

INDUSTRIAL DESIGN,

art and science involved in the creation of machine-made products by large-scale industry for mass distribution. It is concerned with aesthetic appearance, especially in consumer goods, as well as with functional efficiency. The success of a design is measured by the profit it yields its manufacturer and the service and pleasure it affords its owner.

The term *industrial design* was originated in 1919 by the American industrial designer Joseph Sinel (1887-1975). Initially, industrial designers dealt exclusively with machine-made consumer products. Eventually, however, the scope of the profession enlarged to include the design of capital goods, such as farm machinery, industrial tools, and transportation equipment, and the planning of exhibitions, commercial buildings and packaging.

Criteria.

Under prevailing standards of design, a product should have beauty of line, color, proportion, and texture; high efficiency and safety of operation; convenience or comfort in use; ease of maintenance and repair; durability; and expression of function in terms of form. The relative importance of any of these standards may vary depending on the object. Thus, line and proportion may be more desirable in a sofa than in a tractor, where durability and easy maintenance may be paramount. A consideration basic to all good design is the factor of realistic

cost. Thus, effective industrial design requires, besides artistic ability, combined knowledge of engineering principles and materials, production techniques and cost, and marketing conditions.

Applications.

Industrial design has applications not only in consumer products but in interior building space, packaging, and transportation.

Product design.

Today industrial design has been applied to practically all consumer products, notably to home appliances, such as air conditioners, irons, and washing machines; office equipment, such as typewriters, dictaphones, and duplicating machines; electronic communications equipment, such as radios, television sets, phonographs, and tape recorders; bathroom and lighting fixtures; furniture; hardware and tableware; automobiles; and photographic equipment. Industrial design is applied also to products involved in distribution, such as trucks and automatic vending machines, and to industrial materials and equipment.

The industrial designer must be concerned not only with product design but with the conditions under which products are sold. In planning retail stores and display areas, for example, the industrial designer works with the architect to increase the revenue-producing interior space and to create arrangements and atmosphere conducive to sales. Industrial designers also work to facilitate the profitable operation of railroad stations, airports, hotels, shopping centers, exhibitions, restaurants, public auditoriums, television stations, and offices.

Packaging.

The fundamental problem of design in packaging is to provide all the essential information, such as the instructions for use of the product and the legally required identification of its contents, while fulfilling the broader purpose of selling the product. Because of the current trend toward self-service in merchandising, the importance of packaging increases constantly.

Transportation.

Industrial design has made valuable contributions in the field of transportation. Only the largest industrial-design offices are equipped to design the interior of ocean liners, aircraft, trains, buses, and other public vehicles. The exterior and dynamic characteristics of these highly complex mechanisms impose strict interior design limitations. In jet airliners, for example, interior space must be maximally utilized to increase the payload without sacrificing the comfort of the passengers. In ocean liners space and weight factors are not so crucial. To compete with other forms of transportation, present-day ocean liners are designed to offer service and luxury features not feasible in aircraft, trains, or buses.

Methods.

Every design problem requires special procedures, timing, and techniques, but there is a general routine applicable to all. After the industrial designer is informed of the needs of the client—including data on the intended market for the product, budget allocation, and company policy and equipment—specialists associated with the designer conduct a study of competitive products and an extensive field survey of the manufacturer's plant. A design program is planned, and preliminary designs of the proposed

product are then sketched on the basis of the available plant facilities. Rough sketches are chosen for further refinement and study, and the client is then presented with design studies, often in the form of a small model or of a mock-up. Following the selection of the approved design, working drawings indicating the choice of materials and the specifications for finishing and assembly are prepared. A handmade working model is then manufactured and submitted to the client for approval. In the case of an automobile, for example, one or several are handmade and tested at proving grounds before final machine dies are ordered and production begins.

The industrial designer is essentially the creator of a pattern to guide the operations of skilled persons or machines. The development of industrial design led to the creation of new procedures, such as the method of encasing a product to be redesigned in soft modeling clay, in order that the modifications in the design may be molded directly from the old products. Another industrial-design method is based on the fact that small models do not reflect accurately the design characteristics of the full-scale product. Distortion often occurs in magnification as a result of highlights and shadows that change basic spatial relationships. To view the design in full scale, the profession employs a photographic system in which a small drawing is projected to full scale on a section of a wall. Revisions of the design are then made directly on the wall projection by the industrial designers.

History.

Before the Industrial Revolution, goods were handmade by artisans, who were usually involved

in the whole process of creation, took pride in their work, and often sold their wares directly to the customer. The development in the 18th century of the factory system, with mass production and specialization of labor and the appearance of middlemen, changed the situation. Factory workers tending machines had little involvement with a product and felt no responsibility to the buyer. Factory owners were often chiefly concerned with profits. As a result, although many products, such as cast-iron stoves and building units, were functional, many more were ugly and badly made. Applications of machine-made ornaments in hopes of disguising low quality and pleasing a mass market were usually an aesthetic failure. A few late 19th-century reformers, such as the English designer William Morris and members of the ARTS AND CRAFTS MOVEMENT, (q.v.), protested and advocated a return to the standards of medieval handicrafts. They influenced ART NOUVEAU (q.v.) style and the Vienna Secession (see SEZESSIONSTIL) movement, but these attempts at improved design had little effect on mass production at the time.

The Bauhaus.

The concept of industrial design did not really take hold until 1919, when the German architect Walter Gropius founded the BAUHAUS, (q.v.), an artistically revolutionary school of design, in Weimar, Germany. The Bauhaus became a center for artists trying to combine aesthetic concerns with new industrial materials and techniques, in what became known as the INTERNATIONAL STYLE, (q.v.). They generally advocated simplicity of form that was adapted to

the object's function.

Scandinavian and Dutch designers.

In the prosperous years that followed World War I, industrial design also became important in Scandinavia and the Netherlands. Backed by a long craft tradition, such designers as the Swedes Erik Gunnar Asplund and Sven Markelius (1889-1972), the Finn Alvar Aalto, and the Dane Arne Jacobsen (1902-71) and Hans Wegner (1914-) created simple functional designs in furniture and other goods. In the Netherlands, under the influence of the movement known as de Stijl (see STIJL, DE), such men as J. J. P. Oud and Gerrit Thomas Rietveld advocated clean, sharp, geometric design.

American designers.

In the U.S., manufacturers turned to industrial design as a means of competing in the welter of postwar consumer goods. Many inferior products were characterized by superfluous decoration, imitation materials, haphazard and nonfunctional juxtaposition of components, crude color, and easily marred finishes. The Art Deco style, in attempts to capture machinelike qualities in design, was too often used superficially. In the 1920s the designers Norman Bel Geddes, Henry Dreyfuss (1904-72), Raymond Loewy (1893-1986), and Walter Dorwin Teague (1883-1960) established the first important industrial design studios. They all emphasized beauty in functionalism and stressed the elimination of unnecessary decoration and the simplified rearrangement of components. Among the first products to reflect aesthetic planning were automatic refrigerators, designed by Loewy; cameras and optical instruments, designed by

Teague; and telephone equipment and clocks, designed by Dreyfuss. Following the unqualified success of these first designs, many other designers entered the field, notably Egmont Arens (1889-1966), Harold Van Doren (1895-1957), and Russell Wright (1904-76).

The closing of the Bauhaus by the Nazi government in 1933 resulted in the flight of many staff members, who spread the principles of functionalism throughout the Western world. Mies van der Rohe, Marcel Breuer, and others went to the U.S. The Hungarian-born designer László Moholy-Nagy became director of the New Bauhaus in Chicago and later founded his own school of design. In 1944 a group of leading industrial designers founded a nonprofit association now called the Industrial Designers Society of America to promote the study and practice of industrial design. Inclusion in design collections, such as the prestigious one in the Museum of Modern Art in New York City, has brought deserved recognition to outstanding designers and their companies. A museum of design was maintained at Cooper Union (see COOPER UNION FOR THE ADVANCEMENT OF SCIENCE AND ART, THE,) in Manhattan from 1897 to 1967, when it was taken over by the SMITHSONIAN INSTITUTION, (q.v.) to form the core of what is now the Cooper-Hewitt National Design Museum, located in the Manhattan mansion that belonged to the American industrialist Andrew Carnegie.

Recent developments.

In the 1980s and '90s there were several hundred industrial-design offices in the U.S. and thousands of designers employed by

manufacturing firms. Industrial designers were also firmly established in the economies of Europe, Japan, and many developing countries; Italian and Japanese designers, in particular, exerted a powerful international influence.

Numerous schools offered courses in industrial design. Many national design societies and government councils on design belonged to the International Council of Societies of Industrial Design, founded in London in 1957.

A common concern of the profession was how to adapt new technology, with its benefits and hazards, to human needs. In a fast-growing world economy industrial design was also challenged to find ways of influencing purchasing based on considerations other than necessity of replacement of a product due to normal wear and tear. One trend, which is inherent in the field of fashion where frequency of buying is determined by frequency of change in taste, is known as artificially accelerated obsolescence. This trend became more prevalent, despite strong criticism, and has been seen in other lines of products such as automobiles and large home appliances. Nevertheless, it was found justifiable for disposable products in the health and hygiene industry.

For further information on this topic, see the Bibliography, sections 661. Modern art and architecture, 697. Industrial design.

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