The Industrial Designer—His Role and Purpose

Henry Dreyfuss

The industrial designer has frequently had a hand in the design of communication equipment. How does such a person operate? Henry Dreyfuss, noted industrial designer, discusses his work in this invited article.

There is a man in Detroit who is reputed to have said that one day it will be possible to feed every known curve and contour, every angle and plane, into a computer, and then, by merely pushing the proper controls, produce the design of a new automobile.

It is true that we are acquainted with the mathematics of an infinity of planes and curves —and a computer could doubtless be devised to compose and arrange them scientifically. But what of the human factor of good taste—and the "magic" that lies in the disciplines of the designer to assemble and relate those planes and curves in a balance that is both serviceable and pleasing?

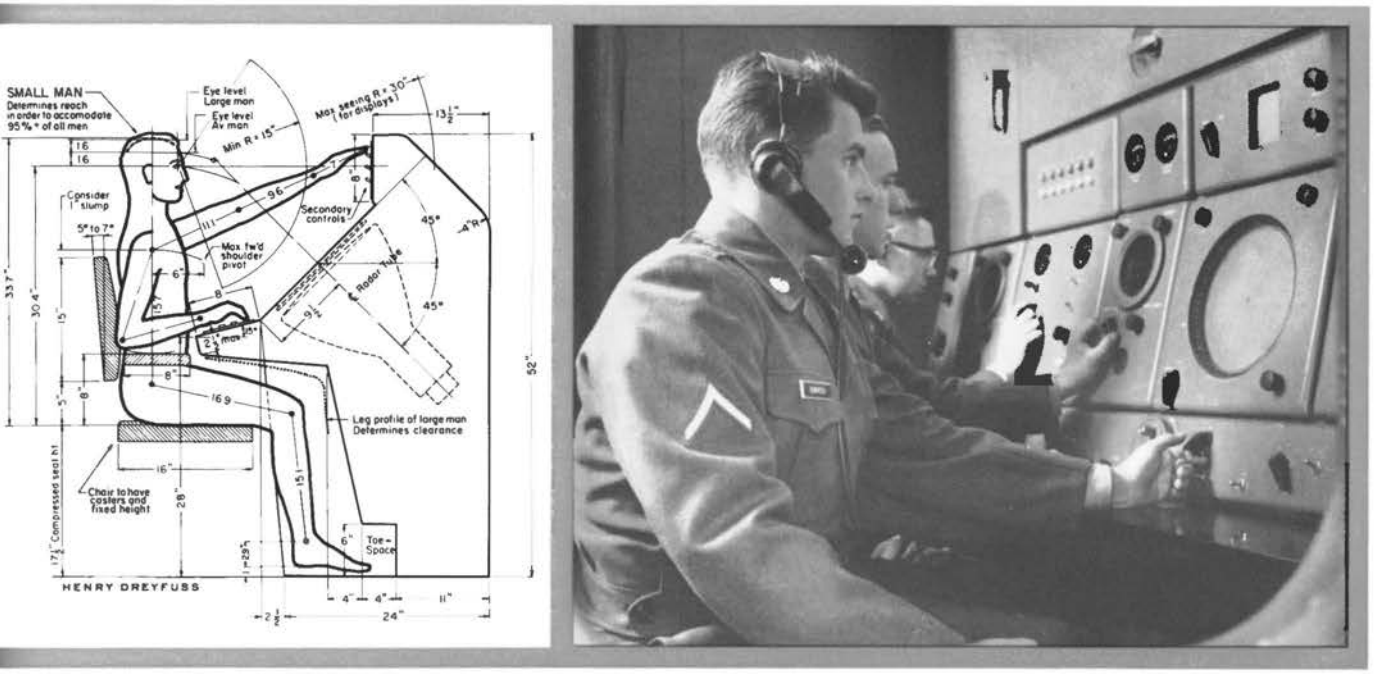
Industrial design cannot claim to be an exact science that can unequivocally prove its merits. Designers must still rely on what they call an "educated hunch"—an intuition resulting from education, experience, research, recognition of engineering problems, understanding of product usage and, finally, a sense of timing.

While the designer is guiding his client in changing a product's appearance, he must be aware of the real danger of being so far in advance of public acceptance that the product is rejected by the consumer! Paradoxically, however, design often begins many years before the product is to be introduced. Therefore, the designer must have an awareness of the pace of change in public taste; then the product will find its natural place in the market at the date of its introduction. The industrial designer must be sure of his ground and have the confidence of his client so that there will be complete accord on design aims.

Purity of design must be everyone's goal, and obsolescence planned solely for merchandising purposes is deplorable. On the other hand, obsolescence resulting from new engineering or technological developments is sound progress, and such advances should be expressed in the design and appearance of the product.

Ideally, when the function has reached perfection, the form is beyond criticism. A very few objects have achieved such excellence—the ball, the wheel, the plowshare are among these, as are some aerodynamic and nautical forms which have been affected by the forces of the elements.

In most cases such extreme simplicity is not possible; many components are needed for the function, and these must be integrated into practical and pleasing forms. Simplicity, however, is



Industrial designers use data from anthropometrical figures (left) in designing consoles such as that shown at right. Console is used in the Nike control van, nerve center of a Nike missile site.

still a constant objective. Beauty, on the other hand, while important, is not a primary objective of the industrial designer. Much more basic to the design process is the enormous concern with the ultimate user of an object.

Except for some few examples that perform entirely unattended, devices in general are used or operated by humans; hence, the industrial designer is preoccupied with human factors. Knowledge of anatomy and of psychology are two of the most important tools he has within his reach. For example, important measurements in the design of a telephone handset are the "modal distance"—the distance from ear to mouth—and the cheekbone clearance. Design for a "solid grip" provides a feeling of security and comfort, while the weight is minimized to reduce user fatigue. However, an experienced industrial designer must not only be acquainted with the anthropometrical figure, but must also be familiar with the pressures each of the body's extremities can exert. In addition, environmental factors, such as the effects of colors and sounds on the senses, are among the many considerations which the industrial designer must respect.

A good design must start with an understanding of the man, woman or child who will eventually use the object. In a broad sense, we say we must fit the machine to the man—not squeeze the man into the machine.

Our work with Bell Laboratories engineering personnel on the consoles for the U. S. Army's NIKE HERCULES system, shown above, is an interesting example of the application of human engineering studies in industrial design. One of the primary problems in developing design criteria for these consoles stemmed from the fact that there were several different companies participating in the contract, and each had its own design philosophy. Consequently, each contractor's design had to be reviewed carefully in its relation to the optimum system that was our objective. We stressed especially the need for consistency in typeface and lettering size, control positions and the manuals relating to the associated displays.

Our earlier work on the BMEWS console was extremely helpful in the NIKE HERCULES development program. For the new system, our goal was to put in front of the operator convenient controls, grouped and located according to related function and sequence of operation. We wanted an uncluttered panel layout to avoid operator confusion and to satisfy all considerations of reach and vision. Also stressed was the importance of nonreflective surfaces, as well as the intensity of illumination of the displays. To reach this end, we made many studies, concentrating on the operator, his capabilities, and his environment. A diagram indicating some of the critical measurements is shown above, contrasted with the actual console in use.

This description is necessarily brief, and no attempt has been made to present all of the human engineering and industrial design aspects of the NIKE HERCULES system consoles. However, the program is of particular interest because it relates to other work that we have done in industry. For instance, the redesign of a turret lathe was comparable in two main areas:

1. MANUALS CONTROLS — These were studied for their location, organization, and handling ease as determined by the human limitations of reach, muscular strength, natural limb motion, speed of action, hand grip characteristics, fatigue and mental habits.
2. SPEED SELECTION AND INDICATION—Here, position, organization, type of information and the needs of legibility were studied in relation to eye level, form and color, maximum reading distance, eye motions, head motions, and color contrast.

On the redesigned turret lathe, shown in the photo below, the controls have been so grouped as to be within the operator's reach without requiring excess stretching or body movement. A comprehensive study of the hand movements required to start the original lathes under normal conditions indicated that sixteen hand movements were needed—the hand movements for starting the redesigned lathe were reduced to only seven. In addition, the operator does not need to move from his normal working position.

The uninitiated may consider the industrial designer's contribution to be a superficial one, similar to the application of cosmetics. Nothing could be farther from the truth. The industrial designer strives toward these five considerations:

1. *Safety and convenience of use*: Protection against loss of life and limb may sometimes require the use of guards, but often better protection can be achieved through placing dangerous components intelligently. The industrial designer tries to make the use of each component obvious, and studies the comfort of the user in his interaction with the shape of a knob or the height of a step.
2. *Ease of maintenance*: This is often overlooked. It is essential that repairs be easily made. All parts must be readily accessible, easy to clean and oil. To the ultimate user, it is just as important to be able to remove the dust from the vacuum cleaner quickly and neatly as it is to be able to change the engine nacelle on a jet airliner expeditiously.
3. *Cost*: Industrial designers have been accused of reading cost sheets with more understanding than they show when they scan a blueprint! It is, however, pointless to produce a product which will prove so expensive that no one can afford it, or so underpriced as not to permit a reasonable profit to the manufacturer. Good design need not increase cost.
4. *Appeal*: This can best be interpreted as quality — the elusive, indefinable attribute that can sway a person to *want* the product. Realistically, it is the difference between the "feel" of closing the door of a Model T Ford and that of a Cadillac—the satisfaction of operating a well-designed control rather than a poorly engineered one.
5. *Appearance*: This item is placed last on the list, because if the preceding goals have been achieved, the product will automatically approach good appearance. It is then left to the industrial designer to apply his knowledge of line and form, proportion, texture and color, and integrate them into a pleasing whole.

Turret lathe, redesigned on basis of human capabilities and limitations, reduces operator effort.

The industrial designer is often found in unexpected places. He has contributed to the development of farm machinery and oil well drilling rigs, to industrial machinery, meters and valves, and to every form of transportation. He has been applying himself extensively to the improvement of the control centers and ground equipment systems that monitor our rockets and missiles. He is employed in government defense efforts on items as varied as the interiors of armored tanks and the capsules that will eventually land man on other planets.

The story is told of the industrial designer who was in his client's showroom, observing reactions to a newly produced tractor. A farmer and his wife were circling the machine and the farmer said, "If that works like it looks, I think we'd better have one." The designer had succeeded in

Each of the variety of telephones shown was designed to perform a specific function. The variety itself indicates the need for the industrial designer as an important member of the development team.

one of his most important functions—to reflect outwardly the excellence of the engineering, the capabilities of the product and its safety and comfort, and had visually conveyed the integrity of the manufacturer.

Raising the level of public taste must be one of the prime responsibilities of the manufacturer. He is abetted in his efforts by both the engineer and industrial designer. The taste-setting potential that exists within the area of the telephone, for example, is incalculable; no other product reaches so many people so often. The frequently-used residential telephone instrument alone has an enormous effect on public taste. Not many years ago the telephone was a necessity grudgingly accepted on an office desk and often hidden in polite homes. Today this essential apparatus is a decorative accessory which has influenced design and color trends. Its function approaches perfection, and the telephone has become a vital part of our lives.

In this sense, Bell Laboratories is a leader of public taste, possibly as much so as in scientific development. Long before industrial design was considered one of the important factors in manufacturing—perhaps before the average man knew what the term meant—the men who were then directing Bell Laboratories had the foresight (and the courage) to seek industrial design aid, and selected our organization. The long-term association has been an exceptional example of exchange of influence. We have profited by the patient understanding and explanations of the engineers, and our efforts hopefully have guided their understanding of the philosophies of industrial design.

It has been our experience that close coordination between the industrial designer and the engineer, from the conceptual stage until the product is released for manufacture, can produce the optimum result. Over the years a mutual respect has developed between the engineer and the industrial designer. The former is rightfully preoccupied with the details of "making it work," and his collaborative industrial designer brings to the problem his "educated hunch" plus an objective outside point of view.

When the engineer automatically applies the precepts of human factors and good taste to his efforts, and when the industrial designer becomes knowledgeable and sympathetic to the problems of engineering, an additional dividend results from their association, to the benefit of the consumer or user, the ultimate judge of all products.