

# STRATEGIES FOR TEACHING SUSTAINABLE DESIGN PRACTICE WITH PRODUCT DESIGN STUDENTS

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## **ABSTRACT**

Teaching students how to tackle the issue of producing practical, commercial product designs that respond to the sustainability imperative is an important challenge for design educators at this time. This paper provides clear strategies for this new aspect of product design teaching, breaking down sustainable design practice into six approaches that allow the educator to introduce a spectrum of sustainable design, providing the opportunity to explore the work of practitioners in each area and tools to differentiate their sustainable design basis.

Designing within, for example, an eco-pluralistic philosophy still provides the opportunity for different strategies that would be contradictory if attempts were made to contain them within one piece. Clarifying sustainable design strategies enables designers to then clarify their intentions for different ideas. Understanding the design intent provides a basis for value judgments as to the success of a product within a sustainable design portfolio. This paper suggests definitions for six approaches which can be used by the product design educator as starting points for students in their quest for a sophisticated understanding of designing for sustainable practice.

*Keywords: sustainable, design strategies, life cycle assessment, product service systems.*

## 1 INVESTED OBJECTS – EMOTIONAL, FINANCIAL

This describes an approach to design in which the aim is to ensure that the object is highly valued by the consumer and therefore has a long user life. It is an approach described as sustainable by designers and design educators, such as Dr Simon Jackson (co-author of a book on sustainable design, 'The New Design Nexus' [1]) during his ABC radio interview on sustainable design in 2006 [2] when he spoke of the importance of producing quality products that could last a long time. Similarly, Stuart Walker describes enduring artefacts in his book, 'Sustainable by Design' [3], where objects have an inspirational/spiritual or social/positional dimension that adds value. The term artefact suggests the object is an expression of a culture, and Walker discusses these objects within the context of museum collections. However, an invested object may be a personalized object, such as that made by a child, or with a link to an experience such as with a holiday souvenir, and the opportunity to personalize objects could increase the likelihood that it is kept in use longer. How can consumers be encouraged to keep an object that cannot be personalised to them, to still have an emotional – or financial - attachment, therefore making its useful life longer, and spreading out over a longer period the effect of the embodied energy required to make it?

One example would be that of attaching a designer name to the object. By raising the profile of the designer or maker, or both, additional value is projected onto the piece ensuring that it will be kept in circulation longer. The London based furniture designer Tom Dixon [4] discussed this in his talk at the Gallery of Modern Art in Brisbane [5] when he described two different approaches he had. The first was where he created individual pieces of furniture that could probably more properly be described as investment art. The example he gave was of his 'Fresh Fat' chairs [6], 30 kg of extruded Polyethylene Terephthalate Glycol (PETG) co-polyester meant the chair in question was not on the face of it very environmentally sound, however, his argument was that it was only produced if it was definitely wanted (rather than as a mass produced object that might not be wanted by the time it was produced in quantity eighteen months after initially conceived, then built and distributed), ensuring it is valued, kept and in fact becomes more valuable over time so will therefore be used indefinitely. His second approach was illustrated by his discussion of Artek [7]. After buying the company, Dixon advertised for old Artek chairs that were being used in government buildings such as schoolhouses, then resold them without revamping them but with a badge describing their use since production. By adding a story to each individual chair, he added value and created a relationship between the chair and its new owner to ensure it was kept.

## 2 CURRENT PRODUCTION LIFE CYCLE ASSESSMENT (LCA)

At its most simple level, this strategy accepts the need for 'temporary products'. This strategy embraces the human desire for change and focuses on creating objects that have a limited life span but are designed to take this into account. Chairs made from cardboard, drinking cups from biodegradable or even edible materials are the most straightforward examples of how this philosophy might be utilized. However, the use in production of full life cycle inventory and environmental impact assessment, including recycling and reuse, but still within a current production philosophy, such as used by car manufacturers, could also still be labelled as applying to 'temporary products', as they have a limited lifespan, albeit it as much as forty years or more in the case of a house, for example. The impact of production, use and disposal/resource recovery necessitate a thorough lifecycle approach that has become a science, with the introduction of software and legislation affecting the markets. One interesting aspect of life cycle assessment is that manufacturers such as Ford [8] have identified the use phase of their product as one that they can affect to improve its LCA. They now offer eco-driving school which they claim reduces the environmental impact of their products dramatically. This example in particular illustrates that a full life cycle inventory approach needs to be thorough and include upstream and downstream suppliers if it is to be effective. It is a complex and still much debated area that in itself creates seemingly contradictory outcomes. For example, is it a good idea to transport timber off cuts, thereby burning oil, to a biomass facility to be burnt, releasing CO<sub>2</sub> that offsets the use of oil to create energy? Life cycle inventory and assessment ideally form the basis for all sustainable design approaches, but as with Tom Dixon's Fresh Fat example, the results currently obtained from a straightforward assessment may exclude designs that are still arguably eco design under a different strategy.

## 3 VALUE ADDING: SMART MATERIALS AND TECHNOLOGY

Technological innovation was identified as a means to achieve sustainable design practice by Dr C. Ryan in his book 'Digital Eco-Sense: Sustainability and ICT – A

New Terrain for Innovation' [9]. This strategy works to improve the value gained from raw materials, predominantly through the use of technology, to ensure that materials are fully valued. Smart materials, techno textiles, manufacturing examples such as pulshaping, metal injection moulding, gas-assisted injection moulding and ultimately 3D home printing based on the current rapid prototyping technology, add value and enable more complex, niche market designs to be produced as increasingly bespoke product. It is a technological response to the need for a craftsperson based approach to utilizing materials. In the same way as demonstrations such as the Australian 'Create from a Crate'[10], or the UK 'One tree project' [11] (repeated in Tasmania) show that materials normally discarded by traditional mass production when divided amongst craftspersons and artists can result in even small, or poor quality materials being fully utilized, technologies such as microwave steam bending [12] and laser cutting can be used to improve the value of the same raw materials, such as small pieces of timber [13].

#### 4 PRODUCT SERVICE SYSTEMS

This is a sophisticated strategy that involves the re-evaluation of a product within a holistic thinking approach based on lifecycle assessment tools. It works on the assumption that the company will be ultimately responsible for the lifecycle of that product (as is becoming more legislated e.g. plastic bags) and therefore must rethink how it could provide that product as a service, on a 'cradle to cradle' rather than 'cradle to grave' basis. Cradle to cradle thinking was first raised by McDonough and Braungart [14], then embraced as a business approach in Natural Capitalism by Hawkins and Lovins [15]. Interface [16] are probably the most well known of this new breed of manufacturer, publicly accepting corporate responsibility for their products. Through this re-evaluation, they have changed their business strategy towards providing a product system service for carpeting that resulted in leasing rather than selling the product.

Flexible design is part of this category. The basis of this is to accept, as with temporary products, changing needs and desires, but rather than replacing a product, it is designed so that the product itself can be altered with changing circumstances. For example it can be made larger, smaller, curvier or flatter, with different surfaces as required. This modular approach extends the life of the product to adapt to changing circumstances and therefore extends the life of the piece. This can be a dramatic rather than a small change, such as illustrated in the work of New Zealand designer David Trubridge [17], who creates a range of products from lights to 3D environments with the use of simple shapes joined together to create complex forms. He uses CAD/CAM plywood pieces fixed together with plastic fixings to build flexible curves that are easily transported flat and can be dismantled and rebuilt in a new form as required.

#### 5 BIOMIMICRY

This strand of sustainable design has emerged most notably from the work of Janine Benyus [18] that approaches design from the point of view of natural systems. Benyus offers workshops at the Biomimicry Institute in America to enable designers and biologists to work together to mimic natural systems in order to create design solutions that work with the environment rather than against it. Moving on from the mathematical inspiration of nature (e.g. golden ratio based on Phi, 1 to 1.618), this emerging discipline strives to create effective closed loop systems that are essentially environmentally neutral. An example of a designer successfully working in this area is

Ross Lovegrove [19]. Embracing technology in production and materials Lovegrove, said by the Italian designer Meda [20], to have a 'creative and conscious approach..(which)..reflects an awareness of environmental and sustainable issues' [21], describes his approach himself as contemporary organic design, with nature as a 'sensible and sustainable system that provides answers to several fundamental questions concerning industrial production' [22].

## 6 HOLISTIC THINKING: STAKEHOLDERS AND DESIGN FOR HUMANITY

This refers to socially responsible design strategies that are based on a holistic approach to production, use and resource recovery. It takes into account the effect of design decisions on stakeholders such as landowners, workers' quality of life, the effect on the lives of users themselves and also of the environment. Whilst it could be argued that an LCA approach should encompass this, different weightings in LCA tools [23] mean that this should be considered as an independent strategy. Back in 1918, a Cambridge economist, Pigou [24], suggested that a three part LCA should be used that included a social impact assessment with the monetarisation of external costs such as welfare economics applied to manufacturing. The Institute of Applied Ecology (established 1985 [25]) echoed this in their triple product line analysis of environment, society and economy, which John Elkington in his book 'Cannibals with Forks' [26] consolidated as triple bottom-line thinking into the corporate arena. One of the difficulties in applying this has been the qualitative nature of the input. It is therefore important to recognize this as a separate strategy so that its impact is not diminished as it could be if considered in the same LCA strategy, using other, double product line LCA tools, as current production 'temporary products'.

Papenek [27] suggested that the first world had enough products and that designers should be designing for the third world. Humanitarian, holistic design is a sustainability strategy that considers global social and corporate responsibility. Humanitarian design is not only for the third world, Architecture for Humanity [28] would add to that design for the homeless in America, for example. For this area of design work appropriate technology would be a major consideration in whether or not the design was successful. Freecharge [29], from Freeplay and Motorol, is an example of designing for appropriate technology, with a wind up phone charger that provides 6 minutes of speaking time for 45 seconds of winding. The disaster relief shelters described at the International Union of Forestry Research Organisations (IUFRO) 2005 [30] are another interesting example. These shelters are designed with no connectors for quick disassembly in the face of a hurricane warning, when they can be laid flat and buried. This design work has also attracted the attention of exhibition designers.

## 7 SUMMARY

As currently students are faced with the fact that a rough sawn chair, such as that designed by Natanel Gluska [31], is presented as an example of successful sustainable design in Fuad-Luke's 'Eco Design Sourcebook' [32], yet is in such contrast to the sophisticated work of practitioners such as Ross Lovegrove [33], with his advanced use of materials and production and elegant design, it is apparent that those students and consumers alike will need to be provided with increasingly clear guidelines on which to base their acceptance of these very different products. With a new design imperative to reassess products on a product service system and life cycle assessment basis there will be a growing need for this clarification of sustainable design practice. Differentiation of

sustainable design strategies and discussion of these different approaches with clients needs to be complex enough for sustainable design practice to develop an integrity that can be challenged and defended academically and in the market. This paper provides starting points for design educators to advance this development.

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