Importance of Ergonomics in designing workplace

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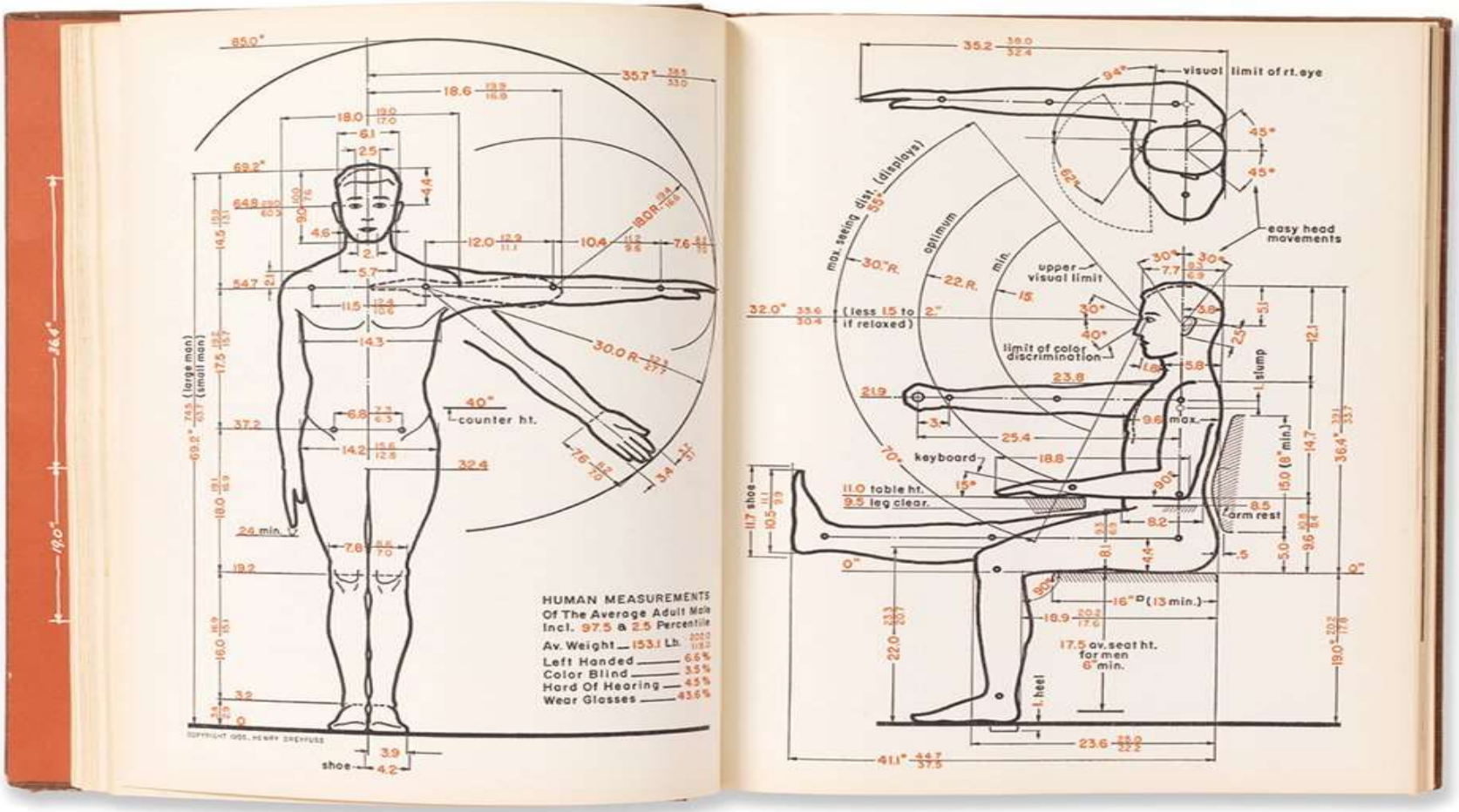
Anthropometry



Anthropometry

- Anthropometry (from Greek ‘anthropos’, human, and ‘metron’- measure) refers to the measurement of the human individual.

- Anthropometry involves the systematic measurement of the physical properties of the human body, primarily dimensional descriptors of body size and shape.

- Today, anthropometry plays an important role in industrial design, clothing design, ergonomics and architecture where statistical data about the distribution of body dimensions in the population are used to optimize products.

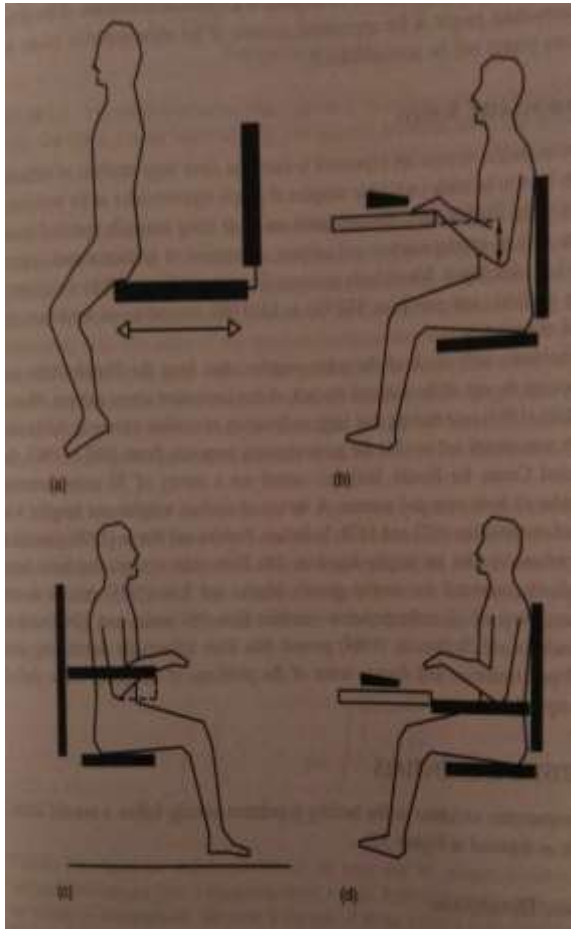
- This ‘population’ is used in statistical sense and refers to the group of people sharing something in common- here for instance it is the workplace.

- Not every human being is same and so is not physical appearance and ability are same. A workplace designed keeping in mind only one operator working on it may cause problem in case where job rotation is very likely to occur or workplace is operated in 2 or 3 shifts.

Design to fit everyone

- Approach of ergonomics is to consider product dimensions in human terms in view of constraints placed on the design by body size variability. Eg. Seats

- Information about body size in not directly applicable to a design problem.
- Designer has to analyze in what ways anthropometric mismatches are possible and then decide on which data might be appropriate to the problem.
- Designer has to develop clear ideas about what constitutes an appropriate match user and product dimensions.
- A suitable percentile has to be chosen.
- If design accommodates people at appropriate extreme of the anthropometric range, less extreme people will get accommodated.



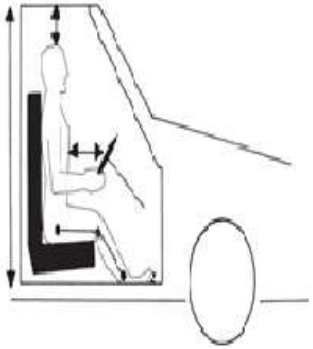
Types of anthropometric data

✓ *Structural data:*

Measurements of bodily dimensions of subjects In static posture. Measurements are made from clearly identifiable anatomical sites.

EXAMPLES

- To specify furniture dimensions.
- To determine ranges of clothing sizes.

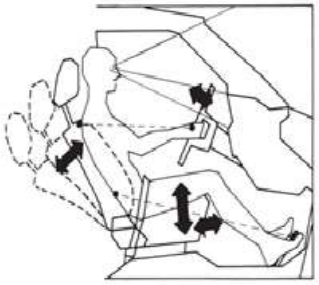


✓ *Functional data:*

Data that are taken under conditions in which the body is e cal activities. The 3D space swept by moving body parts in t takes into account the fact that in natural movements, several joints are involved and generates workspace 'envelops'.

EXAMPLES

- Design of crane cabs
- Design of vehicle interiors



✓ *Newtonian data:*

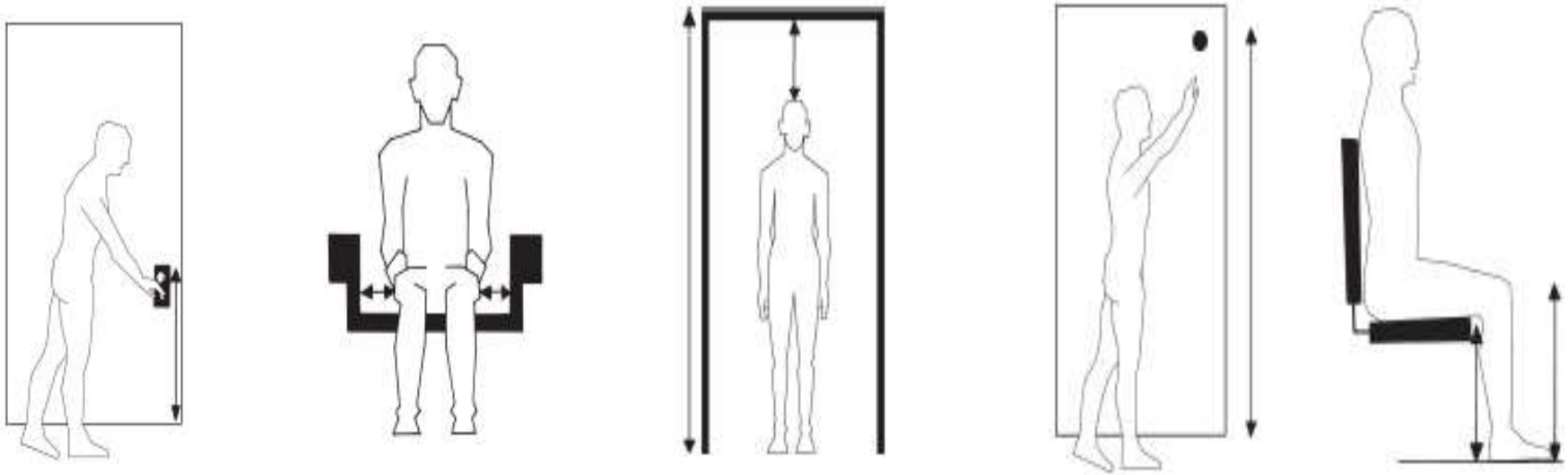
Includes both-body segments data and the data the fc d in different tasks

APPLICATION OF ANTHROPOMETRY IN DESIGN

Some of the applications of anthropometric data are

1. Determine the body dimensions.
2. Determine what principle is to be applied.
3. Defining equipment and facilities.
4. Space requirements.

1.BODY DIMENSIONS



2.PRINCIPLES TO BE APPLIED

There are three principles for applying anthropometric data to specific design problems:

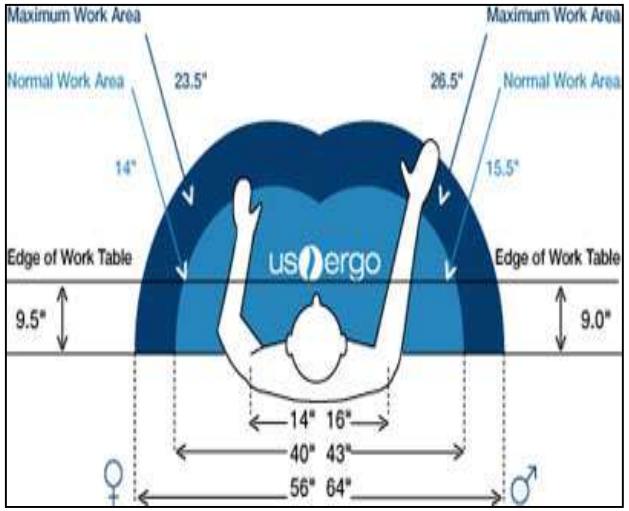
1. Design For Extreme Individuals
2. Design For Adjustable Range
3. Design For The Average

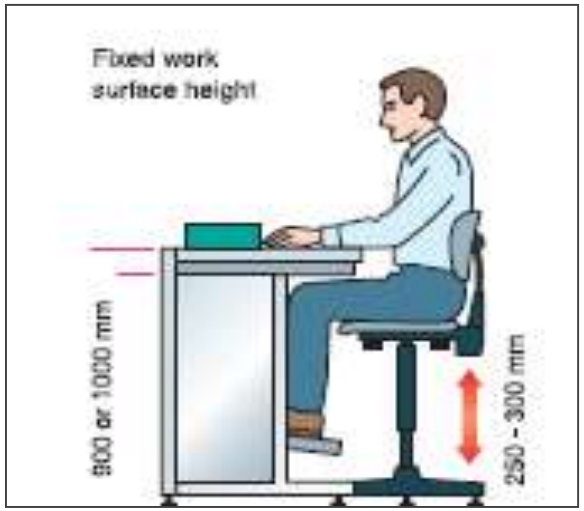
3.EQUIPMENT AND FACILITIES

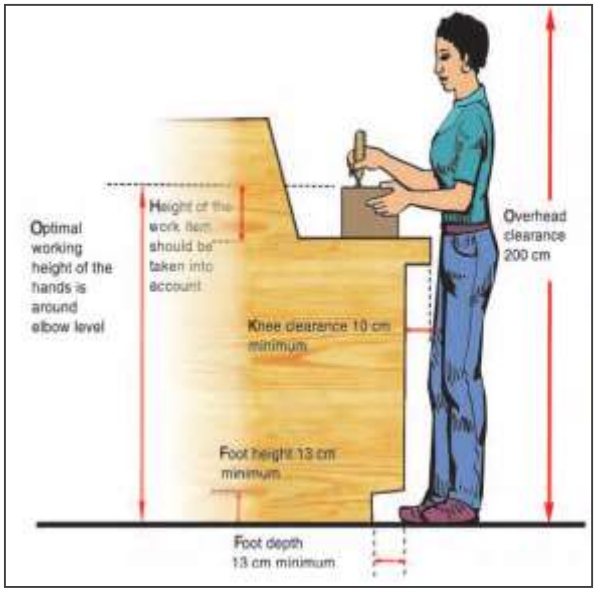
- Criteria of judgment of design features of physical equipment and facilities:
    - Comfort
    - work performance
    - safety, physical effects
- Equipment's are of three kinds:
    - Spaces into which men fit
    - Tools or controls which men use
    - Protective clothing and devices

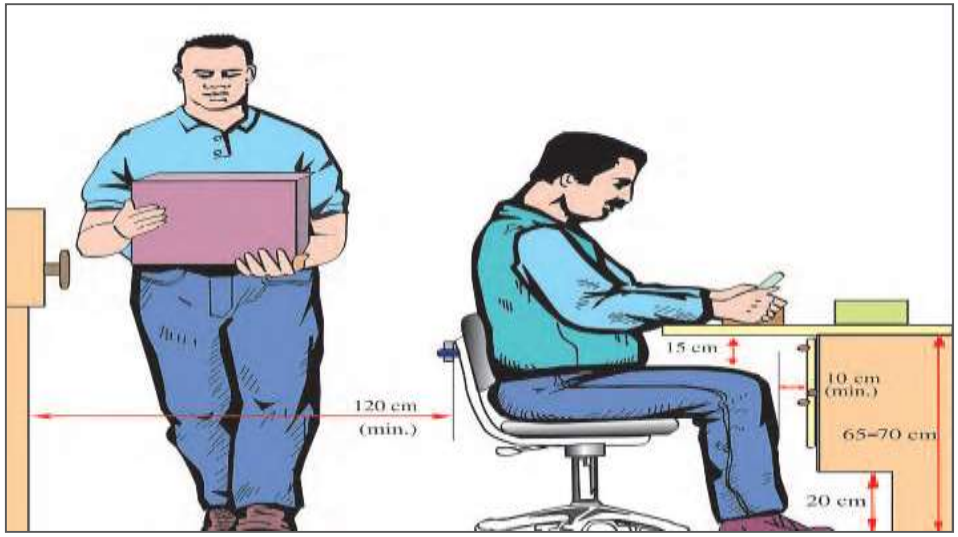
4.SPACES

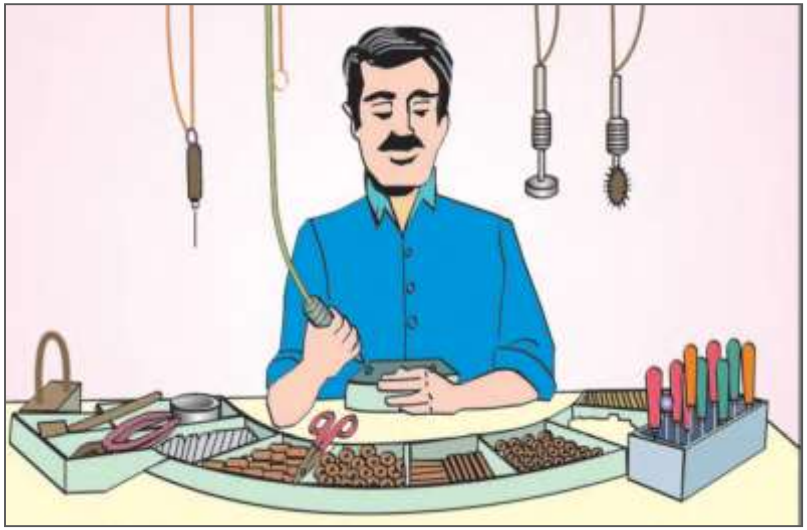
- One of the applications of anthropometric data is the design of work spaces, including the work-space envelopes.











ADVANTAGES OF ANTHROPOMETRIC DATA

- Increase accuracy
- Reduce Fatigue
- Better comfort
- Reduce chance of injuries
- Time management
- Increased productivity

For Standing Workers

Standing work

Employee is required to stand while working due to one or more situations listed below:

- The workstation provides no or limited knee or foot clearance and therefore the task cannot be performed in a seated position.
- Extended reaches are beyond an arm length (above, forward or below) where the upper part of the body has to bend forward to reach.
- Frequent distance movements and if the operator is sitting, he/she may require to stand up.
- Downward force to be exerted by the hand is more than 4.0 kg or the object weight handle is more than 4.0 kg.
- Reduce visibility.

In addition to the above situations, the type of tasks may determine whether a particular workstation is for standing or not. There are four types of task, namely:

1. Precision
2. Light
3. Medium
4. Heavy

Possible problems in standing work

- If the standing posture is the choice for a task and if there is insufficient rest to the legs, or if they have to maintain an awkward posture for long duration, then it can lead to fatigue, pain and discomfort.
- Prolonged daily standing in the awkward posture of the upper body is known to be associated with low back pain.
- Standing in one particular position or in any unnatural posture for long duration could lead to discomfort, tiredness and fatigue.
- To maintain a standing posture for a long duration, the muscles and ligaments would experience static loading; soft tissues in the joints would experience compression, and venous pooling in the leg areas are more likely to occur.
- If there is not enough recovery time for the muscles and the soft tissues in the joint, then fatigue would develop and cause pain.

STANDING WORKSTATION DESIGN PRINCIPLES

The best design of any workstation must demonstrate minimal physical stresses to the employees that may lead to localised fatigue, pain and discomforts to the employees.

- Re-design or rearrange task to allow employee to sit or to stand whenever necessary for him or her to do so.

✓ Avoid tasks which require standing in static posture.

✓ Provide a chair or a stool for sitting on or standing against.

- Provide workstation accessories such as :

✓ A cushioned surface to stand on (anti-fatigue floor mat).

✓ Better soles for shoes.

✓ Adjustable working surface to accommodate differences in employees' height.

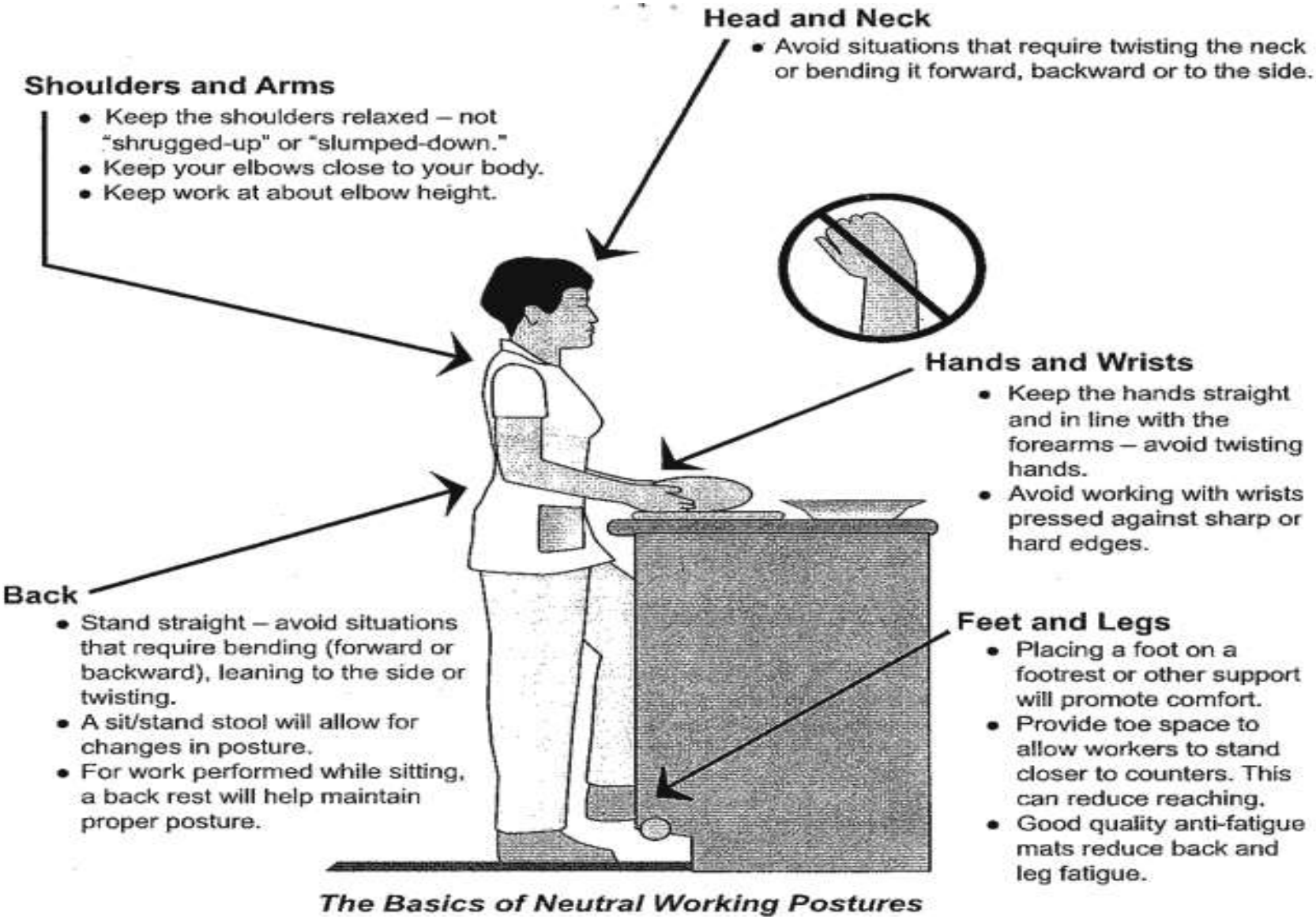
✓ Small foot bench. (e.g. grating for foot to rest)

STANDING WORKSTATION DESIGN PRINCIPLES

- Arrange for task variation so that an employee can perform different tasks that will allow the legs to move and reduce static loading.
- Job or employee rotation – Introduce variability of the task/job so that localised fatigue on certain parts of body is reduced. Monotonous work may induce fatigue to specific parts of the body.
- Introduce frequent short breaks to recover from fatigue during the work cycle.
- Provide proper and sufficient lighting to an employee that performs work in standing position.

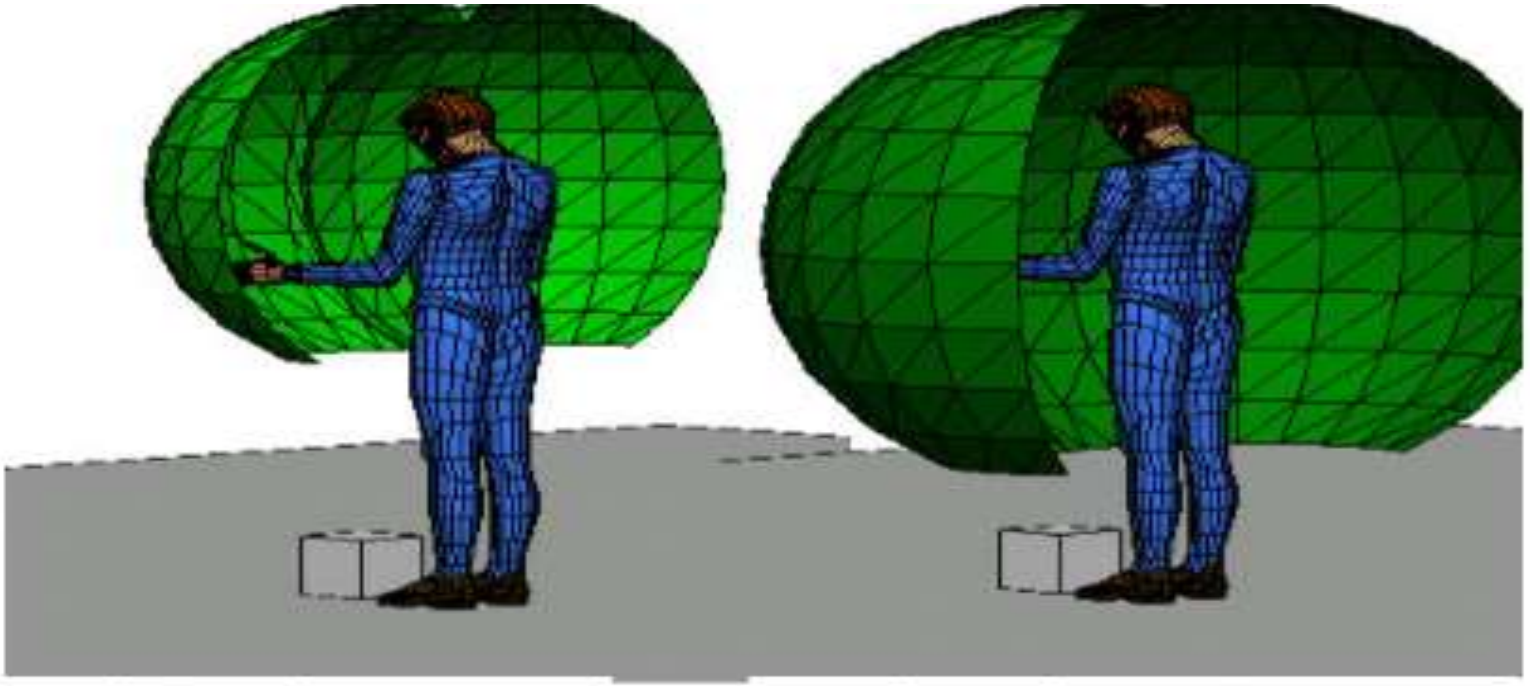
It is recommended that a person who has adequate knowledge on ergonomic principles should do or oversee standing workstation design.

IDEAL STANDING WORK POSTURE



The Basics of Neutral Working Postures

Workspace Envelope

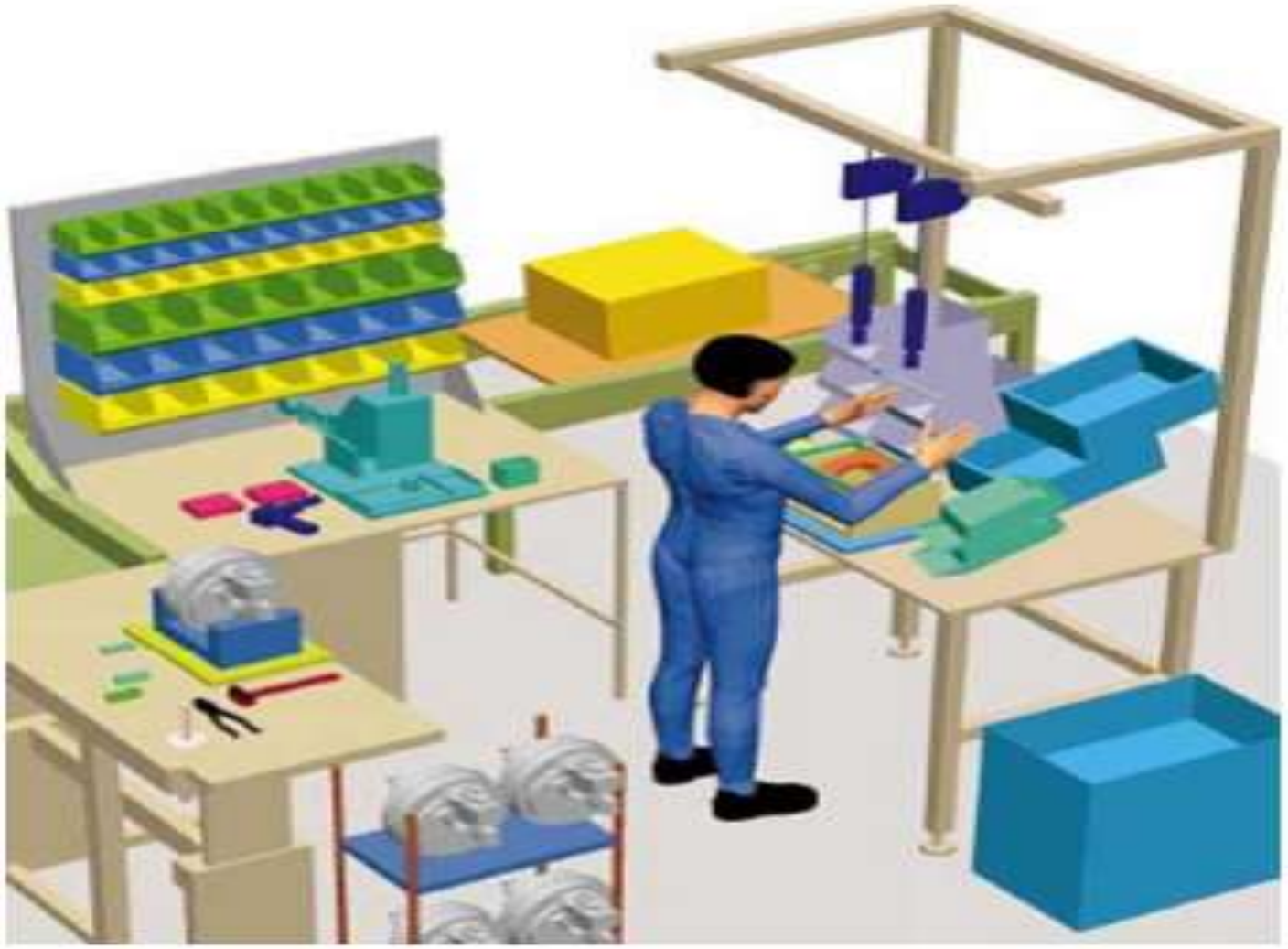


Standing work:
ii. 100% reaching envelope

Standing work:
iii. Reaching envelope with body assistant

The items arranged in the standing workstation should follow the reaching envelope principles. The reaching envelope varies from one individual to another.

Ideal workspace design



For Sitting Workers

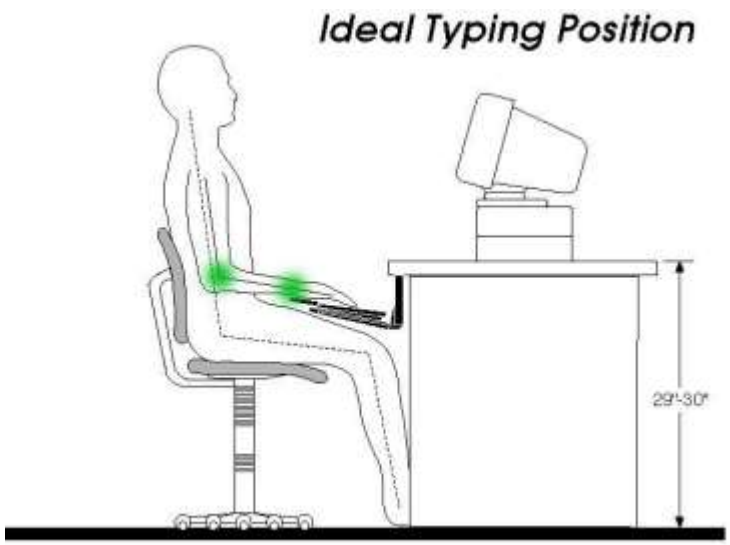
Computer workstation ergonomics

- Chair
- Monitor
- Keyboard
- Mouse
- Document holders
- Lumbar pads/pillows
- Arm rests

- Glare
- Eye strain
- Footrests
- Wrists pads
- Keyboard trays
- Laptops

Posture check

Increased stress, decreased circulation…



Computer Workstation : Head and Shoulders

- Head vertical and facing forward
- Tilted head puts stress on neck and shoulders
- Minimize head rotation
- Shoulders relaxed
- Arms tucked close to body
- No extended reaching

Computer Workstation : Elbows and Wrists

- Elbows relaxed and close to the body
- Elbows not extended forward or backward
- Wrists in a straight line with lower arms
- Hands not flexed up or down, or bent inward or outward

Computer Workstation : Legs and Feet

- Knees bent about 90 degrees
- Thighs parallel to floor
- Chair at a comfortable height
- Obstructions removed
- Feet flat on the floor or on a footrest

Chair Adjustments : Seat Surface

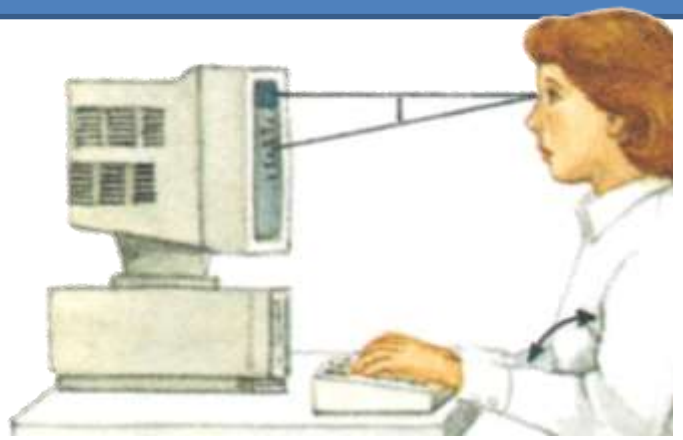
- Comfortable
- Slightly wider than hips/thighs
- Proper length
- Adjustable height
- Adjustable tilt

Chair Adjustments : Back and Arms

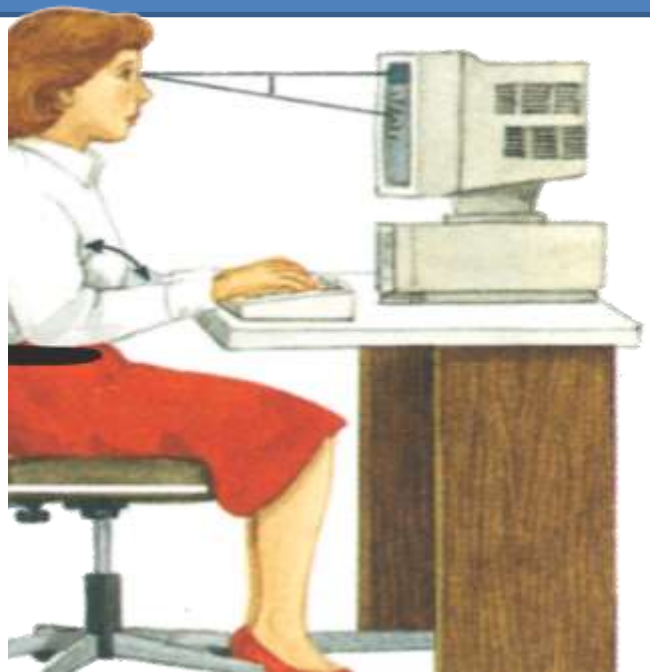
- Backrest with adjustable angle and lumbar support
- Armrest broad and cushioned to support shoulders, elbows, and wrists
- Armrests independently adjustable in height and side to side

Computer Monitor

- Directly in front of you
- Arm's length away
- Proper height so head is level
- Documents placed close to monitor

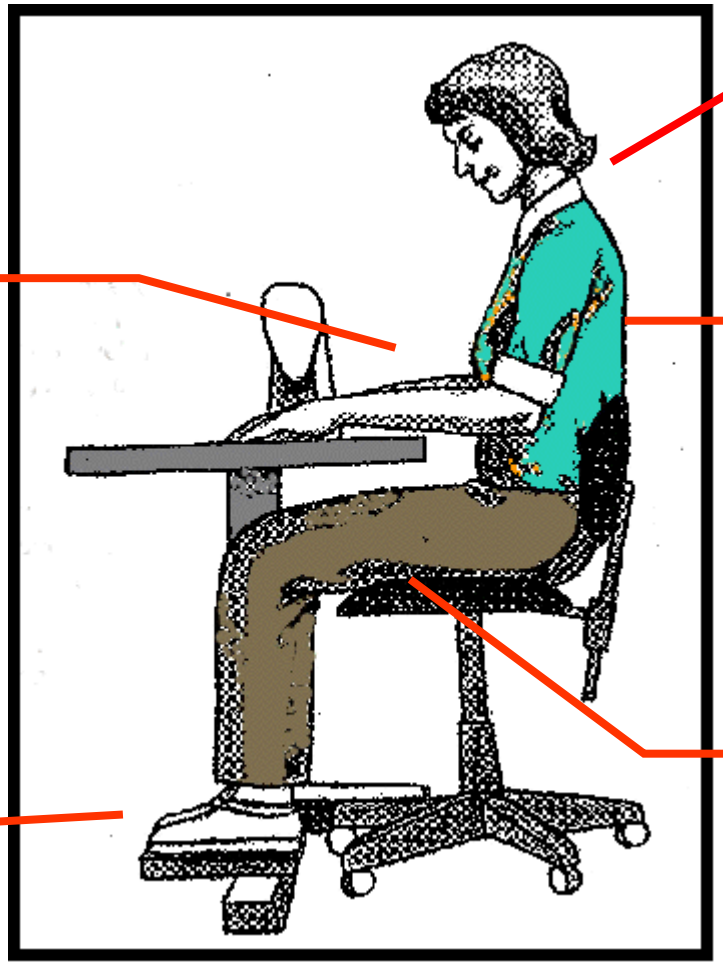


Neutral Keyboard Position



- Elbows close to body and bent about 90 degrees
- Wrists flat and in line with forearms
- Hands not angled up/down or turned in/out
- No wristrest when typing

This is the Best Way to Sit



Head only slightly bent

Arms parallel to work surface

Back Straight

Feet level

Hips and knees at 90 degrees


Thank You