INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
5 & 6 SEPTEMBER 2013, DUBLIN INSTITUTE OF TECHNOLOGY, DUBLIN, IRELAND

# SUPPORTING SUSTAINABILITY THINKING IN POSTGRADUATE DESIGN EDUCATION

**Clare BRASS**
SEED Foundation / Royal College of Art, United Kingdom

**ABSTRACT**
Conventional design education, driving consumerism and growth, is today unsustainable, and must position itself to allow designers to learn to create responsibly, responding to issues that might be considered outside of the 'traditional' remit of design. Like many art and design institutions, we are beginning to grapple with the apparent contradiction in the sustainability debate; we are looking for ways of encouraging students to explore what this might mean in their work and in their future lives, since graduates of this new type of design must be able to earn a living.
Some students are increasingly concerned with sustainability issues, choosing to study design because they recognise that with its cross-cutting qualities and problem solving processes it is an ideal discipline for addressing the social and environmental challenges before us.
A sustainability manifesto has been created to help students position their ideas according to three parameters: environmental, ethical/social, and economic. They are asked to continuously reflect on their work to acquire a balance between each of these three parameters, and to adopt a systemic and entrepreneurial approach and a mix of products and services rather than individual object-centred solutions.
The manifesto incorporates a range of other existing tools, and is itself designed to evolve and adapt alongside the issues that it deals with, and the students are best placed to help with this.
This paper will explain the Manifesto in greater depth, and show how the students themselves are helping to refine and develop it as a teaching tool.

*Keywords: Sustainability, design, social and environmental change*

## 1 INTRODUCTION

We are in the midst of an inevitable change in social and environmental conditions, whose imminent arrival and devastating impact - long forecast by scientists and economists - will require a complete rethink of our economic system. But changing an economic structure of society is a major feat and cannot happen overnight. To facilitate the transition we need to rely on a new generation of professionals who will help build the critical mass needed to shift from a consumer-based economy to a sharing economy. Education will play a key role in preparing a new generation of designers to meet the challenge. As a contribution to this topic, this paper describes the [ongoing] experience of attempting to embed sustainability in the teaching practice of design in a course at the Royal College of Art. It is particularly relevant because it prompts students to focus on the design of systems that are environmentally and economically sustainable as well as socially beneficial, rather than on reducing the negative impact of materials through the design of products; in doing so it tries to view the three pillars of sustainability as a new and exciting opportunity, merging them in such a way as to carve out the role of the designer in a different future.

## 2 CHANGING PARADIGMS, NEW TERRITORY FOR DESIGN

It is normally taken for granted that economic growth is vital for maintaining a healthy economy. But research has shown that wellbeing depends less on material goods than on our lifestyles. The New Economics Foundation's Happy Planet Index[1] measures the combination of environmental impact with wellbeing to measure the environmental efficiency with which country by country, people live long and happy lives.

[1] http://www.happyplanetindex.org/news/archive/HPImap

First published in 2006, it questions the post-war construct that consumerism (good for economic growth and better standards of living) leads to a happier populace, and suggests that GDP (Gross Domestic Product), the standard way in which the health of a nation is generally gauged, may in fact not be the right measure to use. Using global data on life expectancy, experience of welfare and Ecological Footprint[2], the Index shows the relative efficiency with which nations convert the planet's natural resources into long and happy lives for their citizens. This innovative way of measuring the state of our society shows that "high levels of resource consumption do not reliably produce high levels of wellbeing"; nations that top the Index[3] demonstrate that it is possible to achieve happiness and long life expectancy without over-stretching the planet's resources. In fact the USA, arguably the most developed country in the world, is placed 105th out of 151 countries. If you believe the Happy Planet Index, the dominant Western model of development is clearly unsustainable: we need to find other development paths towards sustainable living.

This line of thinking is hardly new. Challenges to the logic of economic growth began to appear as far back as the 1970's when a group of MIT experts published *The Limits to Growth,* exposing for the first time the idea that continuous growth may be environmentally impossible as well as socially undesirable. Commissioned by The Club of Rome (an international group of intellectuals and industrialists) the report modelled the interaction between exponential growth and a world with finite resources, focusing on system dynamics rather than the previously used viewpoint of environmentalism to argue the point that our economic activity was having a negative impact on the planet's wellbeing. Upon its publication, the report was aggressively vilified (Yale economist Henry C. Willich called it "irresponsible nonsense"), perhaps because it fundamentally challenged the market logic of a self-correcting system that could continue to grow indefinitely, and threatened the assumption of the global dominance of the consumer capitalism model.

This alternative view of our economic system poses something of a conundrum to both designers and design educators, who have built an entire educational strategy to fit the prevailing [capitalist free-market] economic model. There is no doubt about the role design has played since the post-war reconstruction effort: it has been a valuable tool for stimulating the endless acquisition of consumer products. Indeed the phrase "Planned Obsolescence" was invented in this period as part of a deliberate drive to seduce people into a desire-buy-use-throw-away-buy-another-one lifestyle.

So if it is true that consumerism's time is almost up, and it does not lead to a better life anyway, whither design? Again, this is not a new question, but rather one that has been uncomfortably swept under the carpet: in the 1970's Victor Papanek's Design for the Real World talked about the need for designers to use their skills to address issues of environmental and societal relevance. The proposed work was initially rejected by 12 publishers and upon publication was then widely ridiculed. Designers were already being trained in the art of what Papanek called "persuading people to buy things they don't need, with money they don't have, in order to impress others who don't care"[4]. Time has perhaps now caught up with the thinking of Papanek and the Club of Rome and their frameworks could never have been more relevant; burgeoning energy costs, dwindling resources, tighter legislation and (perhaps above all) a greater public awareness[5] are creating the right conditions bring sustainability to the forefront of design briefs; we can only conclude that design needs now to position itself to enable designers to earn a living in a way that enhances and protects the environment and society, rather than wreaking havoc upon it, responding to issues that might be considered outside of the 'traditional' remit of design.

## 3 TRYING NEW EDUCATIONAL STRATEGIES FOR A CHANGING WORLD

Students of Innovation Design Engineering (IDE) at the Royal College of Art come from a variety of

[2] The Ecological Footprint measures humanity's demand on the biosphere in terms of the area of biologically productive land and sea required to provide the resources we use and to absorb our waste. The footprint of a country includes the cropland, grazing land, forest and fishing grounds required to produce the food, fibre and timber it consumes and absorb the waste it emits. Biocapacity is the total supply of productive area. The difference between Ecological Footprint and Biocapacity shows whether countries are ecological creditors or debtors. http://www.sciencedaily.com/releases/2007/11/071126142905.htm

[3] Costa Rica: 64, Vietnam: 60.4, Columbia: 59.8

[4] ibid

[5] According to a market research officer, figures from the Ikea online blog which counts 70 million active users, there has been an 85% increase in conversations about sustainability over the last 6 months

backgrounds: scientists, engineers, designers (to name but a few). The challenges set are very much of a systemic rather than product nature, making this an appropriate place to begin experimenting with new approaches to the design profession. Students are increasingly interested in finding new approaches to designing, and around half of the students state they applied to IDE because they sense that design has the cross-cutting qualities and the problem solving processes that make it an ideal discipline for addressing the social and environmental challenges before us. We have been looking for ways of nurturing student interest, and integrating new ways of designing into the course.
The first step in this journey was to add 'sustainability' to Innovation, Design and Engineering as one of the core learning objectives. Since 2008, in order to graduate, a student has to demonstrate ability in all four aspects of the course, articulating their position on sustainability in their work, and explaining how their solution responds to that position. Easily done, but measuring and enforcing student response to this challenge proved more complicated. Some tools and methods began to be developed to help students address the complexity and broad possible interpretations offered by the term 'sustainability', aimed at capturing the interest and instilling a sense of responsibility across the whole cohort, rather than simply targeting students with a predisposition for this way of thinking.

### 3.1 A range of tools

There are already many tools to give designers a better awareness and control over the environmental impact of their design decisions. The process being developed within IDE does not set out to replace or improve on these tools, but rather aims to provide a holistic framework in which those tools each have a role to play in different phases of the design process.
The first year of the MA studies in IDE consists of a series of short and intense modules that cover a range of topics aimed at stretching and developing students' skills in each of the four core areas. SustainRCA runs one of the first modules, in which students are asked to design an entrepreneurial response to a specific social or environmental issue[6]. This requires them to deeply research and understand a given brief, and to include in the solution a revenue-generating concept that addresses it in a new way. For many, this is the first time that they have been asked to think about shifting the focus of their design to systems and stakeholders (and the relationships between them) rather than products, and to think about how their solution provides an economic fit into the real world. They are encouraged to look at different business models, and to explore the opportunities offered by technology to increase new ways of achieving the aims of their projects through such ideas as sharing, aggregation, openness, and cooperation. The results of this short intervention are regularly surprising, not only because all students quickly understand the logic of what is required, but how good they are at it. "It just never occurred to me that I could design anything but stuff" [1st year IDE student feedback].
To embed sustainability principles early on in a student's thinking, and to help them to perceive sustainability as a stimulator of creative innovation rather than as a constraint, a set of guidelines has been drawn up. The guidelines help students research and develop their project ideas from the perspective of three parameters: social, environmental and economic, and to explain the resulting logic of their design decisions. Projects had not simply to 'create' responsibly, or to make something 'less bad' but demonstrate a balance between each of these three parameters to varying degrees, beginning with expressing a personal position about their project. During a project's development they are asked to reflect on their objectives and use them as guidance for the design decisions taken along the way.
The three parameters are described as follows:
**Environmental sustainability** asks students to think about how their work relates to the protection and enhancement of the natural environment / biosphere and ensuring that future generations have the same or greater access to resources as current generations. They are asked to consider, for example:

> Materials and the environmental impact of their extraction, processing, use and disposal; different production methods and comparative efficiency; lifecycle analysis of products; recyclability of materials and how this might be affected by manufacturing processes and design decisions (such as combining materials); durability and the impact of lifestyle / product use throughout its lifetime; existing (or required) infrastructure to ensure all of the above.

[6] An example brief might highlight for example: the dependency of our industrial agricultural systems on mined phosphorus, the impact of the cotton industry on the environment and farmers in India, or the increasing detachment from nature in the context of growing urbanisation.

**Ethical/Social sustainability** is about the way people and communities live, behave and connect to each other, and how our design decisions might protect and enhance these. Things to consider are:

Behaviour change – does the work involve steering people away from unsustainable activities and towards more sustainable way of doing every day things? Networks and relationships – do you need to join up sectors of society that might not currently be working together (e.g. businesses, local / central government, individual people / communities, third sector etc?) Health and wellbeing – is the project creating a healthier life and lifestyle? Equality and inclusivity – can it really be used by different kinds of people in the context being addressed? Fair trade –awareness and control of the labour implications of the project? Animal welfare – does the project impact on other sentient beings (i.e. not only humans)?

**Economic sustainability** relates to the commercial sustainability of the idea. For the idea or project to have any lasting impact, students need to demonstrate that it can, in principal, survive and thrive in the real world, usually within the context of a business, enterprise or commercial organisation. While these must ensure that processes, products and manufacturing activities adequately address the two other sustainability parameters, they must also be able to continue to finance them. Students are not asked to create a fully-fledged business plan, but rather demonstrate an understanding of how their idea works in the real world, taking into account the various stakeholders, and where funding might come from to establish and sustain it. They are also asked to look at:

Scalability – if something works on a micro scale, what is needed to reproduce it on a large scale in order to create real impact? Growth – can the idea be sustained over time? What are the other areas is the project connected to? And on an academic level, is economic growth necessary for an idea to succeed and grow?

To avoid back-casting a sustainability position at the end of a project, and to encourage new visual ways of presenting information related to social, environmental and economic factors, an accompanying document was developed that provides indications of different types of deliverable required at each stage of project development. This 'Sustainability Workflow' maps outputs onto a rigorous double-diamond style four-phase project process[7], requiring specific outputs at each phase. [see figure 1]. Each phase corresponds with a different moment of development of the project and requires a different output and approach.

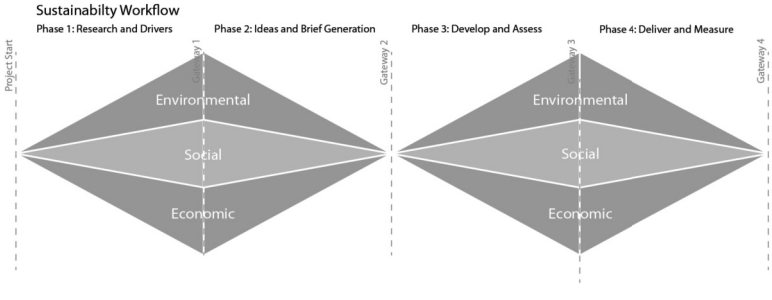


*Figure 1. Sustainability workflow document*

At the end of each work phase students are required to submit an update as to their sustainability thinking which changes according to each phase. They also present the current state of their projects to a review panel that includes a variety of tutors as well as their peers.

## 4 THE FOUR WORK PHASES

**4.1 Phase 1 – Research and Drivers.** Students choose a theme for their project, looking at broad global issues from a 'zoomed-out' perspective. While the project proposal does not need to intrinsically address a social or environmental issue, students are asked to reconnect their social or

[7] http://www.designcouncil.org.uk/designprocess

environmental values to their project ideas. They are asked how they might find a correlation between these values and the ideas they would like to pursue through the project. The deliverable in this phase is almost purely visual - a digital or printed expression of these values using images, annotated with statistics or facts that help them identify the most appropriate direction for their project. Critically, students must stay away from developing solutions and focus simply on exploring the problem.

**4.2 Phase 2 – Idea Generation and Brief Definition**. Students are exploring the design opportunities inherent in an area of interest. They need to zoom in to look at one issue in greater detail and find links to the values expressed in Phase 1 to provide clues to the project brief they are trying to define. They are asked to map out information uncovered about this issue on an A2 board or Prezi (an online presentation tool - www.prezi.com) using key images and statistics in the form of a structure or system to illustrate your project's social, environmental and economic themes, and to begin to get an idea of the stakeholders who might currently be involved. They are asked to support their thoughts about each theme with written explanations, and edit down their thoughts until they have concise statements of the problems and opportunities in these three areas. At this phase, where students may have identified specific products or services essential for the development of their idea, they are encouraged to begin identifying environmental impact through a range of existing software tools such as Sustainable Minds (www.sustainableminds.com/software), a comprehensive and standardized system that allows the designers to credibly estimate, evaluate, compare and track the life cycle environmental and human health performance of products – in the earliest stages of design. Another useful Life Cycle Analysis (LCA) tool is the Eco Indicator 99, a "damage oriented method for Lifecycle Impact Assessment (www.pre-sustainability.com/download/manuals/EI99_Manual.pdf). Standard Eco-Indicators are numbers that express the total environmental load for products or processes. This tool incorporates a membership to a forum where updates and insights can be shared with other users.

**4.3 Phase 3 - Develop/Assess.** Students have identified the brief and are gaining a detailed understanding of the realm of the project. They are encouraged to think about their ambitions for the project and what impact they want to have. They are asked to develop a narrative for their work, showing how their proposed system will be different from any existing ones, including an economic (business) model for how it may be implemented. They are encouraged to use personas to describe how their idea will affect people, and what people are going to do differently. They are also encouraged to explore how their thinking fits with current and forthcoming trends, legislation and standards, and to understand what the variables are and how they could be measured.
With more experimental projects, this is the moment to zoom the vision out to a world-view and connect back to issues of social or environmental significance. This phase is visualised through mapping, exposing a number of barriers to change in the real world; these become the design challenges that need to be resolved through the project. Finally they are asked to reflect on what they may be able to measure with regards to the sustainability objective and how they might do this.
A useful tool that students are encouraged to use include Rupert Bassett and Lynne Elvins' A420 Index, a mapping tool that helps navigate the complex subject of sustainability through the parameters of Financial, Social, Personal and Environmental (www.a420.com/index.htm). Other useful tools in this phase of the project when systems and business models are being addressed, include a whole portfolio of tools provided in the C2C "Innovator's Toolbox" (http://c2ccertified.org/). These include hundreds of Biomimicry strategies for designers that can be examined through the Ask Nature website (www.asknature.org), links to other users in the O2 Global Network of Designers (www.o2.org/) and OpenIdeo, an open innovation platform that shares information and methods for addressing global challenges.

**4.4 Phase 4 - Deliver / measure** – At this stage students should know exactly what the project is about, and have clear design objectives in mind. They must think about which stakeholders they need to engage with to make their project work, and understand (and be able to show how they will measure) the strengths and weaknesses of the three sustainability points of focus. Their final design output should be a scenario in which their system/service or product features.
Real-time CAD based software such as SolidWorks can be used to identify and fine tune design decisions to reduce environmental impact of products, services and processes that have been deployed

(www.solidworks.com/sustainability). A former IDE graduate has created an add-on to the SolidWorks software that allows the designers to visualise and understand the transport implications of products being designed, (www.agencyofdesign.co.uk/projects/manufacturer-to-consumer/) enabling them to make real-time adjustments in form that will help maximize numbers of pieces to be shipped around the world. Another IDE graduate created a tool called The Energy Trump Cards to help designers gain an understanding of the embodied energy used in the manufacture of materials (www.agencyofdesign.co.uk/energytrumps/).

In each of the four phases students have the opportunity to discuss the progress of their work on a one-to-one basis with specialised tutors, who are able to give them feedback regarding the direction of their work. A range of tutors, specialised in enterprise, materials, systems and sustainability are brought in to work with students throughout the process, and other specialists may be called upon for specific needs of individual students and their projects.

Results from the past four years of testing these combined methods have been encouraging, and we are seeing a growing number of enterprising and solution-based projects that address issues of global importance. Feedback and input from students themselves is helping to refine and develop the methods and supporting documentation, which is continuously updated. An insistence on the delivery of visual material has both strengthened the research base of the projects and generated some interesting techniques for mapping and visualising complex information. There is insufficient space in this paper to explain in depth some of the results of the sustainability teaching, but examples include: a bicycle-driven grinding and sorting machine that can be locally built, which enables youth on waste sites in Ghana to harvest copper and pvc from electrical wiring, as a healthier, environmentally cleaner and more lucrative alternative to the current system where the material is burned (www.halwatts.co.uk/Esource); a product/service/system proposal, Natural Disposition, that uses an innovative, environmentally friendly alternative to death and burial process and rituals (http://tinyurl.com/c4bo4pf) and a system for improving the welfare of industrially farmed pigs through a food product made from waste bread, enabling pigs to engage in natural routing behaviour, and a consumer-facing labelling system to allow farmers using the system to connect and communicate with end customers (http://tinyurl.com/97z4o5z).

## 5 CONCLUSION

With a greater emphasis in the curriculum on sustainability within the course, and an offering of specialised modules and tools to do so, IDE has seen a growing interest from applicants who are keen to develop their skills to address social and environmental issues, and to be able to frame them in an entrepreneurial context, possibly reflecting a general shift in attitudes and awareness.

There are some points of learning that are worth underlining as useful to moving students towards more sustainability-focused outcomes. As guidance it would appear to be useful to:

- Structure project work into distinct phases to allow a broad research phase before students start working on a solution
- Require students to explore sustainability issues through extensive visualisation and mapping
- Set sustainability criteria from the outset of a project.
- Offer specialised tutorials throughout the process, and connect students to a wider network of specialists according to their needs

We have passed the limits of our current economic model of consumer-driven material economic growth, and new models of wellbeing are ready to be discovered. There is a need to prepare designers to explore new professional directions and to adapt the way we are training them to do this, preparing them for a new way of working.

We at the beginning of a journey to support this change, and are developing tools and methods to drive it forwards.