Teaching Ethics For Design For Sustainable Behaviour: A pilot study

Dr Debra Lilley, Research Associate
Dr Vicky Lofthouse, Lecturer in Sustainable Design
Sustainable Design Research Group, Department of Design and Technology,
Loughborough University, UK

Abstract
Design for sustainable behaviour is an emerging activity under the banner of sustainable design which aims to reduce the environmental and social impacts of products by moderating users' interaction with them. The intended outcome of design for sustainable behaviour is to reduce negative environmental and societal impacts. However, designers' ability to passively or actively influence user behaviour and the resulting tension between choice and control raises some interesting ethical issues. Whilst several viable strategies for designing sustainable behaviour have been developed, the criterion for selecting appropriate strategies has yet to be defined and there is not, as yet, a clear consensus as to what is an acceptable level of intervention, or how to rate the severity of consequences enacted by different behaviours.

Exploration of the ethical dimensions of influencing behaviour through design is limited and as such few Industrial Design programmes implicitly teach the ethics of design for sustainable behaviour as part of the curriculum. The study reported on in this paper sought to address this gap through the development and delivery of an educational pilot study to test new teaching materials concerning ethics in design. Having outlined the key processes which led to material selection and the identification of appropriate techniques, a 'best-in-class' student case study is presented to illustrate the outcomes of one student project emerging from the pilot study. The paper concludes by reflecting on the appropriateness of the teaching and learning methods, the suitability of the content based on the evaluation which was carried out; and considers the challenges for lecturers in delivering content of this nature.

Key words
sustainability, design, technology, behaviour, ethics

1 Introduction

Design for sustainable behaviour is an emerging activity under the remit of sustainable design. It aims to reduce negative environmental and societal impacts of products and services by moderating the way in which users interact with them. However, designers' ability to passively or actively influence user behaviour and the resulting tension between choice and control raises some interesting ethical issues. Exploration of the ethical dimensions of influencing behaviour through design is limited and as such few Industrial Design programmes implicitly teach ethics of design for sustainable behaviour as part of the curriculum. Only Stanford (where the study of Persuasive Technology originated), have explicitly integrated ethical issues relating to the design of technologies with the intent to influence user behaviour into the curriculum (Berdichevsky and Neuenschwander, 1999).

In response to this need and the lack of a precedent for teaching the ethics of design for sustainable behaviour, internal funding was sought by staff in the Department of Design and Technology at Loughborough University, via a one year Academic Practice Award to develop, deliver and evaluate new materials for the teaching of ethical thinking to support design for sustainable behaviour. The project ran from June 2008 to June 2009. The materials developed were piloted with postgraduate Industrial Design students at Loughborough University as part of an optional Sustainable Design module, where design for sustainable behaviour is currently taught. The process and findings of this project are discussed in this paper.

2 Setting the context

Sustainable design takes into account environmental, economic and social impacts throughout the product life-cycle (Bhamra and Lofthouse, 2007). These interrelated domains are often referred to as the three pillars or triple bottom line of sustainability (Elkington, 1997).

Sustainable design has been taught to undergraduate and postgraduate industrial/product design students' in the Department of Design and Technology at Loughborough University since 2000 when a programme was developed to engage second year students with the sustainable design agenda (Bhamra et al., 2002). This has since been rolled out to all undergraduate and postgraduate students. At present, postgraduate sustainable design teaching is delivered through the Sustainability and Design module as part of the Industrial Design MA/MSc. This module teaches students about: sustainable development; social responsibility; resource use; systems and services; materials; environmental management systems; designers' responsibility and business drivers and design for sustainability. Design for sustainable behaviour was introduced in 2006. Through this element of the module, students are introduced to design strategies for prompting more sustainable behaviour (Bhamra et al., 2008)

supported by 'design-behaviour' an informative and inspirational web-based tool featuring case studies illustrating the application of theory in practice (Lilley and Lofthouse, 2009). This module is typically taught through a combination of lectures, seminars and workshops, supported by a range of web based resources and assessed through an individual design project. It was through the delivery of this material that it became apparent that there was a need for designers to consider the ethical implications of designing products to change behaviour.

2.1 A detailed introduction to design for sustainable behaviour

Designers shape the development of products and services which directly impact upon society and the environment (Papanek, 1971). One such way is by influencing (in various different ways) users' behaviour, whilst engaging with products. Design for sustainable behaviour aims to reduce environmental and social impact of goods through moderating the way in which users interact with them (Lilley, 2007; 2009). Influence can be exerted to a greater or lesser extent through the selection

Eco-Information – design oriented education	
Aim: to make consumables visible, understandable and accessible to inspire consumers to reflect upon their use of resources.	
How it works: 1. Product expresses the presence and consumption of resources e.g. water, energy.	*Examples:* Power Aware Cord – Seeing Personal Energy Consumption (Interactive Institute, 2004).
2. Product encourages the user to interact with resource use.	Tyranny of the Plug Kitchen Machines – Being involved in powering the product (Van Hoff, 2003).
Eco-Choice – design oriented empowerment	
Aim: to encourage consumers to think about their use behaviour and to take responsibility of theirs actions through providing consumers with options.	
How it works: Users have a choice and the product enables sustainable use to take place.	*Example:* Domestic Energy Display - household system level concept (Design Council, 2005).
Eco-feedback – design oriented links to environmentally or socially responsible action	
Aim: to inform users clearly about what they are doing and to facilitate consumers to make environmentally and socially responsible decisions through offering real-time feedback.	
How it works: The product provides tangible aural, visual, or tactile signs as reminders to inform users of resource use.	*Example:* Wattson – wireless energy monitor which raises awareness of energy used in the home (DIY Kyoto, 2005).
Eco-spur – design oriented rewarding incentive and penalty	
Aim: to inspire users to explore more sustainable usage through providing rewordings to "prompt" good behaviour or penalties to "punish" unsustainable usage.	
How it works: The product shows the user the consequences of their actions through "rewarding incentives" and "penalties".	*Example:* Flower Lamp – Rewarding Energy Behaviours (Interactive Institute, 2004).

Teaching Ethics For Design For Sustainable Behaviour: A pilot study

Eco-steer – design oriented affordances and constraints	
Aim: to facilitate users to adopt more environmentally or socially desirable use habits through the prescriptions and/or constraints of use embedded in the product design.	
How it works: The product contains affordances and constraints which encourage users to adopt more sustainable use habits or reform existing unsustainable habits.	*Example:* Unilever Powder Tablet - Counteracting excessive amounts of washing powder consumption by prescribing correct dose (Unilever, 2000).
Eco-technical intervention – design oriented technical intervention	
Aim: to restrain existing use habits and to persuade or control user behaviour automatically by design combined with advanced technology.	
How it works: The product utilises advanced technology to persuade or control user behaviour automatically.	*Example:* Energy Curtain – Interacting with Daily Light Cycles (Interactive Institute, 2004).
Clever design	
Aim: to automatically act environmentally or socially without raising awareness or changing user behaviour purely through innovative product design.	
How it works: The design solution decreases environmental impacts without changing the user's behaviour.	*Example:* Integrated toilet and washbasin – decreases water use by re-using water for hand-washing to flush toilet.

Table 1. Design Intervention Strategies and Examples (Bhamra et al., 2008)

of appropriate strategies, as outlined in Table 1 (Bhamra et al., 2008). At one end of the scale, *informative products* seek to achieve a *voluntary* changes in behaviour; whilst at the other end of the scale, *coercive technologies, force behavioural* change (Fogg, 2003). Eco-Information, for example, makes consumables visible, understandable and accessible to inspire consumers to reflect upon their use of resources and make more informed decisions. Eco-technical Intervention on the other hand restrains existing use habits and controls user behaviour automatically.

Although a range of strategies for designing sustainable behaviour have been developed, the criterion for selecting an appropriate strategy has yet to be defined and is fraught with ethical dilemma. There is not, as yet, a clear consensus as to what is an acceptable level of intervention, or how to rate the severity of consequences enacted by different behaviours. Coercive approaches, could arguably be more effective than informative ones in ensuring change, but is it better to educate the consumer and risk failure or overrule users and "force" behavioural changes in order to achieve demonstrable results?

2.2 Driving the study

Exploration of the ethical dimensions of influencing behaviour through design is limited (Pettersen and Boks, 2008, Lilley, 2009). Several programmes in the Netherlands are leading the way in delivering modules which examine ethics and *technology*, such as the University of Twente Philosophy of Science, Technology and Society MSc. These provided useful inspiration for this project. However few Industrial Design programmes implicitly teach ethics of design for sustainable behaviour as part of the curriculum. Subsequently, teaching resources available, such as the "Ethical Principles of Persuasive Technology" (Berdichevsky and Neuenschwander, 1999), though instructive, are not written for industrial/product designers and do not reflect the broader spectrum of approaches designers could employ.

In recognition of the intentional and unintentional impacts of design on user behaviour, it was felt that graduate designers needed to be better equipped to respond to the ethical challenges presented. It was felt they needed the skills to evaluate their own practice with respect to social, environmental and ethical impacts; the knowledge to

operate professionally within appropriate codes of conduct and the confidence to question their role in promoting and facilitating changes in society.

3 Methodology

It has been suggested that the introduction of ethics into existing curriculum can be managed using a three-step process: audit, plan and implement (RAEng and EPC, 2005). To ensure continuous improvement, however, it is necessary to add a fourth step; evaluation. Consequently a four-stage process was devised to:

- Research and benchmark teaching practice at Loughborough University and in other institutions and review relevant literature to identify suitable content for inclusion and techniques for delivery (Stage 1).
- Compile and develop new material for delivery using selected teaching methods (Stage 2).
- Pilot the material and teaching methods with MA/MSc students (Stage 3).
- Evaluate the suitability of the teaching and learning techniques implemented and appropriateness of the educational content developed (Stage 4).

3.1 Stage 1: Background Research

To investigate current practice in teaching ethics in design, a benchmarking study was carried out. In recognition of the fact that this is an emergent area for industrial design teaching, courses teaching ethics to graphic designers, industrial/product designers, engineering designers and industrial design engineers were all considered appropriate. Institutions were selected on a 'cor look at that' basis (Langrish, 2003) to allow for a broader range of materials to be accessed. Eleven institutions were identified through the literature as teaching ethics in design: Stanford University, Ohio Northern University, University of Illinois at Urbana, Virginia Commonwealth University, Ohio State University (US); Bezalel Academy of Arts and Design (Israel); University of Strathclyde and Imperial College (UK); TU Delft, The University of Twente and Technische Universiteit Eindhoven (The Netherlands). An audit of the curriculum in the Department of Design and Technology, Loughborough University (UK), the host university, was also conducted to identify where ethical concerns are already integrated and to identify opportunities for inclusion.

The focus of the data collection was on the type of content taught and the methods used to teach the material. Data was collected by reviewing published material about courses from the above institutions, via face-to-face interviews (where possible), e-mail correspondence and internet searching. It was collated in a Microsoft Word file then two mapping exercises were carried out to group and record the different types of topics covered and record the types of techniques used to teach ethics (Lofthouse and Lilley, 2009).

Concurrent to the benchmarking study, a literature review was conducted to identify suitable content to inform the teaching materials developed. The following sections report some of the key findings relevant to this paper.

3.1.1 Ethical Issues in Influencing Behaviour through Design

Although the intention of design for sustainable behaviour is to lessen negative impacts of use, in doing so it has the potential to raise ethical problems. A number of ethical issues relevant to the teaching of design for sustainable behaviour emerged from the literature and benchmarking study. These will be considered in turn.

As has been touched on earlier, the intention of the designer, coupled with an assessment of the severity of the consequences of product use or misuse, can inform the selection of a suitable strategy (Lilley, 2009). However, there is not, as yet, a clear consensus as to what is an acceptable level of intervention. Users and designers often have different views on what is an acceptable level of intervention and what types of intervention could be considered too intrusive. Prior research (Lilley, 2009) revealed designers supported interventions which steer user behaviour towards more socially conscious actions without diminishing the user's ability to choose how to interact over those which exert greater control. De Vries (2006) agrees, preferring ethics be "partially built into the device" but that the real decisions be left to the user. The high level of acceptance of 'informative' strategies such as eco-feedback by designers (Lilley, 2007), however, was not matched by their perceived effectiveness in prompting and sustaining changes in user behaviour.

Notwithstanding current technological limitations, Eco-technical Interventions, operating ubiquitously and autonomously, have the potential to be incredibly effective, offering a more reliable and replicable method for ensuring more sustainable behaviour. However, while it is technically possible to restrict irresponsible behaviour, it is socially problematic (de Vries, 2006), as persuasive strategies, though arguably more effective than informative ones, often restrict choice. The trade off between effectiveness and acceptability represents an interesting dilemma. By removing decision making from the user and preventing 'unsustainable' actions we separate cause and effect. Without feedback on cause and effect users may be less likely to learn from, and adapt, their behaviour accordingly. They may perceive persuasive or autonomous

technologies as restrictive and this may reduce acceptance. Users reluctance to submit to prescribed actions may result in unforeseen 'work-arounds' or rebound effects being enacted, which may result in greater environmental or social detriment. Users may engage in 'game-playing' to escalate instead of decrease impacts if the product fails to effectively counsel against inappropriate behaviours or may even deactivate features deemed irritating or overtly moralistic. However, in some cases removing choice may be considered justifiable and tolerable if doing so for the 'greater good' (for example, only marketing A-rated washing machines).

Another issue relates to the delegation of moral responsibility. The role of the designer in motivating and effecting change for the mutual benefit of society and the environment is a fundamental issue. Persuasive technologies "might be seen as a threat to human autonomy, a source of moral laziness or an anti-democratic force in society which lets designers rather than representatives of the people steer our behaviour" (Verbeek, 2006).

Issues associated with trust, privacy and security also need to be discussed. Consumers, for the most part, implicitly place their trust in electronic products. They expect products to "tell the truth" and find it difficult to discern between true and false information. Berdichevsky and Neuenschwander (1999) recognise that persuasive technologies must not misinform in order to achieve their intended outcome, for example, false information should not be used to encourage more sustainable behaviour. Well intentioned interventions may inadvertently diminish users trust in the device if data is manipulated to achieve a persuasive end e.g. exaggerating water usage data to encourage reduced consumption. In terms of privacy and security it is important to recognise that products using an informative approach to influence users' decision making process often use Bluetooth, GPS and motion sensors to gather behavioural data to inform their interactions with users. Although a great deal of information about consumer behaviour is already available via census data, store loyalty cards and CCTV, consumers appear reluctant to provide personal data freely. The collection, storage, sharing and use of data, therefore, must be carefully managed and safeguarded (Berdichevsky and Neuenschwander, 1999). Persuasive technologies must not use personal information to exert leverage to ensure the designers intention is fulfilled, for example by passing information to a third party such as a parent, employer or spouse who may act on it to punish or reward behaviour (Berdichevsky and Neuenschwander, 1999).

3.1.2 Appropriate techniques for teaching ethics to designers

The findings of the literature review indicated that it is not only important to consider what to teach, but *how* and *when* to teach it. Ethical reasoning skills develop gradually, so it is advisable to increase complexity and intellectual demand in relation to the acquisition of knowledge and competency and schedule assessments when students' understanding has developed sufficiently. As the students' level of maturity increases, more complex ethical arguments can be introduced (Wareham et al., 2006). A range of potential techniques for teaching ethics to designers were identified in the practice of benchmarked Universities and supporting pedagogic literature;

- *Role-Play or Structured Controversies*: in which students assume the roles of participants in a controversial case to better understand their motivations, is a recognised technique for teaching ethics (Wareham et al., 2006, IDEA~CETL, 2005, Loui, 1999). Arranging lectures after a structured controversy workshop enables the students to connect the arguments made by stakeholders with ethical theories or debates introduced in the taught material.

- *Case studies:* can be "an extremely effective tool for embedding ethics within an existing curriculum: by getting students to engage with scenarios that they are likely to encounter as professional[s] they are forced to confront and question their own opinions, and justify their actions" (IDEA~CETL, 2005). Case studies enable students to examine and reflect upon ethical issues and connect taught theories and principles to real-world practice (Meyer et al., 2008). Lloyd and van de Poel (2005) however, argue that "the chronological 'neat' way that evidence is presented" in a case study can "give the impression that, with all the evidence laid out, making a decision on an ethical basis can be relatively easy. The implication here is that the actual ethical problem is located, not so much in a choice situation, but in the 'messiness' of social reality, in the 'smaller' ethical decisions that the process of design throws up…. [and that] by cleaning up this messy reality, case study analysis can remove the very element of uncertainty that characterises unfolding ethical situations" (p.660). "Designers have to take into account the many-sidedness of reality" which means "taking to account the full complexity of the situation" (de Vries, 2006). According to Lynch and Kline (2000) in order to be effective, case studies should emphasise the complexity and ambiguity of issues, rather than provide a clearly outlined conflict of values. Although taking a reductionist view can be useful in enabling students to "abstain from

RESEARCH

other aspects" and therefore "be more precise about the aspect in question", to appreciate the complexity of design decision-making they must be encouraged to consider "the full reality of the situation after having studied the aspect of focus" (de Vries, 2006).

- *Games:* can be used to encourage students to engage in the subject-matter on a personal level, to empathise with others, and to highlight their own and others' personal impact. 'Globe Ball' (Scott et al., 2008), for example, encourages participants to reflect on how personal behaviours such as 'taking long baths' or 'driving short distances' negatively or positively impacts on society and the environment.

- *Scenarios of use:* can be particularly useful in enabling designers to imagine and think through the potential effects resulting from the use of the products they design. 'Sustainable Everyday' (Manzini and Jégou, 2003), for example, presents scenarios and solutions showing different visions and ideas of more sustainable everyday living. Other practitioners also uses scenarios or 'vignettes' to visualise new ways of behaviour and create 'Design-Oriented Scenarios for Eco-Innovation' (Kohtala, 2008).

- *Group Discussion:* is a valid mechanism for teaching ethics in design (Online Ethics Center, 2006). The Online Ethics Center recommend a group discussion activity entitled 'Controlling Technology in the Face of Uncertainty', to explore the extent to which technology can be directed and controlled. Students discuss and debate a range of questions such as: What are the positive and negative influences these products have had? Is it the engineer's responsibility to try to reduce negative influences? What can we learn from past experiences that can be applied to current projects? These debates encourage the students to begin to raise issues which can be explored in greater depth as the course unfolds (Lynch and Kline, 2000).

- *Assessments:* such as closed question examinations and quizzes do not lend themselves to the teaching of subjects like ethics where there is no right or wrong answer, and discussion and debate is necessary for students to form an ethical standpoint. Meyer et al (2006) recommend methods that support active learning and engagement such as; self-assessment, written assignments (comprised of a mixture of short answer questions and longer issue-based critical essays), cumulative case-study analysis and a group presentation (to encourage collaboration rather than competition).

3.2 Stage 2: Compilation and development of selected content

Findings from Stage 1 of the project resulted in an enhanced understanding of important ethical issues in design for sustainable behaviour and identified potential mechanisms for their teaching. The content which emerged informed topics for inclusion in the curriculum and the selection of techniques for the delivery of the teaching material

As was outlined in Section 2 the material that was developed and tested for this pilot study was added to content already taught to the postgraduate students. The revised module content included:

- Examination of the role of the designer in facilitating change.
- Understanding consumer behaviour.
- Methods for capturing and understanding user behaviour (supported by practical exercises).
- Strategies for designing sustainable behaviour.
- And reflection on the selection and use of informative versus controlling strategies in the context of escalating consumption of natural resources and the desire for autonomy.

The redesign project focused around designing a product or system to influence user behaviour towards water conservation or waste reduction in the kitchen. In contrast to previous years, students were expected to provide an ethical analysis of their final design.

A full overview of taught inputs, content and methods used can be seen in Figure 1.

In addition to this content, lectures and embedded activities such as; games to highlight personal impact; audiovisual cases studies to promote discussion around specific ethical issues for designers; stakeholder analysis; reflection and debate (e.g. provocative questions and ethical analysis) were provided to support the development and delivery of the project. The development of argumentative reasoning, ethical deliberation and active reflection were encouraged through the use of a reflective design logbook (similar to a journal). The logbook acted as a record of the students progression through the design development containing references to inspirational materials, taught content, idea generation (in the form of sketches and annotated drawings) and analysis.

Designers are not ethicists; therefore, a decision was made not to explicitly teach ethical theories. Instead ethics was broadly introduced as "a rational, consistent system

Teaching Ethics For Design For Sustainable Behaviour: A pilot study

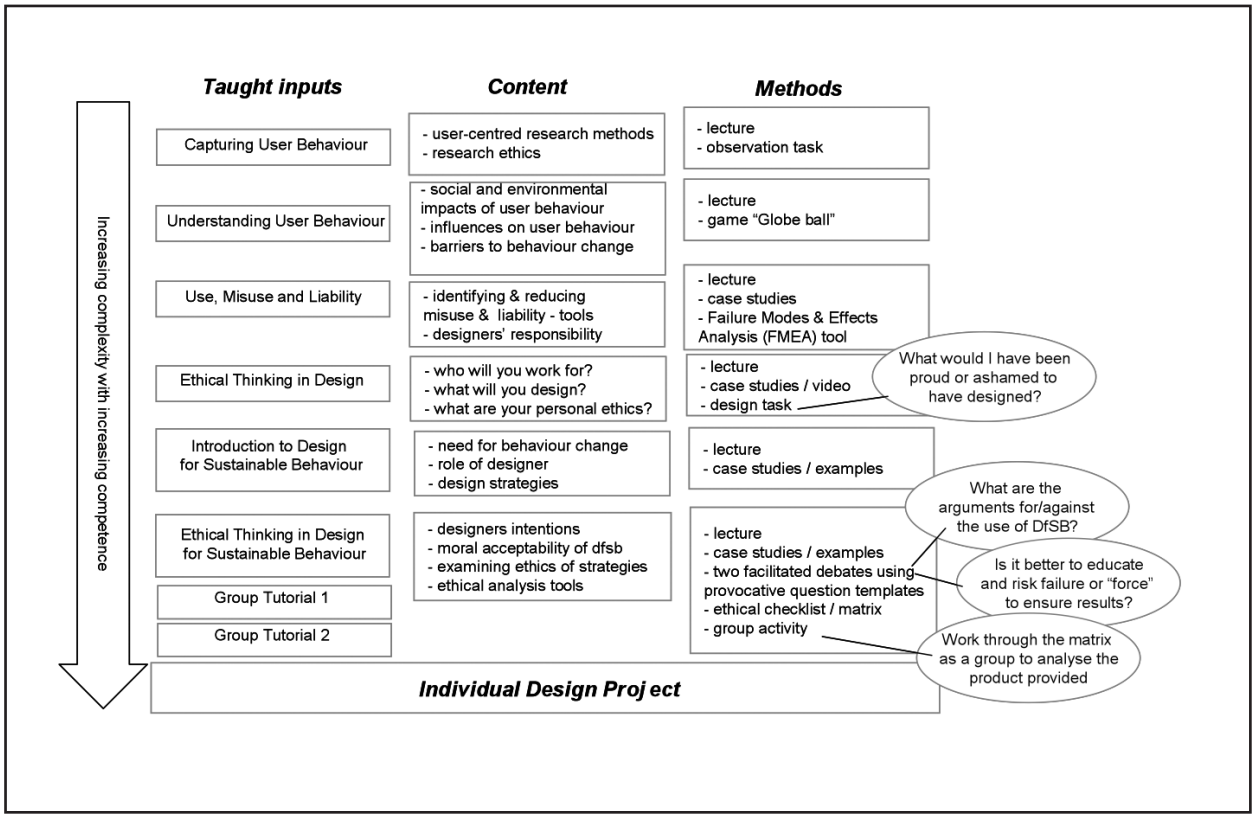

Figure 1. Topics taught and methods used

for determining right and wrong … in the context of specific actions or policies" (Berdichevsky and Neuenschwander, 1999, p. 52). Students were made aware that "design is not a neutral, value-free process" (Garland, 1964) and that to adequately prepare for "the multitude of ethical considerations" they may face in profession life they need to examine their "own stance as a designer" (Media Lab Helsinki, 2008). How design students perceive their role will affect the way they design for sustainable behaviour. Defining a set of ethical principles can be the first step in establishing an ethical standpoint to guide design practice. Through active reflection and guided assessment, the students were encouraged to construct personal and professional ethical stances using subject-specific guidance such as the Industrial Designers Society of America's Code of Ethics (2008) and the First Things First Manifesto (Garland, 1964) as reference. The students' positions were strongly influenced by personal, cultural and familial values which were explored through debating controversial case studies such as the continued sale of Caterpillar bulldozers to the Israeli military.

One of the difficulties of assessing the ethical implications resulting from product use is that it can be difficult for designers to accurately predict user behaviour and evaluate the influence of technologies on behaviour in ethical terms (Verbeek, 2006). A technology can have many potential uses, which can be dependent on the use context, the user's intentions, habits and practices and the social norms which govern behaviour. The unpredictable nature of user behaviour, coupled with the interactive and responsive nature of some behaviour changing devices, may even result in rebound effects such as game playing to escalate rather than reduce use impacts. The possibility of users' actively trying to disable or circumvent functions could potentially cause difficulties when assessing the ethical implications of product interventions as it may be difficult to predict the results of users' actions if they deliberately override the designers intentions for use. To holistically critique product designs from an ethical perspective, designers need to envision potential use contexts and the ethical scenarios they produce (Albrechtslund, 2007). However, few tools for Industrial Designers exist to facilitate this process.

To address this gap, a range of discursive, reflective and analytical tools were developed to facilitate ethical critique throughout the design process:

- a weighted ethical matrix was developed to aid students in evaluating behavioural issues identified through observing users interacting with the product and those resulting from their use of the re-designed product (Figure 2);
- an ethical checklist providing prompt questions to encourage ethical thinking and aid concept selection was introduced;
- and Loughborough University approved ethical research guidelines provided to guide data collection, storage and use.

The weighted ethical matrix shown in Figure 2, was developed drawing inspiration from previous research (Albrechtslund, 2007, Pettersen and Boks, 2008, Berdichevsky and Neuenschwander, 1999, Brey, 2006, Verbeek, 2006) and modelled on the Failure Modes and Effects Analysis process. Part A assisted students in evaluating behavioural issues identified through user centred research conducted in the first stage of the project. Working methodically through the matrix, the students could rate behaviours identified against three parameters; the impact on society and the environment (Low, Medium or High), the longevity of the effects produced (Short term / Long term) and the permanency of the conditions resulting from the effects of user behaviours identified (Reversible / Irreversible). Prompt questions such as; "does this behaviour reduce the quality of life/well-being of those in the vicinity of use?" and "could the continued practice of this behaviour damage or degrade the environment (either locally or globally)?" were provided to aid analysis.

Part B encouraged students to consider and reflect on the ways in which their re-designed product could be used and the potential effect on the user and those affected by its use either directly or indirectly. Students were encouraged to work their way through each behaviour; rate the severity, longevity and permanency of the consequences of that behaviour and then make a decision about the likelihood of that behaviour occurring. Having rated all behaviours identified, the student was tasked with highlighting all those which scored highly in terms of impact, were considered long term, irreversible and had a high or medium probability of occurring for deeper consideration.

An ethical checklist was devised to aid concept selection. Concepts could be evaluated using a series of probing questions examining:

- the designers intent;
- validity of the targeted behaviour;
- the level of control exerted by the product, service or system;
- whether this can be justified in relation to the perceived severity of the behaviour targeted;
- privacy and security issues related to data collection, transfer and storage, accuracy, reliability and trustworthiness; and
- the overall impact on stakeholders who may use the product or system or be affected by its use either directly or indirectly.

Part A : Evaluation of Behavioural Issues Identified

	IMPACT			EFFECT		PERMANENCY	
Behaviour identified through user observation studies	*L*	*M*	*H*	*Short Term*	*Long Term*	*Reversible*	*Irreversible*

Part B: Ethical Evaluation of Re-designed Product /System

		IMPACT			EFFECT		PERMANENCY		OCCURANCE		
How could the product/system be used?	*What would be the impact/consequences of this behaviour on stakeholders?*	*L*	*M*	*H*	*Short*	*Long*	*Reversible*	*Irreversible*	L	M	*H*

Figure 2. Weighted Matrix Parts A and B

Data Collection Method	Analysis Method
Reflective Commentary • A reflective commentary drafted by Lilley as part of a teaching practice evaluation. • Self and peer evaluation bringing together evidence of teaching practice with reference to literature "showing that practice is a product of informed and considered thought" (Fry and Ketteridge, 2003, p. 245).	• Thematic analysis, a method for identifying, analysing and reporting patterns within data (Braun and Clarke, 2006), was used to extract commonly recurring themes in entries made in a personal development journal kept by Lilley throughout the pilot. • The reflective commentary produced was independently assessed by two external reviewers who provided recommendations for improving practice.
Teaching Observation • Observation of Lilley delivering taught content during the pilot by two external assessors on three separate occasions. • Involved taking a "holistic view of learning and teaching in the classroom" and included the "study of interactions taking place between the teacher and students as well as among the students themselves" (Shortland, 2004).	• Written feedback on: o the clarity of purpose/aim and learning objectives; o planning and organisation; o suitability of learning and teaching methods; o presentation and content; o student engagement and/ or participation; o the impact of learning resources.
Module Evaluation Feedback Form • Featured mandatory University-wide statements based on National Student Survey (NSS) categories plus empty space for departmental statements. • Using a Likert scale (1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) students rated the teaching, assessment and feedback, academic support, organisation and management, learning resources and personal development opportunities. • Forms were completed in class to increase the response rate.	• Five feedback forms were returned. • Completed forms were scanned by the Optical Mark Reader (OMR) • Composite raw data was made available to the Module Leader by the departmental Learning and Teaching Co-ordinator via Loughborough University's Student Information (LUSI) system. • Quantitative data was interrogated to identify statements averaging 3 or less. • Qualitative data could not be recalled electronically but was reviewed in hard copy and student comments noted.
Self-Completion Student Questionnaire • Qualitative and quantitative questions. • Distributed in class to elicit students' perceptions of the; o usefulness of taught inputs and reference materials in supporting project work; o most challenging assessment type; o skills and knowledge gained; o extent to which acquired knowledge and skills could inform future work.	• Five questionnaires were returned. • Quantitative responses were collated and commonly recurring perceptions and majority viewpoints elicited. • Qualitative comments were analysed thematically (Braun and Clarke, 2006) to extract individual and group perceptions and supporting verbatim.
Assessment of Student Work • Summative assessment of individual design project comprised of: o verbal presentation; o design folio, ethical analysis and log book.	• Presentations and submitted work was double marked against set assessment criteria to ensure validity and fairness. • A 'best in class' student case study was selected for further analysis on the basis of academic rigour and achievement.

Table 2: Data Collection and Analysis Methods used in Pilot Evaluation

Teaching Ethics For Design For Sustainable Behaviour: A pilot study

Supporting resources were uploaded to the e-learning environment to allow students to review the material at their own pace and allow deeper reflection on the issues presented. At the end of the project the students' work was marked and returned.

3.3 Stage 3: Pilot

The material outlined in Section 3.3 was delivered to Masters students over one semester in order to test the suitability of the tools and techniques identified, and to trial the appropriateness of the educational content. This module was attended by five postgraduate Industrial Design students (all International/non-UK).

Intermittent tutorials provided an opportunity for students to gain constructive advice on their conceptual designs, benefit from feedback from peers and tutors, and clarify any queries regarding assessment. These were supplemented with informal feedback given during lectures and summative feedback on the final presentation. The summative assessment incorporated evaluation and assessment of students' coursework; a 15 minute PowerPoint presentation, design logbook and one-page ethical analysis, to ascertain the quality of the design output, and the extent to which ethical issues were integrated, considered and evaluated.

3.4 Stage 4: Evaluation

Following the pilot, the appropriateness of the methods and content were evaluated by a range of stakeholders including; teaching staff, students, external examiners and independent observers in the class using a range of methods to triangulate the findings in Table 2.

4 'Best in class' student case study

To illustrate the type of design project undertaken and the outputs which emerged, a 'best in class' student case is presented. In the initial phase of the project, Student A carried out user observations, questionnaires and interviews to better understand how practices and habits impact on water consumption in the kitchen, Figure 3. He found that water is often wasted due to inefficient or unconscious behaviours such as; washing individual items directly under running hot water with a soapy sponge, leaving the tap running into the sink with the plug left out whilst collecting items for washing and running the cold tap on full for about five seconds before filling a glass.

In response to these findings Student A sought to remove the wasteful affordances of a binary water delivery system, i.e. tap on, tap off, and create a responsive controlled delivery approach which would change users' relationship with the quantity of water being used, while simultaneously empowering users' to consume water in way that matches their requirements. The resulting design concept, 'onesmallstep' comprised an integrated sink unit with a pressure responsive foot pedal control. Greater foot pressure on the pedal leads to a greater volume of water being delivered through the tap. The core motivation of this concept was to reduce water consumption by reducing the amount and duration of water flow.

As illustrated in Figure 4, the taps in this proposal feature a temperature selector in the form of a 180 degree dampened lever. At one point in the design development the temperature selector was designed to deliberately misinform the user, showing an even progression from cold to hot on the dial whilst actually being biased towards the cold flow.

This form of manipulative persuasion was discounted by the student as it was deemed unethical and in

Figure 3. Users interaction with the tap and water control

Teaching Ethics For Design For Sustainable Behaviour: A pilot study

Figure 4. Reactive Indicator Tap and Tapered Sink

contravention of Berdichevsky and Neuenschwander's heuristics of ethical persuasion (1999).

Another feature of the proposal was that the sink was tapered (see Figure 4), so that it filled up more quickly than a traditional sink with parallel sides. It also included level markers. Both of these features were intended to steer the user towards using less water using subtle passive eco-indicators.

The student used Part B of the weighted matrix to identify potential intended *and unintended* actions. By working through the matrix he was able to rate the consequences of these actions and propose some mitigating actions to improve the design. For example, users may press the pedal without having checked the temperature setting and unleash hot water onto themselves. To counteract this, a temperature reactive indicator was printed on to the tap head. A further example cited was the possibility for a small child, too young to reach a conventional tap, to use the pedal as a plaything. The risks here ranged from burning to the child (worse case) to merely causing an unnecessary mess in the kitchen (best case). To counteract this, the tension on the sprung valve, which operates the pedal and resulting water flow, was made adjustable.

The student's ethical standpoint was that the users' autonomy should be preserved at all costs and that freedom of choice was paramount. Steps were taken to *guide* but not *force* the user toward lower consumption. He articulated this standpoint through the features he selected for his final concept, rejecting those which may have been more effective in reducing consumption yet restrictive of individual choice such as; a plug designed to be unstable so that it blocks the drain by default thus encouraging users to fill the sink instead of running the tap, in favour of those which educate and steer behaviour without compromising an individual's freedom to act. The increase in force required for a greater flow of water, for example, steers the user towards using a more moderate flow, as any more requires a determined flexing of the foot. This also encourages controlled application of water only when needed, removing dead flow. It is interesting to reflect however, that although the students' intent was not to force behavioural change, the pedal does indeed force users to interact with the sink in a prescribed, and limited, way. The necessity to be standing by the sink to operate the pedal is an attempt to reduce the opportunity for the user to leave the tap running unattended whilst collecting items for washing or wiping surfaces (as observed previously). However, this curtailment of choice could drive determined users to enact rebound effects such as wedging a chair on the pedal so that they can fill a bowl for washing up whilst doing other things like feeding their children. This not only illustrates that the strength of interventions is subjective, but that designers must endeavour to identify as many intended and unintended behaviours as possible when evaluating ethical implications of product use.

5 Key Lessons

This section discusses key findings which emerged from the project.

5.1 Reflecting on the success of techniques developed and selected

To aid ethical reflection throughout the design development process, a range of methods including; tutorials, group discussions, case studies, ethical checklists and matrices were developed. The success of these methods differed greatly and only certain techniques were found to be appropriate.

Debate and discussion of ethical issues can be valuable in encouraging students' to assert and defend their own viewpoint. The inclusion of detailed case studies followed by facilitated discussion proved effective in stimulating debate enabling students to engage with emergent issues. However, isolating individual contributions was problematic; the students' ability and inclination to contribute varied considerably. Often a great deal of prompting was required to cultivate and sustain discussions. Integrating electronic interactive voting to pose challenging ethical dilemmas, capture students' reactions and decisions and encourage individuals to take a standpoint on divisive issues, could be a way forward. An alternative would be to ask students to prepare a statement in advance of the debate on a particular case study and assess those preparatory studies (Coates, 2009).

The inclusion of an individual project requiring students to embed ethical thinking into their design work encouraged deeper reflection ensuring that the ethics component was not treated as a standalone concern but dealt with alongside all the attributes of the design process. However, differences in maturity and academic capability affected students' ability to grasp the complexity of emergent ethical issues. Although when questioned verbally, most could defend the design strategy adopted to influence user behaviour, the level of ethical reasoning demonstrated in the one page analysis submitted was, with few exceptions, fairly limited. The most common failure was a lack of adequate reflection on the issue of exerting control on the user and the ethical implications of this.

The ethical checklist and matrix proved useful in directing reflection on selected issues; however, the use of these tools was voluntary and not all issues were applicable to all projects. On reflection, a simplified mandatory tick-box checklist with some open-ended questions to prompt deeper reflection may have been more appropriate. Additionally, due to the focus on the use phase in the design project, the ethical analysis tools were limited to consideration of the research and use phases. To widen their usefulness and applicability to other projects, consideration could to be given to broadening the scope and content across the entire product lifecycle.

5.2 Suitability of content

As discussed previously, a conscious decision was made not to include ethical theory but to teach applied ethics which involves examining specific controversial issues through applying ethical theory to real-life situations. Although it is commonly held that applied ethics teaching should introduce moral theories at the outset to enable their application to particular cases, Lawlor (2007) disagrees. Theory, he argues, is either presented in extensive detail rendering it largely incomprehensible or in so little detail that, although a greater degree of information is absorbed, it is of little value. Developing skills in reasoning and analysis, and applying these skills to relevant subject-specific issues is, he argues, of greater benefit (Lawlor, 2007).

The development of ethical reasoning and reflection is a gradual process. Within this module the complexity of the material and tasks set were gradually increased in relation to the students' growing competency in engaging with the subject matter. The students were given ample opportunities to examine ethical dilemmas emerging from others practice, via case studies, debates and discussions, before being expected to critique their own practice using simple, constructive tools provided to guide the process.

Although opportunities to debate and engage with ethical issues were programmed into the curriculum, more time for reflection in and between teaching inputs was needed and would have been beneficial in improving students' ability to analyse and reflect on the taught material.

5.3 Challenges for the lecturer in delivering content

Ethics in design is a relatively new subject area, particularly in Industrial Design Higher Education, and as such, few lecturers in this field are likely to have experience in teaching ethics. Lecturers may feel ill-equipped to competently assess ethics as there are no established metrics (RAEng, 2009) and the subjective nature of the subject makes it difficult to be consistent. The challenge inherent in teaching ethics is that students often expect 'absolute' answers and struggle with ambiguity or uncertainty. Lecturers may encounter some resistance to 'open-ended' questions posed in ethical debate and cultural influences and societal norms practiced outside of the UK may affect students' ethical arguments and reasoning. To combat this, the lecturer needs to stress that ethics are not 'black and white' and allow opportunities for students to openly debate and engage with ethical issues in order to develop and defend their own ethical standpoint.

It must also be recognised that it can be difficult to remain neutral when teaching emotive subjects. Lecturers may be resistant to taking an ethical stance in their teaching "because they feel it is equivalent to telling the students what their values should be" (Thorpe, 2009). Setting out one's personal view at the outset, coupled with a strong assertion that it is by no means 'correct' can, however, be

a useful starting point and act as a primer for students to challenge this viewpoint, and in doing so, form their own. Reiterating that there are no right and wrong answers as far as ethical considerations are concerned and that it is very much up to the individual to decide where they "draw the line" is important, as is avoiding bias by presenting the many faceted sides of the ethical issues objectively.

6 Conclusions

Design for behavioural change is a powerful tool for reducing sustainability impacts, however with great power comes great responsibility. This project set out to develop material which will help foster this responsibility in design students by encouraging deeper reflection on the social, environmental and ethical implications of design for sustainable behaviour.

This has been a successful project which has identified a number of key lessons with respect to the type of content and how to effectively deliver it, as well as providing insights into the challenges of teaching this subject. These findings will be useful in the development of further pedagogic work to support the continued delivery of ethics in design teaching at Loughborough University whilst providing guidance to academics in other institutions interested in teaching this emerging subject. The strategies outlined and discussed in this paper could also be developed for use with children in the classroom to complement the burgeoning sustainability agenda in UK schools. This would provide an interesting extension to the current work.

References:

Albrechtslund, A., (2007) Ethics and technology design, *Ethics and Information Technology*, Vol. 9, pp. 63-72.

Berdichevsky, D. and Neuenschwander, E., (1999) Towards an Ethics of Persuasive Technology, *Communications of the ACM*, Vol. 42, No. 5, pp. 51-58.

Bhamra, T. A., Lilley. D and Tang, T., (2008) Sustainable Use: Changing consumer behaviour through product design, In: *Changing the Change: Design visions, proposals and tools*, Turin, Italy, 10th-12th July 2008

Bhamra, T. and Lofthouse. V. A (2007) *Design for Sustainability: A Practical Approach*, Gower, UK.

Bhamra, T., Lofthouse. V. A and Norman, E., (2002) EcoDesign Education Strategies: A recent initiative for Industrial Design and Technology undergraduates at Loughborough University, *The Journal of Design and Technology Education*, Vol. 7, pp.133-141.

Braun, V. and Clarke, V. 2006, Using thematic analysis in psychology, *Qualitative Research in Psychology*. No. 3, pp. 77-101

Design Council, (2005) *Home Monitoring Display*, RED Future Currents, http://www.futurecurrents.org/HM_home_monitoring.php, (Accessed October 2008)

De Vries, M. J., (2006) Ethics and the complexity of technology: a design approach, *Philosophia Reformata, the international scientific journal of the Association for Reformational Philosophy*, Vol. 71, No. 2, pp. 118-131.

DIY Kyoto, (2005) Wattson, www.diykyoto.com, (Accessed 2007)

Elkington, J., (1997) *Cannibals with forks: the triple bottom line of 21st century business*, Capstone, Oxford.

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

Fry, H. and Ketteridge, S., (2003) Teaching Portfolios, In: Fry, H., Ketteridge, S. and Marshall, S. (Eds.), *A Handbook for Teaching and Learning in Higher Education; Enhancing Academic Practice, Second Edition*, Routledge Falmer, London, pp. 242-252.

Garland, K. (1964) "first things first" manifesto http://www.kengarland.co.uk/KG%20published%20writing/first%20things%20first/index.html (Accessed August 2006)

IDEA~CETL, (2005) Inter-Disciplinary Ethics Applied Centre for Excellence in Teaching and Learning, http://www.idea.leeds.ac.uk/, (Accessed February 2008)

IDSA, (2008) *The Industrial Designers Society of America* (IDSA), http://www.idsa.org/index.htm, (Accessed September 2008)

Interactive Institute, (2004) *Static! Increasing Energy Awareness*, http://www.tii.se/static/index.htm, (Accessed December 2006)

Kohtala, C. (2008) *Design-Oriented Scenarios for Eco-Innovation*, Unpublished

Langrish, J (1993) Case studies as a biological research process, *Design Studies: Special issue, Case study in design research*, Vol.14, No. 4, p. 357-364.

Teaching Ethics For Design For Sustainable Behaviour: A pilot study

Lawlor, R., (2007) Moral theories in teaching applied ethics, *Journal of Medical Ethics*, Vol. 33, pp. 370-372.

Lilley. D (2007) *Designing for Behavioural Change: Reducing the Social Impacts of Product Use through Design*, Doctoral Thesis, Department of Design and Technology, Loughborough University

Lilley. D (2009) Design for sustainable behaviour: strategies and perceptions, *Design Studies*, Vol. 30, No. 6, pp. 704-720.

Lilley. D and Lofthouse. V. A (2009) Sustainable design education – considering design for behavioural change, *Engineering Education: Journal of the Higher Education Academy Engineering Subject Centre*, Vol. 4, No. 1, pp. 29-41.

Lloyd, P and van de Poel, I (2005) Designing Games to Teach Ethics, In: *Crossing Design Boundaries, 3rd Engineering & Product Design Education International Conference*, Edinburgh, UK

Lofthouse. V. A and Lilley. D (2009) Teaching Ethics in Design: A Review of Current Practice, In: *International Conference on Engineering Design*, ICED'09, 24th-27th August 2009, Stanford University, Stanford, CA, USA

Loui, M. C., (1999) Role Playing in an Engineering Ethics Class, In: *The Online Ethics Center (OEC) International Conference on Ethics in Engineering and Computer Science*, Case Western Reserve University, US, 21st-24th March 1999

Lynch, W. T. and Kline, R., (2000) Engineering practice and engineering ethics, *Science, Technology, & Human Values*, Vol. 25, No. 2, pp. 195-225.

Manzini, E. and Jégou, F., (2003) *Sustainable Everyday, Scenarios of urban life*, Edizone Ambiente, Milan.

Meyer, H., Higbee, K., Stankovic, L. and Stankovic, V., (2008) A HE curriculum for teaching and learning ethical issues arising from persuasive technologies, In: *Engineering Education 2008: International conference on innovation, good practice and research in engineering education*, Loughborough University, UK, 14th-16th July 2008

Online Ethics Center, (2006) *Background Concepts for Teaching Engineering Ethics*, http://www.onlineethics.org/CMS/edu/instructguides/concepts.aspx, (Accessed September 2008)

Papanek, V., (1971) *Design for the Real World: Human Ecology and Social Change*, Pantheon Books, New York.

Pettersen, I. N. and Boks, C., (2008) The ethics in balancing control and freedom when engineering solutions for sustainable behaviour, *International Journal of Sustainable Engineering*, Vol. 1, No. 4, pp. 287-297.

RAEng and EPC, (2005) *An engineering ethics curriculum map*, The Teaching Engineering Ethics Working Group (TEEG) of the Royal Academy of Engineering (RAEng) and the Engineering Professors Council (EPC), London, UK.

RAEng, (2009) *Teaching Engineering Ethics: A workshop for new and experienced teachers of engineering ethics*, The Royal Academy of Engineering, London, UK, 6th May 2009.

Scott, K., van de Velden, R. and Reitenbach, M., (2008) Playground 1: Player's behaviour, In *3rd O2 Lustrum event: Playground*, The Netherlands, 31st May 2008

Shortland, S (2004) Observing teaching in HE: A case study of classroom observation within peer observation, *International Journal of Management Education*, Vol. 4, No.2

Thorpe, A., (2009) *Ethics*, SusDesignTeach JISCmail Discussion Group, Posted 29th January 2009, (Accessed January 2009)

Unilever, (2000) *Tablet Detergents: Towards a More Sustainable Future*, Prepared and issued by Unilever HPC - Europe, June 2000,

Van Hoff, D., (2003) *The tyranny of the plug; kitchen machines that do not need to be plugged*, http://www.vanhoffontwerpen.nl, (Accessed December 2005)

Verbeek, P.-P., (2006) Persuasive Technology and Moral Responsibility, In: *PERSUASIVE 2006 First International Conference on Persuasive Technology for Human Well-Being*, Eindhoven, The Netherlands, 18th-19th May 2006

Wareham, D. G., Takis Elefsiniotis, P. and Elms, D. G., (2006) Introducing ethics using structured controversies, *European Journal of Engineering Education*, Vol. 31, No. 6, pp. 651-660.

d.lilley@lboro.ac.uk
v.a.lofthouse@lboro.ac.uk