# Mindful Design as a Driver for Social Behaviour Change

Dr Kristina Niedderer*

*University of Wolverhampton, UK, k.niedderer@wlv.ac.uk*

Abstract: Design for behaviour change is an approach, which seeks to change behaviour to encourage desirable human practices. The term emerged in the mid-2000's, but work leading to its development started well before then under the preface of emotion design and persuasive design. The currently most prominent application of design for behaviour change is in design for sustainability. Other approaches include crime prevention or health. Although there is an emerging recognition of the social potential of design, design for social behaviour change has remained ignored and under-researched. This paper reviews the recent interest in social behaviour change and social innovation in relation to current design approaches. It situates and develops the approach of mindful design against this background and argues that mindfulness is a key mechanism of designing for behaviour change, especially in social contexts. It proposes that the benefit of mindful design is its ability to shift the focus from an external locus of control to internal locus control. The latter enables conscious decision making and commitment in the individual as an essential basis for attitude change and for lasting behaviour change.


*Keywords: Design, Mindful Design, Behaviour Change, Attitude change, Mindfulness*

## 1. Introduction

It is widely recognised that design in its various forms, including objects, services, interiors, architecture and environments can play an important role in influencing human behaviour [4, 7, 26, 27, 28]. For example, mobile phones have changed our social interaction and expectations of connectedness [25, 41]. The recognition that design can not only influence the interaction we have with its products [35, 36], but also 'how human beings relate to other human beings through the mediating influence of products' [5] has led to the rise of design for behaviour change as an approach for engendering desirable human practices.

While the influence of design on human behaviour has been recognised for some time, formally, 'design for behaviour change' has only been recognised for the last decade and the term itself appears even more recent. Work leading to its development, however, has been conducted for at least two decades under the mantel of affective or emotion design [e.g. 8] - focusing on the affect of design on user experience - and persuasive design, focusing on changing attitudes in a software design context [10]. Until now, design for behaviour change has mainly been applied to problems of sustainability. Although there is an emerging recognition of its social significance in the context of design for sustainability [2, 26, 28], the social potential of design for behaviour change has remained largely ignored and under-researched [6]. The recent push for 'social innovation' [42, 46] has however invigorated the interest in social applications of design for behaviour change.

This paper reviews the recent interest in social innovation and behaviour change in relation to current design approaches, including different areas of application, of perspective and of related conceptual approaches. It develops and situates the approach of mindful design against this background and argues that mindfulness is a key mechanism of design for behaviour change, especially in social contexts.

## 2. Design for behaviour change and its applications

This section reviews the nature of design for behaviour change through its application in different areas. By now, there are a number of distinct areas in design, which have adopted the idea of behaviour change, and which are shaping current understandings of what design for behaviour change is. The currently most prominent application of design for behaviour change is in design for sustainability [2, 9, 11]. In this area, design for behaviour change has a number of goals and approaches, which are driven by the idea of conserving the world's resources. These include on the one hand changing attitudes of design companies to improve product specifications and production patterns for the purpose of reducing e.g. energy consumption, waste, or CO2 consumption, such as lower CO2 emission or the recyclability of all product parts in the car industry. On the other hand, they build on and seek to promote a change in user behaviour, such as the switch from using a car to using a bicycle or public transport.

These goals are promoted through different ways of reinforcement, which either work as incentives or deterrents, and which are either driven by prescription or voluntary engagement. For example, legislation is prescriptive. It can work as a deterrent using tax or fees, e.g. higher fuel tax to deter people from driving, higher tariffs for cars with higher CO2 emissions to reduce CO2 emissions, or a small fee for shopping bags to encourage people to re-use their bags. In the same way, legislation can work as incentives promoting certain actions, such as recent schemes for the promotion of sustainable building or for retrofitting your home with insulation and alternative energy sources. At the other end of the spectrum, there are voluntary initiatives and social pressures, which are dependent on people's commitments to achieve desired goals, such as recycling, initiatives for city gardening, or promotion of the use of cycling to reduce the use of cars and with it to reduce congestion and CO2 emissions, and increase people's health. Successful initiatives often go hand in hand with legislation, such as smoking laws in the UK, which were introduced due to certain pressure groups, and which have created in turn social pressure on individuals to reduce or cease smoking.

Other applications of design for behaviour change include crime prevention [39]. Initiatives, such as the 'Design against Crime' project have developed bike stands, the design of which encourages safe locking of bikes and in turn deters thieves from steeling them. Here, the design acts as a physical guide/deterrent by encouraging safe locking and by making it more difficult to steal a bike. Another, very different example is that of the painted stripe or patch in front of cash machines (or other counters) to deter thieves or intruders [12]. Here the design does not physically deter anybody standing too close to the individual using the cash machine. Instead, it makes visible social expectations of personal (safe) space and related behaviours of keeping distance. Thus any trespasser is visibly breaking social norms, enabling social action to re-establish that norm.

A third arena, where design for behaviour change has found recognition in form of wearable technology based design, is the health sector. Various kinds of devices from body wearable items (badges, bracelets, etc.) to mobile phones have been designed to assess health and physical activity, and to engender awareness in the individual of their own health and health-related behaviours. For this purpose, continuous glucose monitors, activity monitors, fitness

and heart-rate monitors, electro-dermal activity monitors [1, 16, 34] are variously used to measure respiration, heart rate, body posture and activity, skin temperature and emotional arousal. One notable approach in this area combines health with social application: Iida and Suzuki [15] have developed a bracelet based on electro magnetic sensors to measure and encourage physical touch for therapeutic purposes through a reward response (lighting up) of the bracelet.

This leads to a fourth area of application, which is safety design, and which is quite pervasive although less well-recognised with regard to behaviour change. Safety design is applied in anything from computers, to medical care, to atomic power stations in order to direct human behaviour for the purpose of preventing human error. Warning notices on computers (e.g. when saving a document) are a good example, which briefly disrupt the user's consciousness and require an additional action to complete the command (e.g. 'save/don't save/cancel'). Another example is the medical connectors developed by Walters, Chamberlain and Press [45] that provide visual and tactile cues to avoid error and to enhance safer use in hospitals.

These examples and applications indicate that design for behaviour change is an umbrella term for a number of different issues, perspectives and approaches. This includes differences in the focus, i.e. whether the goal of the design is the environment, an object, or social interaction; in the perspective, i.e. whether it is ethically permissible to design objects in such a way that they force people to behave in certain ways [26]; or in the approach, i.e. what kind of dynamic and underlying mechanism should be used to achieve the desired goals, for example, whether design for behaviour change should adopt a passive model that decides for the user, or an active approach that requires the reflection and commitment by the user. It is these three aspects which will be discussed in the following.

## 3.   Different approaches to design for behaviour change

This section considers in more detail the three key issues that shape the understanding of design for behaviour change: the focus, the perspective, and in due course the different approaches taken to make a difference.

There are some significant differences, but also commonalities, in terms of the three different foci: the interaction and impact on our environment, human-object interaction, and social interaction. While any design may need to take account of all three aspects, usually one aspect is the main focus of the design, which is not uncommonly to the detriment of one or both of the other two foci. For example, mobile phones are designed to connect two people in different places synchronously. They are therefore designed first and foremost to establish and maintain this connection as easily, seamlessly and qualitatively well as possible, thus considering the human-object interaction as well as the primary human-human interaction created by the object. What is not usually considered, however, is both the ecological and social environment: firstly, the rapid succession of new phone development is highly unsustainable, and secondly their use – in particular in public places – is often disruptive of the social environment, such that secondary social relationships including those with other passengers on public transport are at best ignored and at worst badly upset [41]. While sustainable design has put the environmental context on the design agenda (even though with variable success), the social context and the nature of social interaction are rarely considered.

The above example highlights that individual and social needs are often competing and that both need to be managed and negotiated. This can only be achieved through increasing awareness of the consequences of our (social) actions and subsequent responsible behaviour change, both on the part of the designer and the user. How they are

managed, and what perspective is to be taken to do so, is an important ethical decision [26]. Although Margolin has suggested a social model of design practice for product design within a process of social service intervention already in 2002 [29], this issue has been slow to progress. Although different perspectives have emerged that are concerned with the ethical implications of influencing people knowingly or unknowingly through design to change their behaviour, there has as yet been little discussion. Ten years on, still, Chick [6] calls for serious research in the area of social innovation in design. By now social innovation is a recognised issue in the European Union [42, 43] which defines social innovations as

> new solutions (products, services, models, markets, processes etc.) that simultaneously meet a social need (more effectively than existing solutions) and lead to new or improved capabilities and relationships and better use of assets and resources. In other words, social innovations are both good for society and enhance society's capacity to act. [43]

They explicitly promote

> … the social and public good […] inspired by the desire to meet social needs which can be neglected by traditional forms of private market provision and which have often been poorly served or unresolved by services organised by the state. Social innovation can take place inside or outside of public services. [30].

Building on references to societal transformation and the development of new products, services and programmes, Chick [9] charts emerging principles of 'design for social innovation' to define design's role in achieving social innovation. Chick's approach is a broad appeal, which seeks to address social problems through design process innovation such as co-design. Other approaches, such as those by Lockten [26, 27, 28] and by Tromp, Hekkert and Verbeek [44] have begun to consider the broad range of human behaviours and experiences to understand better both the design and the use of products and product innovations.

Tromp, Hekkert and Verbeek [44] have developed a framework for socially responsible design from the point of the intended user experience, which is presented in form of a map. In this map, they distinguish four categories of product influences: decisive, coercive, persuasive and seductive, which are used to encourage desirable and discourage undesirable behaviour. Decisive designs are based on constraining behaviour of the design, which does not allow certain undesired behaviours. It tends to be unconscious without offer of an alternative, for example, a tall building without a lift requires the user to exercise by walking up the stairs (ibid., p.12). In contrast, coercive design is identified as "strong and explicit" in its influence, such as speed cameras, which offer drivers the choice of slowing down or keeping to the required speed and incurring a fine. Tromp et al. further distinguish the two categories of persuasive and seductive design, which are characterised respectively as having an explicit and implicit weak influence, as they offer guidance rather than reinforcement, such as a healthy eating campaign (persuasive) or the effect of microwave ovens on social eating habits: because food can be prepared any time (seductive), fewer family meals are taken together [44, p.12].

Through their classification, Tromp et al. distinguish four different approaches to designing for responsible social behaviour. However, there are a number of further issues with can and should be considered in this context. Firstly, there is the acknowledged limitation of the intended user experience, which is indeed difficult to predict since users have a choice about how to behave, which is often wilful and ideosynchratic, subverting any design intentions. Secondly, this intention can only be single-minded and therefore ignore alternative scenarios, which also raises ethical issues. For example, the unquestioning and implicit nature of decisive or seductive design may not always be desirable. For example, the problem with decisive design is that while certain solutions might be desirable, they will

make an alternative impossible. As in the case of the building with only a staircase and no lift, this may be desirable for people's health generally, but it would disadvantage anyone who is not able to walk up or down stairs, or who has to carry any loads, etc. Also, being implicit, design in this case does not engender reflection in the user concerning their behaviour, and therefore where the option of a lift is provided the same user may revert instantaneously and without reflection to old habits of using a lift rather than using the fitness option of the stairs. In contrast, coercive design (and its weaker version, persuasive design) is more likely to change behaviour durably, because they induce reflection based on the choice of action, although education alone tends to be ineffective [14]. Importantly, Tromp et al. propose that coercive and seductive influences together are most suited to changing user behaviour, especially where individual and social intentions are in conflict [44, p.17].

A second approach to design for behaviour change is offered by Lockton [27] with the 'design for intent' toolkit. Although focusing mainly on environmental impact, Lockton also includes a generally pro-social approach. In contrast to Tromp et al's experience based model, Lockton's model takes a functional approach, which considers motivating (internal constraint) as well as enabling and constraining behaviour (external constraint through design), which he defines respectively as:

**Motivating behaviour**

*Motivating users to change behaviour by education, incentives and changing attitudes*

**Enabling behaviour**

*Enabling 'desirable' behaviour by making it easier for the user than the alternatives*

**Constraining behaviour**

*Constraining users to 'desirable' behaviour by making alternatives difficult or impossible*

These definitions helpfully allow dealing with the multi-layered influence of objects. In contrast to Tromp et al., Lockton's approach offers a design strategy for the implementation of the proposed approach. It can accommodate different combinations of Tromp et al's categories under each of Lockton's three categories, although the first appears more likely to adhere to the explicit categories (persuasion and coercion) as well as seduction and the second and third more to the implicit category of decisive design.

Importantly, both approaches acknowledge the significance of user motivation and responsibility for behaviour change, although their role in engendering conscious and voluntary attitude change is not discussed due to the generic focus on behaviour change. The significance of attitude change is twofold: Firstly, attitude change is conscious and requires the voluntary commitment of the individual, in contrast to behaviour change which is often implicit and driven by external factors, such as those described for decisive design. Attitude change thus allows overcoming the ethical issues, which Lockton [26] considers concerning designing for behaviour change. Secondly, conscious and voluntary attitude change is the basis for lasting behaviour change [37]. This is important because, while any artefact may be intentionally designed to influence, direct and change behaviour, both Lockton and Tromp acknowledge that user behaviour can be unpredictable, and users may appropriate objects to their own ends. Design cannot change this through force, but only through conscious reflection and voluntary commitment.

In short, it requires mindfulness on the part of the user of their actions and their consequences, and design is the agent through which this mindfulness is achieved. Mindfulness, as a term from psychology, is taken to be an attitude of openness that leads to increased awareness, reflection and responsibiliy [22]. In recognition of this, in

the following the term 'mindful design' is used. While this term is used elsewhere with regard to the designers awareness within the design process, it is here defined to pertain to the awareness and responsible choice of the user. This use is closest in its aim to Lockton's category of 'motivating behaviour, but goes beyond it by offering a tangible framework as to *how* it may change attitudes. There may also be some overlap with persuasive design, although mindful design is assumed to operate without the educational context which persuasive design requires. In this regard, Tromp et al [44] explain that "Persuasive design is both weak and explicit in its influence (e.g., a campaign to promote healthy eating)" (p.12), which indicates that the persuasive aim is achieved through educational context rather than through design. Mindful design in contrast is assumed to be able to operate without such a supportive context, and instead to work on the intersection of coercive and persuasive design, being strong and explicit, but giving the user the choice of how to act, thus requiring the user to take responsibility. A good example of this is the traffic junction in the Netherlands, where the increasing number of signs did not reduce the rate of accidents, but taking away all signs did improve the situation (ibid, p. 10-11). In contrast to Tromp's interpretation, the argument here is that the improvement is achieved because people have to actively think about their environment and how to navigate it, putting the responsibility on them rather than on the traffic management system. The explicit nature of this design intervention then is not based on the forceful nature of any addition, but on the disruptive nature of the omission, which causes conscious awareness and reflection.

This aspect of mindful awareness has originally been discussed by Niedderer in the context of 'performative objects' [32], which have been classed by Tromp et al as 'coercive design', i.e. as strong and explicit, together with the example of the speed camera. Niedderer's design 'social cups' comprises a set of cups without foot, which requires social interaction between the users to operate the cups safely. It offers the three choices of either connecting at least three cups to make them stand, for the user to keep the cup in their hand, or of lying the empty cup down on the table. The significant difference between the cups and the speed camera is that the speed camera allows only for two options, i.e. to obey the speed limit (law) or not, and that a fine (punishment) is levied for the undesirable action. In contrast, Niedderer's social cups do not have a right or wrong action, nor a fine – in that sense it is non-judgmental and non-coercive. Instead, awareness is raised and judgment may be brought to bear by the participants because each of the three actions has social connotations which may be judged desirable or undesirable, e.g. keeping the drink in your hand may indicate you are prone to drinking too much; putting the cup down without connecting it may stigmatise you as being unsocial; while obliging to the suggested rule of the game and connecting your cup with those of others appears to suggest that you abide by social norms and are able to 'fit in'. The example suggests that mindful design utilises awareness of social norms, emotions and moral values to question them and to enable changes in thinking and perception to facilitate attitude change as a basis for behaviour change. The following section discusses the model of mindful design in more detail.

## 4. Mindful design: using attitude change as a basis for lasting behaviour change

In this section, the model of mindful design is discussed in more detail as a means to facilitate attitude change. It is understood to create and utilises awareness of social norms, emotions and moral values to enable in the user changes in thinking and perception as a basis for lasting behaviour change. The model of mindful design is developed from the model of performative objects, which was proposed by Author in 2007 [32]. While the category of performative object focused exclusively on mindful awareness in social contexts, mindful design accommodates

more broadly the three contexts of environment, human object interaction and social interaction discussed above. As such the category of performative object is reframed as one of three sub-categories of mindful design, and all three categories are understood as socially-driven because of its relationship with social conventions and beliefs as a basis for emotional/moral judgment.

Mindfulness is a concept from psychology, which has been used for changing behaviours [22] as well as for emotion regulation [13]. Mindfulness refers to a mindset of openness and alertness, which regards any information as novel, pays attention to the specific context and considers the information from different perspectives, in order to enable the creation of new categories [23, p.111]. Mindfulness can aid behaviour change, because it encourages reconsidering our actions and their causes, helping to adjust them to new situations and challenges [24]. The idea of mindfulness in design has been developed by Niedderer [31, 32, 33] based on Langer [23, 24] to describe how design objects can be designed to facilitate mindful attention of the physical and social actions within which they are used and of the consequences of these actions. Mindful design works on the basis of a twofold process: firstly a mindful design object creates awareness through a physical or symbolic disruption of its function (or an aspect of it), and secondly, mediation of this disruption through the user directs their awareness to the issue to be mindful of [32, p. 8]. An example of mindful design in an environmental context are the sustainable bathroom tiles which discolour temporarily (disruption) when showering for too long to make the user mindful of the sustainable consequences of their actions [21]. An example, which introduces mindfulness into social interaction, is the 'Brainball' game [17]. It requires two players to move a ball towards the other player to win. The ball is activated by their brain activity using EEG. However, each player can only move the ball when *more relaxed* than their opponent thus questioning our common understanding of human (social) relationships that one has to be stronger/faster to win [32, p.16].

The mindful design approach to behaviour change has a number of benefits:

Firstly, while Tromp et al [44, p. 9] have to work from the assumption that design is for the unmotivated user, mindful design is able to accommodate the inability to predict the user response by lying responsibility on the user. This does not obliterate the need for decisive design in certain areas where it is necessary to exclude human error and where therefore choice needs to be designed out, such as in the example of the medical connectors (above). However, it means that mindful design may have some benefits over coercive and persuasive design. Returning to the example of the traffic junction, normally, street signs and traffic lights, - which follow the idea of coercive design as explained in the example of the speed camera - instil expectations of being guided through dangerous crossings, and thus of passing over the responsibility of the traffic participant to the law maker (traffic agency). In this context, the removal of street signs and traffic lights disrupts these expectations, and directs traffic participants' awareness towards the traffic, requiring them to take active responsibility both for themselves and for others.

Secondly, mindful design assumes conscious attitude change as the basis for lasting behaviour change [22, 3]). This distinguishes it from design for behaviour change which offers externally motivated stimuli as opposed to mindful design for attitude change which offers stimuli for internal motivation. Mindful design facilitates a process of conscious decision making by creating awareness of one's own behaviour and shifting the focus from an external to an internal locus of control through mindful reflection as explained in the example of the traffic junction above. This requires the individual actively to take responsibility for their decision, which is perceived as empowerment, as

opposed to an external locus of control which disempowers the individual [40].

Thirdly, design for behaviour change, especially socially responsible design, assumes that there is a discrepancy between individual and social aims which needs to be addressed through design [44, pp.17-18]. Common examples are the social pressure to reduce smoking versus the individual's desire to continue; or an individual's desire to own and use their own car to be independent etc., which contrasts with a global need to reduce $CO_2$ emissions as well as with energy and material consumption. While this is a widely acknowledged issue, there is a second, implicit assumption, which needs to be questioned, and which is that the social aims are always those that are desirable. With a few simple examples, however, it can be demonstrated that individual and social needs may not only be at odds, but that it can be the social aims that are at fault. For example, in terms of the environment, there are social pressures to own a car, because it is a significant status symbol, and – certainly in countries such as the UK or the US – someone not owning one but using the bike is regarded as oddball, outsider or 'not part of the same group'. Another example is the drinking culture in many Western countries: while there is social pressure to get drunk and 'have a good time', the individual that may resist such social pressure, also is relegated to an outsider. Only recently the option of soft drinks has become more acceptable, mostly on health grounds, but it is still a long way to this being the norm. These examples show that social norms and expectations are not always benign, and that they can shift over time. In contrast to coercive design, which "is very restricting, and […] therefore requires authority to be applied" (ibid. pp.17-18) to address whatever the social problem is. Mindful design by contrast questions assumed (social) authority by making it explicit, and exposing the balance of individual and social aims for critical reflection. For example, the 'Brainball' game questions our common perceptions of games as being a benevolent social diversion, by questioning our belief of having to be stronger/faster to win [32, p.16], thus exposing that games can entrench unwanted socially competitive or aggressive behaviour, which is increasingly becoming a point of debate for computer games.

This leads to a fourth issue, which underpins mindful design. This is the aspect of emotions, and associated social and cultural preconceptions, which influence our moral judgment. The social functional perspective of emotions [18, 19] differentiates between personal and social motivations according to personal (individual, intrapersonal), social (dyadic, group) and societal (cultural) levels [18, p.475] and their different functions, e.g. personal survival, moral guidance [19, p.513; 23]. In particular, Keltner, Horberg and Oveis [20] explain that both integral as well as incidental emotions can shape moral cognition. They explain that

> "many judgments, such as causal attribution, risk perception, or loss aversion once thought to be universal regularities of the mind, are in fact swayed profoundly by fleeting emotions and moods." (p.171)

The recognition that moral beliefs and judgments are often based on emotions rather than on reason has led to a critical stance towards moral judgment. Mindfulness theory has shown that such emotion-based beliefs, or preconceptions, tend to be rigid and not responsive to changing contextual situations. This can lead to inappropriate judgments and therefore such beliefs need to be questioned [22, p.175]. In response, mindful design seeks to induce reflection of the individual on their inner state/emotions, their inter/actions and how these reflect personal and social beliefs, to open them to scrutiny through the disruption of the physical or symbolic function of an object used in the context in question.

While emotions on the one hand can cause mindlessness and therefore provide the starting point for designing for

mindfulness, on the other hand, they can also be used to make certain actions and uses desirable, which suggests that it is useful for mindful design to incorporate Tromp et al's model of seductive design to support the acceptance of mindful design.

## 5. Conclusion

In summary, this paper has set out to define the model of mindful design in relation to existing frameworks of design for behaviour change, including design for intent [26, 27, 28], design for social innovation [6], and socially responsible design [44]. In doing so, this paper has shown that, while Tromp et al's approach [44, pp.11,14] has classified Niedderer's approach of performative objects [32] - and by extension the model of mindful design - under 'coercive influences', this research has explained and demonstrated that mindful design follows a fundamentally different principle, combining aspects of coercive, persuasive and seductive elements to facilitate reflection and self-empowerment.

Unlike the three frameworks of design for behaviour change discussed in this paper, which offer a classification of different approaches, mindful design thus offers a specific conceptual approach which is based on attitude change through conscious reflection and commitment. The benefit of mindful design is its ability to shift the focus from an external locus of control associated with design for behaviour change to internal locus control, which enables conscious decision making and commitment as an essential basis for attitude change and subsequently for lasting behaviour change.

The recognition of the model of mindful design opens several avenues for further inquiry: Firstly, the model of mindful design offers a framework for rethinking the role of design object and the responsibility of the designer in designing for society. Secondly, the theoretical development would benefit from empirical work to understand better the capabilities and boundaries of mindful design. Thirdly, consideration should be given to the ethical stance and implications that designers take in designing for potentially unknown users. Although mindful design as design for attitude change allows for conscious reflection and decision making on the part of the user, potential implications will need to be considered.

## 6. References

[1]     Affectiva. (2013). *Q Sensor 2.0.* Available online: <http://www.affectiva.com/q-sensor/> [Accessed 18 December 2012]

[2]     Bhamra, T. A, Lilley, D. and Tang, T. (2011). Design for Sustainable Behaviour: Using products to change consumer behaviour, *The Design Journal*, vol. 14, no. 4, pp. 427-445.

[3]     Bohner, G. and Wänke, M. (2002). *Attitudes and Attitude Change.* Hove, UK: Psychology Press.

[4]     Brown, T. and J. Wyatt. (2010). Design Thinking for Social Innovation. *Stanford Social Innovation Review*, Winter 2010. Available online: <http://innernorthfoundation.org.au/downloads/design_thinking.pdf > [Accessed 18 December 2012]

[5]     Buchanan, R. (2001). Design Research and the New Learning. *Design Issues,* vol. 17, no. 4, pp. 3-23, p.11.

[6]     Chick, A. (2012). Design for social innovation*, Iridescent: Icograda Journal of Design Research,* vol. 2, no. 1.

[7]     Consolvo, S., D.W. McDonald and J.A. Landay (2009). Theory-Driven Design Strategies for Technologies that Support Behaviour Change in Everyday Life. *CHI 2009: Creative Thought and Self-improvement*. Boston, MA: ACM Press.

[8] Desmet, P.M.A., Overbeeke, C.J., Tax, S.J.E.T. (2001). Designing products with added emotional value: development and application of an approach for research through design. *The Design Journal*, vol. 4, no. 1, pp. 32-47.

[9] Dusch, B. Crilly, N. and Moultrie, J. (2011). From Attitude to Action: The Development of the Cambridge Sustainable Design Tool Kit, Proceedings of CADMC. Cambridge, UK: University of Cambridge,

[10] Fogg, B. J. (2003). *Persuasive Technology; Using Computers to Change What We Think and Do*. Morgan Kaufmann.

[11] Fuad-Luke, A. 2009. *Design activism: Beautiful strangeness for a sustainable world*. London: Earthscan.

[12] Gamman, L. and Thorpe, A. (2012). From Crime Scripts to Empathy Suits - Why role-playing and visualisation of user and abuser "scripts" regarding ATM crime can offer useful design tools to build empathy and catalyse design innovation. *Proceedings of DRS 2012 Bangkok*. Bangkok, Thailand: Chulalongkorn University, pp. 564-581.

[13] Gross, J.J. (2002) Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, vol. 39, pp. 281–291.

[14] Mastache, C., Mistral, W., Velleman, R., and L. Templeton (2008). Partnership working in community alcohol prevention programmes. *Drugs: education, prevention and policy*, Vol. 15 (S1), pp. 4–14, p. 12.

[15] Iida, K. and Suzuki, K. (2010). Enhanced Touch: A Wearable Device for Social Playware. *Creative Showcase and Interactive Art, ACE'2011,* Lisbon, Portugal: ACM.

[16] Iliaifar, A. (2012) *U.S. Military developing high-tech "smart" underwear for soldiers*. Digital Trends, 26 January 2012, Available online: <http://www.digitaltrends.com/cool-tech/u-s-military-developing-high-tech-smart-underwear-for-soldiers/> [Accessed 18 December 2012]

[17] Ilstedt Hjelm, S. (2003) Research + Design: The Making of Brainball, *Interactions*, vol. 10, no. 1, pp. 26-34.

[18] Keltner, D. and Gross, J. J. (1999). Functional Accounts of Emotions. *Cognition and Emotion,* vol.13, no. 5, pp. 467-480.

[19] Keltner, D. and Haidt, J. (1999). Social Functions of Emotions at Four Levels of Analysis. *Cognition & Emotion*, vol. 13, no. 5, pp. 505-521.

[20] Keltner, D., E.J. Horberg and C. Oveis (2006) Emotions as Moral Institutions. In J.P.Forgas (ed.) *Affect in Social Thinking and Behaviour, Frontiers of Social Psychology,* 8, University of California: Psychology Press, 161 -175.

[21] Lagerkvist, S., Lancken, C.v.d., Lindgren, A. and Sävström, K. (2012) *Static! Increasing Energy Awareness: Disappearing-Pattern Tiles. Interactive Institute, Sweden.* Available online: <http://www.tii.se/static/disappearing.htm> [Accessed 18 December 2012]

[22] Langer, E. J. (1989). *Mindfulness*. New York: Addison Wesley Publishing Company.

[23] Langer, E.J. (1997). *The power of mindful learning*. Cambridge, MA: Perseus Publishing.

[24] Langer, E.J., & M. Moldoveanu. (2000). Mindfulness Research and the Future. *Journal of Social Issues*, vol. 56, no. 1, pp. 129-139.

[25] Lilley, D. (2007). *Designing for Behavioural Change: Reducing the Social Impacts of Product Use through Design.* (PhD thesis) Loughborough University, UK.

[26] Lockton, D. (2012). POSIWID and determinism in design for behaviour change, *Working Paper Series*, April 2012. Brunel University. Available online: <http://bura.brunel.ac.uk/handle/2438/6394> [Accessed 18 December 2012]

[27] Lockton, D. (2010). *Design for Intent.* Available online: <http://www.danlockton.com/dwi/Main_Page> [Accessed 18 December 2012]

[28] Lockton, D., D. Harrison and N.A. Stanton (2009). Choice architecture and design with intent. *Proceedings of NDM9*, London, UK: The British Computer Society. Available online: <http://bura.brunel.ac.uk/handle/2438/3558> [Accessed 18 December 2012]

[29] Margolin, V. and Margolin, S. (2002). A "Social Model" of Design: Issues of Practice and Research.

*Design Issues*, vol. 18, no. 4, pp. 24-30, p. 25.

[30] Murray, R., Caulier-Grice, J., Mulgan, G. 2010. *The open book of social innovation.* London: The Young Foundation & NESTA.

[31] Niedderer, K. (in press). Mediating Mindful Social Interactions through Design. In E. Langer and A. Ie (eds.) Handbook of Mindfulness. Wiley-Blackwell.

[32] Niedderer, K. (2007). Designing Mindful Interaction: The Category of the Performative Object.  Design Issues, 23(1), pp. 3-17. URL: http://www.mitpressjournals.org/doi/pdf/10.1162/desi.2007.23.1.3

[33] Niedderer, K. (2005). Exploring the Expressive Potential of Function, in L. Jönsson (ed.) Craft in Dialogue: Six Views on a Practice in Change. Gothenburg, Sweden: IASPIS, pp. 45-56.

[34] Nike. (2012). *Nike+Gear*. Available online: <http://nikeplus.nike.com/plus/products/> [Accessed 18 December 2012]

[35] Norman, D.A. (2002). *The Design of Everyday Things*. New York: Basic Books, pp. 1, 34.

[36] Pearce, S. M. (1995). *On Collecting: An Investigation into Collecting in the European Tradition*. London: Routledge, p. 166.

[37] Petty, R. E., and Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change.* New York: Springer-Verlag.

[38] PFO AB (2012) *PFO*. Available online: http://www.pfoinc.com/products/> [Accessed 18 December 2012]

[39] Press, M., Erol, R., Cooper, R. and Thomas, M. (2000). Design against crime: defining new design knowledge requirements. *Design Management Institute Conference*, Frankfurt, Nov 2000.

[40] Rotter, J.B. (1990). Internal Versus External Control of Reinforcement: Case History of a Variable. *American Psychologist.* Vol. 45, no. 4, pp. 489-493, p. 489.

[41] Srivastava, L. (2005). Mobile phones and the evolution of social behaviour. *Behaviour & Information Technology*, vol. 24, n. 2, pp.111-129.

[42] TEPSIE. (2012) *European Social Innovation Research*. Available online: <http://www.siresearch.eu> [Accessed 18 December 2012]

[43] The Young Foundation (2012) *Social Innovation Overview: A deliverable of the project: "The theoretical, empirical and policy foundations for building social innovation in Europe"* (TEPSIE), European Commission – 7th Framework Programme, Brussels: European Commission, DG Research, p.18.

[44] Tromp, N., Hekkert, P. and Verbeek, P.P. (2011). Design for socially responsible behaviour: A classification of influence based on intended user experience. *Design Issues*, vol. 27, no. 3, pp. 3-19.

[45] Walters, P., Chamberlain, P., Press, M. (2003). In Touch: An investigation of the benefits of tactile cues in safety-critical product applications, in *Techné: Design Wisdom, Proc. of 5th European Academy of Design Conference*, Barcelona, Spain: Barcelona University.

[46] Young, J. (14 January 2009). *Design & Behaviour. Design, Behaviour & Policy: Part II.* Available online: <http://rsadesignbehaviour.wordpress.com/category/background/> [Accessed 18 December 2012]