

# ERGONOMICS

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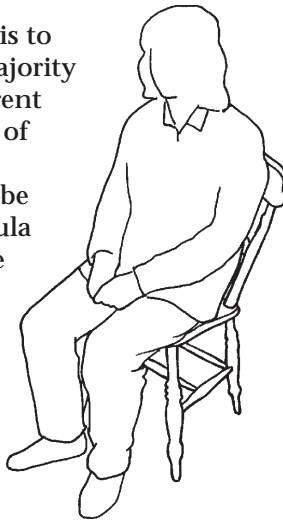
Any engineer designing a product or a system will require exact information about materials, structures, tolerances, power and the capacities of various components, and how to combine them when trying to meet a specification. However, in the past designers relied on common sense when considering the needs of the people who would use and operate the products and systems they designed. The study of people in order to design products and systems which are better adapted to human capabilities is known as **ergonomics**; it is a relatively new science.



**Ergonomists** are employed to improve efficiency, reliability and safety. They aim to improve the design of things, such as control panels, to make them easier for people to use. An ergonomist would carry out detailed experiments to ensure, for example, that information is presented in the most appropriate way; that controls are placed within easy reach and that the force required to operate the controls is in relation to the accuracy required. Ergonomists are also concerned with the environment: the level of lighting, temperature and noise; as these are all important factors in creating good working conditions.

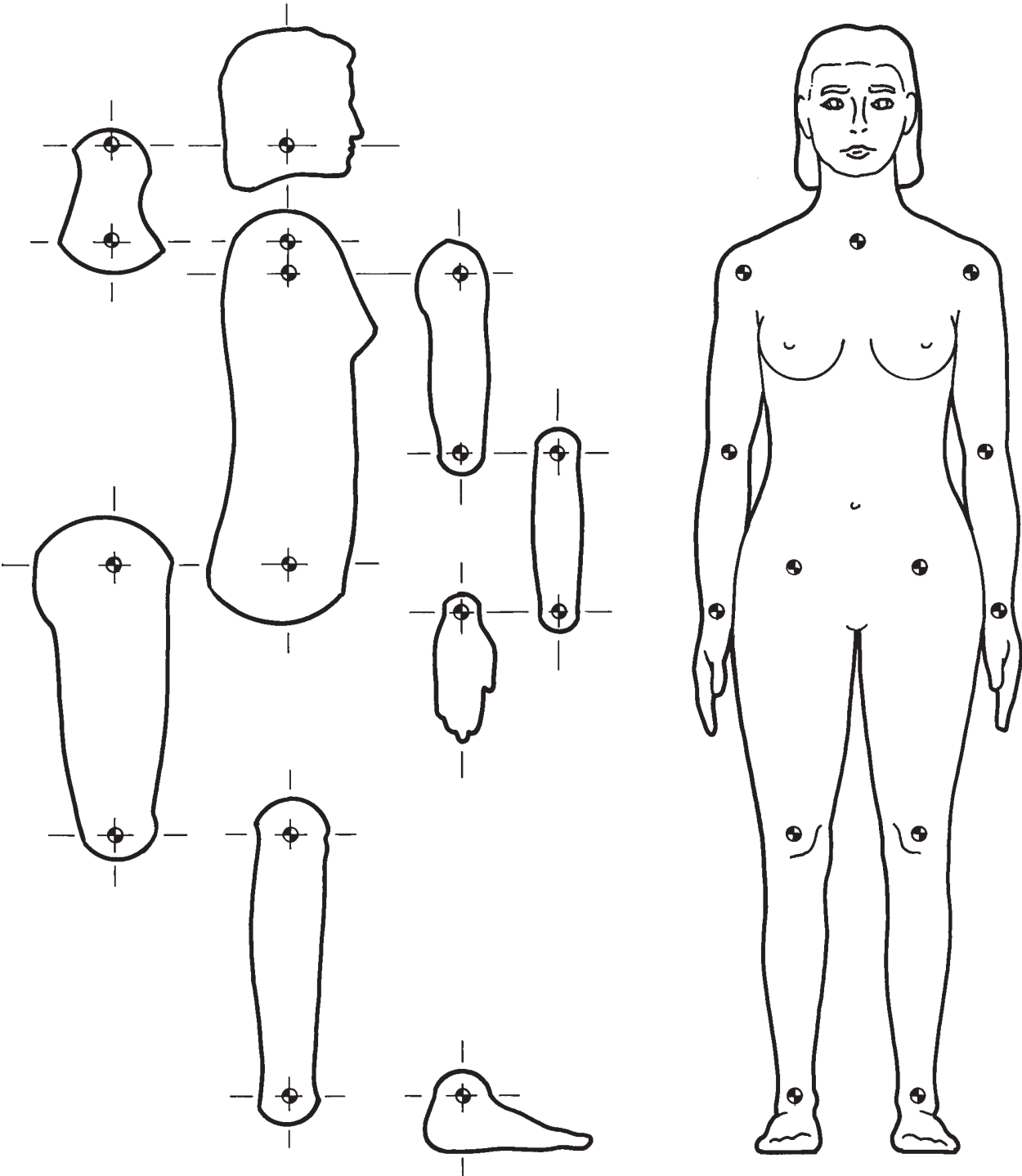
As well as trying to improve the design of new products and systems, ergonomics is also used to improve the efficiency of existing ones. It is very important to ensure that people who spend a long time in the same position do not develop painful and crippling problems such as repetitive strain injury (RSI). Computer operators, for example, sit for long periods repeating very simple movements. One way of solving the problem might be to design a better chair. Most chairs are like the ones you sit on at school, they cannot be adjusted. We have to adjust ourselves to fit the chair, this results in fidgeting, discomfort and loss of attention. Ergonomic designers believe that adjustable chairs would be better. If the operator were more comfortable, efficiency would be improved and there would be less chance of injury. To meet this need engineers have produced fully adjustable chairs, they have up to 150 moving parts and come with a user's manual for the owner!

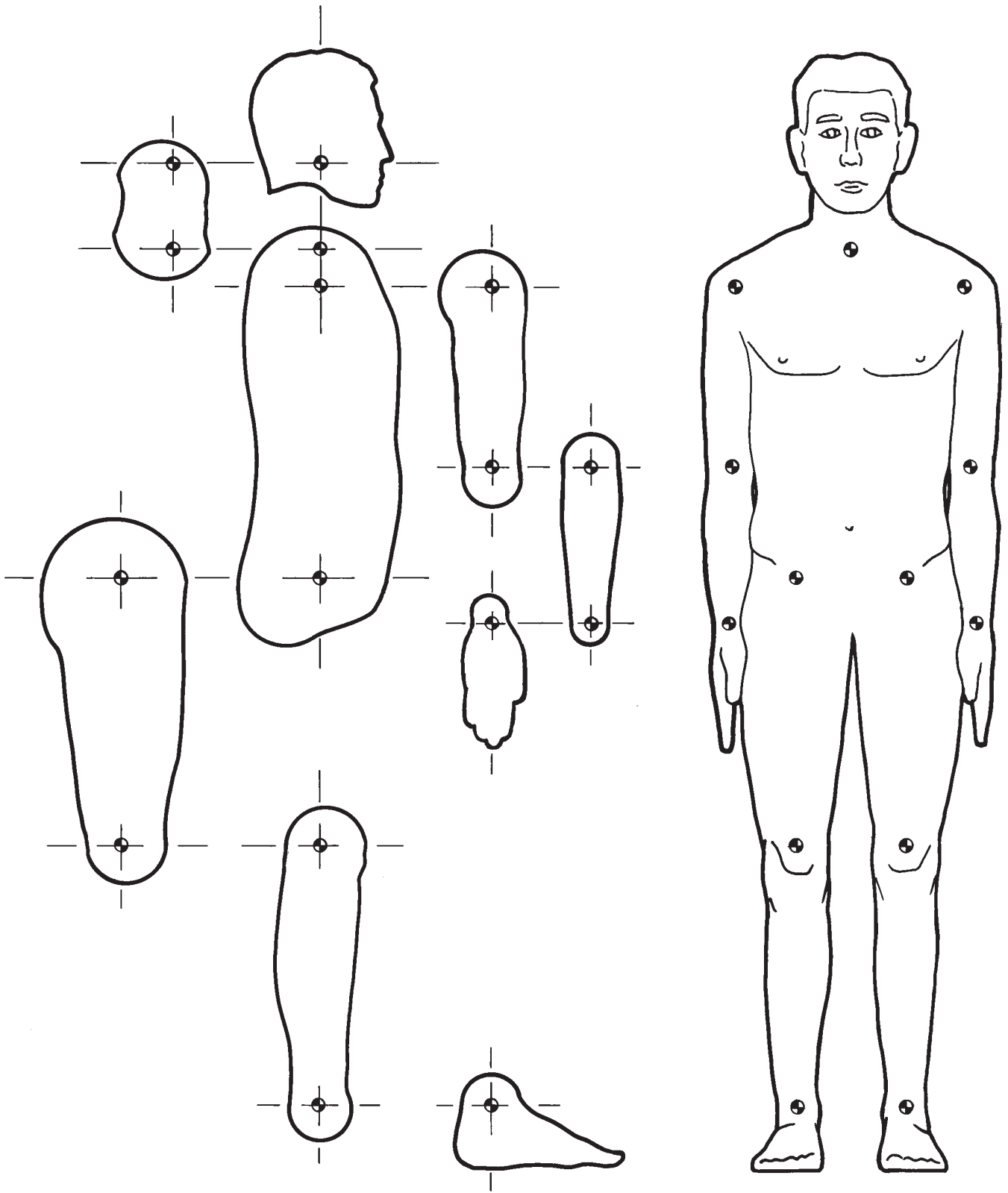
The challenge for designers and engineers is to design things which can be used by the majority of the population. Because we are all different this often means providing a limited form of adjustment. The driver's seat in a car has a number of adjustments which allows it to be customised by each driver. It is only Formula One drivers who have cockpits tailor-made to their own measurements!

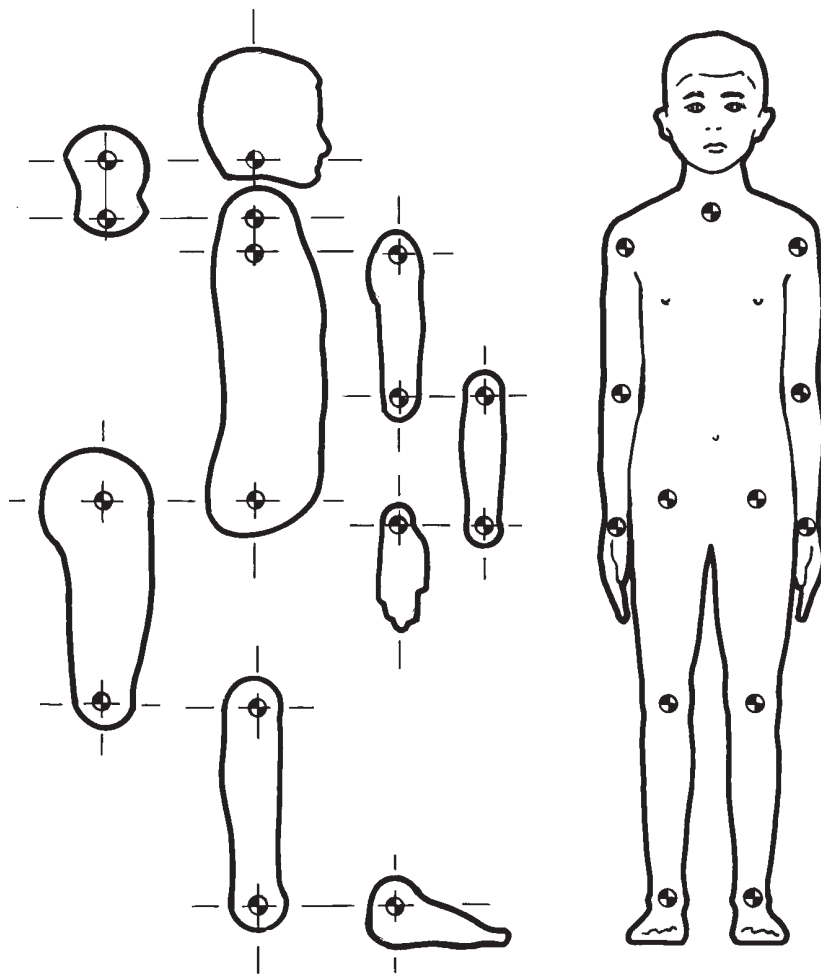


Knowing the measurements of the person or persons for whom you are designing is key to successful design.

**Anthropometrics** is the scientific study of the measurements of the human body. **Henry Dreyfus**, an American industrial designer, pioneered the gathering of this information; he called it human engineering. He was concerned about extreme dimensions as well as the average ones, as people come in all shapes and sizes. In addition to producing charts of the average anatomical sizes of every conceivable part of the body, he also gathered information on every conceivable aspect, such as: the amount of pressure the average foot can comfortably exert on a pedal; how hard a hand can effectively squeeze; the reach of an arm. All this information provides a very detailed picture of the average man and woman. Dreyfus called these average adults **Joe** and **Josephine**. In addition he created Joe and Josephine junior, average six year olds.

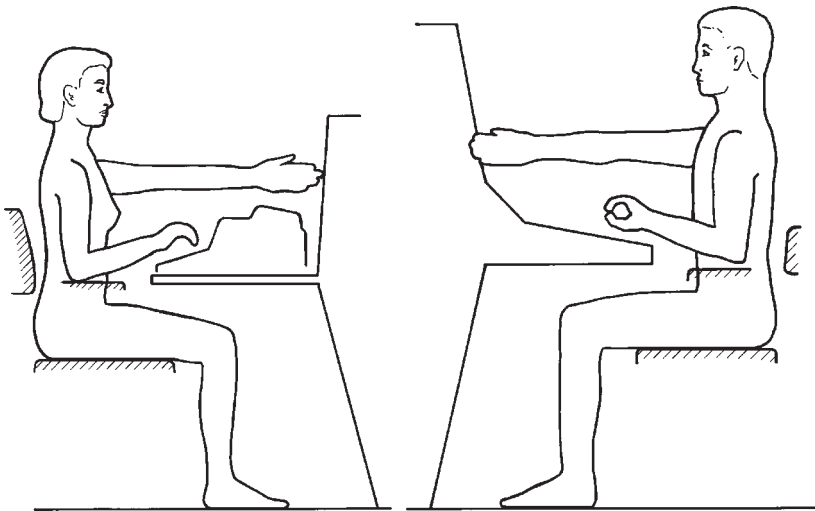






However, ergonomic data differs between races, and changes with time. For example, some Asian races were traditionally smaller than western races. British manufactures exporting beds to Japan had to make smaller beds than those they sold in Europe. However, with improved diet, mainly increased protein intake, these races are quickly catching up. Most races are gradually getting bigger because of both better diet and health care. Look at the doorways in old houses, nowadays many people have to bend down to get through them. Currently the average size of a British male is 1753 mm and the average women is 1626 mm, four hundred years ago the average height was at least 250 mm less.

Ergonomic information can come in the form of charts, line drawings or models with pin joints, known as *ergonomes*. If you copy the line drawings in the handbook onto card you can make an ergonome. Paper fasteners or eyelets can be used to make rotating joints or alternatively, use drawing pins and a board. An ergonome can be used to investigate the size and layout of things you are designing, like the drawings of the console/desk. If you do this you must make sure that the drawing and ergonome are to the same scale!



Models both scale and full-size could be used to investigate the layout of a working environment. A kitchen is a working environment and the position of the sink, cooker, fridge and work-surfaces to one another will affect efficiency. In industry people's movements are recorded using such techniques as time-lapse photography, lights attached to limbs to record movement and electronic probes fitted to prototypes. In a commercial kitchen good organisation and layout are even more important. Look at what goes on behind the counter, next time you buy a hamburger. Ergonomists have evolved a highly efficient layout so that your order is produced in the shortest possible time and is of the highest quality.

The British Standards Institution provides ergonomic information in relation to a wide variety of things. It produces a compendium for design and technology (PD 7302) which contains much useful data. For example:

- dimensions in designing for the elderly;
- design of housing for disabled people;
- play equipment for outdoors installation;
- educational furniture;
- office furniture.