and recent attempts have been made at practical cross-disciplinary syntheses (Daae & Boks, (2014); Lidman & Renström (2011); Dolan et al (2012); Lockton et al (2010b); Pfarr et al (2010).

This highlights another feature of the 'design' perspective on behaviour—designers are engaged generally not in describing existing situations, but in *transforming* existing situations into preferred ones (Simon, 1969). It is the *application* of behavioural models which is of most practical relevance in design—how those models can be translated, applied and tested in practice through use in the real world, rather than in laboratory studies. In this sense, it is wise to heed Box & Draper (1987) that, "essentially, all models are wrong, but some are useful". From a design perspective, we are therefore looking for the 'useful' parts and specifically how these might be applied in a setting beyond the academic world to drive innovation and lasting behaviour change.

For the purpose of the review, both design models dealing with behaviour change and 'toolkits' have been reviewed. Design for behaviour change models seek to provide a general understanding of the way design can be used to influence behaviour, and their mechanisms. They tend to propose some conceptual approach and, while usually referring to a certain subject area, such as health or sustainability, they may be transferable to other areas due to their generic nature. By contrast, toolkits tend to be more specific and practice-orientated – a kind of guide of how to apply models to change certain behaviours in certain contexts.

Approaches proposed by models and toolkits for influencing behaviour are generally either about trying to get people *to do* something, or trying to get people *not to do* something. Most

possible ways to do that are either about changing how *easy* or *difficult* it is to do, or about making it so people *want* to do (or not to do) it. In other words, the mechanism can either rely on a *prescriptive* approach to enabling/constraining, or through calling on *voluntary* commitment through incentives/deterrents. Design approaches typically use motivating behaviour or persuasion to increase the attraction for the individual user to do something (Niedderer 2013, Lockton et al 2010), or they use prescription or prevention measures by redesigning the environment to enable or decrease desirable or undesirable behaviour respectively (e.g. Lockton et al 2010, Tromp et al 2011). This offers four basic approaches, including:

- making the 'target' behaviour easier for a user to do
- making an undesired behaviour harder to do (which may be concomitant effects, but not necessarily)
- trying to get users to want to perform a particular behaviour
- trying to decrease users inclination to perform a particular behaviour.

Although a basic classification, it is also a simple and effective way of categorising different design approaches to assess a situation and match them to specified clients' needs. Therefore, this categorisation appears in some way as a whole or in part in most of the models and toolkits presented. For example, strategies aimed at influencing health and safety behaviour often employ a constraining approach, while strategies in voluntary areas such as the internet domain often relay on motivating features.

Figure 6: The individual-context space with models and tools depicted.

The majority of design for behaviour change approaches identified by this review have appropriated psychological principles of behaviour change introduced in the previous section to influence targeted behaviours. Therefore, the common framing along an individual-context 'agency divide' used above for models of the behavioural sciences is also useful in identifying the mechanisms used in design models dealing with behavioural change (Figure 6). The 'agency structure' divide in behavioural change theory is of significance for the further review because, first, design can be seen to interact at both the level of the individual via hybrid human-artefact interactions, and providing a broader structure and system of provision for society within which individuals act. Second, for design to contribute to a sustainable society the ambition of designers may need to progress from product improvement and re-design to systems innovation. Brezet (1997) proposed that, for example, for eco-design to achieve large-scale reductions in resource use, a move from product improvement and re-design to systems innovation would be required. A range of design for sustainability practitioners are engaging with design that resembles a systems approach (e.g. Ryan, 2011) with the objective to create structural change. The emergent rise of e.g. design thinking, co-design, and service design also suggest design's application beyond products. This trend is apparent below in the discussion of how designers have adopted behavioural science, and social science theories to develop behavioural design models and 'toolkits'.

4.3.1   Design for Behaviour Change approaches targeting the individual

Design for behaviour change models seek to describe the overall approach and reasoning why and how design can change behaviour from a particular angle, in a specific context, or within a particular area of application. The following review of models follows a combination of chronological development in relation to the positioning of models with the agency divide.

4.3.1.1   *Persuasive Technology*

Persuasive technology has investigated different ways in which people respond to computing technologies, and how these in turn can be used to influence or change the performance of target behaviours or social responses. Persuasive technology has been defined as 'any interactive computing system to design people's attitudes or behaviours' (Fogg, 2003).

Fogg's behavioural model for persuasive technology draws on different theories from psychology and computing. Fogg's work emerged from work such as Reeves and Nass's work (2005) on how people relate to computers and interfaces as if they were 'social actors'. The Elaboration Likelihood model (ELM), in particular *central route persuasion,* (Petty & Cacioppo, 1986 a,b) lends perhaps the strongest theoretical foundation to Fogg's model of persuasive technology, focusing on motivating behaviour, with attitude change either as a precursor or a result.

Fogg's (2014) persuasive technology model focuses on *motivation, ability,* and *triggers* (prompts) to encourage or discourage users to act in desired ways. For example, Fogg's *reduction* and *tunnelling* (Fogg 2003) can be seen as triggers to *enabling* particular behaviours by making them simpler. The model has a matrix to guide designers on which tools to use depending on whether they wish to encourage or discourage one-off or on-going behaviours. One key point that Fogg emphasises is intention within persuasive technology:

Fogg indicates that there are three types of intent inherent in the use of persuasive technology; endogenous, exogenous, and autogenous (Fogg, 1998). This perspective of persuasion and intent clearly puts the intent to persuade on some person responsible for programming the computer. In endogenous intent, the persuasion comes from the creator or programmer of the technology, in exogenous intent, the persuasion comes from those who give access to the technology, and with autogenous intent, the user adopts technology themselves in hopes of changing their behaviors. (Shearer, 2014: 5)

Fogg's model is popular in the HCI community, but also beyond. Based on persuasive technology, many prototypes and applications have been developed that aimed to help people to adopt or to maintain a healthier lifestyle. Such interactive design interventions are promising because they could potentially reach a larger group of people than traditional interventions can (Norman et al, 2007). Furthermore, people using these interventions could potentially use them at any place and at any point in time (Fogg, 2010). In his review of eHealth interventions for physical activity and dietary behaviour change, Norman et al (2007) discuss three generations of eHealth interventions. The first generation facilitated tailoring of interventions using computers (e.g., tailored feedback messages), interventions of the second generation allowed for direct interaction between users and technology and the third (now emerging) generation of eHealth interventions makes use of new platforms (mobile devices) with new functions (sensing, location-based knowledge presentation, etc.). A similar view on the future of persuasive technologies is given by Chatterjee and Price (2009).

4.3.1.2   Behaviour Grid

Wendel's 'Behaviour Grid' (2013) is based on behavioural economics and also draws heavily on Fogg (2003). He describes the Behaviour Grid as 15 ways that behaviour can change. Like Fogg, Wendel (2014) contends that behaviour is systematic, and only occurs when three elements converge at the same moment: motivation, ability, a trigger. Therefore, to effect behaviour change, it is necessary to:

- Select the right target behaviour
- Make the target behaviour easy to do
- Ensure a trigger will prompt behaviour.

The premise is that, if successfully designed, the end user will make small changes in habits to embed the new pattern; and that a successful design enables the new habit to form speedily. Further, the process of design for behaviour change involves four phases which need to inform product development:

- Understand how the mind makes decisions and how this influences behaviour change
- Identify the right behaviours to change, depending on end user and product designer's goals
- Design around the behaviour
- Refine continuously following impact evaluation.

Somewhere between a model and a toolkit, this approach provides useful guidance as to how to achieve successful behaviour change.

4.3.1.3   The Loughborough model

The "Loughborough model" of design for behaviour change (Lilley, 2007, Lilley, 2009, Tang and Bhamra, 2008, Bhamra et al., 2008, Tang, 2010) aligns closely to behavioural economics, drawing on mechanisms such as feedback, constraints and affordances as well as persuasive technology. The majority of examples cited in the Loughborough model relate to providing feedback to energy and water users, especially concerning feedback devices for energy and water saving. It predominantly addresses product designers. Lilley (2009) posits that designs should respond to:

- The users level of compliance
- The gravity of the consequences of actions taken
- The context in which the interactions takes place.

It is acknowledged that it is difficult to know where to position interventions and this is a challenge for designers. In real-life design contexts, the way the brief is framed by a client or other stakeholders, and assumptions about what the 'problem' is, can influence the extent to which a designer can 'intervene', and where interventions can be positioned.

4.3.1.4   Design for healthy behaviour

Ludden and Hekkert (2014) have drawn on the Trans-theoretical Model (TTM) to derive a new framework to design for healthy behaviour. The framework reflects that designers need to consider the different stages which people go through to durably change their behaviour. For example, in the first two stages of the TTM, the pre-contemplation and contemplation stage, people built motivation to change. In these stages, people are not aware of a need to change and they are not yet ready to change. People are contemplating whether changing has more benefits than drawbacks for them, they are moving their 'decisional balance' (Prochaska & Velicer 1997). In these stages, a design intervention should probably have the form of a general publicly available intervention, rather than a personal intervention because people will not yet be motivated to buy or even to start using a personal intervention. Interventions in these stages should have an emphasis on raising awareness of the importance of and the benefits of changing. In their framework to design for healthy behaviour, Ludden and Hekkert propose four different design strategies that spread over multiple stages: 'raising awareness', 'enabling', 'motivating' and 'fading out'. (Figure 7)
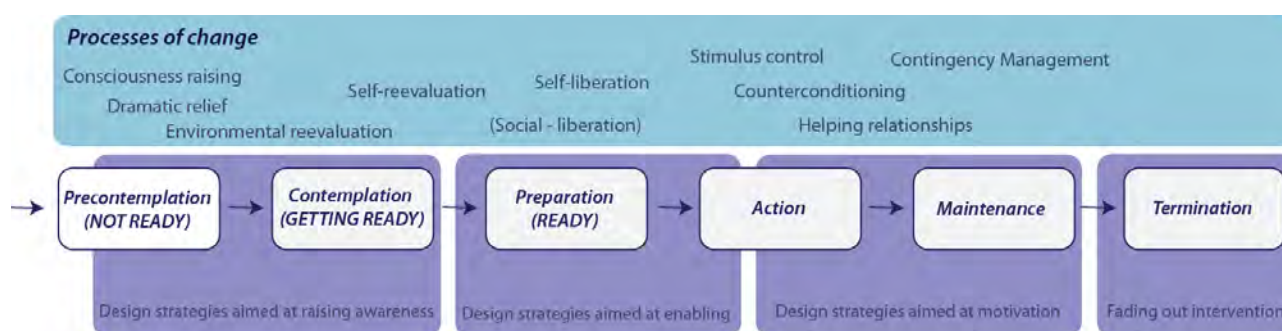

Figure 7: Preliminary framework for stage-matched design interventions.

Design strategies for 'raising awareness' can move people into a process of behaviour change - these are the strategies that help people evaluate the choices they have made so far and place them in a new perspective. The result should be that they move into the

preparation stage because they are ready (i.e., willing, feel capable) to change. Next, design strategies that are aimed at 'enabling' are in order. Ludden & Hekkert (2014) use the term 'enabling' to characterize interventions that support people in making the right choices; choices that lead to adoption of a healthier lifestyle and that fit their personal situation and preferences. In other words, this phase is aimed at empowering people to create their own action plan. Well into the action and maintenance stages, design strategies aimed at motivating are needed. In these stages, people have already changed and strategies that can support them to maintain changes or to help find new possibilities for change are needed. Finally, in entering the termination stage, right before a durable behaviour change is reached, design interventions should incorporate a fading out phase. Prochaska & Velicer (1997) found in their clinical trials a negative effect of stopping personal counselling, people had become dependent on the social support and social monitoring and performed worse after these influences were withdrawn. A similar effect could be expected for personal design interventions.

An example of such an intervention aimed at early stages of change is the game 'Na-aapje' (literally translated as 'little-copy-monkey') that was developed by the Dutch Voedingscentrum (Centre for Food). Na-aapje is a children's game that is designed to raise awareness with children that fruit and vegetables are healthy diet choices. The monkey in the game has to collect fruits and vegetables and the child scores high by collecting many fruits and vegetables.

4.3.1.5 Further approaches

Overall, approaches that use design to influence the individual appear dominant in the Design for Behaviour Change literature, following the trend in the behaviour change literature. Additional approaches within this realm include, for example:

Selvefors et al's 'Design for Sustainable Consumption Behaviour' (2011) is a user centred design approach, which combines consumption behaviour and behavioural intervention strategies to explore how knowledge within these domains can be used in an industry context to develop solutions that support behaviours to reduce resource consumption. Closely related is a slightly earlier approach by Wever et al (2008) which also promotes a user centered design approach for sustainable behaviour. It seeks to encourage industry to design products in such a way that people will be persuaded to use them in an environmentally friendly way.

Anderson (2011) looks at user experience design and what makes people change their behaviour through seduction that is interaction with objects or their environment that they perceive as pleasurable, exciting, and positive in some way. He draws on a number of different models, including Fogg's persuasive technology, the Kano model (about delight factors), as well as more traditional models of aesthetic etc. Anderson (2014) has also developed a model of his ideas for web design under the label 'Mental Notes', which was known to and used by some survey respondent. The 'Mental Notes' are a tool (of cards) that brings together 50+ insights from psychology to use as a reference and brainstorming tool. Each card describes one insight into human behaviour and suggests ways to apply this to the design of Web sites, Web apps, and software applications.

Finally, Nodder (2013) - in a book on which Lockton was technical editor - looks at user experience design and seduction from the opposite end of how it can be abused in by

companies to lure customers. He brings together concepts from behavioural economics, marketing and design to demonstrate people's susceptibility to persuasive techniques. Pfarr and Gregory (2010) also developed a design model based on behavioural economics, called the *Brains, Behavior & Design Toolkit*. They developed and tested a set of behavioural tendencies (p.3), which includes: Loss Aversion, Endowment Effect, Status Quo Bias, Affective Forecasting Error, Context-Dependent Preferences, Affective-Cognitive Decision Making, Introspection and Consideration Override. Pfarr has continued this approach with a series of articles for industry publications such as Fast Company, raising awareness of the potential of behavioural economics in design.

4.3.2   Design for Behavioural Change approaches that address context

There is a limited range of design for behaviour change approaches that address context *per se*, although of course to a certain extend any design will be related to context by its very nature. This is a pattern, which is clearly reflected in the visualisation of our framework map where there are a number of behaviour change theories that address context. However, a limited number of *design for* behaviour change theories were identified to support contextual change, while conversely it is relatively easy to identify design examples that shift the context of our lived environment, and contribute to change.

4.3.2.1   Product-Impact tool

The above design approaches are positioned heavily at influencing targeted behaviours. By contrast, Dorrestijn's Product-Impact Tool (2012) assesses the impact that technical products have on user behaviour. It was used to assess the Dutch RFID public transport e-payment mechanisms. The product-impact tool finds its basis in philosophy, most notably the work of Foucault (2000a,b,c,d) on interrelations between humans and technology. The product impact tool serves to structure the exploration of user guiding and changing effects. The person is placed in the middle of four quadrants of influences: the abstract, the cognitive, the environment and the physical. The tool is one of few that seek to understand how technology (products and visions) have driven change through history. This broader impact, of design driving change, is not at the fore of the dominant design for behaviour change approaches, yet appears in progressive Design for Sustainability literature, e.g. Fry's De-futuring (1999) attempts to conceive of the agency and consequences of future design solutions, while Manzini utilises future scenarios (2003) as thought provoking hypothesis for discussion (2003). This model is one of two that we could comfortably position within the contextual approach. In this context, it is noticeable that it did not draw on psychology but rather philosophy.

4.3.2.2   Moralised products

Jelsma's (2006) "designing moralized products" sees products as "drivers of routine action, i.e. as *actors*".

> *Specific material features of the artifacts involved (e.g. those of cup, saucer and spoon in coffee drinking) support and guide the actions of the user. By realizing this, we start to perceive artifacts in a different way. We had better start seeing them as actively taking part in human action, as drivers of routine action, i.e. as actors. This means that these artifacts have a co-responsibility for the way the action develops and for what results. If we waste energy or produce waste in routine actions, such as in household practices, this has to do with the way artifacts guide us.*

Jesma's design process incorporates user logic and *"scripts"* to encourage the desired interaction with products. This process aims to first understand the "folk logic' of everyday routines (or cognitive models), prior to designing scripts into artefacts that may direct the user towards the desired use. The model has parallels with Lockton's use of mental models introduced above, and the architectural choice model (2013).

4.3.2.3 *MINDSPACE*

The MINDSPACE Model (Dolan et al 2009) was one of the models used by private and public sector stakeholders. It presents a guidance and checklist of influences on behaviour for use in policy making. It was developed by the UK Cabinet Office to help inform policy design to achieve affective behaviour change. MINDSPACE presents the nine effects that influence our behaviour in mostly automatic (rather than deliberate) ways. Dolan et al (2012) position this in neuroscience terms as influencing 'System 1' of our brain that guides automatic, uncontrolled, effortless, associative, fast, unconscious and affective responses. The approach is as follows (see Dolan et al 2012):

- **Messenger:** we are heavily influenced by who communicates information (e.g. our reaction to the authority of who provides the information).
- **Incentives:** our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses (i.e. behavioural economics suggests that there are five sub elements to this; reference point, losses loom larger than gains, we over weight small probabilities, we allocate money to discrete mental accounts, we consistently live for today at the expense of tomorrow).
- **Norms:** we are strongly influenced by what others do (e.g. the ideal behaviour which individuals in a social group try to conform to).
- **Defaults:** we "go with the flow" of pre-set options (e.g. the option that will come into force if no active choice is made. Individuals regularly accept the default option whatever the consequences).
- **Salience:** our attention is drawn to what is novel and seems relevant to us (e.g attention to novel stimuli such as flashing lights, accessible aspects (items on a shop check out) and simple processes (slogan).
- **Priming:** our acts are often influenced by sub-conscious cues (e.g. activation of knowledge in our memory makes it more accessible and influential in the processing new stimuli. People behave differently if they have been primed by certain cues).
- **Affect:** our emotional associations can powerfully shape our actions (e.g. hand hygiene campaigns promoting 'disgust' at dirty hands increases hand washing).
- **Commitments:** we seek to be consistent with our public promises, and reciprocate acts (e.g. overcoming will-power weakness)
- **Ego:** we act in ways that make us feel better about ourselves (e.g. we act and behave to maintain a positive self-image. When we make comparisons we be are biased to believe we perform better than the average person).

This model is based on the Choice Architecture model, referencing Thaler and Sunstein (2008), and Ariely (2008), and therefore is also situated in the context section. It is not exactly a design model (more a straight behaviour change model), and therefore included somewhere in-between those two spaces on the map (Fig. 7).

4.3.2.4   Discussion of context driven behaviour change models

Overall, approaches that use a contextual approach are rather in the minority. This may be partly because some of these theories are not necessarily perceived in terms of behaviour change but rather as object intervention and therefore are simply not recognised in this context; because of the complexity that is required in designing and assessing behaviour change through external factors; and because behaviour change through external manipulation is often prescriptive and therefore is met with suspicion and resistance, unless in a safety context.

For example, in the context of medical design, Grout (2006) has researched how medical devices and technologies can be designed prevent errors or to allow 'safe' failure which can be detected before harm is caused, drawing mainly on prevention strategies (p.45):

> *1. Design mistake prevention into the process.*
> *2. Design mistake detection into the process.*
> *3. Design the process to fail safely.*
> *4. Design a work environment that prevents errors.*

He does so, referring to Norman's design psychology approach (1989) as well as more traditional visual design strategies (e.g. Tufte, 2001), as well as various mistake proofing strategies. While not drawing explicitly on any psychological strategies, in the referral to external factors to change behaviour, we can clearly classify his approach as contextual.

Another example is that of design against crime. Crowe's approach to architectural design against crime (2000) aims to make the reader revisualise the environment and its management in relation to human behaviour to prevent crime. (p.10).

4.3.3   Design for Behaviour Change approaches in the middle-ground

Most design for behaviour change approaches that fall into the middle ground are fairly recent. Interestingly, there are more design models and toolkits in this group, than for example in the 'context' section, which appears to indicate a trend to more holistic thinking in design.

4.3.3.1   Mindful design

Niedderer (2007, 2013, 2014) has adopted Langer's theory of mindfulness (1989, 2010) to develop the concept of mindful design to encourage responsible user action and choice. Mindful design seeks to achieve responsible action through raising critical awareness of the different options rather than relying on a safe default situation, which is for example contrary to 'nudge' models based on choice architecture. It does so by changing the some part of the function of a design to disrupt the user's consciousness to raise their awareness.

Mindful design is based on the belief that design plays an important role within behaviour change, because 'every act of design involves choices that are deeply interested, in the sense that they necessarily serve someone's needs before (or to the exclusion of) those of other parties.' (Greenfield 2011). It is further based on the recognition that objects direct our actions both consciously and unconsciously, and can influence the interaction we have with them and with other people (Norman 2002:1, 34; Pearce 1995: 166). This shifts the traditional focus on human-object interaction to one that is concerned with 'how human beings relate to other human beings through the mediating influence of products' (Buchanan

2001:11). The use of artefacts can affect social interaction in desired and undesired ways (Dunne and Raby 2001, Norman 2002, Ilstedt 2004), and for it to be *mindless* or *mindful* (Langer 1989, Niedderer 2007).

Mindlessness reinforces entrenched behaviours and beliefs without paying attention to the specific situation and its context, and can therefore lead to errors and inappropriate personal or social judgments and behaviours (Langer 1989: 25, 43). For example, mobile phones are designed to connect people, which is their desirable characteristic. However, they can also disrupt the interaction between people. For instance, people who talk on their phones in public spaces become mindless towards their surroundings, which can lead to both annoying as well as dangerous incidents, e.g. when not paying attention in crossing a road.

Mindfulness, in contrast, refers to a mindset of openness and alertness, which regards any information as novel, pays attention to the specific context and considers the information from different perspectives, in order to enable the creation of new categories (Langer 1997: 111). Mindfulness can aid behaviour change, because it encourages reconsidering our actions and their causes, helping to adjust them to new situations and challenges (Langer and Moldoveanu 2000b). A good example of how designing can encourage mindfulness is the example of a certain traffic junction in Drachten, The Netherlands. A junction with a high incident rate, which was not improved by additional signage, therefore the traffic planners finally decided to take away all signs. From a mindful design perspective, it is argued that this causes all traffic participants to actively think about how to navigate their environment and to take responsibility for managing the traffic system. The result was a clear improvement of the situation (Webster, 2007).

Niedderer (2014: 358-360) has developed a detailed guide for designers, which is divided into three main steps:

> **Step 1:** *Identify a lack of mindful interaction or intent within a specific social situation*
> **Step 2:** *Identify mindful options for mediating or improving the identified situation*
> **Step 3:** *Identify how selected mindful options can be implemented through the object*

This guide enables designers to identify appropriate situations for intervention, appropriate options for interventions, and appropriate ways of implementing the selected option(s).

4.3.3.2   Socially responsible design

Tromp et al (2011) have developed a framework for socially responsible design from the point of the intended user experience, which is presented in the form of a map. In this map, they distinguish four categories of product influences: decisive, coercive, persuasive and seductive, which are used to encourage desirable and discourage undesirable behaviour. Decisive designs are based on constraining behaviour of the design, which does not allow certain undesired behaviours. It tends to be unconscious without offer of an alternative, for example, a tall building without a lift requires the user to exercise by walking up the stairs (Tromp et al 2011: 12). In contrast, coercive design is identified as "strong and explicit" in its influence, such as speed cameras, which offer drivers the choice of slowing down or keeping to the required speed and incurring a fine. Tromp et al. further distinguish between the two categories of persuasive and seductive design, which are characterised respectively as having an explicit and implicit weak influence. These offer guidance rather than reinforcement, such as a healthy eating campaign (persuasive) or the effect of microwave ovens on social eating habits: because food can be prepared any time (seductive), fewer family meals are taken

together (Tromp et al 2011:12). Importantly, Tromp et al. conclude that coercive and seductive influences together are most suited to changing user behaviour, especially where individual and social intentions are in conflict (Tromp, Hekkert and Verbeek 2011: 17). As part of their reflections, the authors acknowledge that one of the limitation of the proposed model is the focus on intended user experience. This is because it is difficult to predict since users have a choice about how to behave, which is often willful and idiosyncratic, and subverting given design intentions.

4.3.3.3   Design with intent

Design with Intent (Lockton 2010) outlines a collection of multiple tools and techniques that enable, motivate or constrain the user to encourage desired actions. The toolkit takes a functional approach, which considers motivating (internal constraint) as well as enabling and constraining behaviour (external constraint through design), which is defined respectively as:

- **Motivating behaviour:** Motivating users to change behaviour by education, incentives and changing attitudes
- **Enabling behaviour:** Enabling 'desirable' behaviour by making it easier for the user than the alternatives
- **Constraining behaviour:** Constraining users to 'desirable' behaviour by making alternatives difficult or impossible.

Lockton et al. (2010) draw upon many different theories to support the structure of the toolkit including;

- Environmental and ecological psychology
- Poka-yoke manufacturing quality control
- Affordance techniques
- Heuristic and biases approaches
- Use of rhetoric (applied in pervasive technology)

Drawing on these diverse theories, it proposes eight lenses by which to understand various aspects of personal behaviour and contexts from a diversity of fields, e.g. the Cognitive lens is primarily about cognition, while the Architectural lens is primarily about context. (Table 6) The method creates a 'suggestion tool' inspiring design solutions by proposing techniques with examples that are applicable to particular target behaviours. Although not explicitly related to the behavioural wheel model, the Design with Intent toolkit appears closest to it in its coverage of the different positions, and has been positioned on our map accordingly.

Table 6: 8 lenses of Design with Intent toolkit

Lenses	Patterns
Architectural The Architectural Lens draws on techniques used to influence user behaviour in architecture, urban planning and related disciplines such as traffic management and crime prevention through environmental design	Angles; Converging & diverging; Conveyor belts; Feature deletion; Hiding things; Material Properties; Mazes; Pave the cowpaths; Positioning; Roadblock; Segmentation & spacing; Simplicity

Errorproofing The Errorproofing Lens represents a worldview treating deviations from the target behaviour as 'errors' which design can help avoid, either by making it easier for users to work without making errors, or by making errors impossible in the first place.	Are you sure?; Choice editing; Conditional warnings; Defaults; Did you mean?; Interlock; matched affordances; Opt-outs; Portions; Task lock-in/out
Interaction All the patterns are really about interaction design in one form or another, but the Persuasive / Interaction Lens brings together some of the most common design elements of interfaces where users' interactions with the system affect how their behaviour is influenced, including from the growing field of Persuasive Technology (Fogg, 2003)	Feedback through form; Kairos; Partial completion; Peer feedback; Progress bar; Real-time feedback; Simulation & feedforward; Summary feedback; Tailoring; Tunnelling & wizards
Perceptual The Visual / Perception Lens combines ideas from product semantics, ecological psychology and Gestalt psychology about how users perceive patterns and meanings as they interact with the systems around them	(A)symmetry; Colour associations; Contrast; Fake affordances; Implied sequences; Metaphors; Mimicry & mirroring; Mood; Nakedness; Perceived affordances; Possibility trees; Prominence; Proximity & grouping; Seductive atmospherics; Similarity; Transparency; Watermarking
Cognitive The Cognitive Lens draws on research in behavioural economics and cognitive psychology looking at how people make decisions, and how this is affected by 'heuristics' and 'biases'. If designers understand how users make interaction decisions, that knowledge can be used to influence interaction behaviour. Equally, where users often make poor decisions, design can help counter this.	Assuaging guilt; Commitment & consistency; Decoys; Desire for order; Do as you're told; Emotional engagement; Expert choice; Framing; Habits; Personality; Provoke empathy; Reciprocation; Rephrasing & renaming; Scarcity; Social proof
Security The Security Lens represents a 'security' worldview, i.e. that undesired user behaviour is something to deter and/or prevent though 'countermeasures' designed into products, systems and environments, both physically and online, with examples such as digital rights management.	Coercive atmospherics; Peerveillance; Sousveillance; Surveillance; Threat of injury; Threat to property; What you can do; What you have; What you know; What you've done; Where you are; Who or what you are
Ludic Games are great at engaging people for long periods of time, influencing people's behaviour through their very design. The Ludic Lens includes a number of techniques for influencing user behaviour that can be derived from games and other 'playful' interactions, ranging from basic social psychology mechanisms such as goal-setting, to common game elements such as scores and levels. See also *gamification* (Deterding et al, 2011).	Challenges & targets; Collections; Leave gaps to fill; Levels; Make it a meme; Playfulness; Rewards; Role-playing; Scores; Storytelling; Unpredictable reinforcement
Machiavellian The Machiavellian Lens comprises design patterns which, while diverse, all embody an 'end justifies the means' approach. This may be unethical, but is nevertheless commonly used to control and influence consumers through advertising, pricing structures, planned obsolescence, lock-ins and so on.	Anchoring; Antifeatures & crippleware; Bundling; Degrading performance; First one free; Forced dichotomy; Format lock-in/out, Functional obsolescence; I cut, you choose; Poison pill; Serving suggestion; Slow/no response; Style obsolescence; worry resolution

Weinreich (2011) outlines the role of behaviour change to a broader behavioural change/social marketing audience, drawing on Lockton's Design with Intent and IDEO's design process. Srivastava and Shu (2014) develop an ontology for unifying behaviour change literature, specifically in the context of human operator behaviour in manufacturing, which is also based on the Design with Intent patterns.

4.3.3.4 Community based Social marketing and Design

Southerton et al (2011) concludes that behavioural change "requires shifting the foci of initiatives away from individual consumer decisions and toward shaping and intervening in the shared behaviours of social groups." Clune's (2010a) 'Design for Behaviour Change' model incorporated Mackenzie-Mohr's (2000) Community Based Social Marketing with design in an attempt to intervene in shared social practices. Mohrs model suggests that the behaviour expected to change should be specific and is best addressed at the level of local community, offering four steps:

- stage one: identifying barriers and benefits
- stage two: designing effective strategies based on effective tools
- stage three: piloting the strategy
- stage four: evaluating

To facilitate change, the effective strategies are based on psychological tools such as prompts, norms, incentives, commitments, communication and the removal of barriers. The strategies are largely aimed at reducing barriers or amplifying the benefits. Mohr's original model largely ignores the capacity of design to 'remove barriers' to particular practices. The inclusion of design redresses this, resulting in a model that could be utilized alongside the traditional design process for products and services that target specific behaviours.

4.3.3.5 Further approaches

Practice orientated product design

Practice orientated product design is an emerging area that is attempting to apply the understanding of Social Practice Theory - that material artefacts (designed stuff) influence the trajectory of everyday practices - to design. It does so on the premise that this will ultimately shift everyday practices over time (Kuijer, 2014; Scott et al., 2009). One example of this is re-introducing person-heating as an alternative to the dominant space heating paradigm. Closely related and also in an environmental context, Stern (2000) has developed a framework that discusses both cognitive and structural aspects from an actor oriented perspective which emphasises target behaviours,

The Modes of Transitions Framework

The Modes of Transitions Framework (Kursat Ozenc, 2014) offers designers a way to understand people that go through a process of change (a *transition*). The framework structures human-centered design methods to analyze and comprehend transitions, combines it with scenario-based design to provide a means of action; and suggests using research-through design methods in the prototyping phase.

Dimensions of Behaviour Change

In an environmental context, Daae and Boks' (2014) 'Dimensions of Behaviour Change' tool is a detailed method and card deck aiming to guide designers through the process of specifying techniques for influencing behaviour. The tool was developed based on existing literature and on five workshops with design practitioners, which were used to identify "55 variations of how to affect behaviour, which are categorised into nine dimensions". In a similar, slightly earlier approach, Lidman & Renström (2011) have developed a model with five design strategies: enlighten, spur, steer, force and match, also for sustainability.

4.3.3.6 Discussion of approaches to the middle-ground

The discussion of emerging theories and toolkits in the 'middle-ground' demonstrates that there is a recent recognition of the need to combine individual and contextual approaches to provide a more holistic approach. Because of the mostly very recent development of the different approaches – few are older than about five years – systematic testing of the application of most of these approaches has yet to be conducted on any scale. In addition, the complexity of the combined approaches makes their testing even more challenging, which is has to be a core aim for the further development of the field.

4.3.4 Discussion of design for behaviour change models and toolkits

4.3.4.1 Designing mental models

The design approaches discussed in section 4.3 mostly use behaviour change models to provide an understanding of the user's mental models for designers. Mental models can be broadly described as "knowledge of how the system works, what its components are, how they are related, what the internal processes are, and how they affect the components". They thus allow designers "not only to construct actions for novel tasks but also to explain why a particular action produces the results it does" Carroll et al (1987: xx). Within the design process, understanding user behaviour in context, through investigating users' own understanding and mental models of the systems, is critical if a user's current model leads to undesirable, dangerous, or inefficient actions. This then gives the designer the options of designing e.g. to shift the user's mental model (if incorrect) to a more accurate one, perhaps by making the 'system model' evident or by increasing the repertoire of models available to the user. Alternatively, one might redesign a system so that it appears to work in the way that the user assumes, working with the existing model even if incorrect. For example, redesigning thermostat controls to following users' logic (Lockton et al., 2013).

The alternative to working with mental models is for designers to outright ignore users' mental models—while still trying to influence behaviour. The most obvious ones are related to safety, where the designer is interested in a particular 'safe' behavioural outcome regardless of whether users' understanding is 'correct' or not. For example, preventing undesirable or erroneous behaviour to increase safety, as in the example of anti-ligature furnishings and fixtures in mental health units (Qin and Nordentoft 2005). This closely aligns with the libertarian paternalism of the choice architecture model.

However, the use of both prescriptive and implicit approaches raises ethical issues. For example, prescriptive design can be problematic in that while certain solutions might be

desirable, they will make an alternative impossible. As in the case of the building with only a staircase and no lift, this may be desirable for people's health generally, but it would disadvantage anyone who is not able to walk up or down stairs, or who has to carry any loads, etc. Similarly, implicit design solutions do not enable explicit consent of the user concerning their choice of behaviour, and therefore might either be perceived as inappropriate manipulation or it may lack effect if the change is not conscious and might result in the user reverting to previous behaviour where there are no implicit prompts. For example, where the option of a lift is provided the same user (who was previously implicitly primed to take the stairs) may revert instantaneously and without reflection to old habits of using a lift rather than using the fitness option of the stairs. Therefore a combination of implicit and explicit factors is generally seen as the most effective, since education (persuasive design) alone tends to be ineffective (Mastache, Mistral, Velleman and Templeton 2008).

Besides theoretical models, which are key to explaining mental models and their application within design, toolkits and design guides have become an increasingly common way of bringing principles from literature, and design patterns and methods together in a practically applicable form. They often supplement theoretical models or are derived from them. In the design for behaviour change context, most such toolkits or guides are inherently multidisciplinary, reflecting the diversity of relevant knowledge, but in translating this knowledge for a design practitioner audience, the content is inevitably adapted and reduced in complexity. This can lead to criticism of the notion of toolkits themselves (Kimbell, 2013), but as a way of facilitating informed, structured creativity, the use of toolkits can increase the diversity of designers' idea generation in response to behaviour change problems (Lockton et al, 2013b).

The models, guides and toolkits discussed here enable problem-solving and idea generation (Golembewski and Selby, 2010), but also reflection and analysis of existing and proposed situations, e.g. the impact of products in use. A holistic, socially responsible approach to design for behaviour change in practice must include this degree of reflection, and as such, structured tools to prompt this thinking during the design process can make a useful contribution.

It has been illuminating to see that stakeholders from private and public sectors used some design for behaviour change approaches, such as tools developed by Fogg (Persuasive technology) and by Lilley (Loughborough model) and the Design with Intent toolkit. However, generally, they appeared more familiar with behaviour change models from the behavioural sciences such as Nudge techniques, the Health-Belief Model, Theory of Planned Behaviour and Stage-Based Change Models, some of which were developed into their own models such as the MINDSPACE model.

4.3.4.2   The agency divide in design for behaviour change

Design for behaviour change approaches are strongly based on behavioural science principles. This allows the design approaches to incorporate the human behavioural component into the design thinking to develop appropriate models and tools of designing for behavioural change. The above examples and applications indicate that design for behaviour change is an umbrella term for a number of different issues, perspectives and approaches. This includes differences in the focus, i.e. whether the goal of the design is the environment, an object, or social interaction; in the perspective, i.e. whether it is ethically permissible to design objects in such a way that they force people to behave in certain ways (Lockton 2012b); or in

the approach, i.e. what kind of dynamic and underlying mechanism should be used to achieve the desired goals, for example, whether design for behaviour change should adopt a passive model that decides for the user, or an active approach that requires the reflection and commitment by the user.

The majority of approaches appear to be focused on the traditional individual-rational-agency model while few appear to focus entirely on a contextual perspective. There appears to be a recent trend towards the middle-ground with models including a combination of individual and contextual factors. The review has further indicated that a large number of the toolkits and models that aim to facilitate design for behaviour change are based on or draw on behavioural economics, while others draw on a range of different models. Figure 8 illustrates the current dominance of behavioural economics which has—at least politically—partly supplanted a previous focus on *changing attitudes and beliefs* as a precursor to behaviour change, exemplified by models such as Ajzen's (1985) 'Theory of Planned Behaviour'. As Stern (2000) and Guagnano et al (1995) showed in relation to recycling behaviour, contextual factors, often related to the built environment (such as the lack of presence of kerbside recycling bins) will often trump even deeply held 'pro-environment' attitudes in terms of influencing actual behaviour. This is certainly not to decry the value and potential of increasing thoughtfulness (Grist, 2010; John et al, 2011) through the design of products, services and environments, but simply highlighting that *context*—something with which designers are already very familiar—plays a powerful role in behaviour change.

Even where spatial or other contextual factors are included, most common current models primarily focus on *individual* decision-making, lacking consideration of the *social* aspects of decisions, and the evolving social practices which affect how people interact with their environment (Kuijer and de Jong, 2011; Shove, 2010; Wilhite, 2013). Hazas et al (2012), specifically talking about 'design for sustainable behaviour' feedback interventions in the home, criticise the dominant models of individuals making "constant and active choices" about their behaviour around energy and resource use, without taking sufficient account of the contexts of everyday life, social and time commitments, and negotiating priorities within a family or household. A similar argument can be made about behaviours at work, and indeed in the health, wellbeing, performance and productivity domains. Indeed, the more complex the action or problem (like the wicked problems of unsustainability), the further away it moves from individual agency and the more challenging it is to identify product level solutions.

A tension is revealed here, in that the agency inherent in design artefacts to create societal change over time is not explicit in some of the dominant design for behavioural change models. This lack of focus is challenging in that all design creates change, yet design is traditionally bad at measuring the causal impact of design on change. The absence of valid reviews on the causal impact of design over time makes attempts to justify the relevance of design and behaviour change difficult. In lieu of concrete case studies highlighting the impact of design for behaviour change studies, the following section introduces a range of example that illustrates design for behaviour change across differing sectors, and the 'agency divide'.

Whether proposing an individualist or contextual approach, all theories/toolkits can be seen to use one or more of three strategies—making it easier to do an identified target behaviour (enabling), motivating users to do it, or constraining users so they have to do or cannot do it. It is also relatively easy to apply the enabling / motivating / constraining distinction in reverse, i.e. looking at an existing example of design and assessing what the approach might have been. Therefore, this thinking, and many of its approaches can be used both as analytical

tools as well as design tools. Thereby it is important to distinguish between *means* (the design techniques themselves) and the intended *ends* (the intended effects of the design on behaviour) and their relationship, because people do not always act as designers intend them to.
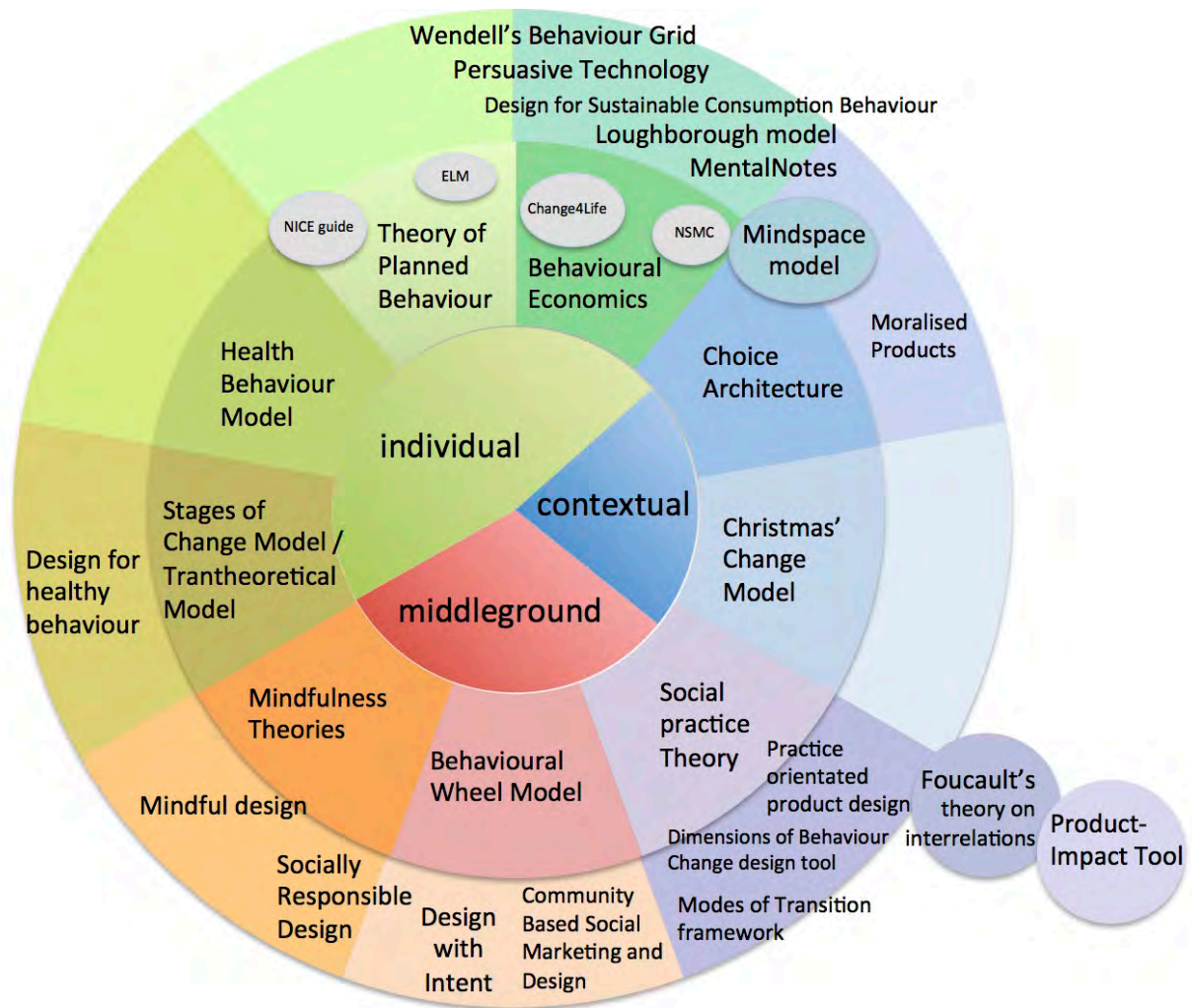

Figure 8: Categorisation of approaches in relation to behavioural theories.

4.4   Design for behaviour change examples

This section reviews the application of design for behaviour change through the discussion of a number of selected design for behaviour change examples. By now, there are a number of distinct areas in design, which have adopted the idea of behaviour change, and which are shaping current understandings of what design for behaviour change is. Examples have been organised by area of application, including sustainability, health and wellbeing, safety and social design. This structure has been chosen because the case studies and examples are often anecdotal and not explicitly related to any models. The discussion seeks to draw out, on the one hand, the relationship of the examples with specific models and, on the other, it discusses how examples have been interpreted through the application of such models.

Currently the most prominent application of design for behaviour change is in design for sustainability (e.g. Fuad-Luke 2009, Dusch, Crilly and Moultrie 2011, Bhamra et al 2011). In this area, design for behaviour change has a number of goals and approaches, which are driven by the idea of conserving the world's resources. These include on the one hand changing attitudes of design companies to improve product specifications and production patterns for the purpose of reducing e.g. energy consumption, waste, or CO2 consumption, such as lower CO2 emission or the recyclability of all product parts in the car industry. On the other hand, they build on and seek to promote a change in user behaviour, such as the switch from using a car to a bicycle or public transport. These goals are promoted through different ways of reinforcement, which either work as incentives or deterrents, and which are either driven by prescription or voluntary engagement. For example, legislation is prescriptive. It can work as a deterrent using tax or fees, e.g. higher fuel tax to deter people from driving, higher tariffs for cars with higher CO2 emissions to reduce CO2 emissions, or a small fee for shopping bags to encourage people to re-use their bags. In the same way, legislation can work as incentives promoting certain actions, such as recent schemes for the promotion of sustainable building or for retrofitting your home with insulation and alternative energy sources. At the other end of the spectrum, there are voluntary initiatives and social pressures, which are dependent on people's commitments to achieve desired goals, such as recycling, initiatives for city gardening, or promotion of the use of cycling to reduce the use of cars and with it to reduce congestion and CO2 emissions, and increase people's health. Successful initiatives often go hand in hand with legislation, such as smoking laws in the UK, which were introduced due to certain pressure groups, and which have created in turn social pressure on individuals to reduce or cease smoking.

A second arena, where design for behaviour change has found recognition is in the health sector. Various kinds of devices from body wearable items (badges, bracelets, etc.) to mobile phones have been designed to assess health and physical activity, and to engender awareness in the individual of their own health and health-related behaviours. For this purpose, continuous glucose monitors, activity monitors, fitness and heart-rate monitors, electro-dermal activity monitors (e.g. Affectiva 2013, Iliaifar 2012, Nike 2012) are variously used to measure respiration, heart rate, body posture and activity, skin temperature and emotional arousal. One notable approach in this area combines health with social application: Iida and Suzuki (2010) have developed a bracelet based on electromagnetic sensors to measure and encourage physical touch for therapeutic purposes through a reward response (lighting up) of the bracelet. In addition to technology, physical environment design has also been used to promote positive behaviour change as will be discussed.

This leads to a third area of application, which is safety design, and which is quite pervasive although less well-recognised with regard to behaviour change. Safety design is applied in anything from computers, to medical care, to atomic power stations in order to direct human behaviour for the purpose of preventing human error. Warning notices on computers (e.g. when saving a document) are a good example, which briefly disrupt the user's consciousness and require an additional action to complete the command (e.g. 'save/don't save/cancel'). Another example is the medical connectors developed by Walters, Chamberlain and Press (2003) that provide visual and tactile cues to avoid error and to enhance safer use in hospitals.

Other applications of design for behaviour change in relation to safety include crime prevention (e.g. Press, Erol, Cooper and Thomas 2000). Initiatives, such as the 'Design against Crime' project have developed bike stands, the design of which encourages safe locking of bikes and in turn deters thieves from steeling them. Here, the design acts as a physical guide/deterrent by encouraging safe locking and by making it more difficult to steal a bike.

This overlaps with a fourth area - that of social design - which seeks to influence, manage or change social interactions through design. This may include anything from managing social interaction, e.g. through interactive devices such as mobile phones or social networking sites, to direct personal interaction on the streets, in the home, or indeed anywhere were social interaction may occur. One example from design for crime, which is based very much on the principles of social design, is that of the painted stripe or patch in front of cash machines (or other counters) to deter thieves or intruders (Gamman and Thorpe 2012) by showing any trespasser to visibly breaking social norms, enabling action to re-establish that norm. Here the design does not physically deter anybody standing too close to or interfering with the individual using the cash machine, i.e. it does not make anybody physically safer. Instead, it makes visible social expectations of personal (safe) space and related behaviours of keeping distance, drawing on social conventions and respect.

Taking each of these four areas in turn, examples from the literature review, survey and focus groups are presented below in relation to the agency dive to show the scope of design for behaviour change application. Each section discusses a selection of appropriate 'segments' of the agency divide to demonstrate how different approaches ask different questions and therefore provide different results.

One aspect which has been problematic in the discussion of design for behaviour change examples is that they – coming largely from professional practice – are often of an anecdotal nature without the detailed data that would allow meticulous analysis. Also, many examples have therefore to be interpreted through retrospective analysis. This is the basis on which this section can offer a selection of examples, and which points to the need for future projects to make data and results available for others to learn and to improve the implementation design for behaviour change in the field.

4.4.1   Sustainability

Design for ecological sustainability is a growing area which seeks to help address the enormous challenges we are facing to maintain the balance and health of our planet earth. For example, targets such as an 80-95% reduction in CO2e emissions from 1990 levels (EU 2013) and 80% reduction in the UK (Crown 2008) are common, resulting in an increasing focus on efforts to reduce CO2 in the broad areas of energy, travel, food, and consumption of goods and services.

Each of these themes can be broken down with respect to the key activities and practices that are likely to result in significant reduction in environmental impacts. The bullet points below outline key drivers of emissions that could form the basis of design for behaviour change campaigns:

- Energy: The majority of domestic energy use (78%) in the UK is associated with space and water heating (DECC 2012, p.21), and is seen as a priority area.
- Food: food related CO2e emissions could be reduced by eliminating meat (35%), eliminating food waste (12%), purchasing local (5%) and avoiding packaging waste (3%) (Hoolohan, Berners-Lee et al. 2013, p.1065).
- Transport: encourage a shift to low emission mobility. This would prioritize walking and cycling followed by public transport and car share modes, along with reduced air travel. 'Road transport is the most significant source of emissions in this sector, in particular passenger cars' (DECC 2013)
- Consumption of goods and services: e.g. reduction in fast fashion consumption. Extended producer responsibility.

In each of these areas, many changes are needed to address the core problem. Indeed there are too many to talk about in a single document. Therefore, the following discussion will focus on the example of thermal comfort that relates to energy use (Space and water heating are the dominant energy-using appliances in the UK) discussing how it can be addressed through different models of behaviour change. We use this example as a case study to illustrate a range of potential design for behaviour change options.

4.4.1.1   Theory of Planned behaviour and related design models

A traditional behavioural change campaign based on the theory of planned behaviour might involve *slogans and posters* aimed to raise individual awareness, encouraging individuals to 'turn it down and turn it off' linked to an environmental message. This position of 'educating consumers' has been heavily critiqued, as raising awareness alone rarely leads to change (McKenzie-Mohr 2000), (Figure 9, 9a).

Figure 9: Sustainability and planned behaviour.
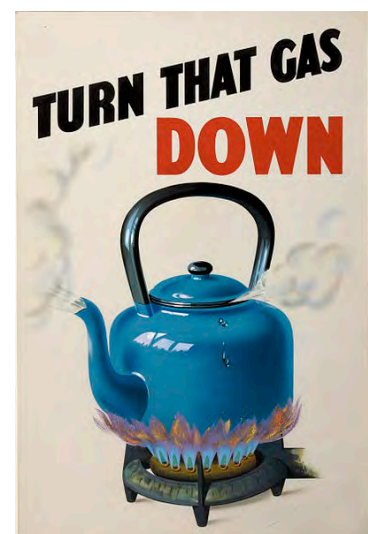

Figure 9a: Information and education campain. Traditional campaign poster. (United Kingdom Government; in the public domain)

4.4.1.2   Behavioural economics: motivating, triggering, prompting and providing feedback

Rather than using verbal persuasion, the Loughborough model uses *visual* and *sensory feedback mechanisms* that might reveal the invisible to the user and encourage reduced consumption. In home energy display meters such as the Onzo and Wattson feedback mechanisms are seen as examples of the Loughborough model. The range of visual and *sensory feedback* mechanisms attempted by designers is diverse. For example Tiffany Holmes (2007) eco-visualisation project revealed community energy use via a projected tree that's health transformed dependent on energy use. Darby's review of direct, indirect and inadvertent feedback mechanisms for energy use identified that feedback mechanisms raised energy awareness and reduced consumption in the order of 10% (Darby 2000). Onzo claim an 8% reduction from a sample of 5,000 participants (Wanvik 2014). Feedback mechanisms are closely aligned to Fogg's triggers, that may result for example in a simple switch located in an appropriate location to make the act of turning heating mechanisms off as convenient as possible (Figure 10).

Figure 10: behavioural economics in sustainable design

4.4.1.3   Choice architecture and elimination by design

Rather than appeal to the users to change behaviour, choice architecture utilises defaults to prescribe, physically constrain or enable the desired action to take place. (Figure 11) For example, *"Aircon off"* chose to ignore the users logic and turn heating and cooling off when a room is vacated for more than a set period of time.

Design also has the capacity to design away the problem by providing a different environment or context. For example, architects may apply *passive architecture* principles that eliminate the need for space heating, radically changing the context via what may traditionally be viewed as good design. Designing away energy use from a sustainability perspective may have a higher sustaining potential.

Figure 11: Using choice architecture to drive sustainable

4.4.1.4 *Practice oriented product design*

The Practice Orientated Product design approach (Kuijer 2014) has attempted to rethink thermal comfort practices, moving from space heating to personal heating, designing a range of novel solutions that *heat the person* directly to reduce the need for space heating.

Personal heating strategies may be inspired by cultures and circumstances where space heating is not dominant. For example the Japanese Kotatsu is a low table that integrates a duvet and heater. Sitting under the table allows one to stay warm without the expense of heating an entire room. (Figure 12, 12a)

Figure 12: Application of practice-orientated product design to sustainability

Figure 12a: Japanese Kotatsu - heated table with quilt cover. CAPL: capl.washjeff.edu, Creative Commons 3.0 US License.

4.4.1.5 *Behavioural Wheel Model - Design with Intent:*

Design with Intent (Lockton et al 2010) illustrates 101 patterns for influencing behaviour, at the heart of Lockton's approach is gaining a better understanding of people. Taking a *heuristic* approach to understanding thermostat settings attempts to understand the mental models of users. The mental models then inform a range of potential design solutions that better match the users' logic, and reduce wasteful consumption (Lockton et al 2013). (Figure 13)

Figure 13: taking account of mental models with 'Design with Intent' to design for sustainability

4.4.1.6   Mindful and socially responsible design approaches

The cool biz campaign implemented by the Japanese Ministry of Environment (MOE 2005) sought to achieve thermal comfort by challenging 'social norms'. The campaign fixed thermostats in government building to $28^{\circ}C$, and encouraged relaxed dress codes at work, removing the need for a three-piece suit and necktie in a hot climate. Cool Biz was supported at senior levels of government who were photographed in more casual attire. The campaign is interesting as it targets both the individual and the environment. Fashion designers also responded to the challenge by releasing smart business attire alternatives, and utilising different fabrics that breathed in the warmer environment. (Figure 14)

Figure 14: Directing sustainable behaviour through mindfulness

The above approaches highlights the breadth of possible means by which design can influence behaviour associated with thermal comfort. Exploring multiple points of intervention is a sound design for behavioural change strategy. What approach is selected will depend largely on the capacity available to the designer or organisation to intervene. A combination of approaches that target the person, and the environment would be desirable.

4.4.2   Health and Wellbeing

Designing for health is a large subject, which encompasses anything from medical technologies to health services, from healthcare to a healthy lifestyle. One of the most pressing challenges that our society faces today is the rise of so called 'lifestyle diseases', such as obesity and diabetes. A change towards a more healthy lifestyle could in many cases prevent or diminish such diseases, which would reduce demands and costs in care. Moreover, it could lead to a higher level of wellbeing for many people.

Another health challenge that we face as a society is the increasing number of people that are facing burnout or (mild) depression. Successful interventions aimed at improving people's mental wellbeing could help people face the demanding lives that we lead. Ever-increasing demands in care call for solutions that people can use on an individual basis. Various types of individualised non-person interventions could potentially reach a larger group of people than traditional interventions and alleviate pressure on the care system.

The design of our environment as well as specifically designed personal interventions can help people to adopt a healthier lifestyle and to take better care of their mental wellbeing. Therefore, designers and computer scientists regularly endeavour to design interventions aimed at persuading people to adopt a healthier lifestyle and improving mental wellbeing (e.g., Toscos et al., 2006; Nelson, 2012). Well-known examples include the *Bayer blood*

sugar monitor which seeks to encourage children with diabetes to monitor their own blood sugar levels to stay healthier, or the range of smart watches and bands, such as the *Nike Fuel Band* which enable more general health monitoring. One of the examples put forward by respondents was "about an interactive toothbrush for children to help them learn how to brush their teeth as well as brush their teeth in a playful way."
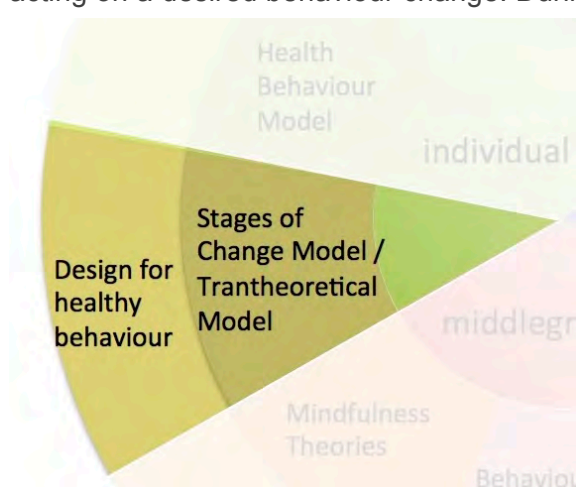
In order to enable designers to design for such situations, it is necessary for them to understand both the situation and the user. To make an informed decision about both, they need to be able to know which model to choose for which case and in which context, and to be able to transfer any given model onto a new and different case. It is therefore important for designers to understand different approaches and what triggers they utilise. One of the best ways to gain this understanding is to look at examples. In the following, we therefore discuss a number of examples with regard to some of the most relevant theories.

4.4.2.1   Transtheoeretical model and designing for healthy behaviour

Following the framework of design for healthy behaviour and the Transtheoretical model (TTM) (figure 15), Ludden and Offringa (forthcoming) designed a sequence of products that aimed to help people to diminish their intake of sugar-containing beverages. For many people, their daily intake of sugar is too high which has a negative effect on their general health and wellbeing. Limiting the intake of sugar-containing beverages can be a solution to this problem. This topic was explored as a design case study to explore sequential interventions. Following the 'design for healthy behaviour framework' three different products were designed for three different phases of behavioural change. The first product was designed to match the motivational state of people in early stages of behaviour change. For this stage, two things are important: (1) In this phase, people do not want to change, therefore, they will not be willing to buy a product that supports a behavioural change. (2) The product should raise awareness of the unhealthy behaviour of drinking sugar-containing beverages. The product that was designed for this phase was a cooling sleeve that displays the amount of sugar that different types of beverages contain. This cooling sleeve would be available as an environmental intervention, for example by handing them out at a supermarket. A link was placed on the sleeve that lead the user to the second phase.

In the second phase, people should be supported to move from raised awareness to actually acting on a desired behaviour change. During this phase, people have to come to realise that

they should and that they are able to change their behaviour. The product that was designed for this phase was a mobile application that supports people in tracking their daily intake of sugar-containing beverages (see Figure 16). Based on the provided data, an advice or option for a change in behaviour would be given that links to the third phase: the option of buying a product to support the desired behaviour change.

Figure 15: Designing for healthy behaviour based on the TTM

In the third phase, people have decided that they want to change their behaviour and to support themselves to make the change they have bought either a bottle that contains an hourglass or a cap that contains an hourglass (Figure 16). The bottle (or a different bottle with the cap) will be placed in sight and reminds people that they have to drink enough water. Water is the best alternative for sugar containing beverages.

Figure 16: Three products designed for three different stages of change

The design case illustrates how a trigger in the environment (in this case, a free gift handed out at a supermarket) can serve as a first step towards a change in behaviour. The key thing is not to stop at the trigger but to design a sequence of interventions that are connected. This series of products focuses on three stages: (I) raising awareness (a free *cooling sleeve* that depicts the amount of sugar that different beverages contain), (II) awareness and enabling (a free mobile application that helps people to keep track of the amount of sugar-containing beverages that they consume) and (III) motivation (a water bottle containing an hour glass that reminds people to drink enough water instead of sugar-containing beverages).

4.4.2.2   *Theory of planned behaviour and behavioural economics within health*

To improve the general level of wellbeing of people with dementia who live in a care facility, Visch et al (Visch et al., 2011) explored several design interventions that were aimed to activate people with dementia. The aim of the project is to investigate how designers can make use of elements of gaming to increase motivation of users. The basic principles of persuasive technology are reflected in their design (triggers, motivation, ability). For example, they designed a device that would project a pattern of leaves on a table that invited inhabitants of the care facility to stroke through the leaves thereby changing the pattern.

In their work on using strategies from behavioural economics (Figure 17) to persuade people to make healthy choices, Lee et al. designed several interventions to promote healthy snacking in the workplace (Lee et al 2011, see also www.Snackbot.org). These interventions aimed to present choices in a way that leverages people's decision processes and induces them to make self-beneficial choices. For example, one of the interventions they designed

was a robot (Figure 18) that would present two types of snacks, whereby it was made easier to pick a healthy snack (apple) than it was to pick a less healthy snack (cookie). By removing the cue for an unhealthy habit (eating cookies is made slightly more difficult) and adding a prompt for a healthier alternative (picking the apple as a snack is made slightly easier) the choice for the healthier option is pre-programmed.

Figure 17: Theory of planned behaviour and behavioural economic within health

Figure 18: Snackbot presenting apples on a tray and cookies beneath the tray.

4.4.2.3 *Using choice architecture and environmental design to increase wellbeing*

At a contextual level, respondents offered the example of the design of public spaces for liveable cities that are safe, walkable and rideable and rely heavily on the context of the designed environment (Figure 19). Like mass media campaigns, such interventions can potentially reach large groups of people, simply because they can be placed in environments where many people encounter them. An example of such an environmental design intervention is a change in the design of staircases that would make them more attractive to use or easier to reach such as the staircases at the MOMA museum in New York (Figure 20). Other examples include the provision of *bike lanes* (preferably separate), bridges, priority traffic signals, traffic calmed streets and secure parking were central strategies to increased levels of cycling (Pucher and Buehler, 2007). This also included a project for "*rough sleepers* who live in London". It included the "commissioning of a hostel to address their multiple needs" and to change and improve health behaviours.

The creation of an outdoor gym for visitors to a UK National Trust property shows how the environment around us can be designed to promote healthy activity when visiting an outdoor space (Figure 21). The National Health Service (NHS) in the UK is acknowledging this with the new project "NHS Forest". The project aims to improve the health and wellbeing of staff, patients and communities through increasing access to green space on or near to NHS land and encourage greater social cohesion between NHS sites and the local communities around them (NHS Forest, 2014). The project sees this as sustainable benefit for users of the NHS.

Figure 19: Choice architecture and related design examples

Figure 20: Staircases at the MOMA in New York are wide and more easily accessible than elevators.

This links to the ideas of supportive hospital (and healthcare) environments. Macklin (2014) highlights the opportunities to integrate nature with healthcare, discussing opportunities for children to engage in outdoor play (growing plants without dirt). Bishop (2009) found that patients of 7-18 years regarded "natural spaces" as preferred areas, providing a contrast to the "indoor" environment. Gardens at the study site found to be vital for emotional self-regulation, self-restoration and the provision of privacy. We propose that positive behaviours subsequently arise from these interactions.

Figure 21: Outdoor gym produced by design company Boex using natural elements (Boex, 2014).

Wayfinding in hospital spaces provides another example where physical architectural features guide and manage behaviour of individuals that may ultimately reduce stress and anxiety. These systems are not just about better signage or coloured lines on floors (Ulrich et al., 2004). In relation to behaviour change, the premise of wayfinding design is to plan for people's behaviour in the real setting: (i) to design for their ability to perceive, select and understand information when faced with dense and stimulus rich environments, (ii) to design for their ability to understand the spatial characteristics of settings and their movements through them and finally, (iii) to design for their ability to develop decisions in order to reach destinations (Passini, 1996). Further to this, when reducing violence and aggression in A&E, the Design Council (2011) propose on site environmental signage, leaflets, to ensure a consistent level of information, reduces anxiety and subsequently instances of aggressive behaviour.

An example of wayfinding being successfully implemented comes from The Royal Children's Hospital (RCH) in Melbourne, where it has helped ease navigation across the settings eight floors (BuroNorth, 2012, 2013). The process involved consultation with over 600 children, resulting in an environmental theme. Area landmarks were based around a journey from "underground" to "sky" with wards named after animals expected at each area of a journey e.g. "Koalas" at the "tree top" level. Post-installation checks found a 45% reduction in journey times and a significant reduction in the number of users requiring help with finding their destination (78% to 14%). Along with this improved wayfinding behaviour there may well be a reduction in anxiety associated with this activity.

4.4.2.4   Mindful and socially responsible design approaches in the health sector

Models of mindfulness as a principle and method are perhaps most frequently used in a health context (Figure 22). One of the survey respondents offers an example of behaviour change on an interpersonal level through *patient empowerment*, which clearly draws on ideas of mindfulness although these are not explicitly named. The example explains that

Instead of Healthcare professionals trying to provide all the answers to patient's problems, we train them to start by asking the patient what they have been doing recently to help their health. This changes the conversation direction from the start. Also, instead of trying to impose behaviour change on patients we train GPs to work with the patient to set their own goals and overcome problems and barriers themselves or with the support of GPs. This is a cultural shift on both sides of the conversation and has worked well in localise areas such as Ayreshire, Cambridge and Torquay when the local NHS, GPs and patients were all trained at the same time.

Figure 22: Mindful design within the health context.

While in the above example, the mindfulness is instigated in the patient, or user, in the following examples – although not explicitly stated – mindfulness is required on the part of the designer to create supportive environments, some of which in turn can enable space for reflection and meditation to lead to a mindful attitude of the user or patient. This is based on research that mindfulness can increase health through enabling feelings of empowerment, and through removing perceived obstacles.

Roger Ulrich provided the foundations for investigating the relationship between design and patient wellbeing. In his seminal work in the area Ulrich (1984) showed that patients who viewed nature (trees) had shorter postoperative stays, took fewer pain relief drugs, and had more favorable comments about their condition in medical notes when matched with patients who viewed a brick wall. This suggests that there are positive effects in one's psychological behaviour when in a more supportive environment, helping recovery and ease stress (Ulrich, 1992). In addition, developing patient spaces as supportive environments, staff areas can have positive effects through increasing productivity, efficiency and staff satisfaction (Macklin, 2014; Ulrich, 1991). There are three key elements that define the theory of supportive environments which feed into design (see Ulrich 1991). Environments should

- Not raise obstacles to *coping* with stress and create stressors
- Promote access to physical features and *social interactions* that have a stress reducing effect
- Be *designed* for patients, visitors and staff

These points cover the subjective and wellbeing aspects ambient and other physical features create. Achieving these factors can promote behaviour for sustained recovery and wellbeing as improving people's experiences collectively will improve their behaviour (Design Council, 2011).

For example, research has found that colours should be used to achieve a friendly and welcoming atmospheres (Dalke et al., 2006). Blue and green coloured walls in a (reproduced) healthcare environment were preferred and considered less stressful than orange which was seen as arousing or white walls perceived as clinical (Verhoeven et al., 2006; Phuri, 2006).

Within dementia care, colour has been used to help improve patient orientation. The teal blue walls contrasted against brown upholstery and ash wood features of the space helping patients with impaired vision to recognise doors, windows and seating (Boex, 2014, Figure 23). Such features may help with Wayfinding and positive experiences that may subsequently contribute to positive behaviours within the spaces. Likewise colour in emergency departments can help improve the waiting experience helping calm patients and visitors in the stressful environment. Subsequently this can help contribute to a reduction in aggressive behaviour (Design Council, 2011).

Devlin and Arneil (2003) comment that lighting requires a reduction in glare, more daylight, softer lighting, and a concentration on residential style lighting. Where natural light is not available, the creative use of artificial light has been found to have positive effects. Macklin (2014) report on the use of LED lights in pre-operative induction rooms, to reduce anxiety in children prior to surgery, forming a "twinkling star" distraction scenario.

Figure 23: : Dementia ward designed by Boex (Boex, 2014).

Installation of floor-to-ceiling windows outside surgery suites and induction rooms has led to both staff and patients responding positively, citing the nature backdrop as providing a calming, relaxing atmosphere to interact with physicians before surgery (Macklin, 2014). This improves the social interaction between clinical teams and patients. Windows and views help develop a perceptual and cognitive link with the external environment as they provide a smoothing peaceful distraction (Verderber and Reuman, 1987). Verderber and Reuman (1987) showed that patients and staff dissatisfied with views within the hospital perceived a lack of control the screens and curtains around them and reported lower levels of wellbeing.

Another example deals with social interactions through meeting spaces and gardens. Social interaction can play a supportive role in recovery. An example of the importance of these spaces was highlighted by the UK design company Boex who produced a collection of outside bench seating designed specifically for a space of quiet reflection within Barbara Castle Way Healthcare Centre in Blackburn. The oak timber surfaces feature letters hand carved depicting connections to the local area. The messages portray popular activities within the local surroundings in order to engage with the visitor (Figure 24). Such spaces not only provide an area for personal contemplation but for family, visitors and patients to congregate. Importantly, the space highlights natural elements which have a positive on health and wellbeing and may promote coping behaviour through these social interactions.

Figure 24: Hospital Courtyard produced by Boex (Boex, 2014)

When working with children and adolescents Macklin (2014) notes the importance of normalcy and personalisation, which can be achieved through environmental design. Continuation of family routines, including mealtimes, incorporating both sick and well siblings is cited as a positive concept, thus provision of areas for both should be considered. Ensuring that socialisation with friends, siblings and family can occur in settings similar to home environments was seen as important (e.g. watching TV, visiting cafes or cinemas). This theme was also cited by Bishop (2009) who included shops, common rooms and play areas as social areas for hospital design. Areas to facilitate such activities should be designed incorporating previously discussed themes of light, colour, nature etc.

These examples demonstrate is that the physical attributes of healthcare spaces can be mindfully designed to provide 'supportive environments' that transcend solely ambient features to promote positive experiential and behavioural qualities.

4.4.3   Social Design

Social design is a broad amalgamation of approaches that are concerned with the social interactions in people's everyday lives since these permeate our entire life, whether in public or private (e.g. Chick 2012). Social behaviours are driven by a number of different factors, including social and cultural norms, as well as physical and psychological factors and emotions. Importantly, designed physical artefacts and surroundings are ubiquitous, and they can affect our interactions positively or negatively. For example, novel artefacts may change behaviour and such new behaviour may be regarded as appropriate or not, in the same way that established behaviours may or may not be appropriate in novel contexts and situations. One of the focus group participants offered an apt visual representation of designing for behaviour change which shows the complexity and orientation of design practice with regard to social change (Figure 25).

Figure 25: Behaviour change model by Actant Consulting Ltd www.actatnt.co (with permission)

Design has a large role to play in creating these situations. For example, the emergence of mobile phones and their use in public spaces has created a novel situation for which no social and cultural codex of interaction exist(ed). Hence mobile phones are often used in inappropriate situations, such as when driving or crossing a road, or in inappropriate ways, such as when talking loudly on one's phone in public spaces and annoying bystanders. Such interaction with (novel) artefacts can cause both risky and annoying situation, while in another situation it might create beneficial interactions.

Therefore its is vital that designers have the tools to understand the people's interaction and the impact of design on such human-object and social interaction, which can function both on a social-emotional and on an physical-operational level. In addition, many of the examples of social design by their nature cross over into other areas such as safety or health.

4.4.3.1 Transtheoretical model and related design models in social context

There have been few explicit design models in the area of social design focusing on the individual. However, there are a number of behaviour change models, such as the trans-theoretical model (Prochaska 1979, Figure 26), which has been adopted by Ludden and Offringa (forthcoming) for the application in the context of designing for healthy behaviour. Some of these examples are as much about social change as about health change.

For example, campaigns against smoking did not just have to appeal to the sense of the individual improving their health, but more importantly to the social pressures and consequences of smoking. This has included for example the prestige of being seen smoking, or the understanding (and care about the fact) that smoking harms others. Generally, educational campaigns, using strong visual graphics and information, have been used to achieve change in this regard, often together with measures from the contextual agency divide, such as legislation.

Figure 26: The TTM in social context

Social application of the TTM (Prochaska 1979) effectively draws on the 'social' criteria that underpin this model, including: *raising consciousness*, *increasing awareness* of the issues at stake, an *environmental re-evaluation* of their affect on others, as well as *social liberation* and h*elping relationships* as a recognition that other people and society as a whole can be a supportive factor.

4.4.3.2 Choice architecture in social context

Choice architecture (Figure 27) is used to determine the context within which people operate and make decisions. According to Thaler and Sunstein (2011: 58-59), in a social context, peer pressure acts as a strong basis for social nudges with positive or negative consequences such as:" Obesity is contagious. If your best friends get fat, your risk of gaining weight goes up", or Broadcasters mimic one another, producing otherwise inexplicable fads in programming" (p.59). This has also translated into design, especially advertising, not always with desirable aims or consequences.

Figure 27: Designing information using principles of choice architecture

One example offered by Thaler and Sunstein is an experiment with tax compliance (p. 72). The experiment offered four groups of taxpayers four different reasons for paying their tax including: beneficial use of tax, threat of punishment, help with filling in the form, and the information that more than 90% of people in the town pay their tax. They found that it was the last piece of information that inferred a sense of conformity that had the greatest effect on compliance with tax laws. This indicates that the design of social information provided in such contexts is crucial and can be used to help change behaviour.

4.4.3.3   The social impact through environmental design and passive architecture

While choice architecture seeks to influence people's decision making behaviour by psychological means, environmental design and 'passive architecture' (the latter may be seen as a design-related translation of a part of the Christmas model) seek to stimulate behaviour through physical means, sometimes in combination with psychological means (Figure 28).

Figure 28: Christmas Change model and passive architecture

In the context of social design, this can at times take 'anti-social' forms in that passive architecture might be designed to reinforce or prevent certain existing behaviours rather than to question them. One example, in this regard is the design of public seating. While traditional benches offer versatile use, modern designs often are designed to reinforce avoidance behaviour with regard to strangers. For that reason, recent public seating design often has seats separated by dividing arm rests or even with seats facing in opposite directions, pandering to people's habit of protecting their personal space and creating physical or psychological barriers. In extreme cases surfaces that one might sit on are studded with spikes to avoid homeless persons to rest (Niedderer 2014).

A positive example of passive architecture offered by respondents was the example of spaces in *law courts* which were designed to de-stress and calm users. It was argued that this encourages more prosecution witnesses to appear and makes parties in civil and family cases more open to resolution of disputes which been found to reduce time in court by 10% and to reduce violence and aggression in court.

4.4.3.4   Christmas Change Model and the 'outcome start system'

The Christmas model (Figure 29) is rather broader in its approach than choice architecture or passive architecture, considering external factors that frame people's behaviour. One example offered by one of the survey respondents concerns the social context of homeless people with mental health issues, which may have developed due to the often abusive social situations they found themselves in. The 'Mental health – good practice guide' (Communities and Local Government 2010) offers various examples (p.92ff) of how considering the comprehensive needs of homeless people can help them achieve a change of lifestyle. Although not explicitly related to the CCM, the 'the outcome start system' (p. 42) developed

and applied in the guide and examples follows very much the principles laid out in the CCM and translates them into the context of the care and rehabilitation of homeless people.

> *Jon is 45 years old. He was taken into care as a baby following a head injury and was diagnosed with a specific learning disability in 1997. He experienced sexual abuse as a young person and has self-harmed since he was nine years old (cutting and burning). From the age of 13, Jon has misused alcohol and solvents; currently he only uses alcohol. He became homeless at 16...*

> *Jon is a risk to others – becoming aggressive when drinking and has committed offences of assault, affray and criminal damage... Jon is equally at risk from others and has been financially and physically abused...*

Jon's fortunes turned with the help of the programme, which provided

> *a raft of support in place from the learning disabilities team, the mental health team, the street outreach team, Mind, and the council's homelessness prevention team.*

> *Jon has not offended since June (almost six months) which is a major achievement for him and his health has improved, leading to significant savings to community safety, police and health budgets. (p.101-102)*

Many social problems are highly complex and require a comprehensive and co-ordinated response to change the context, especially where individuals are not able to take control for themselves. In this context, regularly, design refers to service interventions which may include a combination of physical interventions (e.g. providing a accommodation) as well as psychological and medical support.

4.4.3.5 *Mindful design approaches to social responsibility*

Mindful design and socially responsible design approaches (Niedderer, 2013; Tromp et al 2011) are seeking to change individual's perceptions of their social environment to facilitate change towards it (Figure 29). Two examples are discussed in the following.

Figure 29: Mindful and Socially Responsible Design

Firstly, a design approach to reducing crime at cash machines. This is first of all considered an issue of safety and security for crime prevention. However, the example by Gamman and Thorpe (2012) re-interprets this to use social mechanisms (rather than physical ones) to deter thieves. They explain that a stripe or patch was painted in front of a cash machine to deter thieves or intruders by showing that any trespasser is visibly breaking social norms, enabling action by others (e.g. person at cash machine, bystander, police) to re-establish that norm. Significantly, using mindful design principles, this example can be explained as working by making visible social expectations of personal (safe) space and related behaviours of keeping distance, drawing on social conventions and respect.

A second important example is that of the *traffic junction* in Drachten (Webster, 2007), and today many others in the UK and elsewhere. Indeed, a UK example was mentioned by one of the survey respondents (Figure 30):

The removal of barriers along Kensington High Street, the removal of so-called safety apparatus and with the removal of this safety apparatus the road became safer. (FG1).

Figure 30: Shared Space Road Design, Kensington, London
(Photograph: Romazur 2012, Creative commons license).

These are examples of both social design and of safety design. Both examples refer to junctions with traffic safety issues. Because the high incident rate was not improved with additional signage, in the end traffic planners decided to take away all signs to improve traffic behaviour to create a 'shared social space'. The design works because it causes individuals to take note of their social context, and by doing so it requires them to take responsibility and thus it creates a safer traffic environment. Overall, it appears that many examples of social design respond to or can be explained by a mindful design pattern because they are reliant on social responsible action and reflection.

These examples show that social design is broad, and often connected to other issues such as health or safety. They also demonstrate that often problems can be resolved and social behaviours improved if viewing them as social constructs and accordingly changing social pressures or attitudes.

4.4.4 Safety

At present, the research area relating to how design can lead to behaviour change in the safety environment is not a particularly mature research area. There is still much that needs to be explored and tested to further aid insight. However, there are some examples which clearly illustrate how the principles of design for behaviour-change have been applied within the Safety domain.

In particular, The UK construction industry has a sustained approach to improve the safety of its workers and reduce the number of accidents and deaths within it for many years (Hartley and Cheyne, 2010). Interventions and initiatives have tackled various aspects of risk, ranging through design, elimination, protective equipment and behaviour. However, the construction industry is still dangerous with typically between 70 to 80 deaths per year. In Hartley and Cheyne's study, a number of visual cues were identified repeatedly, relating to housekeeping, pedestrian walkways, safety signs, the usage of personal protective equipment (PPE) and the behaviour of people already on site. Influences on behaviour were discussed through focus-groups involving those working on-site. 'First impressions' were thought to impact on risk-taking behaviour amongst the workers on the construction sites.

The findings relating to construction sites have potential implications for the management of safety within the construction industry in general in terms of establishing the importance of creating an impression of a high level of safety culture at all times. Based on the increased risk of injury and death within the industry, the UK Health and Safety Executive (HSE, 2012) developed the concept of 'safe by design'. This is the integration of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life of the building or structure being designed, including construction, use, maintenance and demolition. It encompasses all design including facilities, hardware, systems, equipment, products, tooling, materials, energy, controls, layout and configuration.

The 'safe design' approach begins in the conceptual and planning phases with an emphasis on making choices about design, materials used and methods of manufacture or construction to enhance the safety of the finished product. There are few studies which directly look into how design leads to behaviour change in the occupational health and safety domain. However, there are factors which can influence adoption of a design and in turn, how effective a particular design is at influencing safety once it has been suggested or made.

In a literature review on behaviour and safety research in a manufacturing setting Grindle, Dickinson et al. (2000) noted that there have been two main routes to changing behaviour in a workplace setting: engineering and behavioural interventions. The engineering perspective has also been termed Safety Engineering and involves the fitment of rails, guards and personal protective equipment to reduce the hazards prevalent in an environment. Grindle, Dickinson et al. (2000) note that the main disadvantages of this method include the time, resources and capital required to identify and then mitigate every possible hazardous condition within the environments. This approach also has the drawback of not expressly developing a safety culture but perhaps instead an over-reliance on safety systems. This may mean any unsafe areas, which have not been identified and mitigated. Accident could result of these areas developing without barriers or guards presumed to be safe. Finally any safety design or barrier put in place is likely to be possible to circumvent or mitigate - intentionally or otherwise - thus vastly reducing the effectiveness of such interventions.

Whysall, Haslam et al. (2004) observed that ergonomists recommend physical design changes to make an environment or working practices safer but few went on to analyse how effective these recommendations had been on safety or if they had been implemented at all. This could possibly be one of the reasons why so little is known about the extent to which design alone can lead to behaviour change as those involved with improving the design are often not the ones then also implementing or overseeing this change and therefore little data is collected.

Safe by Design – Examples:

Following the HSE's lead, numerous organisations now recognise and actively use the principles of 'safe by design' within the working environment. The Construction industry in particular is an obvious key stakeholder in this regard but a clear example of implementation of the general principles of "Safe by Design" can be found within Network Rail (Hyland et al 2012). Within railway operations, closure of the railway network for carrying out work is costly and therefore work carried out in such circumstances normally has strict time constraints. Detailed planning is therefore required to ensure that 'hand back' of the railway infrastructure can be safely achieved. Under such conditions 'safe by design' is critical when assessing all aspects of the work to be undertaken. Safety systems for personnel and materials handling must be considered and incorporated into all work designs and those planning the works must consider whether or not a safe system of work can be established that allows the railway to continue running. If a safe and practicable system cannot be identified, then work may need to be undertaken by shutting down the railway network which is costly and creates poor public relations between the industry and the customer.

4.4.4.1 Stages of Change model in the context of safety design

As described previously in this review, the 'Stages of Change' concept lies at the heart of the Transtheoretical Model of behaviour change, and studies of change have found that people move through a series of stages when modifying behaviour (Figure 31). While the time a person can stay in each stage is variable, the tasks required to move to the next stage are not.

Figure 31: The TTM in a safety context

The States of Change model was first applied to smoking but can be more generally applied to a wide variety of problem behaviours including, smoking cessation, exercise, low fat diet, alcohol abuse, weight control, drug abuse, medical compliance. Since it relates primarily to addictive behaviours, the applicability of the Stages of Change/Transtheoretical model to general safety has been less clear. However, there is one study by Whysall, Haslam et al. (2006) which does consider whether the model can also be applied at an organisational level in the context of safety design.

Whysall, Haslam et al. (2006) have investigated if taking into account how ready for change the clients are through the use of the State of Change model to assess what stage the organisation is at and therefore how ready for change certain organisations are. It was found this more tailored service aimed at taking a greater number of factors into account as well as giving consideration to which changes should be provided. This in turn should lead to increased changes in safety behaviour through the organisations being more likely to implement any suggestions made. For example if it is clear that the organisation has already shown commitment to change and implemented a lot of physical barriers to reduce hazards, then a greater focus on training or more abstract tailored suggestions for future improvements can be made.

4.4.4.2 Safety through behavioural economics

Figure 32: Designing with behavioural economics in a safety context

The second approach to changing behaviour to a safer way of interacting with an environment is the use of behavioural interventions (Figure 33). These have been described by Fitch, Hermann et al. (1976) as being *'based on systematically controlling the psychological environment by precisely defining and rewarding safe behaviours and extinguishing unsafe behaviours'*. Such stimulus-response, reward mechanisms relate to an early psychological method developed by Skinner and are known as positive reinforcement. This approach has previously been applied to occupational health and safety and is briefly discussed in a literature review by Wirth, Sigurdsson (2008).

Related to behaviour interventions, much of the current literature suggests that an improved design alone (for example, a new workstation) is not enough to cause behaviour change or affect safety. However some effective methods for initiating or helping to develop this change of behaviour have been proposed. One such example is from a recent paper by Robertson, Ciriello et al. (2013) whereby it was found that when workers were split into two groups; those who were trained in safe behaviours for sitting and standing when using workstations and those who were not. Those who were trained were observed to follow the safety guidelines more often than those who were minimally trained and furthermore the trained group also reported significantly lower amounts of discomfort and musculoskeletal discomfort across the 15 days of testing. According to these findings, appropriate design along with training on how to effectively use it can lead to a behavioural change towards more safe working practices. - However, some of the current literature is not in agreement with this finding instead suggesting that training alone is not sufficient to effectively alter behaviour to be more in line with recognised safe practices. There is suggestion that other methods are further required to bring about the desired change. One such method suggested by Sigurdsson, Artnak et al. (2012) was the use of motivational interventions. This study

involved training workers in how to optimally set up and use their keyboard for safe operation. The participants were separated into two groups; those which received vouchers as incentives if they were observed to be using their keyboard with a negative tilt-as instructed; and those who received no incentive at all. It was found those who were incentivised applied the best-practice rules when using their keyboard whereas those who were not incentivised made no alterations to its position following the training course. Furthermore after the discontinuation of incentives, two out of three of the participants continued to use the keyboard in its optimal position suggesting incentives may have a lasting effect on safe behaviour even after the incentives have ceased. This study finds not only that design alone is not enough to change behaviour (most keyboards have the ability of negative tilt but few people use it) but training in a design's proper usage may still not be sufficient to alter one's behaviour.

In a similar vein Yu, Moon et al. (2013) conducted a study to establish whether designing a system which gave feedback on maintaining a safe seated posture performance could influence the extent to which participants altered their behaviour when seated. A chair was designed which automatically monitored performance in regard to best practice guidelines and either gave: 1) no feedback; 2) immediate feedback - whereby a pop-up appeared on their computer informing them of their poor posture; or 3) delayed feedback where feedback on their posture was given by a pop-up at the end of each test session. It was found that both feedback conditions led to improvements in seated posture compared to the no feedback condition. The immediate feedback condition was also found to be more effective in encouraging participants to maintain a safe posture than was the delayed feedback condition. A similar study by Sigurdsson and Austin (2008) supported these findings and also found lasting effects on maintaining a safe posture even when the level of feedback on performance was reduced. These studies suggest that not only is feedback essential to changing behaviour but that a design which incorporates this feedback can be a particularly effective mechanism to initiating the desired behaviour change and may even lead to prolonged results when the feedback has been reduced or removed.

4.4.4.3   Choice architecture in safety design

Choice architecture is a term used to describe the way in which decisions may be influenced by how any available choices are presented (Figure 33). In essence, parallels can be drawn between choice architecture and traditional architecture. As a method, choice architecture is used to affect outcomes through the manner in which the person or organisation actually presents the choice to the decision-maker. For example, nations that require its citizens to opt out of organ transplant donations have a significantly higher organ-donor rate than nations where the citizens must actively choose to take part (Thaler and Sunstein 2011: 58-59). Another variation is to illustrate the various outcomes of a decision in a way that is easy for the choice-maker to understand.

Figure 33: TTM in the safety context

The area of safety is perhaps one of the clearest examples where the default mechanism of choice architecture is desirable, i.e. where designed mechanisms are put in place so that it is very difficult or impossible to operate a device in such a way that a person could be injured. This is important because, in such a context, trying to persuade an individual to use a device correctly simply does not work.

Perhaps one of the clearest examples of how design can influence safety behaviour changes can be found by again examining the construction industry and there are several published studies, which examine this in practice. The UK construction industry has attempted to improve the safety of its workers and reduce the number of accidents and deaths within it for many years (Hartley and Cheyne, 2010). Interventions and initiatives have tackled various aspects of risk, ranging through design, elimination, protective equipment, and behaviour. However as was described earlier, the construction industry is still dangerous (typically between 70 to 80 deaths per year) and Hartley and Cheyne's study demonstrates how a range of 'choice architecture' interventions are thought to impact on risk-taking behaviour amongst the workers on the construction sites.

4.4.4.4   Behavioural Wheel model and Design with Intent

Lockton et al (2010) define 'Design with Intent' as 'design intended to influence or result in certain user behaviour' Figure 34). The starting point of the Design with Intent Method is the existence of a product, service or environment—a *system*—where users' behaviour is important to its operation, or where it would be strategically desirable to alter the way it is used. The goal of the design process is to modify or redesign the system to achieve this: in other words, to influence the users' behaviour towards a particular 'target behaviour'.

Figure 34: Design with Intent in a safety context

Lockton et al have reviewed examples from a variety of disciplines and whilst many of them relate to changes to encourage sustainable design, there are some obvious safety-related examples. For example, in road safety, several 'traffic calming' measures built into the road environment can be thought of as 'Design with Intent' since the principle of the design concept is to slow the traffic down (thereby changing driver behaviour towards safety) particularly in a built-up environment (Figure 35). Other road safety measures include pedestrian crossing facilities where the road-users are prevented from crossing the road at undesirable locations through the use of guard-rails and barriers (Figure 36).

Figure 35: Arpingstone. (2003). Traffic calming measures (road narrowing and speed bumps) in Yate, near Bristol, England. Creative Commons license.

Figure 36: Pedestrian crossing facility. Creative Commons license.

4.4.4.5   *Mindful and socially responsible design approaches to increase safety*

Mindfulness is a key mechanism of designing for behaviour change, especially in social contexts (Niedderer, 2013, Figure 37). It proposes that the benefit of 'mindful' design is its ability to shift the focus from an external locus of control to internal locus control. The latter enables conscious decision making and commitment in the individual as an essential basis for attitude change and for lasting behaviour change.

Figure 37: Mindful design in safety

To use road-user behaviour again as an example, and demonstrating the overlap with social design, the concept of 'shared space' in road design can be conceptualised in terms of 'mindful' design within behavioural safety since it supposes that the road users will take responsibility for both their own safety and also that of other road users when using a road junction (Figure 38). In 'shared space' environments, the control of the road manoeuvre is entirely determined by the actions of the road-users rather than being controlled by conventional traffic engineering measures such as signage, road-markings and signals. This creates a radical behaviour change forcing the users to proceed with much great caution within a shared-space intersection compared to a conventional intersection as the users are "mindfully" aware that all other road-users are in a similar 'uncontrolled' situation.

Figure 38: Shared Space Road Design, Kensington, London (Photograph: Romazur 2012, Creative commons license).

4.4.5   Discussion of the overview of design for behaviour change examples

This section has presented the discussion of a selection of examples across the four key subject areas, including sustainability, health and wellbeing, safety and social design. The discussion of each area has been organised by the analysis of examples through models from different 'slices' of the behaviour change map. The discussions have followed the format of the previous sections along the agency divide from 'individual' to 'contextual' to the 'middle-ground'. The discussions accordingly have covered examples selected to illustrate the application of different *design for behaviour change models* within those 'slices', or of *behaviour change models* where the former are not clearly existing or referenced.

Figure 39: Design for behaviour change map with examples

In the discussion of examples, two things become apparent. One is that many examples are not explicitly related to any models, often because either they are not well documented, or because they have not been systematically developed and tested. Therefore the description of examples often remains anecdotal. The second, which ensues in part from the first, is that there are many overlaps where examples often can be attributed to more than one subject area, or can be explained through two or more models. This is partly due to the complexity of

real examples, but partly due to the lack of clarity and attribution as discussed earlier. The investigation and reporting of examples can further be hampered by the confidentiality of work, or by the difficulty of reporting on failure in practice where disclosure could entail costly litigation.

These two observations indicate that there is a lack of common ground for both investigating and reporting on such applied work, including issues such as how to deal with legal and ethical issues. Thus there appears to be an urgent need to establish an agreed format or formats for testing and reporting in order to enable the more systematic development, analysis and evaluation of examples, and to produce examples that can serve as models of practice in how to apply design for behaviour change based upon solid foundations.

Figure 39 adds the examples to the visual map that has built up throughout the discussion. It demonstrates the split between strongly individual and contextual examples, although examples start to emerge in the middle-ground. As indicated in the beginning, not all examples were easy to place because of their implicit nature. Further, it was important to see that the examples of theories and toolkits used by private and public stakeholders partly responded to behaviour change models, some to design for behaviour change models, and some responded to other approaches, not yet included in this visualisation. Therefore, this map is an on-going and developing project, which we aim to build up more comprehensively over time to represent all the theories and examples that we have been able to collect this far, and will collect in the future.

4.5   Discussion of theory review

The review of theories, approaches and examples has shown that design for behaviour change is an evolving landscape of work that utilizes many theories and debates. Design for behaviour change theories have clearly evolved from theories and models of the behavioural sciences. These are still at times dominant while at others design for behaviour change models have started to emerge independently.

An important distinction between behaviour change and design for behaviour change models is that the first predominantly seek to measure behaviour change, or where they aim to influence behaviour it tends to be focused on human intervention. Design for behaviour change, by contrast, acknowledges that behaviour and interactions are mediated and strongly influenced by our external world, both material and non material, including e.g. artefacts, polies, services, environments etc.

Overall, 'traditional' theories tend to be more distinct and sit within either the individual or contextual spaces. Design for behaviour change thus appears to move along a continuum between behaviour change through environmental design (context) effecting passive behaviour management to behaviour change through conscious individual attitude change (content) (Figure 40).

More recent theories, especially those including design and those in new domains of use, have started to embrace approaches in the 'middle-ground', which are utilising a more holistic system-based model where individual and contextual approaches are integrated and are not mutually exclusive. In conclusion of the review, we posit that design for behavioural change has an increased chance of succeeding when the content and context is consistent.

Figure 40: behaviour change continuum

Design for behavioural change can be viewed as an emerging discipline. There appears to be more frequent use of behaviour change models in practice than design for behaviour change models. This may be due to the limited agency of design at a managerial level, as well as the fragmented nature of Design for Behavioural change theory at present.

With respect to successful long-term change, design for behaviour change at present lacks case studies and examples that provide a clear demonstration of the impact of approaches and application in practice. There appears to be a gap between models and execution, which is caused by a lack of translation of theory into practice, and which in turn causes a lack of well documented and evidenced examples. This may in part be because of the recent emergence of design models, which have not yet had time to filter through into broader use by design practitioners. Therefore the success of the approaches is still open for debate.

This contemporary understanding of Design for Behavioural Change is expanded upon in the 'results of innovation and access review' in the following section.

5. Results of Innovation and Access Review

This section presents the findings elicited through the online survey and follow-up focus groups about the understanding and use of design for behaviour change in the context of sustainable innovation. Besides providing an insight into theories and examples used within professional practice that have been discussed above as part of the theory review, the survey and focus groups produced a rich set of insights concerning the understanding and use of design for behaviour change.

While the survey covered information on the demographics of the survey respondents, the role of innovation, the understanding and use of design for behaviour change, as well as access and barriers to the implementation of design for behaviour change, the focus groups allowed further themes to emerge such as a more detailed discussion of the understanding of behaviour change, of ethical issues and of potential ways forward. Suggestions concerning the latter, which were gathered at the final results workshop on 18 September 2014 in response to the summary report presented there, are also included here.

In the following, the findings and insights of the survey and focus groups are presented in an integrated manner, since the focus groups were designed to extend the information gathered through the survey and as such have covered overlapping and complementary themes. Within this analysis, while the survey has provides statistically significant data, the data gathered through the focus groups enable an in-depth discussion and richer illustration of the issues raised through the survey, and also add insights into further issues not addressed by the survey. [1]

5.1 Demographics

The demographics have revealed some interesting trends. These relate to the level of engagement related to area of location as well as the balance of respondents in terms of size and type of organisation.

About two thirds of the 131 respondents of the online survey were from SMEs (63%). These were divided into Micro-businesses (37%), and S&MEs (26% divided into SE 11%, ME 15%). 37% were from Large Organisations (Figure 41).[2] Thus, interestingly, Micro businesses (Mi) and Large Organisations (LO) were equally strong represented while small and medium size enterprises were slightly less prominent, which may indicate that S&MEs are operating in an economic bracket that is less viable and allows less scope for non-commercial engagement.

About 55% of respondents worked in private/commercial organisations, followed by 31% in the public and education sector. The remaining 14% included charities, social enterprises and professional bodies (Figure 42). Characteristically, over 70% of SMEs that responded were private/commercial companies. By contrast over 70% of LOs who responded were public sector organisations (including education institutes). This trend was mirrored in the focus groups, with 11 out of 16 participants (68%) being from SME's, and with 9 of 16 participants being from commercial businesses (56%), 8 of whom were from SMEs. LOs involved were predominantly from public sector, education and government agencies.

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[1] In the following analysis, figures from the online survey are rounded to the nearest full digit.
[2] The term 'SME' is used to refer to small, medium and micro size businesses. The term 'S&ME' by contrast is used to refer to small and medium size enterprises only.

Figure 41: distribution of size of organisation   **Figure 42: distribution of type**[3]

Answers to the turnover accorded with the size of organisations specified (Figure 43). Characteristically, turnover for Micro businesses are in the lower banding (0-500,000GBP) while Small, Medium and Large enterprises largely show a turnover of more than GBP1,000,000: SE over 50%, ME nearly 60%, LE 100% (of those respondent's who knew the turnover of their company). There is a marked gap in turnover between 500,000-1,000,000GBP, which appears to be an area where business is not viable (enough).

Figure 43: organisations' turnover

In terms of location, 46% of organisations responding to the survey were located in London, with an equal 46% being situated across the rest of the UK, including Scotland, Wales and the South West. In addition, 27% of respondents were from overseas or international organisations covering North America, Europe, Asia and Australia (Figure 44).

Of all respondents, 58% were national organisations, and 42% indicated that they are also operating internationally. (Figure 45). Interestingly, large organisations are spread more evenly across the UK, with 74% claiming to operate at national level only. In contrast, responding SMEs are predominantly located in London and/or operate internationally.

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[3] The results for the distribution type have been adjusted for the four types to include the 'other' results. This is because respondents of several public and private organsations had difficulties identifying themselves with the given headings and categorized themselves under 'other'. From the point of the investigators however they clearly fit into one of the four given categories and therefore have been distributed accordingly to provide a clearer picture.

For the focus groups more than 50% of participants came from London, indicating a stronger interest and perhaps pressure to engage, both, in innovation and with issues of behaviour change.

Figure 44: National distribution of respondents' organisations

Figure 45: National distribution of respondents' organisations

We also wanted to know who our respondents were. The results indicated that respondents were typically holding a range of roles in their organization (Figure 46). When filtering the responses by size of organization, the majority of respondents of Micro enterprises unsurprisingly were the CEOs (70%); of SEs were both CEOs (50%) and R&D personnel (29%); of MEs were across the full range of respondents (CEOs, marketing, production, R&D (39%), and other (27%); of LOs were predominantly R&D (42%) and a range of other roles (>50%).

Figure 46: respondent's roles in their organisation

5.2   The role of innovation

In order to generate some common ground for the subsequent questions, we first asked respondents about their understanding of innovation. The results indicated that there generally appears to be a consensus of what innovation means, with 87% of respondents agreeing somewhat or fully with the definition of "*innovation is the successful application of an idea, practice, or object perceived as new*" (Figure 47). The term 'successful was however criticized and we suggest to remove it from the definition for future use.

Figure 47: level of consensus with the given definition of innovation

As to their area of application, the respondents' organisations targeted the full range of sectors and there is no significant difference between small and large organisations. The sectors featuring most strongly are: Health and Social Care, Digital and Creative, Consumer products, Consultancy and Education (Figure 48).

In terms of primary products, the survey revealed that services provided the largest share with 53%, followed by digital and creative products (32%) and 2D products (27%), (Figure 49). Characteristically, the SMEs' share as providers of services is comparatively larger than those of LOs, which score comparatively higher in the resource intensive areas such as material development and production. Service Innovations are also the most important type of innovation (70%), ahead of process and product innovation with 64% and 60% respectively.

Figure 48: target sectors   **Figure 49: range of primary products**

When asking what types of innovation are most common in respondent's organisations, overall, service innovation was perceived as the most common innovation with 72%, followed by process and product innovations respectively with 70% and 64% (Figure 51). However, looking at the detail, for S&MEs, product innovation was most important (>60%), while for Micro enterprises and Large Organisations process innovation (74%) and service innovation (84%) respectively were most important. Additional mention was made of policy innovation and innovation for behaviour change.

Importantly, 3%, mainly from large organisations, said that innovation was not common in their institution and that they felt that their companies would benefit from putting more focus on innovation. While 3% appears a very small percentage, this is likely to be much higher in the non-respondent group, because respondents in the rule are those who are interested in the topic of the survey.

Figure 50: Level of consensus with the given definition on innovation

According to respondents, both in-house and external innovation activities are clearly led by designers (78% and 48% respectively), followed by engineers (36%, 31%) and market research (30%, 33%) and diverse other measures (28%, 29%) including teamwork. (Figure 51). Psychologists are mainly utilised as external consultants (18% internal and 29%), while economists feature fairly low in driving innovation (15%, 4%). These figures indicate the importance of design in driving innovation, which is a fairly consistent picture across SMEs and large companies.

While there might be some bias towards design due to the target audience (businesses and organisations subscribed to the Design Council newsletter) – given the breadth of organisations that responded to the survey, including accountants, charities, transport, agriculture etc – It is clear that designers are not only used in design organisations to drive innovation.

	Designers	Engineers	Economists	Psychologists	Market researchers	Trend forecasters	Other (Please specify)	Total Respondents
Through external consultants	47.92% 23	31.25% 15	4.17% 2	29.17% 14	33.33% 16	20.83% 10	29.17% 14	48
Through in-house research & development	77.50% 62	36.25% 29	15.00% 12	17.50% 14	30.00% 24	13.75% 11	27.50% 22	80

Figure 51: Person roles facilitating innovation in organisations

When asked why innovation is important, improving services and products appeared most important overall (as indicated by 80% of respondents) followed by the aim to meet demands from clients and/or the public (68%) and of being a market leader (59%), (Figure 52). Interestingly, compliance with legal obligations were perceived as least important, indicated by only 21% of respondents overall, whereby legislation is slightly more important for large organisations (31%). This raises the question as to how governments and policy makers can influence SMEs to facilitate responsible behaviour change innovation. It appears likely to be more successful through co-operation and providing business opportunities than through any regulations. Most importantly, together with legal concerns (21%), ecological issues are least considered as a driver for innovation (39%), with social sustainability being somewhat higher on the agenda (52%). This might be interpreted as a lack of concern for those issues that drive ethical innovations and raises the question how ethical innovation can be put higher on the innovation agenda.

Figure 52: reasons for innovation

5.3   Awareness, role and understanding of design for behaviour change

When turning from innovation to behaviour change, there was a strong overall *awareness* of design for behaviour change among the respondents, with 93% of respondents having some awareness. Of these, 48% were 'very aware', 31% 'aware' and 14% 'a little' aware. 7% said they were not aware (Figure 53). Amongst those aware of design for behaviour change, MIs had the highest percentage of being 'very aware' (52%) while SEs had the highest percentage of not being aware at all (18%), possibly reinforcing the earlier observation that SEs might operate within a tight viability frame with little room for manoeuvre.

While the figure of overall awareness of the respondents is encouraging, this cannot be seen as representative of the non-respondent population, because of the self-selection process of those aware of, and interested in the topic. Therefore awareness in the overall target population is likely to be significantly lower.

Compared to the *awareness* of design for behaviour change, the extent to which it actually *informs* innovation was predictably lower: while still 86% of respondents felt that principles or practices informed innovation in their organisation to some extent, the proportion of those who used it 'a lot' was relatively lower with 28%, while 29% would use them 'somewhat' and 27% would use them 'a little', with 16% not at all (Figure 54). Interestingly, Micro enterprises reported that 'a lot' of their work is strongly informed by design for behaviour change guidance (52%) while in Large organisations only 10% are informed 'a lot' by such guidance. S&MEs with 45% and 36% respectively. This seems to indicate a tendency of smaller organisations being better informed of design for behaviour change than larger ones.

Figure 53: Awareness of design for behaviour change

Figure 54: extent to which design for behaviour change principles or practices inform innovation

When questioning respondents further about their specific *implementation practices*, the percentage of engagement diminished significantly further. It fell from a perception of informing the work of 86% (Figure 54) to only 57% of respondents reporting that their work was based on specific principles or practices of design for behaviour change (Figure 55). Of these, 28% said they refer explicitly to (design for) behaviour change guidelines, toolkits or practices, 29% refer to them but not in detail and, most importantly, 31% do not refer to any guidelines but would like to. 4% didn't feel that this was necessary and a further 8% did not know whether or not their organisations use any guidance. In particular the number of MIs that would like to use such guidance with 43% is comparatively higher than that of Small, Medium and Large organisations (4-25%). 35 respondents also volunteered examples of their practice or of theories used, which have been discussed in the context of the theory review in section 4 above.

Figure 55: Use of design for behaviour change approaches

These comparisons show that while there is a good awareness of design for behaviour change, the extent to which it informs and guides innovation, are much lower, while at the same time there is a clear interest by SMEs as well as LOs to engage more.

When questioning how behaviour change was used, and who or what organisations are seeking to influence, it emerged that respondents' organisations most strongly seek to influence customers (68%), followed by the public (58%), with own employees being considered least (29%), (Figure 56). Influencing policy and the government were also mentioned. Thereby, SMEs were most focused on influencing customers, while large organisations were more strongly trying to influence the public, which was most likely correlated to the high percentage of public sector organisations among large organisations.

Figure 56: target audiences who organisations are seeking to influence

Among the changes sought, long-term change is the most considered (78%), followed by other behaviour related issues including values and attitudes, decision making, removal of behavioural barriers, and opportunities for new practices or alternative behaviours. One-time change ranks last (14%). (Figure 57).

Figure 57: Types of change targeted

Further, looking at their target areas, organisations that are using design for behaviour change innovations seek most strongly to influence health and well-being (66%), followed by social sustainability (51%), ecological sustainability (45%) and economic sustainability (43%), while mobility (24%), safety (19%) and crime prevention (10%) appear of least concern. Compared with the reasons for innovation more generally (Figure 52), this significantly shows that those with a concern for behaviour change appear to recognise ethical concerns more strongly (Figure 58) than those not concerned with design for behaviour change.

Figure 58: areas of concern of design for behaviour change

The final question of the survey in the section on behaviour change asked respondents to give an example of behaviour change from their own work if possible, including the results or effectiveness of any such work and its evaluation. This question was answered by 35 people, and thus has brought together a number of examples of design for behaviour change covering a wide range of applications from tooth brushing for children, to designing for mental health, to policy decisions for pensions and financial debt. Significant for their engagement in this area, 19 of the 35 examples were put forward by Micro businesses. Selected examples have been discussed above as part of section 4.4, and others are included in the discussions below. In terms of their quality, most examples remained anecdotal for the reasons discussed earlier. Some were documented more extensively in related magazines or reports, but rarely was an explicit connection made between the underlying models and the application through examples. One reason for this might be that such documentation often is there to show the successes of the schemes, rather than to reveal the theoretical and methodological underpinnings.

What became apparent from the examples was the variability in the understanding of design for behaviour change. The variability in the meaning of design for behaviour change was therefore probed further through the focus groups. Concerning the understanding of behaviour change, responses raised issues about the different understandings and interpretations of behaviour change, including

- its transformative nature;
- what the drivers are, and how they should be used or administered;
- whether behaviour change could or should be short-term or long-term;
- who owns and administers behaviour change, whether it should be a prescribed or voluntary process, an individual's responsibility (and possibly gain) or a social issue;
- about whose or what ethical stance or values should be adhered to; and
- who the beneficiary/beneficiaries should be or who might take responsibility for their potentially positive and negative effects.

Discussing these issue in more detail below, when asked about their <u>understanding or definition</u> of design for behaviour change, many of the participants' answers converged on the idea that design for behaviour change is "*an approach for changing the behaviour of people*" *(FG1)* and that it utilises psychological theory suggesting knowledge of behaviour change was essential to inform the design stance to behaviour change. For example it was perceived that as a designer, there is a need to understand *"physiological and psychological drivers behind behaviours so that you can accommodate that, you can design for what people need" (FG1).* When looking at the experience, it was perceived that designers have an important role in making the process desirable to the user:

> *Behaviour change is a quite high level requirement for individual people, so … the key thing is about how to make that process to be desirable, and that is actually what design can do about it (FG2)*

It also highlighted that design itself is not a homogenous construct, but comprises many forms and formats:

> *For me it's changing behaviours through design. I guess my definition of design is quite broad so it might be design of a service, the design of product, graphic design, or just using design methodology. (FG1)*

Overall, answers covered a breadth of meanings and raised questions as to <u>what exactly behaviour change means and for whom</u>, reaching from "*understanding … underlying wants and needs, and emerging new behaviours*" *(FG2)* of customers to "*promot[ing] emotional wellbeing in people's interaction" (FG1)* with their environment. This included businesses and public as well as individuals as potential change agents, but also potential recipients of schemes to change behaviour; commercially driven schemes as well as community schemes driven by social welfare. There appeared to be a consensus, especially in the first focus group, that behaviour change should be seen to support social benefit, rather than commercial gain, although the two would not necessarily have to exclude each other.

There further was variation in the <u>approach to implementing design for behaviour change</u> and its ownership. While some regarded behaviour change as a high level responsibility for individual people *(FG2),* others saw it more as a communal practice that "*us[es] design principles to develop some sort of initiative project intervention that seeks to change a behaviour" (FG1).* Two examples were illustrating this view vividly:

> *A great example from Lambeth is the project for community 'Freshview' which is basically a street makeover project. So there's a couple of council guys that work with the community to do anything that that community wants to do to approve the appearance of their street.   And anything goes. So it can be planting and making planters, it can be painting walls, making it look more colourful and exciting and we just recently did an evaluation of that which proved that it reduced littering because the environment is better, it built the strength and the cohesion of that community, a lot of those 'Freshview' projects are now being delivered without the council at all. They're just totally taken on by the community. Wellbeing has improved, perceptions around safety have improved.   So there's all sorts of knock on benefits that I think are fundamentally linked to behaviour change. (FG1) (see also: Lambeth Council 2014)*

> *I had a project before [...] It's about older people in Kensington […] people are quite interested in the other local people's opinion and […] lifestyle, for example, so actually at the beginning we created something attractive [with input] from the locals. So we took photos of the people in Kensington and put them on the bus stop because that is the place people always browse, and then we also changed the bus stops, so it means we can cover different areas in Kensington to look at different types of people involved. And also we interviewed people because it's not easy to ask people's opinions straightaway, just some stranger there, but when you ask a lot of people in that area, there must be someone who will be happy to do the recording, and using those results actually can be a kind of trigger. So we collected all the sound from the people,*

what's their opinion about older people in that area, what kind of activities there are or whatever, relating to the sector, and we played the recorder with photos at the bus stop. There were just so many people came around, and afterwards we made a video out of it and, you know, it's quite efficient to make a video about something, and once you put on whatever social channel and people will start to know what is happening, and then if people are really interested they can follow you or they can also give opinion, like, Twitter or Instagram. (FG2)

Yet other participants distanced themselves from behaviour change altogether:

In terms of the behaviour I would like to kind of probably scrub out the word behaviour,.. I'm quite interested in design for change. Behaviour for me feels incredibly prescriptive, … individualistic, … I also think that there's been a whole shift change in terms of language. (FG1)

Overall, it was apparent that, although design was used in various ways, the design element, and the <u>link between effective change and design</u> did not appear to be as clear to participants as might have been expected. The array of definitions and understandings of design for behaviour change appear to point to its challenging nature whose complexities require careful consideration because of its ethical and value implications. For example, the aspect of free choice versus prescription, which regularly enters into the debate about behaviour change, also emerged here, questioning the <u>ethical and commercial implication</u> of who decides what is desirable and for whom:

I think for me the key word … is change and to understand where you're at and where you want to go, so before you can start to implement any new products or service, you need to understand what you're aiming for, and I guess I want to introduce a commercial level in there as well, so whether that's about selling more product or in the case of an energy company, selling less of our core product, which behavioural change is huge… (FG2)

I guess I'm interested in one level in why now. Why have we seen this kind of ascendency of design for behaviour change… I work for big companies and all of a sudden it's become legitimate for them to try to do behaviour change on the back of, for example, sustainability or health… whereas… about ten years ago… it was all about choice… Aligned with that I think there's a whole debate in relation to values and ethics and change in why, who... I think that there's also a piece that it's a wonderful money machine at the moment. (FG1)

These two quotes highlight the dilemma that on the one hand it is difficult to determine what behaviour a designer or company or other organisation might want to change. On the other hand, this might be dependent on commercial needs where companies are concerned: while for some behaviour change may offer a new revenue stream, for others it might question commercial viability as in the example of the energy company above. This is dependent on how behaviour change is interpreted, and it also highlights its transformative potential.

Overall, the views of what behaviour change was ranged from catering to existing customer (buyer) behaviours, to behaviour management within specific situations, to what one might call 'ethical' behaviour change in a small way, to large scale behaviour interventions with a global ethical agenda. This appears to indicate a need to develop the understanding of design for behaviour change among professionals more broadly, especially with regard to the ethical responsibilities of design proposed with this study.

5.4   Benefits and challenges of design for behaviour change

During the focus groups, participants were further asked to reflect on the benefits of behaviour change as well as its challenges and obstacles. More consistent themes were revealed here, which were identified as referring to the *designer*, the *recipient/user*, and *wider social benefits* respectively, and which are used to structure the following discussions.

5.4.1   Benefits

Considering the benefit for the designer or company, the discussion on the one hand revealed direct commercial gain as a driver: "*you can make lots of money from it*" although specific detail on how this was achieved was not clearly made suggesting a perceived level of face value benefit to design for behaviour change*.* Indeed, benefits went beyond monetary value with more indirect benefits in form of reputation. For example, the reputation of a company can be enhanced by use of the concept particularly if it is seen as acting for social good:

> *The idea behind brand is you are the company that's designing stuff for social good, using technology or design or whatever, it might be for social good, so you get perceived to be a cool company.* (FG2)

The idea of reputation or brand as a potential benefit raised the question of the perceived level of sincerity and face value attributed to the use of design for behaviour change, and what the benefits might be for the recipients or users. On the other hand, most participants/designers were rather critical of the aspect of commercial exploitation that could clearly be linked to the use of behaviour change. The distanced themselves – sometimes from their own organisation – to look critically at the role of behaviour change, and how it could be used for individual or social benefits. Designers thus appeared to have an ambassadorial role in promoting ethical behaviour change practices within their companies as well as making it attractive to clients.

> *There's almost an assumption today, building on that, that we're driving behavioural change for good, and I'm not sure that all businesses do that. [...] Yes, I think that business and behavioural change are not linked, there is no link, apart from behavioural change can be brought about by a business. (FG2).*

One participant offered the example of a mobile based website to further explain the tensions that can arise for a designer or company in trying to provide some social benefit

> *…creation of one go-to place, using a few tricks to create footfall, like people can find stuff on there and then using that as the arena to join people up and then engaging with key service providers, so that they not only get joined up but they go out and do stuff for themselves and for local community… One of the big challenges for us is to do it in a socially useful way. Yes, we can do that but do it in a way that's not manipulative, which was the big thing with the Nudge, or the commentary on the Nudge book, which is this is great but at what point would it become manipulative? (FG2)*

These examples indicate that there is clearly some tension, and perhaps unease, still of how to approach the potential dual role and perception of designers/companies as change agents, reaching – at one end – from an uncritical commercially driven motivation targeting consumer behaviour to a socially driven 'facilitator role' to stimulate synergetic social change.

When focusing on the benefits for recipients or users, design for behaviour change was seen both as having benefits as a 'customer focused' approach as well as an efficient way to deliver change offering "*ease, convenience… empowerment" (FG2).* This included subjective benefits, such as "*feeling good about yourself"(FG2)* after using a step counter or other health product, which one participant summarised as engendering

> *Personal affirmation, something that is endorsing your behaviour or the sense that you're doing the right thing…as a more worthy person.* (FG2)

others perceived the benefits of design for behaviour change on personal well-being in a more philosophical way

Quality of life is the ultimate benefit in improving self-knowledge, a sense of security, being able to be more autonomous in your decision making, or in the design for decision making (FG1)

Beyond individual benefits for designers/companies or recipients/users, also several broader benefits were mentioned that included affects and effects on society more generally. One considered the possible economic benefits of behaviour change to society:

Behavioural change can be quite cheap, quite cost effective if you get it right and a quick way of delivering change. I think about energy, actually getting people to use less product is a lot quicker and cheaper than building a power station. Customer focused not product focused. (FG2)

An additional advantage that was mentioned was the notion that design for behaviour change could increase reflectiveness, and as a consequence might offer more effective as well as person centred outcomes:

..in terms of benefits … design for behaviour change can be quite thought provoking. (FG1)

Arguably it produces better outputs or more effective outputs and services (FG1)

User centred design plus behaviour change does maybe equal some kind of participatory empowering (FG1)

Many of the benefits transcended a single group benefit (e.g. the customer). One participant summarized this succinctly:

[benefits are] profit and commerciality and delivering sustainable business, which actually has societal good in it. (FG2)

Overall, the discussion revealed that there were multiple benefits and beneficiaries and that benefits varied depending on the context in which design for behaviour change was applied. It also became clear that participants felt that more clarity was needed as to who owned any change and who was the recipient of any benefits in order to make behaviour change more generally seen as beneficial and socially acceptable.

5.4.2   Challenges

While potentially beneficial, the implementation of design for behaviour change also faces significant challenges. Even though it was thought that behaviour change could have financial benefits and build reputation, when discussing challenges, key challenges named were investment, both, financial investment and conceptual buy-in from business stakeholders:

[A challenge] is actually saying how we make money out of finding solutions to achieve social good, or environmental good in society. (FG1)

I think it's one of the major weaknesses, challenges, getting profit for behaviour change, and that's where it doesn't play to businesses' strength (FG2)

it's a bit fluffy, so actually that makes it quite hard to get funding for these kinds of things within business in particular and backing, because actually it's not demonstrated itself yet unless you've got somebody at the top who's a real believer in that kind of thing (FG2)

So you've got to make sure that you've got the right people who are actually wanting to sign up to these projects and do these different things because you can have great ideas but not going any place because they're not getting the sort of sponsorship that it needs (FG1)

Using psychology or either using the sort of framing terms of psychology in terms of room design can get a very quick negative reaction from developers, from quite a large proportion of the population (FG1)

This lack of investment was thought to arise from the absence of clearly defined benefits – or, more precisely, from benefits that may lie outside of any immediate financial gain, as well as from a lack of available evidence, which individuals could use to cite in support (as will be discussed later) and to persuade the various stakeholders.

A further reason cited was ethical sensitivities, a discussion point, which developed within both focus groups:

> There's a lot of behaviour change stuff that's happening which may be beneficial to the people doing it but not to the people that it's targeted to get their behaviour to change. (FG1)

> Perception of what is reasonable under the policy legislation changes. (FG1)

> There's a growing literature that's pointing towards "good business behaviour" in terms of ethical business behaviour and effect on the bottom line in year X but also in terms of the sustainability of that bottom line which is why of course [there is] corporate social responsibility. (FG1)

If design for behaviour change is to be used to drive innovation, a consistent understanding of how to use it by stakeholders may enable ethical and legislative sensitivities to be developed, understood and accepted. Sensitivities may also depend on the approach undertaken to elicit the behaviour change. For example coercion may achieve change but using this may have ethical ramifications for the business or individual adopting this tactic.

The concerns with ethics was particularly complex and will need further debate, which was beyond the scope of this project, to come to more definite conclusions and recommendations. For the time being, it raised questions about the ethical position of the designer or company, about who decides what are 'desirable' goals, and what means should be used to achieve them. It thus highlighted the challenge for designers and their relationship with those they design for:

> When I think of behaviour change, I think of a boulder. It's easier to push a boulder down a hill than it is to push a boulder up a hill, and if what I want to do is to get somebody to a better place, stop them smoking, stop them drinking, get them to use less carbon, whatever I perceive is the better place, so I've got an issue between my set of values and choices and my audience's set of values and choices, so I have to decide whether my audience is below me and I've got to push the rock on them or they're above me and I push the rock up the hill to get there. (FG2)

Further challenges that emerged during the discussion were that of scale of change and future proofing of innovative concepts. Considering the former, the question was raised about "nano gain versus a wider gain and who is gaining out of that" (FG1). Indeed, scale of change is important as it may influence the type of interventions used, the context of the intervention (social, service, product development) and the feasibility of it as a business proposition. All these factors may influence stakeholder's consideration as to the appropriateness of design for behaviour change in principal. As one participant commented "it can be…a very narrow benefit (FG1)". Understanding the array of benefits with evidence for this may be needed to obtain investment from stakeholders.

A second aspect related to the scale of change was the issue how long any intervention might retain currency. The perception was that as behaviour moves on, interventions also have to move on and hence there will be overheads, but also ethical considerations in keeping any interventions up-to-date:

> I also think that there is a challenge with keeping it current and keeping it up to date and making sure that we're on top of things and that maybe a behavioural change that related ten years ago doesn't relate now (FG1)

…actually how fast is some of this moving and can we innovate in real time and what's the risk? (FG2)

[The] perception of what's reasonable now, what's acceptable now, changes literally month to month at the moment (FG1)

Overall, the perception was that if design for behaviour change is to be used to drive innovation, a developing a consistent understanding of how to use it together with the development of ethical and legislative sensitivity is necessary for it to be understood and accepted more widely. In particular, sensitivities may depend on the approach taken to behaviour change: for example, approaches based on motivation are generally more easily accepted, but may not lead to certain change, while prescriptive approaches may achieve change but using them may have ethical ramifications to be considered.

5.5   Access and barriers to design for behaviour change

A key part of the project was to develop an understanding of how information on design for behaviour change is accessed and what the barriers or obstacles to access and implementation are. Obstacles refer to factors that may specifically limit the uptake of design for behaviour change.

The survey revealed that information in support of design for behaviour change overall currently is mostly accessed or generated through publicly available academic research (65%), complemented by in-house research and publicly accessible non-academic research with 57% each as well as business networks and social media (53%). External consultancy is only used by 21% of organisations (Figure 59).

Notably, Micro businesses use publicly accessible non-academic research and in-house research more than publicly accessible academic research, while the trend reverses with Medium and Large organisations, which utilise comparatively more academic research. This might indicate that academic research is harder to find, read, and often has to be paid for, and are therefore harder to access for Micro and Small businesses who have limited resources in terms of staff time and expertise.
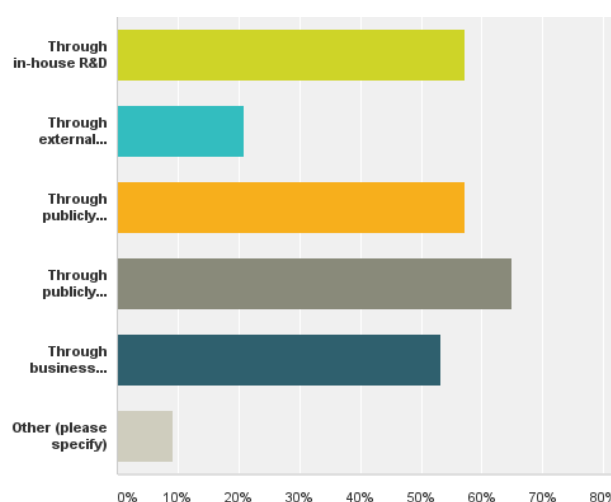

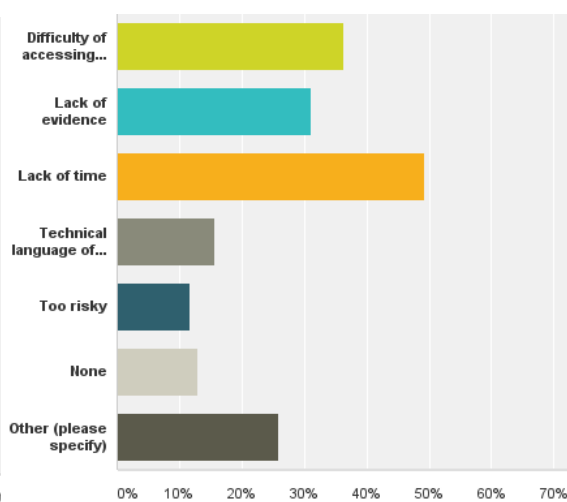**Figure 59: access to design for behaviour change   Figure 60: barriers to access**

The survey revealed also that the greatest obstacles to accessing or applying design for behaviour change are: a lack of time (49%), difficulty in accessing relevant research (36%), and the lack of evidence available (31%). Other obstacles included cost as well as a lack of awareness, interest and belief, especially by larger companies, as well as clients' inclination, especially for the smaller organisations (Figure 60).

The perception of a 'lack of time' can be interpreted as being indicative of a lack of priority, perhaps due to a lack of recognition of the clear benefits of design for behaviour change. If so, this would suggest that there is an urgent need for more explicit information and debate about the aims and benefits of design for behaviour change to raise its level of priority.

The focus groups further elaborated on these findings. Key areas that emerged included a lack of metrics and evidence, along with people's perceptions of not knowing enough about design for behaviour change and its benefits. Metrics and evidence were closely linked, as both describe the need and desire for a clearer use of design for behaviour change:

> *We also think that there's a lack of sort of measures and metrics for figuring out what works and what doesn't* (FG1).

This indicates that for businesses who recognise the potential for improvement it may be necessary to understand how effective a strategy has been to them. The absence of metrics for assessing the approach or method of design for behaviour change along with any product or service that might be produced is an obstacle. At the same time, there may be a hesitation towards measuring the results, because of any potential negative/undesirable outcomes being laid open, which business leaders may fear could be harmful to their business

> *Obstacles are the fact that people don't really want to know what the result of their design is* (FG1)

> *In buildings there's very little post-occupancy evaluation. Where I work we're probably one of the few places that is really into it and really interested in it but it's not from a place of profit it's because we're interested in doing better buildings* (FG1)

This lack of metrics provides a challenge, and opportunity, for both academic and non-academic professionals. Due to the diverse context that design for behaviour change spans, creating metrics and approaches of evaluations will take time. This was understood and appreciated by participants:

> *Understanding behaviours is still a relatively new science, and it's incredibly complicated so do you know when you press that button, you get that result?* (FG1)

The development of metrics will require research to investigate not only design for behaviour change as a concept but also how business applies it in practice. One way in which to tackle this which has yet to be fully developed might be to create well evidenced examples:

> *[There] is a lack of research and empirical evidence data to back up outcomes, case studies that you might be able to refer to easily to influence approaches* (FG1)

There are two motivations for generating a better evidence base and examples, firstly to support designers in their work, and secondly to help designers find support for working with design for behaviour change within their institutions:

> *As designers you end up in places where you do need to get more maybe expert advice in terms of sociologists and psychologists and things because we operate within the behaviour change realm a lot without necessarily knowing the theory behind it* (FG1)

> *It's quite a challenge in itself in finding out more to actually be able to put forward those arguments and business cases* (FG2)

Respondents further felt that evidenced examples could provide a source of ideas to drive innovation. This should however not be through prescriptive toolkits, but in a way that helps elicit thinking within an area. In order for this to be considered, a common language around design for behaviour change needs to be developed. Present <u>academic language</u> in this area was perceived as problematic by some. Whether this was related to the concept as a whole or specific theories that exist within it was not further elicited. Nevertheless, it was seen as a "relatively new language" and "a bit new…a bit fluffy" (FG2). Originating from an academic background and diverse theoretical landscape may mean the language that is used in the field has yet to be fully developed and distilled into a consistent and coherent format.

Overall, the findings concerning access and obstacles of implementation highlight the need for evidence based examples and evaluation frameworks to eliminate any risk, aid innovation and help designers persuade managers and clients, while at the same time kindling the fear of potential exposure for some companies. Further, language was perceived as an issue that needed attention, and commitment to design for behaviour change (in terms of time) was identified as a major issue, which may be addressed through a better evidence base.

5.6   The way forward: participants' suggestions

Probing the understanding of design for behaviour change, its benefits, challenges and obstacles through the survey and focus groups was used to lead to reflecting on issues of access and the way forward.

In terms of what might help with accessing and implementing design for behaviour change (Table 7), 57% of survey respondents felt that clear evidence of the benefits and open access to academic journals would help accessing and implementing design for behaviour change, as well as easier access to information, e.g. through networks and workshops (56%). Rated as almost as important was the availability of more relevant examples (52%) and guidance that is more specific to individuals' areas of interest (51%). Technical language (23%) and awareness raising (35%) were seen as least important for improving accessibility.

Table 7: Supportive measures for accessing and implementing design for behaviour change

Answer Choices	Responses	
Clear evidence of benefits	57.14%	44
Easier access to information, e.g through networks and workshops	55.84%	43
Free (open access) academic journals	57.14%	44
Guidance that is more specific to your areas of interest	50.65%	39
Less technical language of available research	23.38%	18
More awareness, e.g. through social media or SME specific journals	35.06%	27
More relevant examples	51.95%	40
Other (please specify)	16.88%	13
Total Respondents: 77		

In line with perceptions of perceived difficulties of accessing design for behaviour change, Micro-businesses felt that access was the greatest issue and would be of most help, while for large organisations evidence was most importance. The focus groups broadly confirmed these findings and elicited important further detail on the 'way forward' of what might be helpful to professionals seeking to engage with design for behaviour change practices. Further insights were added through the results workshop, where the summary results were presented and discussed, and which are integrated in the following discussion.

Overall, aspects of design for behaviour change, which participants want to do but which they currently are not able to, include access to academic journals (including conceptual access), evaluation of design for behaviour change, the problem of design as a concept and confidence in the concept of design for behaviour change, along with understanding why it may fail. From the discussion about how to overcome challenges/obstacles developed an understanding of what would be most useful to practitioners.

<u>Easier and open access</u> to information was one of the key suggestions, with the request for information to be pushed out "*rather than having a whole system where you have to go and find things* (FG2)" and to help with questions such as "*in what circumstances is it good or bad to be explicit about the activity you're doing has been behavioural change? (FG2)*". The request for information arose directly from the difficulty, in particular for small companies, of accessing academic journals. This was mentioned in spite of an increasing number of journals and articles being available open access, and it indicated that at times the issue is not the restriction in access, but the lack of knowledge of how to access free information, e.g. professionals were unaware of simple means of gaining access such as searching for open access articles through Google Scholar.

Besides access, it was considered important to be able to (understand how to) <u>evaluate</u> design for behaviour change projects, or have examples of evaluation as guidance, as a means of building confidence in the concept of design for behaviour change, along with understanding why it may fail:

> *One practical thing to have would be access to more examples which were well evidenced, not because we want to replicate them but as practitioners we need to try and start with something so we need to give something a go if they've written about something, so we need some ideas of stuff we could try* (FG2).

> *Having some empirical evidence that enables us to…influence good design (pFGL)*

In addition to applied evidence and examples, <u>stronger links between academia and industry</u> were suggested as helpful. Indeed, there was a strong call to make working with academia more accessible and approachable, for example through partnership programmes, and alignment of goals with a focus on practical as well as theoretical benefits:

> *there are a lot of these schemes about for being able to tap into universities and things like that. But as a single person business often they don't feel like they're accessible to me. There are so many hoops that I have to go through to qualify for it or it's going to cost 50 grand and I've got to match fund it or something like that. So some way of being able to actually access the academics, the support that's available from universities and things like that would be really useful* (FG2)

> *Working with academic partners…[where] our goals are at least aligned (pFGL)*

A further need identified was for <u>cross-disciplinary working</u> and knowledge to inform one's own work more broadly by covering the different aspects of behaviour change, including

"*technologies, services, other people* (FG1)". One way suggested was to have a practitioner based information resource:

> *What would be really useful would be a sort of practitioners' journal, like a proper practitioners' journal where you can publish your stuff where it's written in a sort of quite open language not written for academics, it's written for other practitioners* (FG1).

This indicates that current language is an obstacle and provides weight to the notion that the field needs to be developed and distilled into a consistent and coherent format. Additionally, an alternative approach of a conference was discussed but the time input and lack of focus made a conference less desirable compared to an accessible practitioner based journal. Indeed, this was preferred to the development of bespoke practitioner toolkits:

> *That for me the whole reason for a journal that we were talking about is there's debate, … there's different perspectives, … for me I certainly don't want a 'what works', five key points, here's the toolbox and you go and do it. Please don't do that* (FG1).

> *I think what I find most useful is clear information, scientifically established information on people's changing needs in terms of living, daily living, that's for the general public, quite apart from the specialist requirements* (FG1).

> *[If there were] something in the middle where we're actually interpreting the work from the academic journals in ways that practitioners can actually use without it being necessarily something that's really kind of sexed up out there for the Amazon market (FG1).*

In this sense, it was thought that a journal might offer a platform and resource for practitioners to gather information from one single place but also enable collaboration between academia and industry through joint publications. Participants were particularly keen to encourage academics to publish in such a journal with the aim to see academic work being applied rather than theoretical in nature.

A pertinent point was made that any resources should support a common language by "*being written in a … quite open language not written for academics … [but] for other practitioners*". This links to the perception of the current language of design for behaviour change being an obstacle, and providing weight to the notion that the field needs to be developed and distilled into a consistent and coherent format. Once achieved it will help design for behaviour change to be more clearly understood and increase its use within the business setting.

In the context of the journal idea, there was also a call for sharing resources. Due to the diverse range of applications of design for behaviour change, participants felt that they cannot know everything and that sharing of resources would be a good thing, despite the fact business growth requires competitive advantages:

> *A wide range of networks representing different types of users that could share experience and, of course, case studies are always useful. People can identify with them* (FG1).

The use of resource sharing goes further as it supports an evidence base of examples that demonstrate successful results. It was felt that such a basis would help persuade stakeholders (colleagues, managers, investors) to adopt design for behaviour change practices and strategies. The need for accessibility of such evidence through visually quick and persuasive information was highlighted:

> *[what I] would love is one-page visual example case studies, so basically see the slides you had up, I'd love that with just a line that says what was the results (*FG1)

> *Have an evidence-base to influence good design, you can then say, well this works because of this and the weight gets taken off of perhaps a perceived aesthetic value or a cultural value and loosens up all of that* (FG1).

Overall, it was felt that transferring the many theoretical understandings into a format of applied use, utilising a shared information and resource platform (e.g. journal), would be the way forward. In addition, closer collaborations, and creating evaluation protocols could help build and support an evidence base of shared examples. This might include joint project initiatives or student prizes to further explore and develop the opportunities offered by design for behaviour change.

5.7   Summary of Innovation and Access Review

The results of the online survey and focus groups complemented the literature review and importantly added further insights about the understanding and use of design for behaviour change by professionals from private and public organisations. The focus groups, in particular, gave insight into difficulties encountered in accessing and implementing design for behaviour change, and in finding a way forward to address these difficulties. Design for behaviour change was applied across a variety of sectors, and the approaches to using the concept ranged from using bespoke toolkits through to utilising knowledge gained through academic qualifications as well as personal experience.

The understanding of design for behaviour change that emerged from the discussions can be summarised as follows:

- It is transformative in nature;
- It is important to understand its drivers, and how they can be used;
- Behaviour change can have short-term or (preferably) long-term effects;
- It is important for any behaviour change project to determine
    o   who owns and administers it;
    o   whose or what ethical stance or values should be adhered to; and
    o   whether it is based on an individual's responsibility (and possibly gain) or is a social issue;
    o   whether it should be a prescribed or voluntary process;
    o   who the beneficiary/beneficiaries will be
    o   who might take responsibility for their potentially positive and negative effects.

The benefits of using design for behaviour change included facilitating a reflective approach that considers wider social and environmental issues along with a focus on the customer/user as a driver for innovation. The main benefits can be summarised as:

- Commercial gain for a company or organisation;
- Raising for a company or organisation's reputation or brand;
- Individual/subjective benefits;
- Social benefits;
- Holding potential economic benefits of behaviour change to society;
- Promoting a customer/person focused approach;
- Promoting a more reflective approach;
- Promoting ethical behaviour change practices.

Some of the main challenges and obstacles in implementing design for behaviour change were found to relate both, to the lack of relevant and easily accessible examples and evidence, and the lack of a coherent approach and language of design for behaviour change. This translates into problems with implementation within industry through a lack of conceptual and financial buy-in and can be summarised as:

Challenges:

- Need to find financial investment and conceptual buy-in;
- Absence of clearly defined benefits;
- Benefits that may lie outside of any immediate financial gain;
- Potential ethical sensitivities;
- Need for the alignment of values;
- Scale of change and future proofing.

Obstacles that arose from the given challenges:

- Lack of time/commitment;
- Financial risk due;
- Not enough knowledge of the process and its benefits;
- Unapproachable (academic) language;
- Lack of metrics / evaluation frameworks and evidence;
- Fear of potentially negative/undesirable outcomes revealed by evaluation.

Considering possible ways forward aired a number of ideas, which included creating a shared language of design for behaviour change and present this on a platform that is accessible to practitioners. For example, an open access practitioner journal was proposed and supported in this regard. Future success of design for behaviour change was perceived also as depending on stronger links between academia and industry in an effort to achieve an evidence base and shared language.

The way forward for design for behaviour change as emerged from this project can be summarised as a need for the development of:

- A consistent use of terms and language between and within contexts;
- A practitioner based publication resource, e.g. practitioner journal;
- Easy processes for academia and industry to work together and to learn from each other;
- Easy processes for sharing resources to enable cross-disciplinary working;
- Clear and easy to use evaluation metrics and approaches;
- The production of explicit, evidence based examples.

6. Conclusion

6.1   Summary

This report has presented the findings of the "Creating Sustainable Innovation through Design for Behaviour Change" project. It has explained the project background and aims, the methodology of the project, and the outcomes of the research. The project itself has taken a three-fold approach, including a literature review, an online survey and two follow-up focus groups. The findings have been presented in this report as a theory review and a review of access and innovation, and the report is published on the project website: www.behaviourchange.eu

The theory review has generated a broad cross-sectional overview of existing theories and approaches, covering theories from behaviour change, from the emerging design for behaviour change literature, and examples of their application in diverse practical contexts. The theory review has drawn on the literature review as well as on the online survey and the focus groups. It has revealed the extent of existing literature and examples, including the influences on and development and application of design for behaviour change approaches. It has also revealed the gaps and overlaps within literature and examples through the mapping of approaches according to the 'agency divide'. It has mapped overlaps between different approaches as well as the separation between different areas of design, some of which are developed further than others in terms of adopting design for behaviour change.

The innovation and access review has drawn mainly on the online survey and focus groups. It has generated important insights into perceptions of the understanding and values of design for behaviour change among private and public service stakeholders, about benefits, challenges and obstacles, and about availability and access to information about design for behaviour change. Most importantly, overall, the review has elicited possible ways of how to take design for behaviour change forward to strengthen its role in driving sustainable innovation.

In the following, we summarise the most important insights from the project review and draw out the key recommendations concerning the use and promotion of design for behaviour change by and for all stakeholders, including professional practice, academic research, and policy.

6.2   Key insights

6.2.1   Key insights: mapping the field of design for behaviour change

The theory review has created an overview map of some of the key directions and approaches of design for behaviour change to enable a better positioning and selection of approaches for practical application. The theory review started with surveying underpinning behaviour change approaches from the behavioural sciences, before moving on to reviewing design for behaviour change approaches, and relevant examples.

The review found that there is a multiplicity of approaches to behaviour change from behavioural sciences which can be organised according to the agency divide into individual (content), contextual and holistic/integrated approaches. The same applies for approaches from design for behaviour change, although these tend to be more recent, and therefore generally not yet as widely used. In addition, the review recognised that there were also approaches from other areas, such as the social sciences and philosophy. In general, all approaches from the behavioural and social sciences, from philosophy and design offered human-centered approaches, the majority of which is focused on providing enhanced services as part of their aim for innovation.

Where *behavioural science approaches* were used unmediated, the majority focused on changing the individual (content). The more traditional *design approaches* were also situated in this area. Approaches that addressed context only were much more limited. Approaches to context were often connected to policy about changes to the environment to direct human behaviour. Most of the more recent design for behaviour change theories were situated in the 'middle-ground' taking an integrated approach that recognises the interconnection between the context and the individual.

The review has also shown some important synergies between academic research and its adoption in professional and policy contexts. For example, MINDSPACE (see Dolan et al. 2012), a set of guidelines used by the government, builds on behaviour change models of choice architecture. However, there are not many such clear examples of synergies where academic research has generated clear guidelines. Rather, most design examples and professional approaches are not referenced to any models that might underpin them, indicating that there is a significant gap that is to be closed.

The map created aims to offer an overview of existing approaches, their underpinnings and potential applications and thus to help close the identified gap. It also shows some of the overlap between the different methods, which is due to the complexity of the problem of behaviour change. This complexity indicates that some more specific and approachable metrics need to be developed to enable the appropriate evaluation of examples. This development is likely to require the collaboration and commitment from both professional and academic stakeholders to provide the commitment to the time and financial input required to conduct the evaluation and documentation of real examples to help build a substantial evidence base of examples that would support the broader adoption of design for behaviour change.

6.2.2   Key insights: understanding, benefits and ethics

The review has generated an important understanding of design for behaviour change in terms of the approaches that are used and how and where they might be applied. It has shown some important synergies between academic research and its adoption in professional and policy contexts, but also that there is currently a lack of consensus of what design for behaviour change means and what it could or should aim to achieve. Therefore, importantly, beyond the concern for individual approaches and implementation, there was a concern about the need for a shared understanding and values. The project results have indicated that there is a breadth of understanding in terms of values across different areas of application. The discussion centres on the judgment of whom behaviour change is for, by whom it is implemented, and who will benefit from it. The examples put forward reached from changing customer behaviour to increase sales to large-scale global changes, such as reducing carbon emissions. There were many strong examples and some implicit consensus by participants and authors that design for behaviour change in its fullest extent is an approach to ethical change that makes innovation sustainable not just for the individual, but for us as well as for future generations. Therefore, behaviour change has to reach everyone, including customers, companies, stakeholders and society as a whole. Already in 2006, Stern (2006) has explained in his review "the economics of climate change" that "tackling climate change is the pro-growth strategy for the longer term". Thus longer-term thinking will be of great importance.

The understanding of design for behaviour change that emerged from the review can be summarised as follows:

- It is transformative in nature;
- It is important to understand its drivers, and how they can be used;
- Behaviour change can have short-term or (preferably) long-term effects;
- It is important for any behaviour change project to determine
    - who owns and administers it;
    - whose or what ethical stance or values should be adhered to; and
    - whether it is based on an individual's responsibility (and possibly gain) or is a social issue;
    - whether it should be a prescribed or voluntary process;
    - who the beneficiary/beneficiaries will be
    - who might take responsibility for their potentially positive and negative effects.

The benefits of using design for behaviour change that emerged from the review can be summarised as:

- Commercial gain for a company or organisation;
- Raising for a company or organisation's reputation or brand;
- Individual/subjective benefits;
- Social benefits;
- Holding potential economic benefits of behaviour change to society;
- Promoting a customer/person focused approach;
- Promoting a more reflective approach;
- Promoting ethical behaviour change practices.

6.2.3   Key insights: challenges and obstacles to access and implementation

In terms of access and implementation of design for behaviour change, a number of challenges and obstacles were uncovered, which are intertwined with the understanding of its value. The first was the issue of language, and the perception that a clearer, shared language would help communicate the benefits of design for behaviour change to decision makers and thus promote its implementation.

The second was the need to avoid any risks. This was perhaps the main obstacle for adopting design for behaviour change. The fear of potentially negative financial impact or risk clearly stifles commitment of time and financial resources which compounds the problem. The lack of clarity of understanding of design for behaviour change, and therefore of the appreciation of its benefits, as well as the lack of evidence base was perceived as the root cause of this obstacle.

It was also strongly felt by participants that there was a lack of evidence and relevant examples. It was felt that good examples would provide insight into how design for behaviour change might work, and allow designers to learn from the examples to adapt and transfer such examples into their own context of work. Equally important was the need for examples as evidence, or indeed post-evaluation of existing projects to understand the success of any intervention. The existence of such examples was also perceived to counter the perception of risk.

In this context, collaboration was perceived as a way to achieve shared language, a reduction of the perception of risk through better information and a better evidence-base. Therefore, easier access for public and private service providers to working with academics was seen as desirable, as was collaboration in terms of undertaking evaluations of design for behaviour change projects. This included a call for free access to academic journals. While desirable, and there is a move towards an open access culture, this does not always recognise the current constraints on academia of having to operate as a business with all its consequences.

Challenges that were identified through the review:

- Need to find financial investment and conceptual buy-in;
- Absence of clearly defined benefits;
- Benefits that may lie outside of any immediate financial gain;
- Potential ethical sensitivities;
- Need for the alignment of values;
- Scale of change and future proofing.

Obstacles that arose from the given challenges:

- Lack of time/commitment;
- Financial risk due;
- Not enough knowledge of the process and its benefits;
- Unapproachable (academic) language;
- Lack of metrics / evaluation frameworks and evidence;
- Fear of potentially negative/undesirable outcomes revealed by evaluation.

6.2.4   Key insights: the way forward

Through the conceptual and visual mapping of design for behaviour change approaches, the project has taken a first step towards providing some foundations for a coherent understanding of design for behaviour change. Together with the involvement of private and public stakeholders, this has generated a clear understanding of tendencies as well as gaps that future work has to address. These include:

- A lack of information and in-depth understanding, which stifles its wider adoption;
- A lack of shared language to communicate between the various stakeholders;
- The need for a more extensive debate about ethical questions by whom and for whom design for behaviour change is driven;
- A lack of evidence in the form of case studies and examples to guide work in this area and help to convince decision makers in the light of real and perceived risks;
- A need for agreed methods of evaluation to enable building up a library of case studies and examples.

In answer to these gaps, the discussions have generated a number of suggestions of what needs to be addressed, and how to address the identified issues. Key suggestions correspond directly to the above identified issues. Pointing to 'the way forward' they call for:

- A consistent use of terms and language between and within contexts through closer collaboration and knowledge sharing;
- A practitioner based publication resource, e.g. practitioner journal, to collect information and make it available in one easily accessible place;
- Easy processes for academia and industry to work together and to learn from each other;
- Easy processes for sharing resources to enable cross-disciplinary working;
- Development of shared clear and easy to use evaluation metrics and approaches;
- The production of explicit, evidence based examples.

6.3   Recommendations

In this final section, we draw together all the insights gathered from the project to formulate a number of recommendations concerning the recognition, promotion, and use of design for behaviour change. This is a broad range of recommendations, which address different stakeholders, and we have therefore grouped them into three subheadings, including policy makers, professional practice, and academia.

6.3.1   Recommendations for policy makers, strategists, and managers

Design for behaviour change can have an important role in promoting ethical and sustainable futures through innovation. Key recommendations to policy makers, strategists and managers are therefore to:

- Promote raising awareness of design for behaviour change and its benefits to help spread ethical and sustainable practices;
- Promote the role of design for behaviour change within the innovation process in order to promote ethical and sustainable innovation;
- Promote a long-term thinking that looks beyond immediate financial gain to ethical and sustainable benefits in the longer term;
- Prioritise incentives and business support for co-operation over legal requirements to encourage sustainable innovation, because the latter have shown to be of minor relevance for innovation;
- Facilitate easier ways for professional practice – especially Micro-businesses – and academia to collaborate on design for behaviour change and sustainable innovation projects through a reduction of red tape and easier access to financial support.

6.3.2   Advice for using design for behaviour change in professional practice

The feedback from professionals was often around the issue of better understanding design for behaviour change to make it relevant and applicable. Therefore, the following contains both some key information as well as some recommendations concerning designing:

- Recognise that the design for behaviour change can offer benefits both financially and in terms of reputation through promoting ethical and sustainable approaches;
- An easy way to design more effectively for behaviour change is to considers both context and individual behaviour, this may include considering
    o whether intended behaviour change effects will be short-term or (preferably) long-term;
    o who will own and administer the behaviour change (intervention);
    o whose or what ethical stance or values will underpin any design intervention;
    o whether any intended behaviour change is based on an individual's responsibility or on social responsibilities and norms;
    o whether any change should be implemented through a prescribed or voluntary process;
    o who the beneficiary/beneficiaries will be
- Free access to academic research is already available through many open access journals which can be searched and accessed conveniently, e.g. through Google Scholar.
- The www.behaviourchange.eu page has been created to function as a hub, and offer access to relevant literature, resources and contacts

6.3.3   Recommendations for academia

From the review, and in particular the focus groups, some key requests emerged concerning academic work into design for behaviour change. This included the request:

- To make clear(er) the benefits of design for behaviour change to help professional stakeholders in adopting design for behaviour change;
- To develop a more accessible language and make resources available more easily;
- To develop accessible evaluation metrics in collaboration with professional stakeholders;
- To include professional stakeholders more actively in collaborations on design for behaviour change to develop and test design for behaviour change examples.

6.4   A forum for the future

This project has been the first starting point to create a platform or hub for advancing design for behaviour change and which can be accessed from this web page:

www.behaviourchange.eu

This platform currently contains all the project results as well as a wide range of other links to further literature, resources and contacts. It will be expanded further over time to become more comprehensive.

To carry forward and address the identified issues in the future, we have also established a Special Interest Group under the auspices of the Design Research Society. The Design for Behaviour Change SIG has its own discussion group, and you are invited to join us to contribute to the discussion, share information, or start collaborations:

http://www.linkedin.com/groups/Design-Behaviour-Change-Special-Interest-8137299

You can also follow us on twitter:

@behaviourchangeu

or you can contact us directly on:

info@behaviourchange.eu

We look forward to hearing from you and to work together on some all changing collaborations!
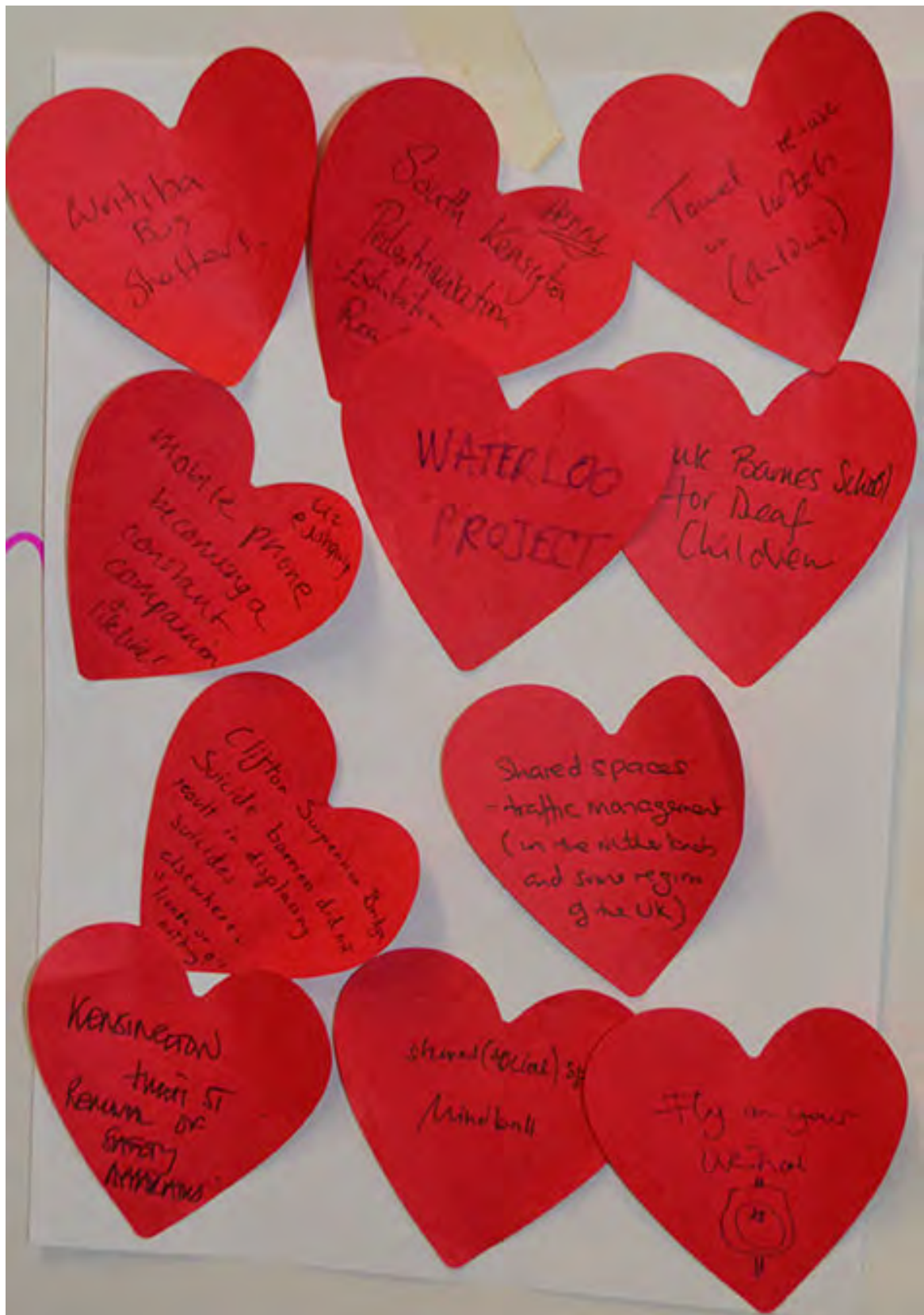
7. Acknowledgements

Figure 61: Design from behaviour change examples from Focus Group 1

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9. Appendix 1

AHRC Sustainable Innovation Draft Questionnaire - 30 April 2014

COVER PAGE

Creating Sustainable Innovation through Design for Behaviour Change

PROJECT The project seeks to develop a better understanding of how Public and Private Sector Organisations access information on, and implement sustainable innovation through design for behaviour change. The aim is to improve how design research is made available for the benefit of promoting sustainable innovation.

SURVEY We invite you to participate in the project by completing this brief 10 minute survey. Your participation will help promote sustainable innovation through improving knowledge exchange between academy and industry, public and private sectors. We will ask you briefly about your organization, its position on innovation and behaviour change, and how you access relevant research.

BENEFIT Participants of the survey are entitled to a copy of the final research report with the findings from the survey and the project as a whole. Participants of the survey can also volunteer to participate in one of the two follow-up focus groups which will discuss in more detail the opportunities and challenges for sustainable innovation through design for behaviour change.

WHO WE ARE This prestigious Arts and Humanities Research Council funded project is conducted by a team of design researchers and behavioural scientists from the Universities of Wolverhampton, Warwick, Lancaster, Loughborough, Twente, Delft, and the Royal College of Art.

PROJECT WEBSITE http://www.behaviourchange.eu

CONSENT
By continuing with this survey you agree for the information provided by you in this survey to be used for the purposes and publications of this research. Your data will be dealt with confidentially and any information provided will be anonymous. Your contact details will not be forwarded to any third parties, or used in any other way.

1. Tell us about your organisation and you

- What type of organisation do you work for? [single answer]
  - Charity
  - Private / Commercial Organisation
  - Public Sector Services
  - Social Enterprise / Community Interest Company
  - Other (please specify) [open textbox]

- How many employees does your organisation have? [single answer]
  - 1-10
  - 11-49
  - 50-249
  - >250

- What is your organisation's annual turnover? [single answer]
  - £0-100,000
  - £100,000-500,000
  - £500,000-1,000,000
  - > £1,000,000
  - Don't know

- What is your job role within your organisation? [single answer]
  - Director/Owner/CEO
  - Marketing and Sales
  - Production
  - Research and Development
  - Other (please specify) [open textbox]

- What is your organisation's primary product or service? [tick all that apply]
  - Agriculture
  - Building Industry
  - Consumer Products and Retail
  - Consultancy
  - Education
  - Entertainment
  - Finance, Insurance and Banking
  - Food and Beverage
  - Health, Social Care and Wellbeing
  - Legal and Compliance
  - Non-consumer Technology
  - Sports and Leisure
  - Transport
  - Other (please specify) [open textbox]

- What medium does your organisation predominately engage with? [tick all that apply]
  - 2 dimensional products (e.g printed materials, interfaces)
  - 3 dimensional products (e.g. furniture, tableware, tools, parts, packaging)

- Buildings and Architecture
- Digital products (software)
- Digital products (hardware)
- Electronics
- Food and beverage
- Materials
- Services
- Urban Design and Planning
- Other (please specify) [open textbox]

- Where is your organisation located in the UK: [single answer]
  - London
  - Midlands-East
  - Midlands-West
  - North-East
  - North-West
  - Northern Ireland
  - Scotland – Lowlands
  - Scotland – Highlands
  - South
  - South-East
  - South-West
  - Wales
  - Other (Please specify) [open textbox]

- Is your organisation national only? [single answer]
  - Yes
  - No

    If no: what other countries are you active in? [open textbox]

2. Innovation

- One definition of innovation is the successful application of an idea, practice, or object perceived as new. To what extent do you agree with this definition? [single answer]
  - Fully agree
  - Somewhat agree
  - Somewhat disagree
  - Fully disagree

  If you disagree: what is the understanding of innovation in your organization, if any? [open textbox]

- What types of innovation are common in your organisation? [tick all that apply]
  - Service innovation
  - Process innovation
  - Product innovation
  - None
  - Other (please specify) [open textbox]

- Why is innovation important to your organisation? [tick up to three]
    - To meet demands from clients and/or public
    - To comply with legislation
    - To improve services and/or products
    - To be a market leader
    - To increase market share and/or profitability
    - To promote social sustainability
    - To promote ecological sustainability
    - Other (please specify) [open textbox]

- How does your organisation facilitate innovation? [tick all that apply]
    - Through using external consultants
        - Designers
        - Engineers
        - Economists
        - Market research and trend forecasting
        - Psychologists
        - Trend forecasters
        - Other(s) (please specify) [open textbox]
    - Through in-house research & development involving…
        - Designers
        - Engineers
        - Economists
        - Market research and trend forecasting
        - Psychologists
        - Trend forecasters
        - Other(s) (please specify) [open textbox]

3. Facilitating Behaviour Change

Behaviour change, as an approach for engendering desirable human practices, is becoming increasingly important as a means to address current social, economic and ecological challenges. For example, behavioural change is used to reduce waste or energy consumption or change health behaviours. Innovation has an important role in facilitating behaviour change, e.g. through designing products and services that promote sustainable practices and life styles.

- To what extent are you aware of design for behaviour change? [Likert scale]
    - Very aware
    - Aware
    - A little
    - Not at all [logic: go to section 4]

- To what extent do design for behaviour change principles or practices inform innovation in your organisation? [Likert scale]
    - A lot
    - Somewhat
    - A little
    - Not at all [logic: go to section 4]

- Does your organisation use any design for behaviour change guidelines, toolkits or practices? [single answer]
    - o   Yes, we refer to them to inform innovation
    - o   Yes, but not in detail
    - o   No, but we would like to
    - o   No, we don't feel this would be necessary

    If yes, please name and describe any guidelines or practices you use.
    [open textbox]

- Who is your organisation most trying to influence when designing for behaviour change? [single answer]
    - o   Own employees
    - o   Customers
    - o   Public
    - o   Other (please specify) [open textbox]

- What are you most hoping to influence or achieve when designing for behaviour change? [tick all that apply]
    - o   Values and attitudes
    - o   Decision making
    - o   One time change
    - o   Long-term change
    - o   Removal of behavioural barriers
    - o   Opportunities for new practices or alternate behaviours
    - o   Other (please specify) [open textbox]

- What outcomes or area of application are you most trying to influence? [tick all that apply]
    - o   Health and wellbeing
    - o   Safety
    - o   Crime prevention
    - o   Mobility
    - o   Sustainability
    - o   Economic efficiency
    - o   Social Integration
    - o   Other (please specify) [open textbox]

- If you / your company are actively involved in designing for behavioural change… Can you give an example, including the results or effectiveness of any behaviour change work your organisation has implemented and how this was evaluated? [open text box]

4. Access and barriers to knowledge

- How do you find, generate or access relevant information on designing for behaviour change? [tick all that apply]
    - o   Through in-house R&D
    - o   Through external consultancy
    - o   Through publicly available non-academic research
    - o   Through publicly available academic research
    - o   Through business networks and social media
    - o   Other (please specify) [open textbox]

- What difficulties does your organization encounter in accessing or implementing design for behaviour change? [tick all that apply]
  o Difficulty of accessing relevant research
  o Lack of evidence
  o Lack of time
  o Technical language of available research
  o Too risky
  o None
  o Other (please specify) [open textbox]

- What would make it easier for your organization to access and implement design for behaviour change? [tick all that apply]
  o Clear evidence of benefits
  o Easier access to information, e.g. through networks and workshops
  o Free (open access) academic journals
  o Guidance that is more specific to your areas of interest
  o Less technical language of available research
  o More awareness, e.g. through social media or SME specific journals
  o More relevant examples
  o Other (please specify) [open textbox]

5. Finishing off

Thank you for your time in completing this survey. Your input will be much appreciated.

If you would like to receive an electronic copy of the final report with the outcomes of the survey, please enter your email address here:
[textbox]
(Your email will not be used for any other purposes, and will be dissociated from your survey answers)

If you are interested in participating in one of the half-day follow-up Focus Groups, please indicate in which of the two events you would be interested:
  o 10 July 2014, Royal College of Art, London
  o 16 July 2014, Warwick University, Warwick
(A remuneration fee for participants will be available.)

Thank you once again for your participation. If you have any feedback or questions, please email: Kristina Niedderer <k.niedderer@wlv.ac.uk>

10.   Appendix 2: work plans for focus groups 1 and 2

Creating Sustainable Innovation through Design for Behaviour Change
Focus group work plan for FG at RCA, London, 10 July 2014

	Programme	Content	Purpose	Timing - Task	Facilitator
12.30	Arrivals & lunch	Informal welcome & networking		---	All
13.30	Introduction from organisers	About the project / survey so far. Purpose of the FG group	*Setting the scene*	10 min. 2 min. questions 3 min. consent form	Kristina
13.45	Introductions from participants	Introducing each other, their interest in behaviour change in design, and any examples or case studies – what design techniques or principles have you used?	*Getting to know each other/s concerns*	5 min. Intro/setting task 7 min. talk to each other in pairs – put experience with, and position on DfBC on post-it(s). 30 min. reporting about each other (12 people, 2 mins each = 24 mins) 3 min. sum-up	Stephen - lead
14.30	Your take on design for behaviour change and its challenges	Discussion of participants' approaches to this area, and the problems encountered in accessing and implementing it	*Gathering insights* / *Discussing*	15 min: Mini-design exercise –how would you go about addressing this problem? 10 min: discuss position on/understanding of DfBC & its benefits (notes taken by scribes) 10 min. discuss in groups of 3-4: what are challenges & obstacles of implementing DfBC – put position(s) on DfBC on post-it(s) 10 min. reporting & discussion	Dan – lead design ex. Andrew/Paul - lead (scribes: Dan, Kristina)
15.15	Tea break			(use break to collect key issues raised	
15.45	What's the way forward? What would be helpful to you? What do you want to do, that you can't?	Arrive, collaboratively, at a set or list of features / criteria for making behaviour change research more accessible or usable to SMEs in the context of innovation—issues potentially including evidence, language, examples, methods, theories	*Structuring*	5 min. intro of session 15 min. discuss in groups of 3-4: what would be helpful 15 min. feedback to group 15 min. open discussion 10 min. – draw together key results	Dan - lead
16.45	Wrapping up	Summary, thank you & announce results workshop Formalities	*resume*	5min. Summary and thank you 5 min. Possibilities of dissemination & collaboration: announce results workshop 5 min. Claim forms & Evaluation forms	Kristina - lead
17.00	End				

Creating Sustainable Innovation through Design for Behaviour Change
Focus group work plan for FG at Warwick University, 16 July 2014

	Programme	Content	Purpose	Timing - Task	Facilitator
12.30	**Arrivals & lunch**	Informal welcome & networking		---	All
13.30	**Introduction from organisers**	About the project / survey so far Purpose of the FG group	*Setting the scene*	15 min. 2 min. questions 3 min. consent form	Kristina – lead Jamie – technical all
13.50	**Introductions from participants**	Introducing each other, their interest in behaviour change in design, and any examples or case studies – what design techniques or principles have you used?	*Getting to know each other's concerns*	5 min. Intro/setting task 7 min. talk to each other in pairs – put experience with, and position on DfBC on post-it(s). 30 min. reporting about each other (6 people, 3 mins each ~ 18 mins) 5 min. sum-up	Jamie - lead
14.25	**Your take on design for behaviour change and its challenges**	Discussion of participants' approaches to this area, and the problems encountered in accessing and implementing it	*Gathering insights* *Discussing*	20 min: Mini-design exercise –how would you go about addressing this problem? 10 min: group discussion of position on/understanding of DfBC 10 min. discuss in groups of 3-4: what are the benefits, and the challenges & obstacles of implementing DfBC – put position(s) on DfBC on post-it(s) 15 min. reporting & discussion	Kristina lead design exc. Kristina/Robin Robin - lead
15.20	**Tea break**			(use break to collect key issues raised	
15.45	**What's the way forward? What would be helpful to you? What do you want to do, that you can't?**	Arrive, collaboratively, at a set or list of features / criteria for making behaviour change research more accessible or usable to SMEs in the context of innovation—issues potentially including evidence, language, examples, methods, theories	*Structuring*	5 min. intro of session 15 min. discuss in groups of 3-4: what would be helpful 15 min. feedback to group 15 min. open discussion 10 min. – draw together key results	Rebecca (Kristina scribe)
16.45	**Wrapping up**	Summary, thank you & announce results workshop Formalities	*resume*	5min. Summary and thank you 5 min, Possibilities of dissemination & collaboration: announce results workshop 5 min. Claim forms & Evaluation forms	Kristina
17.00	End				