Rewarding Learning

AS LEVEL Section A

FACT FILES

Technology & Design

For first teaching from September 2011

For first award in Summer 2012

Influences on Product Design

FACT FILE

tech nology and design

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1.13 Influences on Product Design

Learning Outcomes

Students should be able to:

- Demonstrate knowledge and understanding of:
  - changes in fashion;
  - cultural and social changes;
  - scientific advances;
  - environmental influences (3Rs, sustainability, life cycle analysis).

Course Content

Changes in fashion

Designers must be well informed, not only with current and future applications of technology, but with what has gone before. As a designer you cannot afford to design in a vacuum without external stimulus.

All the objects surrounding us have been designed – this is something intrinsic to our society. A well-designed product is not only characterized by its great practical utility; it also has to convey something more, in order to be attractive and so distinguish itself from the competition. A product's design has to take into account technological innovations, economic conditions, society's changing priorities and the latest developments in art and architecture. All these factors influence design and give rise to constant changes.

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Product design as we understand it today is often traced to the birth of mechanized production during the Industrial Revolution. Before this, objects were made through craft production, where conception and realization were usually undertaken by an individual creator. The advent of industrial processes and the division of labour separated design from making. At the same time, design enjoyed no special status among the many interrelated aspects of mechanized manufacture. It was only through design reformers, such as William Morris, that it acquired theoretical and philosophical dimensions. As a result, the late nineteenth and early twentieth centuries witnessed an extraordinary flowering of design idealism in Europe from the Arts and Crafts Movement to Art Nouveau and the Jugendstil. The unification of design theory with industrial production came soon after, through the efforts of, among others, Walter Gropius.

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Gropius founded the Bauhaus in 1919 in an attempt to both reconcile social idealism with commercial reality and to support the emerging industrial and technological culture. The principles were further developed by the New Bauhaus in Chicago – later named the Institute of Design. The influential fusion of design and industrial civilisation that they promoted became known as the Modern Movement of the International Style. However, by the 1960s the functionalism of the modern movement was being criticised leading to Pop Design and Post-modernism.

Mass production in the 20th century has ensured that good design is available and affordable to millions. The designer has achieved celebrity status formerly associated with fine artists. Charles Rennie Mackintosh, Eileen Gray, Le Corbusier, Philippe Starck – these are some of the names that epitomize 20th century and new millennium design. Their creations, originally intended as functional objects, have become desirable accessories and icons of style, and are now celebrated as works of art in their own right.

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The connection between form and function has been one of the most controversial issues in the history of design. When products were first mass produced in Victorian times they were highly decorated to look like hand-made products, whether their decoration was appropriate or not. The development of 'reform ' groups such as the Arts and Crafts movement gradually brought about change in the concept of design. The form of products was to be simplified and the products well made from suitable materials. At the turn of the 20th century, developments in materials and technology enabled the production of innovative new products such as the telephone. Many of these products were so innovative that there was no benchmark on which to base their designs.

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The development of mass production techniques required that products be standardised, simple and easy to produce. The modernist movement, which supported functionalism, suggested that the form of a product must suit its function and not include any excessive or unnecessary decoration. Therefore, for a product to be mass produced at a profit, it needed to be simple and easy to produce.

For many consumers nowadays, design has become an important means of self-expression. Consumers choose products not just for what they do, but for what they tell the world about their lifestyle choices. Many products are no longer simple, functional artefacts. For example, the purchase of a pair of trainers takes into account many factors such as how comfortable they are but the overriding reason for buying them may be their appearance and branding. Product performance and reliability are no longer real issues for the consumer as most products carry guarantees and are subject to rigorous QA procedures. The main reason for choosing one product from another with similar functions is its aesthetic qualities.

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One of the roles of the designer, then is to provide the product with the right style or image for a particular target market group. Get this wrong and the product will not sell; get it right then it will become an object of desire for aspiring consumers. Now that so many products are mass produced and sold in their millions, the designer must inject a sense of individuality or personality into an object. For example the Italian design company Alessi is famous for its playful design of affordable objects and appliances for the kitchen, using bright and colourful polymers and stainless steel to create contemporary and humorous products.

Cultural and Social Changes

Design and technology have improved the lives of millions of people world-wide. The changes brought about by developments in technology, however, have resulted in far-reaching social consequences.


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The invention of the steam engine by James Wyatt in 1765 marked the beginning of the 'industrial revolution', which fundamentally changed life world-wide. Industrialisation and specialisation led to changes in production, the workforce, transportation and infrastructure. Many new fields of design were needed to accommodate this and the professional designer came into being. Population explosions occurred in towns and cities where production was centred and a new urban way of life was created. More people needed more products and mass production responded to this need. Expensive and time-consuming crafted work could now be replaced by machine work. Products once exclusively for the rich could now be made at an affordable price for ordinary working people.
The modern mass-consumer society is a feature of the affluent developed world where people's wants are satisfied by a continual stream of new products. It is also referred to as a 'throw away' culture with an increasing demand for convenience products such as fast food and over-packaged goods.


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Mass consumerism, as we know it, developed during the 1930s out of popular culture, lifestyle and fashion. This was a time when international commerce and transportation systems developed and, with them, new opportunities for product design such as luxury ships, aeroplanes, hotels, theatres and department stores designed in an Art deco style. Innovative new products and materials were introduced, especially in electrical consumer goods such as radios, refrigerators and washing machines. As people's standard of living improved, their demand for new products increased. Advertising and marketing became an important new industry, using market research, packaging and product styling to sell new products. The design of aesthetically pleasing products, most notably 'streamlining' became an important marketing tool.


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After the Second World War (1939-1945), for many ,there was a period of hardship and very few luxuries as countries struggled to recover. By the mid-1950s, however, a new consumer society was developing. It started primarily in America and soon spread to Europe – the teenager was born. Up until this point young men and women wore the same type of clothes as their parents and listened to the same type of music. The advent of Rock 'n' Roll was to change this and soon teenagers were rebelling against their parents' values and began carving out a style of their own. Design evolved rapidly to meet the expanding needs of the teenage market, incorporating high fashion and consumer goods such as portable radios for the beach and cars, motorbikes and scooters for the increasingly mobile and independent youth culture.

Built-in obsolescence is a method of stimulating consumer demand by designing products that wear out or become unfashionable after a short period of time. First proposed by an engineer working for General Electric in the 1930s, built-in obsolescence had been embraced by a range of industries, particularly in the American motor and domestic appliance sectors by the 1950s.


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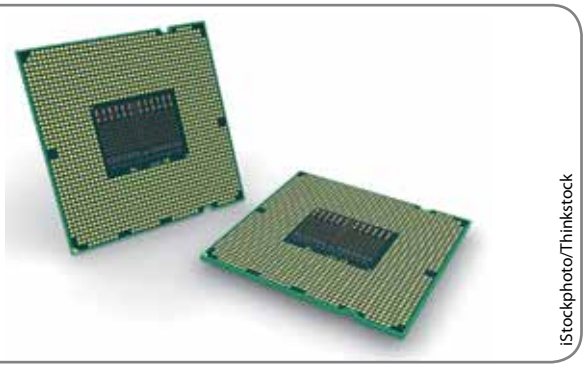
Scientific Advances

In the 20th century, developments in materials and manufacturing technologies, together with changes in lifestyle, revolutionised product design. New materials such as metal alloys, polymers and composites enabled new ways of designing and manufacturing. In particular, the development of digital computers in the 1940s and the silicon chip in the 1960s enabled relatively inexpensive portable computer technology, which transformed modern industrial society.



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The most important technological development in recent years has been in the field of microelectronics. Not only have products reduced in size through technological advances but multi-functional products have become possible. For example, the mobile phone has reduced in size considerably from models first introduced in the 1980s. when most were too large to be carried in as jacket pocket so they were typically installed in vehicles as car phones. The miniaturisation of mobile phones has been possible due to three key developments.

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- Advanced integrated circuits (ICs) or microprocessors that allow more circuitry to be included on each microchip, increasing functionality and power.
- Advanced battery technology including Lithium-Ion rechargeable batteries, providing a lightweight means of storing a lot of energy resulting in smaller and thinner fuel cells.
- Advanced liquid crystal displays (LCDs) enabling colour screens that are brighter and require much smaller current, meaning greater energy efficiency and slimmer housings.

The widespread use of these technologies has also led to advances in manufacturing that have reduced unit costs considerably, enabling low-cost electronic products.
The mobile phone is now multi-functional. It is now much more than a telephone. Communication, entertainment and computing services are converging within the same device, offering substantial choice to consumers. Mobile phones often have features beyond sending text messages and making voice calls. Product convergence has enabled Bluetooth connectivity, Internet access, built-in cameras, camcorders, games and MP3 players to be included on a single device.

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The continued development of smart materials has seen them being applied to a whole range of innovative products and systems where their ability to respond to changes and return to their original state is a real advantage. Some smart materials are:

- Smart glass – used to change light transmission properties of windows or skylights when a voltage is applied i.e. changes opacity from transparent to translucent.
- Shape memory alloys (SMAs) – Used in spectacle frames as the crystal structure of this advanced composite, once deformed, can regain or remember its original shape.

Smart fluid/oils/grease – Used in a car's suspension system to dampen the ride depending upon road conditions, e.g. second generation Audi TT. The fluid contains metallic elements that alter the viscosity of the fluid when a magnetic field is applied.

Environmental Influences

Sustainability means safeguarding the world for ourselves and for future generations, using energy and other resources in a way that minimises their depletion, and designing for a better quality of life. In recent years we have had to rethink our approach to design, materials usage and manufacturing methods by moving towards an approach that considers economic, social and environmental issues and the use of cleaner design technology. These are not simply issues for governments and large companies – how can you contribute towards a more sustainable future?

Life-cycle Assessment.

It is the case with any design decision and solution that an optimum is looked for and a balance drawn between cost and benefit. Balancing the needs against the impact to the environment is becoming increasingly more difficult for manufacturers as they strive to develop new products and processes. Life-cycle assessment (LCA) is a technique now widely used to assess and evaluate the impact of the product or packaging 'from the cradle to the grave' through the extraction and processing of raw materials, the production phase, and life-cycle processes including distribution, use and final disposal of the product.

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Consumers are becoming more aware of environmental issues and expect companies to pay attention to the environmental impact of their products. However, British Standards and the ISO 14000 series of standards now demand continuous improvement in a company's environmental management systems, of which a life-cycle inventory is an important aspect.

A life-cycle inventory describes which raw materials are used and what emissions will occur during the life of a product. The basis of this study is to collate an objective inventory of all the inputs and outputs of industrial processes that occur during the life cycle of a product, including:

- environmental inputs and outputs of raw materials and energy resources
- economic inputs and outputs of products, components or energy that are outputs from other processes

The life-cycle inventory can be expressed as a process tree where each box represents a process with defined inputs and outputs that forms part of the life cycle. The second stage of this process is to interpret the data to assess the overall environmental impact of the product.

Reduce, Reuse, Recycle

Perhaps the most important economic factor for a designer of sustainable products to consider is that waste is lost profit. These are some simple options to consider when deciding how to minimise waste production at the end-of-life stage.

Reduce – For all designers, one of the first priorities for sustainability should be to reduce the quantities of any material chosen whenever possible. Therefore, packaging designers must optimise the amount of materials needed to package a product in order to minimise the consumption of resources, which will in turn achieve significant cost savings and improve profit margins.

Manufacturers are obliged to reduce packaging use under the UK Producer Responsibility Obligations (Packaging Waste) regulations (1997). The Government's Envirowise programme suggests that manufacturers:

- consider the materials and designs they use
- examine ways of eliminating or reducing the packaging requirement of a product
- optimise packaging use, i.e. match packaging to the level of protection needed.

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Reuse – Part of the cyclic factor of sustainable design is the reuse of products, which minimises the extraction and processing of raw materials and the energy resources required for recycling.

A number of companies adopt returnable, or refillable, containers for some of their products, for example the door-step delivery of milk in glass bottles. Refillables appear to offer environmental benefits yet they often require greater use of resources in their manufacture and distribution to enable the to withstand the rigours of repeated use. This initial use of extra resources can be offset by the reuse of the container but only in local distribution and collections scheme. If reuse is to be economically viable then the cost of collection, washing and refilling should be less than producing a new container.

Refillable containers have been one of the most dramatic developments in retailing in recent years, most notably in the reduction of packaging size of detergents and fabric conditioners. Concentrated forms of these products have been realised though technological developments, which has resulted in less packaging per dose of detergent.

Recycle – Essentially, recycling takes waste materials and products and reprocesses them to manufacture something new. Some materials, such as paper and boards, can be made into the same products and others can be made into something completely different such as plastic cups into pencils. Recycling is an important aspect of a modern consumer society with millions of tonnes of waste being disposed of in landfill sites or incinerated, causing environmental concerns.

Metals are ideally suited to recycling as they can be readily melted down and reused many times. The first stage in the recycling process is that the ferrous and non-ferrous metals need to be separated.

Ferrous metals such as steel and cast iron are graded by size prior to being melted down. They have a relatively low scrap value and this can be an issue as it could be more economical to use steel produced from raw materials as opposed to using steel made from scrap. Although there is a case against the recycling of steel on economic grounds it is the world's most recycled material.

Non-ferrous metals, such as aluminium on the other hand, are of more value in their scrap form. These metals are sorted into different materials and are used according to their particular grade.

One of the issues of recycling metal is that in some cases it is very difficult to tell the difference between ferrous and non-ferrous scrap. A drinks can could be manufactured from steel or aluminium and when covered in graphics it is difficult to tell what material it is made from.
The best test in this instance is to check the can with a magnet. Steel is magnetic and aluminium is not. This characteristic is often exploited in the recycling plant. As the material passes along a conveyor belt a large electromagnet separates the metals. Once done, the steel is sent to be melted in an electric arc furnace and the aluminium is sent to a second furnace. It actually takes less energy to recycle aluminium that produce it from bauxite.

Revision questions

1. Scientific advances and changes in fashion can have an influence on the design of products.

   With reference to a product of your choice, describe **one** main scientific advancement and **one** main change in fashion and explain how each of these changes have influenced the design of the product.

2. Cultural and social changes can have an influence on the design of products. With reference to the car, outline **one** main cultural change and **one** main social change and explain how these changes have influenced the design of the car.

3. The challenge for designers is to incorporate the 3Rs when designing sustainable products in orders to minimise their impact on the environment.

   (i) Briefly explain what is meant by the 3RS in the context of product design.

   (ii) Select **one** product and briefly explain how any one of the 3Rs has been incorporated into its design.

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