Shrinking and scaffolding: supporting behaviour change towards implementing sustainable design

Rachael K. Gould\textsuperscript{i}, Cecilia Bratti\textsuperscript{i}, Martin Svensson\textsuperscript{ii} & Göran I. Broman\textsuperscript{i}

\textsuperscript{i} Department of Strategic Sustainable Development, Blekinge Institute of Technology, Sweden  
\textsuperscript{ii} Department of Industrial Economics, Blekinge Institute of Technology, Sweden

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.
### 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.

<table>
<thead>
<tr>
<th>Data collection methods/design activities</th>
<th>Type of data collected</th>
<th>Number of participants</th>
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| 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.
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.
| 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  | • 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 |
| 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 | |
The five main barriers to effective climate communication identified by Stoknes (Stoknes, 2014) are as follows:

- **Distant**: The climate issue is construed as distant (in a number of ways).
- **Doom**: Framing the issue as disaster, cost and sacrifice backfires.
- **Dissonance**: The lack of convenient climate friendly behaviours weakens attitudes over time.
- **Denial**: Gives refuge from fear, guilt and threats.
- **Identity**: Activates cultural filters so that one’s identity overrides the facts.

### 3.4 Summary of the challenge

As argued in this section, when organisations are seeking to support individual behaviour change towards implementing sustainable design, the challenge is to seek to avoid or counteract the barriers by:

- helping individuals to increase their motivation to implement sustainable design;
- helping individuals to develop the capability to implement sustainable design, including by increasing capability in such a way as to increase motivation;
- providing individuals with the opportunity to implement sustainable design, including by providing opportunity to increase motivation; and
- avoiding triggering psychological barriers while supporting the individuals.

In the next section, we will explore how to address the challenge.

### 4 Theorising – formulating a model

Based on the challenges identified in the previous phase, we created the following design/ideation questions to guide the design activities. The COM-B model is of the individual’s behavioural system and we want to ask about what the organisation can do: *How might organisations support individual behaviour change towards implementing sustainable design?* Since the ‘opportunity’ part of the model represents factors external to the individual, it is also integrated into the framing of the other questions. We also ask how organisations can provide opportunity for individuals to develop their capability, although this is not illustrated in the COM-B model.

- **How might organisations provide individuals with the (O) opportunity (possibilities and prompts) to increase their (M) motivation to implement sustainable design?**
- **How might organisations provide individuals with the (O) opportunity (possibilities and prompts) to develop the (C) capability (skills and knowledge) to implement sustainable design, including by increasing capability in such a way as to increase motivation?**
- **How might organisations provide individuals with the (O) opportunity - possibilities and prompts – to implement sustainable design, including by providing opportunity to increase motivation?**
- **How to avoid triggering (S) psychological barriers while supporting the individuals?**

We then consulted the literature in order to further understand these questions and gain inspiration. What we learnt from the literature is described in the following subsections. The opportunity question was addressed independently and through
addressing the motivation and capability questions since these questions ask about what the organisation can do.

4.1 Motivation to implement sustainable design

How might organisations provide individuals with the opportunity (possibilities and prompts) to increase their motivation to implement sustainable design?

In order to further understand the ‘motivation box’ of the COM-B model, we draw upon an established theory on motivation: self-determination theory. This theory states that intrinsic and extrinsic motivation does not exist as a dichotomy, but rather as a spectrum. Intrinsic motivation, at one end of the spectrum is when the motivation lies in the behaviour itself. For example, I exercise because I enjoy exercising. The theory describes the continuum of extrinsic-intrinsic motivators from less to more autonomous as follows: externally regulated – introjected – identified – integrated – intrinsic (Deci et al., 2017). Externally regulated motivators seek to control the individual’s behaviour through contingent rewards and threats. Introjected regulated motivators seek to loosely controlling behaviour through giving a sense of approval/disapproval. Providing opportunity for individuals to personally identify the importance of their work/behaviours is a form of identified regulation. The most internalised form of extrinsic motivation is integrated regulation, where individuals understand alignment between the desired work/behaviours and that which is important to them in life.

According to self-determination theory, there are three basic psychological needs to be met to achieve intrinsic motivation (Deci et al., 2017):

i. a sense of self-efficacy - feel competent and confident;

ii. self-determination - “experience freedom to experiment and initiate their own behaviours and not feel pressured and coerced to behave as directed”;

iii. and relatedness - “feel respect and belonging in relation to both supervisors and peers”.

Autonomous motivation (both intrinsic and well-internalised extrinsic motivation) lead to higher quality of work, less burn-out, increased knowledge-sharing and more work satisfaction (Deci et al., 2017). We thus consider intrinsic motivators and the more autonomous extrinsic motivators of particular interest when seeking to help individuals to be motivated to implement sustainable design. As such, we can expand the second point above as follows: Organisations can help individuals to increase their motivation to implement sustainable design by supporting individuals to experience self-determination in relation to implementing sustainable design, through...

a. ...helping the individuals to feel free to experiment and initiate their own sustainable design behaviours and not feel pressured and coerced to behave as directed; or

b. ...providing the opportunity for individuals to understand alignment between their work/behaviours with that which is important to them in life; or

c. ...providing the opportunity for individuals to personally identify the importance of their work/behaviours.
4.2 Capability to implement sustainable design

How might organisations provide individuals with the opportunity (possibilities and prompts) to develop the capability (skills and knowledge) to implement sustainable design, including by increasing capability in such a way as to increase motivation?

Drawing on the literature on sustainable design education, we looked at what types of learning are relevant for increasing capability to implement sustainable design. What we found is described in the following sub-sections.

4.2.1 Second-order social learning

Social learning (learning in a social context) is an approach to learning that is relevant for transitions towards sustainability (Schäpke et al., 2017). Some authors argue that social learning is particularly useful for dealing with uncertainty and complexity by allowing for collective experimentation and reflection (Schäpke et al., 2017). The pre-conditions for social learning are (Schäpke et al., 2017):

a. participatory setting;
b. trustful atmosphere; and
c. intensive, open dialogue between participants as well as reflecting on your own position.

The aim of the social learning should be second-order learning since this is the type of learning which leads to behaviour change through changes in underlying values and assumptions (Argyris and Schön, 1978). Second-order learning is important for adapting to continuously changing and increasingly complex environments and is therefore relevant for sustainable design. Conditions for second-order learning are (Grin and Graaf, 1996; Schäpke et al., 2013):

a. surprises;
b. outside views; and
c. safe spaces.

4.2.2 Individual dimension of organisational learning

Organisational learning is the “mutual learning of an organisation and the individuals in it” (March, 1991). Sustainable development is dependent on organisational learning (Lozano, 2014). However, this learning can be impeded by corporate structures, especially when routines and systems promote maintenance of the status quo (Jamali, 2006).

In this research, we focus on the individual and it is therefore also important to remember aspects related to the fact that the individual sits in the context of an organisation. Lam (2000) provides a model of types of cognitive knowledge that spans the individual and collective dimensions – as shown in Figure 4. Lam’s model also tells us that we need to consider both explicit and tacit knowledge.

*Embrained knowledge* is primarily learnt through formal education and training of individuals (Lam, 2000). This is probably one of the most obvious types of knowledge
and learning for us to think about since it is knowledge that is highly valued by our part of the world.

On the other hand, tacit knowledge is intuitive, personal, experience-based, unarticulated, and action-orientated. It is achieved through practice and transmitted through trusting social networks (Lam, 2000). Learning of tacit knowledge occurs through direct interaction and mutual adjustment. It is organic with little standardisation - individualistic but collaborative learning. Embodied knowledge is constructed through practical experience in a relevant context, through interactive problem-solving (Lam, 2000). For our research project, the individual team members therefore need a sustainable design problem-solving context in order to learn the embodied knowledge dimension of sustainable design. This context could be a project with a client, or a dummy project. To accelerate transfer of tacit knowledge, perhaps it would be good to have academic researchers heavily involved in the problem-solving. This goal-oriented/milestone/project work learning mechanism (or problem-based learning) has been identified as a successful learning mechanism for sustainability focused organisational learning (Siebenhüner and Arnold, 2007).

It is not only necessary to consider both tacit and explicit knowledge, but even the interaction between them. In fact, the learning and innovation capability of an organisation is critically dependent on how well it can nurture the interaction of tacit and explicit knowledge (Lam, 2000).

In summary, when organisations want to increase capability in order to support individual behaviour change towards implementing sustainable design, they should seek to:

a. increase embrained (individual explicit) knowledge through formal education and training of individuals;
b. increase embodied (individual tacit) knowledge through practical experience and interactive problem-solving in a relevant context; and
c. nurture the interaction of tacit and explicit knowledge through iterations between (a) and (b).
Although not completely agreed upon in the field, the trend is moving from arguing for discontinuous change to continuous change (By, 2005). This leads to an emergent approach to organisational learning that focuses on readiness to learn and change (By, 2005; Jamali, 2006). This gives rise to the question: *How might organisations support individuals to develop their readiness to learn about sustainable design?*

### 4.3 Opportunity to implement sustainable design

*How might organisations provide individuals with the opportunity (possibilities and prompts) to implement sustainable design, including by providing opportunity to increase motivation?*

Opportunity is what lies outside of the individual that makes the behaviour possible or prompts it (Michie et al., 2011). For example, giving employees the (perceived) power or authority to implement sustainable design is important for successful implementation (Verhulst and Boks, 2014).

This component can be very variable according to the nature of the organisation. When prompting individuals, organisations need to avoid triggering psychological barriers (as described in section 3.3) and therefore need strategies for sound communication – see next subsection.

### 4.4 Strategies for sound communication

*How to avoid triggering psychological barriers while supporting the individuals?*

While supporting individual behaviour change towards implementing sustainable design, we also need to avoid triggering psychological barriers in the individuals, as described in Section 3.3. Stoknes (2014) lists the following requirements for successful climate communication:

1. Feels personal, near and urgent.
2. Uses cognitive framings that do not backfire on the climate issue through negative effects.
3. Reduces dissonance by providing opportunities for visible and consistent action.
4. Avoids triggering the emotional need for denial.
5. Reduces cultural and political polarization on the issue.

Stoknes (2014) identified the following 5 strategies for communicating climate messages such as to encourage action without triggering barriers (Table 3).

1. **“Social: Use the power of social networks.”**
2. **Supportive: Find deep framings that are positive and support action.**
3. **Simple: Make it easy and convenient to act in a climate-friendly manner.**
4. **Story: Use the power of storytelling.**
5. **Signals: Use indicators and metrics that monitor progress on green growth and jobs.”**

### 4.5 Summarising a model

The following propositions summarise the model that has been formulated in the previous subsections.
Propositions:

Organisations can support individual behaviour change towards implementing sustainable design by...

(O) ...providing individuals with the opportunity to implement sustainable design.

(M) ...helping individuals to increase their motivation to implement sustainable design by supporting individuals to:

   (Mi) feel competent and confident in implementing sustainable design;
   (Mii) experience self-determination in relation to implementing sustainable design, through:
      (Miia) helping the individuals to feel free to experiment and initiate their own sustainable design behaviours and not feel pressured and coerced to behave as directed; or
      (Miib) providing the opportunity for individuals to understand alignment between their work/behaviours with that which is important to them in life; or
   (Miic) providing the opportunity for individuals to personally identify the importance of their work/behaviours; and
   (Miii) feel respect and belonging with both supervisors and peers in relation to sustainable design.

(C) ...helping individuals to increase their capability to implement sustainable design by providing opportunities to for individuals to:

   (Ciiia) increase embrained (individual explicit) knowledge through formal education and training of individuals;
   (Ciiib) increase embodied (individual tacit) knowledge through practical experience and interactive problem-solving in a relevant context; and
   (Ciiic) nurture the interaction of tacit and explicit knowledge through iterations between Ciiia and Ciiib.

This learning should then ideally occur:

   (Cia) in participatory settings;
   (Cib) with a trustful atmosphere;
   (Cic) through intensive, open dialogue between participants as well as reflecting on your own position;

   (Ciia) through surprises;
   (Ciib) through being exposed to outside views; and
   (Ciic) in safe spaces.

(S) Using generalisations of the following climate communication strategies will help engage the individuals in action rather than triggering psychological barriers:
(Si) Social: Use the power of social networks.
(Sii) Supportive: Find deep framings that are positive and support action.
(Siii) Simple: Make it easy and convenient to act in a climate-friendly manner.
(Siv) Story: Use the power of storytelling.
(Sv) Signals: Use indicators and metrics that monitor progress on green growth and jobs.

The above points are not specific to the nature of our partner company in this study and could therefore potentially be applicable to any product development organisation that is starting out on their journey to implement sustainable design.

5 Designing, acting, observing and reflecting

In the following subsections, we describe how we applied the above propositions to design actions and then how we tested the actions. The two main activities described are an ideation workshop and evening classes. (The letters in brackets relate to the above propositions.)

5.1 Design – ideation workshop

Our overarching design question for the workshop was: How might we support individuals to engage in sustainable design behaviours? We used various creative ideation techniques, for example, round robin and sticky brainstorming, to generate ideas in response to various ideation questions. The ideation questions, along with background framing, were created from the theory in section 4.1. The questions were as follows:

- How might we help individuals to develop the capability - skills and knowledge - to engage in sustainable design behaviours? (C)
- How might we provide individuals with the opportunity - possibilities and prompts - to engage in sustainable design behaviours? (O)
- How might we support individuals to feel competent and confident in engaging in sustainable design? (Mi)
- How might we support individuals to experience autonomy in relation to sustainable design? (in other words, to feel free to experiment and initiate their own sustainable design behaviours and not feel pressured and coerced to behave as directed) (Miia)
  - ....by providing the opportunity for individuals to personally identify the importance of their work/behaviours? (Miic)
  - ...by providing the opportunity for individuals to understand alignment between their work/behaviours with that which is important to them in life? (Miib)
- How might we support individuals to feel respect and belonging with both supervisors and peers in relation to sustainable design? (Miii)
- How might organisations use the power of social networks to engage individuals in sustainable design? (Si)

108 ideas were captured in the workshop. Here are some examples:

- “Design for sustainable behaviour’ competition between offices. For example, to design fun waste sorting.” (Mii ✓ Miii ✓ Cia ✓ Ciic ✓ Ciib ✓ Si ✓ Siii ✓)
• “The management talk about why sustainability is important to them on a personal level” (Miib Miii Sii)
• “[The company] must create 'champions' that other employees can learn from and be inspired by” (Cia Si)
• “Instagram drive: #sustainability inspiration that I’ve seen” (C Si)
• “Gallery: why sustainability is important for me” (Miib Sii)
• “Path choice - individual chooses themselves how to increase their competence” (C Miia)

To date, the following ideas have been implemented:

• A sustainable design channel on the company’s intranet has been created. In the channel, individuals can share and discuss that which interests them, with occasional input from the researchers. (Miii Cia Ciib Ciic Ciiia Ciiib Ciiic Si)
• Two further evening classes were held. (See next subsection.)

Overall, focusing on behaviour change was well accepted by the research participants. They were keen and expressed how important they think it is. This was a little unexpected – we were expecting to have to justify it more. This gives an indication of potential workability.

5.2 Act, observe & reflect – evening class
Sustainability-oriented learning should use existing learning mechanisms within the company-specific context (Siebenhüner and Arnold, 2007) and an evening class was therefore relevant since the partner company regularly offers evening classes in a variety of topics. In addition, training has been considered important for implementing sustainable design by both beginner and experienced firms (Verhulst and Boks, 2014).

In the evening classes, we introduced sustainability science, explained the benefits for companies of applying sustainable design and described briefly how they can employ sustainable design when implementing their company’s product innovation process. Before all of that, however, we opened with an example. We chose an example that we hoped would be considered positive and that we could tell as a story from the perspective of product developers (designed Sii). In fact, throughout the class we used many examples from organisations that have successfully implemented sustainable design (designed Sii). In fact, many questionnaire respondents cited the examples as being what they anticipated remembering from the evening. In response to a question about what was the most valuable thing that they learnt, one respondent mentioned that it is possible to find win-wins (business-sustainability benefits) but that you usually hear pessimism in this area.

We introduced sustainability science without going into so much of the complexity and explained how the presented definition of sustainability helps to handle the complexity, with the aim of giving them confidence (designed Mi).

When explained the ‘why’, we touched on both why sustainable design can be beneficial from a business perspective and why society needs companies to work with it. This would hopefully help them to understand possible alignment between their
practices and that which is important for them - sustainability for society and benefits for the company (designed Miib✓). When asked about what they would remember, one participant even said “The importance of my role for sustainable development”. All respondents answered ‘yes’ to the question ‘After this evening’s class, do you now understand more about the potential benefits for [this company] of working with sustainable design?’ (observed Miib✓)

When describing how to work with sustainable design, we tried to make it quite simple by starting from their process and relating to what they already do (designed Siii✓). Our aim was to increase their competence and their confidence in being able to get started (designed Mi✓). There was some evidence that we succeeded – 5 of 31 questionnaire free-text answers mentioned ease or possibility and none mentioned the opposite. For example, one respondent said “It is possible to change” in response to a question about what was the most valuable thing that they learnt (observed Miib✓).

To help participants to understand the ‘how’, we started with a group discussion exercise (designed Cia✓) with a pretend client case (designed Ciib✓) and simplified versions of sustainable design decision support (designed Siii✓). The groups seemed to already have a trustful atmosphere (designed Ci✓), with the possible exception of one group. We strove to further encourage this atmosphere and to create a safe space for learning (designed Ciic✓). We emphasised that this was just an exercise by highlighting that it is not a test and the focus is not on the output, but rather on experiencing the process. We also asked them to ask questions throughout the evening and to give us feedback on the ‘how’ (designed Cia✓).

On the post-class questionnaire, almost half of the participants answered ‘yes’ to the question about whether they had been surprised during the class. In addition, slightly more than a third named something from the class that had surprised them, for example, the variation in the sustainable design strategies that they were taught. (observed Ciia✓)

The evening class, by its very nature, aimed to help individuals to increase their capability to engage in sustainable design practices (observed C✓). All respondents answered ‘yes’ to the question: ‘After this evening’s class, do you now understand more about sustainable design and how you can work with it?’ Furthermore, many cited the key messages from the class when asked what was the most valuable thing that they had learnt.

5.3 Observe & reflect – 2018 survey

When asked how their confidence in their ability to perform sustainable design has changed over the past 18 months, 44% (N=27) of the 2018 survey respondents answered that they have more confidence than 18 months ago and the remainder said that it has not changed (Mi✓). Of those who work with, or have worked with, the company’s innovation design process (N=9), 5 were confident to some degree that they could take the first steps of working with sustainable design in an innovation project (and 2 said that they already do) (Mi✓).
55% of respondents (N=27) said that they understand the benefits of working with sustainable design when working with the company’s innovation process (Miib✓). The primary mechanisms for increasing competence reported by respondents were attending the evening classes and reading articles or similar.

6 Discussion

6.1 General learnings
We formulated a model that describes how organisations might support individual behaviour change towards implementing sustainable design. This is represented by the propositions listed in section 4.5. We also used the model to design actions for how our specific partner organisation can support individual behaviour change towards implementing sustainable design.

6.2 Specific findings: Shrink and scaffold the tasks
It may be obvious, and is at least often discussed, that it is important to increase product designers’ competence in sustainable design when seeking successful implementation. However, it was not obvious to us before this research how important it is to shrink and scaffold the tasks such that the individual feels competent and confident. To scaffold somebody’s learning means to break it up into readily achievable chunks and provide temporary support to help the learner progress (Dictionary, 2003; Glossary, 2015). As introduced in section 4.1.1, feeling that ‘I can do this’ and ‘I can be better at this’ (self-efficacy) is key to being intrinsically motivated. If the action feels too large, then individuals will not take it and dissonance will prevail (Stoknes, 2015). Stretch goals (BHAGs) work when the team has strong self-efficacy; self-efficacy first needs to be built by shrinking the change (Bandura and Schunk, 1981).

Breaking (unsustainable) habits is a demanding task for the individual. The energy to do so is a finite resource and the steps towards sustainable action therefore need to be small enough to feel achievable (Lorenzoni et al., 2007). If it is easier to act in line with our attitudes, then we can avoid triggering dissonance and denial (Stoknes, 2015). In fact, since what we do (our behaviour) also strongly influences our attitudes (Treuer et al., 2017, cited in Stoknes, 2015), an easy first/next step, through nudging, for example, will help increase positive attitudes and motivation (the arrows from right to left in the COM-B model). The increased motivation will then likely lead to increased engagement in sustainable design behaviours, creating a virtuous cycle. The power that our current behaviour has over our attitudes highlights how it is a weak strategy to depend on facts and traditional capacity-developing education when wanting to change behaviour and a more favourable strategy would be to start by shrinking the tasks and scaffolding the learning journey alongside small and increasingly sophisticated actions that the individuals can undertake.

By having a small next step that feels achievable, we can break out of the ‘doom’ framing that sustainable development is ‘all cost and sacrifice’ (Stoknes, 2015). Achieving a small task that is in line with desired behaviour raises hope that change is possible. Furthermore, an achievable and meaningful first/next step can prevent the
distance barrier by making sustainability near and relevant to our personal behaviour (Stoknes, 2015). Small wins also reduce the individual’s perception of scale, demand and required skill level (Weick, 1984). This is particularly important for sustainable design due to the (perceived) complexity of sustainable development.

Verhulst and Boks (2014) found that the support element of scaffolding is important when implementing sustainable design, for example, shifting from external experts in the beginning to internal ambassadors later. When we are scaffolding the steps, we should be careful not to lead individuals to reduce cognitive dissonance to do something else (Stoknes, 2015). The small steps need to be a catalyst for impactful activities – stepping stones that build confidence and hope.

This notion of shrinking and scaffolding tasks is, of course, not only relevant when creating independent behaviour change interventions, but even (maybe especially) when communicating suggested actions on the ‘technical side’ of sustainable design. For example, it would be easy to just keep adding to a guide on how to integrate sustainable development and the company’s product design process as one learns more and more about how to do it. However, it is better if we plan to release information and enhance the processes in a step-wise fashion with steps that reflect the user’s skill and motivation levels.

6.3 Utility of the model
In this subsection, we share reflections on the utility of the model for designing actions, illustrated by the reflection loop shown in Figure 6. Using the model worked well, particularly in the ideation workshop where it was nearly the final version. Ideas have been generated against the components M, C and S (although we left the last mainly to further work). Academics and practitioners alike agreed that the model expanded our horizons beyond that which we otherwise would have considered when designing actions.

It was relatively more difficult to generate ideas around the ‘opportunity’ component. Possible explanations include poor understanding or explanation by the facilitation team and poor utility of that part of the model (in the version at that time). However, the participants noted that many of the ideas that they generated around capability, motivation and strategies for sustainability communication were relevant also here. That is, they experienced that many of their previous ideas were also ‘opportunity’ ideas. (That was also key in helping us understand that ‘opportunity’ is largely the framing for how the organisation can help the individuals, that is, the framing for all the other components.)

The thinking around shrinking and scaffolding the tasks was readily accepted by participants of the ideation workshop. They related to their own feelings of not being
competent enough to get started. They left the workshop determined to put some small and meaningful first stepping stones in place.

6.4 Workability
In this subsection, we share reflections on the workability. Workability is an evaluation criterium for action research where academics and research participants collectively judge how well the implementation works to solve the problem in the local context or whether revision of the model or redesign of the actions is needed (Greenwood and Levin, 2007).

We have so far only made a start to judge workability. Responses to the post-evening-class questionnaire indicate that the actions may have increased feelings of competence and confidence to do sustainable design, understanding of alignment of own tasks with the overall goal and increased competence, including some expression of being surprised by elements that they learnt. These indicate potential progress in combating barriers related to capability and motivation to change behaviour towards implementing sustainable design. We have not yet managed to evaluate if behaviour has changed.

6.5 Comparison with other studies
Verhulst and Boks (2014) explored the human side of sustainable design through the construct of empowerment in a case study with 8 Belgian and Dutch firms (some beginners, some experienced). Their suggested three dimensions of successful empowerment for sustainable design are authority, resources and specialisation, and self-determination. By authority, they mean power and division of responsibility, which falls under the opportunity element of our model. Their ‘resources and specialisation’ dimension is equivalent to our capability element and their self-determination dimension corresponds directly to self-determination in our work. Our findings are therefore compatible with their findings, but also cover additional considerations.

6.6 Conclusions
We argue that it is important for academics to not just define what project teams should ideally do when implementing sustainable design, but to also scaffold the journey as a series of simpler steps with decreasing temporary support.

Organisations can support individual behaviour change towards implementing sustainable design by providing individuals with the opportunity to implement sustainable design, helping individuals to increase their motivation to implement sustainable design and helping individuals to increase their capability to implement sustainable design. While doing this, using generalisations of climate communication strategies will to help engage the individuals in action rather than triggering psychological barriers. (See section 4.5 for details.)

Our recommendation for practitioner organisations is to use our model to identify potential actions for supporting individual behaviour change towards implementing sustainable design. Our recommendation for researchers and others who are
developing support for sustainable design is to design steps that are (1) meaningful AND (2) within reach for individual project team members as they start to integrate sustainability into their product design work. Our model (section 4.5) aids the support designer.

Future research should involve further investigation of workability and utility. Similar to Kuijer and Bakker (2015), this work assumes some predictability of individual behaviour change, and thus some uniformity of response. This is in line with much of the science on behaviour, but some authors argue that behaviour is completely unpredictable. It is therefore important to include testing to see if individual project team members generally respond in the same way to actions taken by the organisation.

ACKNOWLEDGEMENTS

We are particularly grateful for the rich relationship that we have with our partner organisation. Without their enthusiasm, persistence and financial support, this project would not have been possible. We gratefully acknowledge financial support for the Model Driven Development and Decision-Support project from The Knowledge Foundation (Stiftelsen för kunskaps- och kompetensutveckling), Blekinge Institute of Technology, and the other project partners.

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