Shrinking and scaffolding:
supporting behaviour change towards implementing sustainable design

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Abstract

To start to include sustainability in a design project is a transition. This transition requires change in how people do things, that is, behaviour change, and it takes place in the midst of the usual pressures of product design. Prior research on sustainable design has mostly explored the so-called technical side – identifying what tasks should be performed, such as specifics of including sustainability criteria when analysing product concepts. Recent studies have advocated the consideration of the human nature of the people who are to implement these 'technical' tasks, to undergo and drive the transition.

We therefore embarked on an action research project to support behaviour change towards implementing sustainable design in the individual members of design project teams. Our action research partner was a design consultancy who wanted to begin working with sustainable design. Our research question was: *How might the partner organisation support individual behaviour change towards implementing sustainable design?*

Firstly, we identified some barriers to behaviour change; these barriers were related to motivation, capability and opportunity to apply sustainable design. Secondly, to investigate how to address the barriers and support individual behaviour change, we integrated concepts on behaviour change, motivation, learning for sustainability and climate communication to form a conceptual system (a theoretical model). In parallel, we undertook a participatory action research project with the consultancy, where we iteratively and collaboratively employed our model to develop ideas for specific actions that the organisation could take. We also tried out some of these actions and observed the outcomes.

We learnt that it is important to not just define what 'technical' tasks project teams should ideally perform, but to also scaffold the journey as a series of simpler steps. Shrinking the 'technical' tasks into meaningful steps that are within reach helps individuals to feel confident and competent, which in turn leads to increased intrinsic motivation and behaviour change. Progressively achieving small steps aligned with

their values reduces the risk of dissonance and denial, and therefore increases the potential for action.

In this article, we present our model and our learnings.

1 Introduction

"Simplicity is the ultimate sophistication" is a phrase often attributed to Leonardo da Vinci. Designers of support for sustainable design should take heed. In this paper, we argue for shrinking sustainable design tasks into a series of *simple* (readily achievable) steps and to *scaffold* – provide temporary support to help designers to progress with – these steps for implementing sustainable design. This paper describes the theory building, and action research with a design consultancy, that corroborates that shrinking and scaffolding tasks, amongst other actions, can support behaviour change towards implementing sustainable design.

Sustainable design[1] is product design that aids transition to a sustainable society. Implementing sustainable design is therefore a transformative task. The nature of sustainability itself is complex; it relates to social and ecological systems, and includes considering not only current global issues, but also potential future issues (Broman and Robert, 2017). Sustainability has therefore been named a 'wicked problem' requiring a change of the whole system (Schäpke et al., 2013). Change is needed not only in technology and economy, but also in human aspects related to culture and organisations (Loorbach and Wijsman, 2013). For example, there is a psychological dimension; individuals can experience unsustainability as distant, in time and in space (Stoknes, 2014).

The transformation involved in sustainable production and consumption in particular is also recognised as fundamentally complex (Tukker et al., 2008). Integrating sustainable development and new product development "complicates an already complex process" (Goffin, 2012). Some authors argue that the slow progress in implementing sustainable design may be due to insufficient consideration of the socio-psychological dimension (for example Pigosso, Rozenfeld and McAloone (2013), Brones, de Carvalho and Zancul (2014), and Verhulst and Boks(2012)). One barrier to the uptake of sustainable design is that users experience many of the tools as complicated and time-consuming (Bovea and Perez-Belis, 2012), and according to European ecodesign practitioners, overly complex (Prendeville et al., 2013). From a survey in Japan and South Korea in 2003, Boks (2006) found that the main challenges were socio-psychological – the gap between proponents and executors, organisational complexities and unwillingness. Problems with implementation might also be due to insufficient attention to change processes and management (Brones and de Carvalho, 2015). All of these challenges relate to the *human side* – the socio-psychological side – of sustainable design.

The fact that sociological, psychological, emotional and intangible factors are essential for successful implementation of sustainable design was pointed out early by Post and Altman (1994). And Cohen-Rosenthal (2000) found that an effective implementation strategy must therefore include human commitment, skills and social organisation.

[1] Sustainable design is also known as ecodesign and sustainable product development.

The identification of the importance of socio-psychological factors and the simultaneous relative lack of consideration of these factors have led to more research on the human side of sustainable design, sometimes called the 'soft side of ecodesign' (e.g. Boks, 2006). In 2006, Boks concluded that previous publications did not provide enough insights on the role of socio-psychological factors in the context of ecodesign. In fact, even by 2015, half of the sustainability integration models studied by Brones and de Carvalho (2015) did not include any consideration of change management.

Boks and McAloone (2009) stated that product design research needs to include more consideration of the human elements and that this should include both *individuals* and organisational change. Since then, research on the human side has started to converge on the following general principles: the transformative nature of the process, the need for a systemic and multi-level approach and the need to incorporate both organisational and *individual dimensions* (Brones et al., 2017).

Implementing sustainable design demands design project teams to apply new tools, methods, approaches and even to think in different ways (Lambrechts et al., 2013; O'Rafferty et al., 2014; Wiek et al., 2011) – a change of mindset (Johansson, 2002). Competence and motivation are very specific to successful implementation of sustainable design in companies (Johansson, 2002). Competence can exist within and between individuals (Lam, 2000) and motivation exists within individuals. Working for individual behaviour change towards sustainable design practices in product development project team members is therefore important.

Despite the identified need for support for both individual and organisational dimensions, behavioural aspects of integrating 'sustainability' have barely been studied (Brones et al., 2017). Knowing how to help with the behavioural aspects of the transition to sustainable design was also needed by the partner company. Based on the above, we posed the following research question for our project with the design consultancy:

How might the partner organisation support individual behaviour change towards implementing sustainable design?

Work on 'Design for sustainable behaviour' has addressed a related question. That body of work addresses how the design of a product can influence user's behaviour to be more sustainable, often by reducing frequency or impact of unsustainable behaviours (Coskun et al., 2015). Design for sustainable *user* behaviour are often mapped along a spectrum from user-in-control to product-in-control and, depending on the user's attitude, these can result in positive or negative behaviour change (Zachrisson and Boks, 2012). Much of that work has focused on electricity consumption and the domestic context (Coskun et al., 2015). Our research is not concerned with how individuals (perhaps mindlessly) interact with inanimate objects such as fridges and showers; our research focused on how designers can adjust their design practices. Our 'users' are users of design processes and practices in the particular context of a design consultancy, not regular users of physical artefacts. The work on designing for sustainable user behaviour is also based on a wide range of theoretical grounds. Much

of it rarely considers the individual in a social context and often considers attitudes, beliefs and needs as fixed (Kuijer and Bakker, 2015). We therefore chose not to start from the literature on design for sustainable behaviour, but rather start from the literature on behaviour change while seeking inspiration from the theoretical grounds for design for sustainable behaviour where that ground is stated and is relevant to our question.

2 Research design: Action research with theory building

There are several essential choice moments in qualitative research. We will address each of the following essential choice moments from Savin-Baden and Howell Major (2013): Philosophical stance, Who or what of study, Research approach, Data collection, handling and interpretation, and Quality.

2.1 Collaboratively knowing how to practically do – a philosophical stance

To develop tangible solutions, we need to focus on knowing *how to* do sustainable development - to focus on learning *how to practically* make change happen (Fazey et al., 2018). The research question is therefore a 'how to' question.

The question is grounded in a desire to enhance practice, which is in line with the purpose of sustainability science to be solutions-orientated (Miller, 2013; Miller et al., 2014). Due to the complexity of sustainable development, research in this area should be iterative attempts to achieve change (Fazey et al., 2018).

Attempts to change practice cannot be achieved by academic researchers alone. It is the research participants (for example, product developers) whose practices are being investigated and so their reality (mental construction) is part of the reality that the research must engage with. Seeking to understand individuals, and reality as an individual's mental construction, is representative of research that takes a constructivism stance (Savin-Baden and Howell Major, 2013). Taking a constructivism stance, to understand how to enhance individuals' practice (that is, change their reality), we need to engage with these individuals through *collaborative* research.

Collaborative research also benefits from increased diversity of opinion and skills. This diversity, along with the participants' deep understanding of their reality, can lead to better designed solutions.

2.2 Studying behaviour and practice – the who and what

The phenomena of our study are the individual's behaviour related to implementing sustainable design and processes for changing behaviour. The individuals of interest are members of product design project teams at the consultancy that we are working with.

2.3 Participatory action research with theory building – our approach

Together, academic researchers and participants from the partner company chose to engage in *action research* due to its inherent intention to improve *practice* (and address 'how to'). In particular, we chose the type of action research that is

participative knowledge construction. This combines action research with collaborative methods for constructing knowledge together with those immediately affected (participatory research). In the action research literature, this combination is known as participatory action research (Bergold and Thomas, 2012), pragmatic action research (Greenwood and Levin, 2007) or pragmatic orientated action research (Johansson and Lindhult, 2008). The people who are immediately affected are knowing subjects, participants, rather than objects of the research. In our case, the participants are employees of a product design consultancy that uses a design-thinking-based product innovation process.

Greenwood and Levin's (2007) stance on action research is one of knowing *how* is more important than knowing *that*, which aligns with the need for sustainable development research to address the *how*. The authors also share our view on valuing the knowledge of the participants and the need to bring together academic and practical knowledge.

When undertaking the research, we found a lack of theories that we could apply directly in the context of sustainable design implementation. We therefore constructed a new model for our context by combining and synthesising relevant theory from neighbouring areas. Our research design therefore became action research with more theory building than is probably usual for participatory action research.

Our action research consisted of iteratively completing the cycle shown in figure 1. There were two overlapping phases of research. The initial phase is illustrated by the triangle in the top-left of the figure. In the second phase, we iteratively designed and (to a limited extent) tested actions that the organisation can take to tackle the identified challenges. As such, this phase focused on designing and prototyping actions.

The cycle is based on Kemmis et al.'s (2013) plan-act-observe-reflect spiral. We divided up the 'plan' step into 'theorise' and 'design', thus giving a 5-step cycle shown in the figure. As already mentioned, we could not find readily applicable theory that addressed the research question and it was therefore necessary to make the theorise step more explicit than is sometimes required for action research. We completed multiple iterations, but to varying levels of detail (as shown in Figure 2). The description here is a simplification to aid communication of what was an iterative and alive process, complicated with the messiness of reality.

Section 3 covers the results from the first phase and sections 4 and 5 cover the results from the second phase.

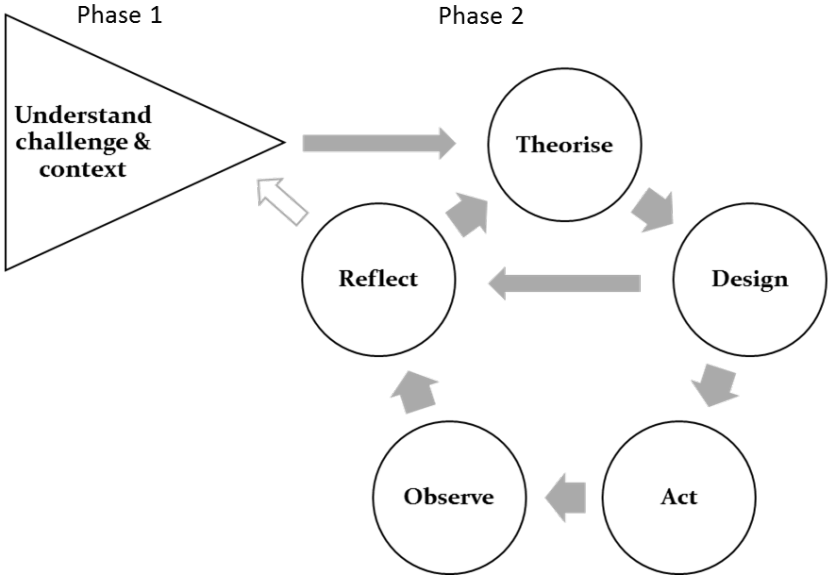

Figure 1 – Our action research cycle comprised of two phases. After the initial phase (shown in the triangle), we iterated between 5 steps.

2.3.1 Phase 1 – understanding the challenge and context

Understand challenge & context: The aim of the initial phase was to increase collective understanding of relevant academic fields and of the practices in the context of the action research partner organisation. This included seeking to understand the challenge, what is hindering individuals from changing their behaviour to implement sustainable design and what they need. An important aspect of this phase was also building relationships between academic researchers and participants.

2.3.2 Phase 2 – designing and testing

Theorise: We employed existing literature (from related fields) to theorise – to formulate and express a conceptual system – in accordance with Jaccard and Jacoby (2010). A conceptual system is concepts placed in relationship with each other to facilitate understanding, a model. With each iteration, we increased our understanding of the challenge and the potential solution space and so we modified or added to our model. We explain this in section 4 and summarise with propositions in section 5.

Design: In the design step, we applied the model to design actions that could be taken in this particular action research project. This step involved generating ideas and then selecting the ideas – a small design process.

Act and *observe:* We then undertook selected actions and gathered data on how it went. We have so far implemented this step to a very limited extent.

Reflect: Using the evidence that we collected connected to undertaking the actions in conjunction with our experience from designing the actions, we reflected on and updated our understanding of the challenge and the potential solution space.

2.3.3 Partnering with a design consultancy

Our partner organisation was a design consultancy that consults in two ways. They have consultants placed in client companies, usually working on detailed engineering design, and they run product innovation projects together with clients. When running innovation projects, they use a product design process that is based on design thinking. Their goal with the research project was to start working with sustainable design in their innovation projects. The consultancy was founded just over 20 years ago. There are around 250 employees located in 16 towns across Scandinavia.

2.4 Research methods

To meet the aims of the two phases, we iteratively reviewed literature, collected empirical data and designed actions. The academic researchers reviewed literature on sustainable design, product development, the human side of ecodesign, behaviour change, motivation and organisational learning and change, as well as the intersections between these areas. Figure 2 illustrates how the empirical activities were distributed across the steps. Many activities occurred in parallel and were iterative, building on the learning achieved in the parallel or previous activities. The empirical data collection and design activities are detailed in Table 1.

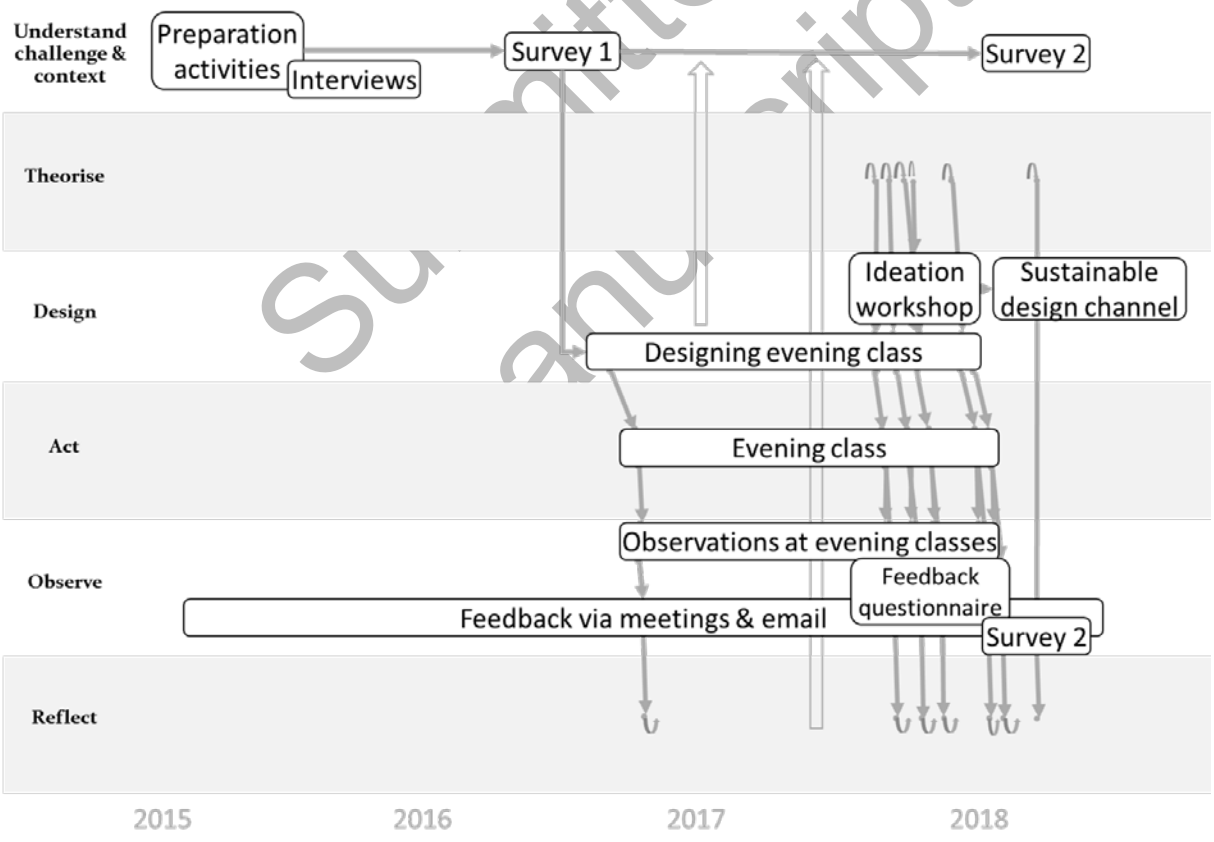

Figure 2 – We undertook various empirical activities across the various iterations. The arrows show the order of the activities. The half-circle arrows illustrate the progression from 'reflect' to 'theorise'.

Table 1 – We employed a variety of data collection methods and design activities.

Data collection methods/design activities	*Type of data collected*	*Number of participants*
Preparatory work that helped set the scene for greater levels of participation (in line with Bergold & Thomas (2012)); early 2015. Including a focus-group style workshop for exploring needs, which is "one of the key instruments for the creation of a 'communicative space'" (Bergold and Thomas, 2012, sec. 4.4); April 2015.	Documentation Presented info Expressed needs and challenges Observations	5 practitioners 5 academics
Interviews with practitioners on their perspectives; September 2015.	Interview responses (Observations)	4 participants 3 academics
Survey of employees; June 2016 and May-June 2018	Responses	50 in 2016 28 in 2018
Designed and delivered a ~2.5-hour evening class in sustainable design, with specific focus on how to integrate sustainability in their product design process. This integration is a key result of the wider action research project (of which this work is a part) and is described by Gould et al. (2017). October 2016 – January 2018.	Personal experience from designing Expressed challenges and needs Observations	~50 practitioners (in 6 classes in 6 different towns) 2 academics
Feedback questionnaire after evening class - three yes-no questions and 2-4 free-text questions; September 2017 – January 2018.	Responses	31 practitioners (in 4 classes)
Ideation workshop with both academic and practitioner participants; November 2017.	Ideas for actions Expressed challenges and needs Observations	3 practitioners 2 academics
Meetings (and emails); continuously during project.	Expressed challenges and needs Observations Ideas for actions Feedback on ideas	6 practitioners total 3 academics total (14 meetings)

2.5 Creating a democratic, safe space - ethical considerations

Key principles of action research are that democracy is a pre-requisite and that a safe space where participants can be open and show dissent needs to be developed (Bergold and Thomas, 2012; Greenwood and Levin, 2007). Although building trust can take time, we believe that we have been fairly successful in creating this space and a power-equality between academic and practice-based knowledge since participants have been open with both positive and negative comments and even emotional sharing of frustrations. All survey and interview data was handled anonymously. This paper was also reviewed by a company representative before being submitted.

2.6 Iterative and multi-sourced – quality of our research design

The selection of action research as an approach and the top-level design was made jointly by academic researchers and company participants. In action research, it is not a matter of standardizing methods, but rather choosing methods appropriate to the participants (Bergold and Thomas, 2012). Many of the methods that we started out with are not especially participatory, for example, interviews and surveys. However, the interviews and surveys were research techniques that were familiar to the participants and therefore served both as a knowledge building step (for all involved) and for constructing the safe space and trust necessary for the later use of more

participatory methods. The iterative nature of our research and the multiple data sources give strength to the design.

Of Greenwood and Levin's (2007) three dimensions to credibility of action research – argumentation, workability and transcontextual credibility – our design addresses the first two. We constructed models through argumentation based on literature, and our testing sought to investigate the adequacy of our suggestion according to how well it works in the local context (known as workability (Greenwood and Levin, 2007)). Expanding on the argumentation dimension, and in line with Jaccard and Jacoby (2010), we consider the primary evaluative criteria of a good model or theory to be its utility. In our case, it is utility for organisations and researchers who are seeking to support individual behaviour change towards implementing sustainable design. As yet, our understanding of the utility of the model comes only from experience of using them in the action research project, especially in the ideation workshop. Further work over time is needed in order to judge utility, and therefore determine quality. Additional quality criteria for a theory are that it is consistent internally and in agreement with existing knowledge (Shaw, 1982). Our research was designed to do exactly this by using existing knowledge and combining it in a coherent manner such that it can be applied in the new context.

3 Phase 1 results: behavioural barriers

In this section, we share the results of the first phase. The first phase was about understanding the challenge: Why is sustainable design not already widely implemented? What is needed for individual behaviour change? What is hindering individual behaviour change towards implementing sustainable design?

3.1 What is needed for individual behaviour change?

Searching the literature regarding a suitable model of behaviour change, we selected the COM-B model. The model comes from the health psychology field, built based on a review of 19 behaviour change frameworks, including 2 related to sustainable development and is comprehensive in its coverage of (health) interventions (Michie et al., 2011). The model also includes the broader conceptualisation of motivating behaviour from today's discourse, that is, it allows for not just planned behaviour (from choice and intention) but also those processes that lead to 'automatic' behaviour. The model also includes, and gives equal status to, individual, group and environmental (intra-psychic and external) factors. Davis et al. (2015) state that the model meets their nine criteria for behaviour change theories. We therefore consider it a relevant and useful model of an individual's behaviour system.

The COM-B model (shown in Figure 3) represents the behaviour system and illustrates that an individual's behaviour is influenced by some combination of their capability and motivation and the opportunities they experience (Michie et al., 2011). These interdependent factors are, in turn, influenced by the behaviour. Michie et al. (2011) define the influencing factors as written in the left-hand boxes in the figure.

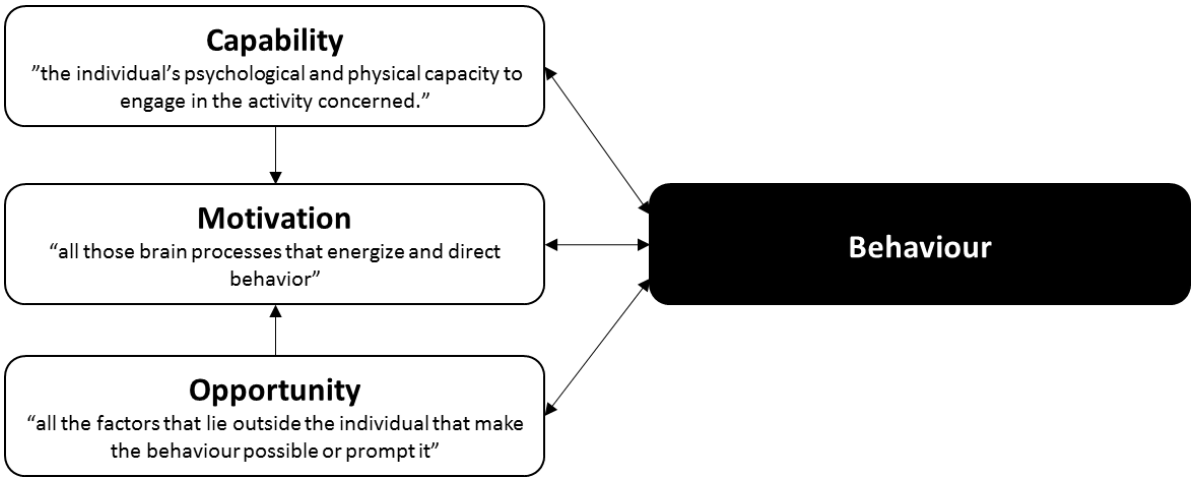

Figure 3 - COM-B model: an individual's behaviour is influenced by some combination of their capability and motivation and the opportunities they experience, while the behaviour also influences these factors (Michie et al., 2011).

From the COM-B model, we can see that, in order to achieve individual behaviour change, the organisation (and others helping them) can aim to increase:

- *capability*, including knowledge and skills
- *motivation* (from habitual processes, emotional responding, and analytical decision-making)
- *opportunity*, including both possibilities and prompts

3.2 What is hindering individual behaviour change towards implementing sustainable design?

Considering more specifically the context of supporting individual behaviour change towards implementing sustainable design, we were able to easily map barriers to sustainable design from the literature onto the above model. Table 2 maps two sets of barriers from the sustainable design literature onto the elements of the COM-B model. The identification of barriers against all three behaviour-change factors illustrates that organisations likely need to work with all three factors.

The COM-B model can be considered relevant to our project also due to the results of a survey of individuals at the partner organisation. Over 60 % (N=49 in 2016) answered that they did not feel enabled by management to work with sustainability (answered 0 or 1 on a scale of 0 (not at all) to 3 (completely)), although the respondents had answered that they considered sustainability to be (at least partially) important to the company's work (all respondents answered 1, 2 or 3 on a scale of 0 (not at all) to 3 (completely)). Regarding capability, 53 % (N=50 in 2016) answered either "0" or "1" on a scale of 0 (not at all) to 3 (completely) in response to the question: "To what extent do you understand how to include sustainability in your main tasks?" A further 30 % answered "2" with only 6 % (3 people) answering that they completely understand. In addition, in the free text part of the survey, three respondents commented on the particular nature of consultancy work in such a way as to indicate perceived lack of (and dependence on) customer demand.

Table 2 - Mapping sustainable design barriers onto the COM-B behavioural system factors.

	O'Rafferty and O'Connor (2010), based on Woolthuis (2005)	*Rossi et al. (2016)- Barriers for the implementation of ecodesign methods and tools in companies*
Barriers related to increasing CAPABILITY in order to increase motivation and change behaviour	• Lack of awareness, training and motivation of employees • Lack of awareness of viable technology options • Lack of technical knowledge (material substitutability) • Perceived lack of customer demand • Sustainability viewed as periphery to core business	• Need for knowledge of ecodesign issues • Need for knowledge of existing ecodesign tools • Lack of awareness of benefits achievable • Lack of awareness of benefits • Difficulty in identification of the advantages/ disadvantages connected with the application of ecodesign strategies for products • Perception of high cost for tools • Perception of no demand from the market
Barriers related to increasing MOTIVATION and thus changing behaviour	• Risk adverse attitudes and resistance to engaging in new business opportunities through ecodesign • Fear [of] unknown	
Barriers related to increasing OPPORTUNITY in order to increase motivation and change behaviour	• Failure of managers to harness strategic considerations • Focus on short-term investments • Fragmented product development process in SMEs • Lack of clear internal ecodesign or innovation strategies • Lack of managerial and operation resources (time, money, skills) • Lack of top management commitment and leadership • Lack of viable technology options or alternatives • Low levels of trust in intermediary and business support organisations • Poor perception of ecodesign by investors • Sunk investments • Supply chain position and relationships	• Complexity of the product development process • Lack of cooperation between departments • Lack of environmental goals • Lack of environmental vision • Lack of involvement of sales and marketing departments • Lack of management commitment • Lack of specialist staff • Lack of standardization in the product development process • Management instability • Need to dispose of a multifunctional team • Organizational complexity

3.3 What are the psychological barriers hindering communication from leading to behaviour change?

When providing opportunities for individuals to increase their capability and motivation and to change their behaviour towards implementing sustainable design, organisations and support-designers need to communicate with these individuals. When communicating about sustainability, the messages themselves can trigger psychological barriers (self-defence mechanisms) in individuals due to the political nature of, for example, climate change messages; these psychological barriers hinder individuals from truly hearing the messages, taking action and changing their behaviour (Stoknes, 2014). Since the climate challenge is a subset of the sustainability challenge, and they thus share characteristics, we assume that the same psychological barriers may be triggered when informing product design project team members about sustainable development and making suggestions for how they can do sustainable design.