ERGONOMICS & AESTHETIC CONSIDERATION IN DESIGN

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Content

- Ergonomics of Design.
- Man-Machine relationship.
- Equipments for control.
- Ergonomics considerations in design of controls.
- Equipments for display.
- Ergonomics considerations in design of display.
- Aesthetic considerations regarding shape, size.
- Morgan’s colour code
Ergonomics

Definition:

Ergonomics is the process of designing or arranging workplaces, products and systems so that they fit the people who use them.

- Ergonomics is the study of the interaction between people and machines and the factors that affect the interaction.

- Its purpose is to improve the performance of systems by improving human machine interaction.

- This can be done by ‘designing-in’ a better interface or by ‘designing-out’ factors in the work environment.
Importance of Ergonomics

- Increased employee satisfaction
- Increased productivity
- Decreased musculoskeletal injury
- Decreased fatigue & tiredness
ERGONOMICS - IMPORTANCE

- Work Related Musculoskeletal Disorders (WMSD) are fastest-growing injury category

1997 study of 420 medical secretaries

- 63% reported neck/shoulder pain
- 51% low back pain
- 30% hand/wrist pain
Principles of Ergonomics

- 1- Neutral Postures. The neutral posture refers to the human body aligned and balanced.
- 2- Reduce Excessive Force.
- 3- Keep Things Easy to Reach.
- 3- Work in Power or Comfort Zone.
- 4- Reduce Excessive Motion.
- 5- Reduce Static Load.
- 6- Minimize Pressure Points.
- 7- Provide Clearance.
Neutral Posture

Awkward Postures
- Back Flexion
- Back Extension
- Twisting about Waist
- Lateral Bending
Dangers of Sitting All Day, Every Day

- Foggy brain
- Strained neck
- Sore shoulders and back
- Heart disease
- Overproductive pancreas
- Colon cancer
- Weak abs
- Disc damage
- Tight hips
- Soft glutes
Screen should be free of glare and should tilt and pivot.

Upper Back

Lower Back (support lumbar curve)

Sitting Bones (distributed pressure)

Thigh Behind the Knee (distributed pressure)

Arms (minimal bend at the wrist)

Area Behind the Knee (not touching seat pan)

Feet (flat on floor or footrest)
Ergonomic Design Consideration In Relation To Work

Display Design

- Display is a device that provides information about a situation which has already or is just occurring.
- Display provides both prime and secondary information needed by operator in carrying out required action.
- Design gives either static or dynamics information, in which dynamic information changes over the time. E.g. Traffic signal.
Design of controls

- **Hand Lever:** it provides quick control for large force and with this fine adjustment is difficult to achieve. These are only suitable for on-off or strap-up, step-down type of operation.

- **Hand Wheel:** it provides controlling torque by using any or both hands in case of heavy loads with good accuracy of adjustments.

- **Knobs:** These are used for light load applications with fingers or hands and are generally used in instrument control panels.

- **Push Buttons and Switches:** These are used for light loads and are usually operated by one finger.

- **Foot Pedals:** These are used for repetitive actions where cycle time is very short and are employed in sitting position of the operator.
1. Control Display Ratio (C/D Ratio): The CD ratio is defined as the ratio between the movement of control device and the moving element of the display showing or representing the control movement. It should be obvious that this relationship shall be of considerable importance to the operator operating the control.

2. Directional Relation in Control and Display: There should be correct relationship between the direction of movement if control and that of the moving element of the display. If the control moves clockwise the pointer should also move clockwise.

3. Control Resistance: The force offered by the control to the intended movement is known as control resistance; it is offered by the control and keeps a relation with the resistance offered by the device being activated by the control.

4. Operational Coding of Controls: Coding means the technique of conveying information quickly may be through colours numbers or letters etc. controls are required to be coded in order to identify them so as to reduce the overall operational time. Effective methods of control coding are to regulate/control their size, shape, method of operation, position colour and labels.
Working Conditions

- Working Premises
- Good House Keeping
- Lighting
- Anthropometry: is the branch of ergonomics that deals with body shape and size.
Aspects of Aesthetic Design:

1. Shape: Shape (form) is the image presented by the outer surface of an object or structure. There are 05 basic types of the products namely,

- **Step form**: structure having vertical ascent. Ex. Multi-storey building.
- **Taper form**: It consists of tapered blocks or taper cylinders.
- **Shear form**: It has a square outlet.
- **Streamline form**: It has a streamlined shape having a smooth flow as seen in automobile and aeroplane structures.
- **Sculpture form**: It consists of ellipsoids, parabolise and hyperboloids.
2. **Colour**: Colour is one of the major contributors to the aesthetic appeal of the product. Many colours are linked with different moods and conditions. Morgan has suggested the colour code given in table.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Danger, Hot</td>
</tr>
<tr>
<td>Orange</td>
<td>Possible danger</td>
</tr>
<tr>
<td>Yellow</td>
<td>Caution</td>
</tr>
<tr>
<td>Green</td>
<td>Safe</td>
</tr>
<tr>
<td>Blue</td>
<td>Cold</td>
</tr>
<tr>
<td>Grey</td>
<td>Dull</td>
</tr>
</tbody>
</table>
3. **Continuity:** A product which has good continuity of elements is aesthetically appealing. For example, a fillet radius at the change of cross section adds the continuity to the product, and hence improves the appearance.

4. **Variety:** Variety is particularly useful while marketing the range of products. The variety relieves the user of the boredom. For example, in consumer appliances, the functionally identical products are manufactured in a number of varieties by a single manufacturer.

5. **Proportion:** Proportion is concerned with the relationship, in size, between connected items or elements of items. The product which is out of proportion is not aesthetically pleasing.

6. **Contrast:** Contrast is a distinction between the adjacent elements of the product which have clearly different characteristic and functions. The contrast improves the aesthetic appeal of the product.

7. **Impression and purpose:** The product not only should look nice but also should look as if it will work. The product should give the impression of the satisfactory performance or purpose.
8. **Style**: Style is a visual quality of the product which sets it apart from the rest of the functionally identical products. Good style will skilfully reflect a current public mood, which may be influenced by the technological developments, or by a prevailing social or environmental climate.

9. **Material and surface finish**: The material and surface finish of the product contribute significantly to the appearance. The material like, stainless steel gives better appearance than the C.I., plain carbon steel.

10. **Tolerances**: Proper tolerance of the mating parts improves the aesthetic appeal of the product. Unwanted clearance or interference hampers the aesthetic appeal.

11. **Noise**: Unwanted noise is disturbing and is suggestive of some malfunction within the product, and hence it greatly reduces the aesthetic appeal.
1. The appearance should contribute to the performance of the product. For example, the aerodynamic of the car will have a lesser air resistance resulting in lesser fuel consumption.

2. The appearance should reflect the function of the product. For example, the aerodynamic indicates the speed.

3. The appearance should reflect the quality of the product.

4. The appearance should not be at too much extra cost unless it is a prime requirement.

5. The appearance should be achieved by the effective and economical use of materials.

6. The appearance should be suitable to the environment in which the product is used.
Important questions

1) Define Ergonomics.

2) List with examples five basic forms for the shape of Product.

3) List the types of controls.

4) List the types of Display.

5) Explain the relationship between functional requirement and external appearance of the Product.

6) Explain the scope of ergonomics in product design.

7) Explain the meaning of different colours as per Morgan’s code.

8) Explain man – machine joint system.

9) Explain the ergonomics considerations in design of controls.

10) Explain the ergonomics considerations in design of Display.

11) Briefly list and explain Principles of Ergonomics