Unit 1- Man-machine relationship and Operational designing and its relationship with human factor

Human factors are a system concerned with the relationship among human beings, work place or work environment and machines. All man-machine systems are produced with some objective in view.

This objective is always well defined and the system is designed so as achieve the objective as successfully as possible. In view of this the operational functions of both the components and constituents i.e. man and machine should be clearly defined. There is one another aspect of man-machine system which, though not strictly a part of it effects the system performance to a great extent. This is the system environment or what we call as working conditions. The proper integration of man and machine, which is beneficial for human operator and enhances the overall system performance, is a primary aim of the ergonomics discipline.

1. Characteristics of Man-machine System Are as follows:

(1) The man-machine system consists of the man, the machine and system environment.

(2) It is essentially artificial by nature and is specifically developed to fulfill some purpose or specific aim.

(3) It has specific inputs and outputs which are appropriately balanced.

(4) It is variable in size and complexity and is dynamic in performance.

(5) Subsystems of man machine system interact with and effects the other parts.

(6) The man-machine system becomes more efficient when inputs and out puts are adequately balanced.

(7) Environmental factors or system environment effects system performance.

Depending upon size and complexity, man machine systems are of following three types:

(1) Manual Systems:

They are essentially man directed systems. These are flexible in nature and small in size. Simple tools and equipment are used and the efficiency is dependent upon the human factor. A large variability is possible in a manual system as every worker may select different method to do the same job.

(2) Mechanical Systems:

They are more complex and inflexible in nature than manual systems. The machine component is power driven and human activity is information processing, decision making and controlling occasionally knows semi automatic systems, they have components which are well integrated. This is the feature which renders these systems rather inflexible. An automobile and a machine tool operated by driver or operator are good examples of his class.

(3) Automatic Systems:

A complex system in which all operational functions are performed by automatic devices is known as automatic system. Operational functions are sensing information processing decision making and action. It is completely inflexible in nature and cannot be adopted to uses other that the one for which it has be designed.

The human element/component performs the jobs of monitoring, programming the function, maintenance and up keep. An automatic telephone exchange, a digital computer and automatic screw cutting, machines are good examples of automatic systems. A perfectly reliable automatic system does not exist at present.

Operational designing and its relationship with human factors

An operational designing is one which can be accessed and used by everyone, irrespective of their age, ability or gender. In order to achieve the designers need to be aware of people's differing abilities and widen the user group they design for. Inclusive facilities do not just mean buildings but relate to all elements of the surroundings including public open spaces which also serve to link different parts of the built environment together.

For example, **the entrance of a new building** should be accessible to everyone irrespective of their age, ability or gender. Where an existing building is to be altered every attempt should be made to make the main entrance accessible. If the building is listed, reasonable adjustments should be considered in the same way as for other buildings.

ACCESSIBLE ENTRANCES

● it should be clearly signposted and should include the international symbol of access, from the edge of the site, and the principal entrance if this is not the accessible entrance.

● Any structural supports at the entrance should not be a hazard to visually impaired individuals.

● It Should have a level landing at least 1500mm by 1500mm clear of any door swings immediately in front of the entrance and be of a material that does not impede wheels.

● Door entry systems should be accessible to deaf and hard of hearing and people who cannot speak (e.g. LED display and induction couplers fitted) 1400mm is the upper height limit.

● It is important that where practical the principal entrance to a building is inclusive and the following should be considered: the prominence of the entrance, the type of the threshold to allow convenient access, the ease of operation of the door, and the provision of an overhead canopy should the door require to be kept locked.

Concept of "Fallacy of an average man" in Designing

Operational designing aim to give inclusive design that seeks to provide an environment which addresses everyone's varying needs. To do this, designers should involve potential users at all stages of the design process; from the design brief stage to the detailed design. When a product or a machine is design based on the measure of average man, it fails to fit people who are not in the average range that is tallest and shortest. During the World War II, the US Air Force expanded rapidly accompanied with a decline in performance and a rash of deaths even during training. The high death rate in the Air Force was a mystery for many years, but after blaming the pilots and their training programs, the military finally realized that the cockpit itself was to blame, that it didn't fit most pilots. At first, they assumed it was just too small and that the average man had grown since the 1920s, so in 1950, they asked researchers at Wright Air Force base in Ohio to calculate the new average.

One of these researches was a young Harvard graduate named Gilbert S. Daniels. In his research measuring thousands of airmen on a set of ten critical physical dimensions, Daniels realized that none of the pilots he measured was average on all ten dimensions. Not a single one. When he looked at just three dimensions, less than five percent were average. Daniels realized that by designing something for an average pilot, it was literally designed to fit nobody.

Revisiting the thought experiment that we had at the start, being a lead designer and now knowing the **Average User Fallacy,** how should you go about optimizing your design? In an ideal world, not constrained by resources, the solution would be to custom fit every person with their own set of measurements. But the real world is never that simple. You are always bound by constraints

and need to strike a balance. On the one end, you have witnessed the horrors of designing for the average and on the other hand custom fitting everyone is unattainable.

Average user fallacy is not ubiquitous. For example, if you are designing a chair, a car seat, a modern cockpit, you are not restricted to fixed dimensions. You use levers and other mechanisms to allow multitudes of body dimensions to access them comfortably. These dynamic systems let users navigate it seamlessly through its continuous design space. But there are certain designs that are inherently subjected to average user fallacy. These systems have certain rigidity within them that render them incapable of dynamic adjustments.

One perfect example is the dress. Once bought, the size remains fixed. So, the dress manufacturers based on their motive to maximize the profit, try to reach as many people as possible while still reducing the different varieties in sizes that they have to produce. This leads to the system of making clothes in distinct discrete intervals marked by S, M, L, XL etc and thus solving the average user fallacy problem.