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## Industrial design

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# INTRODUCTION

## I

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**Industrial Design**, a specialist field of design.

(noun): specific plans, drawings or instructions that contribute to the creation and development of products such as consumer products, transport vehicles, and machines, with an emphasis on product usability; a particular physical embodiment of such plans in a product.

(verb): the process of generating and applying plans, drawings and instructions so as to contribute to product development, usually with manufacturing industry. It can include a wide range of creative and systematic processes.

# THE APPLICATION OF INDUSTRIAL II DESIGN

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Emerging and established technologies provide numerous opportunities to address and re-evaluate human needs and desires. New materials or new communication technologies may even stimulate unrealized needs and desires. Technology needs to be “packaged” if it is to be sold to consumers and used safely and reliably by them. Industrial design is the art and science of packaging technology to make it useful and appealing to consumers - particularly mass markets and it can make a contribution to a huge range of products ranging from toys to railway trains. Even NASA have employed industrial designers to improve the efficiency of the work environments used by astronauts. Mass production requires that a product will sell in high volume. In order to sell, a product must appeal to a sufficient number of people (a market group) by having the requisite attributes, advantages over other products, to induce purchase. Such advantages may include the saving of time and energy in a particular task, financial savings, increased user safety compared with previous models, or the imparting of status through ownership. It may simply be more attractive or give more pleasure in use. An industrial designer is often called upon to act as an interpreter of contemporary culture, in addition to other, manufacturer-oriented, roles.

Industrial designers are rarely required to invent new products. Typically they work with other specialists to develop products such as household appliances and artefacts (toasters, cookers, television sets, computers, and furniture); sports equipment (sailing dinghies, specialist clothing, and racquets); technical equipment (cameras and MP3 players); research equipment (for technical measurement and analysis); and vehicles (buses, trains, cars, and bicycles). They can also be involved in some areas of interior design (such as shop fitting and exhibition design). It is a sign of the importance of the discipline that a wide spectrum of manufacturers seeks to employ industrial designers within a development team—either on a consultancy basis or as staff members.

Industrial design has close links with manufacturing, [materials science](#), [marketing](#), [packaging](#), and ergonomics. The whole product development process is increasingly multidisciplinary.

It is worthwhile for a manufacturer to invest in careful product development before a product is launched on to a particular market. Not investing in product development can result in very expensive failures, such as a product recall because of safety defects, or a general lack of sales. Industrial designers often collaborate with engineering designers in the development of products such as cars, household products or machines. While engineering designers tend to focus on the specification of materials, the strength of components or the tools and processes of manufacture, industrial designers focus on making products pleasurable, attractive and understandable. Those people who exhibit skills of both camps are probably best described as industrial design engineers.

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As a general rule, the more direct the contact a product has with its users, the greater is the opportunity for industrial design to make a contribution. Thus the design, development, and production of consumer products and their packaging fall within the remit of the industrial designer, while car gearbox design or the development of aircraft components is the province of engineers. Increasingly, industrial designers work at the “interface” between people and things, and at the interface between disciplines. Computer software and instruction manuals are good examples of products on which industrial designers may work alongside computer scientists, graphic designers, and ergonomists to develop clear, logical, and usable displays and instructions—that is, the interface (interaction) between users and products.

The profession of industrial designer emerged in the early 20th century. Since 1945 there has been a trend towards specialization. In the motor industry, for example, an industrial designer may be limited to producing concepts for body styling or interiors. In other fields, however, and especially in small companies, a manufacturer may expect an experienced industrial designer to coordinate a wide range of responsibilities, including the design, material selection, packaging, and display of a product.

## METHODS OF DESIGN

### III

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Because the industrial designer operates with many conflicting demands, the methods of industrial design practice are varied. A product may require an expressive form to embody its idea, or a particular texture or colouring (conveying ruggedness or delicacy, for example); it may have to be suited to the physical size of a wide range of people, and it may need to communicate information (such as feedback during use); it is likely that it will need to be easy to maintain and repair; it must be capable of being manufactured economically and at the lowest possible ecological cost; and it needs to be attractive in appearance and price after transport to shops and stores. The working approach and methods of the industrial designer must inevitably address a diverse range of interests and concerns, and, therefore, competing criteria. As a consequence the industrial designer must embody something of the knowledge, sensibility, and

competence of the engineer, the artist, the scientist, the economist, and the sociologist.

Industrial design is a process of resolving conflict. The skill of an industrial designer lies in being able to build appropriate knowledge within a broadly creative strategy and within realistic deadlines. Questioning assumptions can be as important as identifying requirements, since this may lead to genuinely innovative resolutions. This in turn can lead to significant advantages for one company over its competitors.

Most industrial design tasks begin with a brief. The brief outlines, from the client's point of view, the job to be undertaken, with its parameters and timescale. It enables focused discussion to take place between various specialists, and a redefinition of the brief often results after a period of investigation. Many innovative products have resulted from creative interpretation of design briefs. Marketing data, analyses of competing products, and ergonomic research may all contribute to the articulation of a brief.

Industrial designers tend to progress through a series of stages in which the solution (or a number of alternative solutions) is progressively defined with increasing levels of detail. A second feature of descriptions of design processes is that they contain sequences of iterative (repetative) cycles of activities. The construction of tentative proposals is followed by testing, modifying, testing again, and so on. It's for this reason that industrial designers make so many models. Design ideas are quickly modelled in two dimensions (by drawing and sketching) and in three dimensions (in wood, plaster or rigid foam). Such models facilitate examination and evaluation by other specialists, by managers or even by the public (in special "user trials"), as well as by the design team. Following this sketch modelling, further material, costing, or production research is incorporated into the creative development in order to assess the feasibility of the most promising ideas. Only then can robust models or prototypes be built for final evaluation by the client or senior management. A full specification and costing of the product will precede manufacture. Planning and project management are also vital skills. Large corporations such as Sony, the Japanese electronics giant, may have hundreds of industrial design projects running simultaneously.

Computer technology now has a significant role in industrial design and has reduced development time. "Photorealistic" images of proposed products can be generated very quickly for viewing on screen. Digital components can be constructed and assembled in a virtual world. Traditional craft-based ways of modelling and drafting are being replaced by rapid prototyping technologies with which three-dimensional models can be directly constructed by computer-controlled tools from computer-aided design (CAD) drawings. Processes such as stereolithography and fused deposition modelling allow industrial designers to print 3D components that are strong enough to be incorporated into prototype products. In this way ideas are turned into reality very quickly, allowing them to be tested. Computers also support planning, coordination, and interaction between multinational teams of designers, via teleconferencing and sharing of computer files. Virtual reality can even allow industrial designers to interact in a "virtual space" to develop products while they still exist only within a computer.

## THE DEVELOPMENT OF INDUSTRIAL IV DESIGN

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Industrial design is a living and dynamic phenomenon. At any meeting of industrial designers it would be possible to hear very different opinions as to the beginnings of the discipline, the influences on it, and the priorities for it. Nevertheless, two major roots are clear. One is in marketing and the exploitation of industrial design to increase product sales and company turnover. The other, providing a more suitable historical starting point, is more abstract: it concerns the debate regarding human beings' role in a manufacturing society, including the search for appropriate aesthetic forms in a rapidly developing "machine age".

## A Design and Social Reform

The Industrial Revolution of the 18th century and beyond saw a move away from individual production to the division of labour in factories. For the workers the conditions were often dangerous and dirty, and failed to encourage any sense of pride in the output. As for the products, which included furniture, cutlery, and textiles, they were meant to appeal to a new urban middle class, who provided a ready demand for cheap, highly decorated products. In the 19th century, a number of eminent critics and reformers, such as John Ruskin and William Morris, identified clear links between industrial systems of manufacture, various impoverishments of society, and, with reference to design, a lack of critical abilities in manufacturers and consumers. The Great Exhibition held in Hyde Park, London, in 1851 is often used to illustrate this debate, since it presented a variety of artefacts and machines from many countries, which included rational, utilitarian designs alongside the opulence of Victorian manufacturing ingenuity.

Among the British and European reformers the growing belief was that design for industry was a fundamental social concern—an issue for government policy and education. The earnestness of the belief characterizes the "design for industry" debate in the late 19th and early 20th centuries.

The establishment of schools of design (such as the Central School of Arts and Crafts in 1896 in London) was an early attempt to develop critical awareness of artefacts and architecture. The German government encouraged cooperation between applied artists, manufacturers, and retailers through the Deutscher Werkbund (the German Association of Craftsmen, founded 1907), and one of the members of this organization, Peter Behrens, may be viewed as one of the first true industrial designers, as a result of his work with the German corporation AEG. The heated debate in the Werkbund, which continued in the Bauhaus school of design (founded in Weimar in 1919), concerned the relationships between art and craft sensibilities, the exploitation of the machine and new materials, and design for industrial production. The International Style, with its uncompromising forms of architecture (best seen in the work of architects such as Le Corbusier and Ludwig Mies van der Rohe), was an important influence on the emerging profession of industrial design.

The Scandinavian countries, with their established craft traditions and late industrialization, demonstrated how industrial design (furniture, textiles, and consumer products) could blend modernist ideals concerning mass production, appropriate decoration, and directness of form with subtle human factors, a knowledge of materials and marketability. Alvar Aalto (Finland) and Bruno Mathsson (Sweden) are notable for their deceptively simple, functional designs. Particularly worthy of note are the designs for furniture using laminated wood.

Scandinavian style was a major influence in international industrial design during the 1950s.

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Companies such as Citroën in France, Braun in Germany, and Olivetti in Italy developed an enviable reputation for product success in the post-war era, owing in part to their faith in design and its implications for investment, quality, and relationships. Their work has been recognized with numerous international design awards.

## B Industrial Design and Marketing

In Britain and the rest of Europe the Industrial Revolution starkly demonstrated the principle of division of labour. However, it was in the United States that Henry Ford revolutionized vehicle production by the introduction and development of assembly line techniques with his Model T car of 1908. These were rapidly introduced to other fields of industry. Mass production required mass sales and American manufacturers of the 1920s were not slow to recognize the potential of industrial design. While there was a developing market for consumer goods at this time, American companies had broadly similar product ranges, selling at consistent prices as a result of similar manufacturing capability. Additional pressures brought about by the stock market crash in 1929 increased the desire of companies to create an advantage in these highly competitive markets. Companies began to use the skills and expertise of a group of people who had first-hand experience of how to make products sell. These included the window dressers for department stores and the commercial artists who drew illustrations for mail order catalogues. Walter Dorwin Teague, Norman Bel Geddes, Henry Dreyfus, and Raymond Loewy began their careers in this way and established successful industrial design consultancies in America in the 1920s and 1930s through collaboration with major corporations.

The term "industrial design" was first used in this period to describe their work, which focused on consumer products such as cars and other vehicles; refrigerators and cookers; and a wide variety of domestic mechanical and electrical products, such as food mixers and clocks. Marketing advantages came about not only from a product's highly styled, "modern" look but also, often, from distinct manufacturing or assembly improvements and from perceptive insights into usability. Often the industrial designers' products were cheaper to make and easier to use, and greatly outsold their predecessors, thus dramatically elevating the status of the profession of industrial designer. The period is often associated with "streamlining", which involved the exploitation of 19th-century studies of efficient natural forms (such as those of birds and fish). It led to the application of the teardrop shape not only in the outer form of cars, trains and aeroplanes but in the styling of static consumer objects such as toasters and paper-staplers as an emblem of modernity. The resulting derogatory epithet applied to industrial designers of "mere stylist" lingers to this day.

## RECENT DEVELOPMENT OF INDUSTRIAL V DESIGN IN BRITAIN

During World War II the British government successfully intervened in industrial design in order to encourage economy in the use of materials in consumer products. Partly as a result of this experience, the Council of Industrial Design was established and became a model for similar bodies in many other countries. Later to become the Design Council, it provided a focus and a mouthpiece for the promotion of design activity, including industrial design, in Britain. The incorporation of the International Council of Societies of Industrial Design occurred in 1957. During the 1960s the mood was characterized by earnest appeals for the integration of industrial design with engineering, marketing, management, and the relatively new science of ergonomics. Design activity was also seen as requiring academic study. All this led to new initiatives in schools, colleges, and universities. Bachelor of Arts degrees in industrial design were awarded for the first time in the early 1970s. Fuel price rises in the 1970s and growing competition from overseas dictated urgent attention to design, manufacturing, and investment in new technology and marketing. Japanese manufacturers such as Honda (motorcycles and cars) and Sony (audio equipment) came to dominate industries that had been lacking in innovation and investment. Industrial design played an important role in attempting a revival in the face of Japanese and other Far Eastern competitors (such as Taiwan). The 1980s saw some indication of the power of design, including industrial design, as a marketing tool.

Industrial design in the early 21st Century is part of a sophisticated commercial strategy by manufacturers. Many companies employ industrial designers but these are usually employed in multidisciplinary teams. Other companies are serviced by design consultancies who increasingly seek to offer comprehensive product development services including market analysis, concept development, design detailing, support services for manufacture and even marketing and promotion. While many corporations in Europe and the US have moved their manufacturing to cheaper countries such as China and Taiwan most have retained and even enlarged their design and development departments in their home country (for example Dyson in the UK). This is an indication of the importance that design has for the commercial success of an organisation.

As noted above, the traditional industrial designer who was responsible only for the styling of the shell of a product has today been superseded by a new type of industrial designer - someone who is able to collaborate in multidisciplinary teams, who understands the working methods and knowledge of the engineers, the marketeers, the ergonomists, and material scientists. Good industrial designers still exhibit the creativity and inventiveness of old but the knowledge required and working processes that must be adopted mean that creativity must be applied within a highly organized context. Computer based working is now the norm for most industrial designers. Some large corporations share CAD files around the world so that products can undergo development 24 hours a day. Design education has contributed here. Many universities around the world now offer Masters courses, as well as undergraduate courses, in industrial design and their curricula have developed to reflect the changing industrial scene.

Industrial design is still a core activity in new product development. It contributes to the creative identification of new market needs, customer requirements and commercial opportunities. Industrial design provides a catalyst for organisations to generate design briefs which are then creatively transformed into new product ideas and the associated detailed instructions for manufacture.

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**Further Reading**

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