



ME502 Ergonomics

Vision & Illumination



What is visual ergonomics?

Visual: Association with vision.

Ergonomics: Study of work and its environment in order to improve efficiency

Visual Ergonomics - Its refer to the study of vision in the work environment, in order to improve efficiency

Why is visual ergonomics important?

As humans, we spend 3 quarters of day in working. Therefore we must understand our eyes. And it is important to make use well without causing unnecessary strain.



What is vision?

The facilities of seeing things, forms and colours, sight and apparition.

- Appropriate Illumination
- Lighting Intensity
- Nature of the people

What is illumination?

The degree of visibility of our environment

- Work type
- Human needs
- Environment conditions



What is Illumination?

Illumination is the amount of light falling on to a surface. The light may come from the sun, lamps in a room or any other light source.

- unit is *lux*,

The human eye responds to a very wide range of illumination levels, from a few lux in a darkened room to hundreds of thousands of lux outside under the midday sun.

Illumination levels

In the open during the day time - between 2000 and 100 000 lx

At night artificial light - between 50 and 500 lx are normal.



Why Illumination is important?

- The quality of lighting in a workplace can have a significant effect on productivity.
- Enough lighting work can produce more products with fewer mistakes, which can lead to a 10-50 % increase in productivity.
- Good lighting can decrease errors by 30-60 % as well as decrease eye-strain and the headaches, nausea, and neck pain which often accompany eyestrain.
- Adequate lighting allows workers to concentrate better on their work which increases productivity.



Visual perception

Is the ability to interpret the surrounding environment by processing information that is contained in visible light.

Visual perception depends on the following factors

- Eyesight
- Degree and quality of illumination
- Size and shape of object and distance
- Colour and contrast of object and background
- Speed of object relative to the viewer



Characteristics of work place lighting

1. Illumination - Amount of light falling on the surface
(lux or foot-candles)
2. Luminance - amount of light reflected from a surface
(candela/m²[cd/m²])
3. Reflectance - rate of luminance and illuminance at a surface

White paper - 95%

White cloth - 65%

Newspaper - 55%

Wood - 45%

Black paper - 5%

4. Contrast - is a property of a display system

$$= \frac{100 \times (\text{luminous of bright} - \text{luminous of dark})}{\text{luminous of bright}}$$

5. Glare

Glare



Is difficulty seeing in the presence of bright light such as direct or reflected sunlight or artificial light such as car headlamps at night.

Sharp contrasts

The degree of acceptable contrast ratio depends on the specific circumstances

1. Age of the viewer,
2. Size of the source of glare,
3. Distance from the viewer's line of sight
4. The intensity of the general illumination in the room.



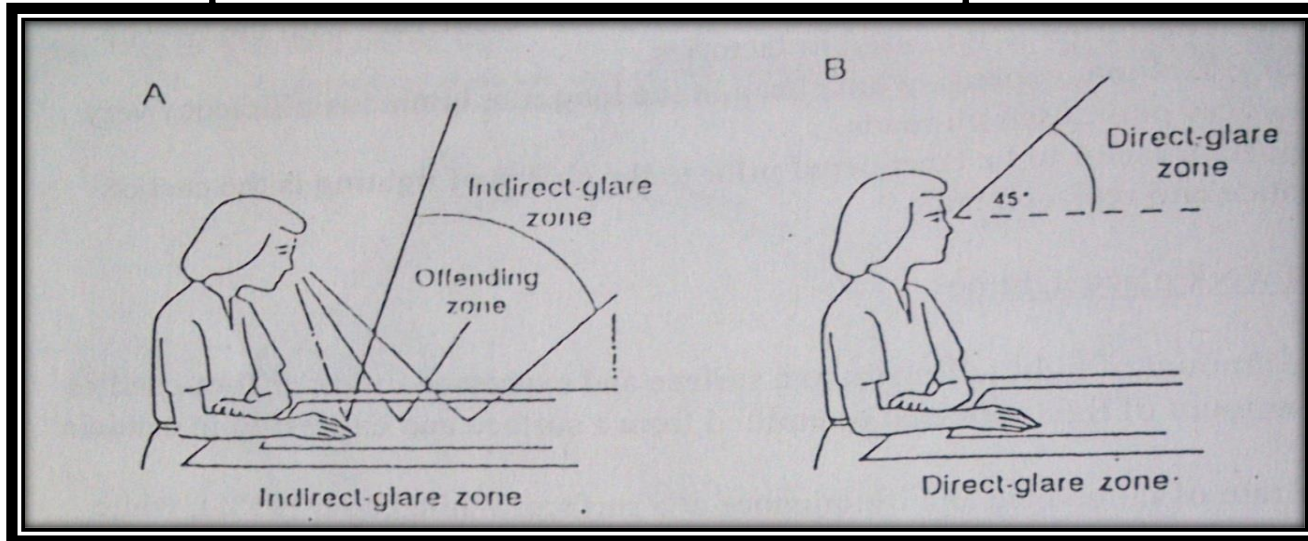
Age

In 1968 the Blackwell's determined the contrast necessary to satisfy people of different ages.

Age	Glare Index
< 40	1.0
40 year olds	1.2
50 year olds	1.6
65 year olds	2.7

Two types of 'glare' at work

1. **Direct glare** - when the eyes look directly into a light source (the sun, headlights of an oncoming car, task light at work).
2. **Indirect glare** - Its reflected from a surface into the eyes (the headlights of a following car reflected in the rear-view mirror, a task light or a bright window pane reflected in the computer screen).



Both kinds can be avoided by proper ergonomic measures



General rules

1. All the objects and major surfaces in the visual field should appear to be about equally bright.
2. Surfaces in the middle of the visual field should not have a luminance contrast of more than 3:1.
3. Contrast between the middle field and the rim of the visual field should not exceed 10:1.
4. The working field should be brightest in the middle and darker towards the edges.
5. Excessive contrast is more troublesome if it occurs at the sides of and below the visual field than at the top of the field.
6. Light sources should not contrast with their background by more than 20:1

Physiological requirements of artificial lighting

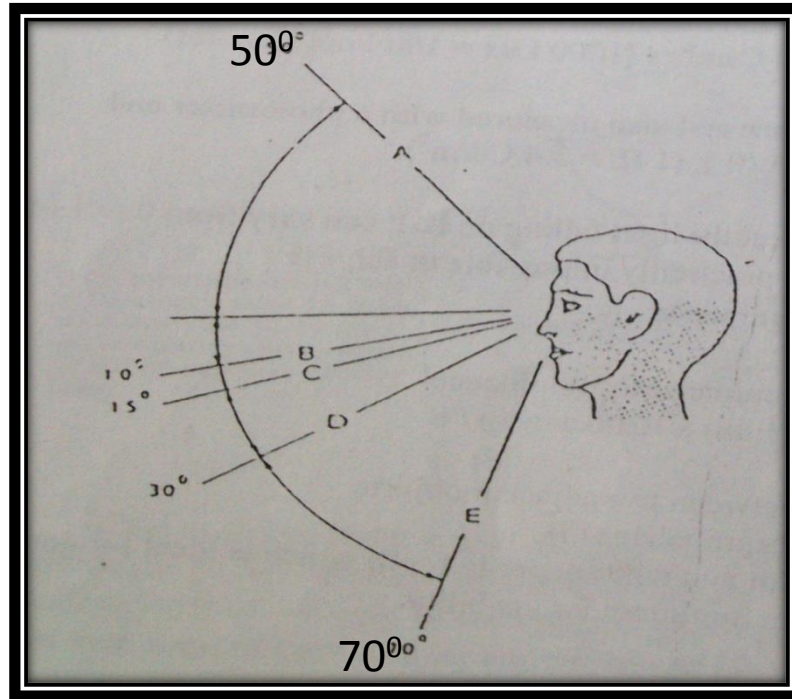
For visual comfort and good optical performance the following conditions should be met

1. Suitable level of luminance
2. Spatial balance of surface luminance
3. Temporal uniformity of lighting
4. Avoidance of glare with appropriate lights

Visual needs



1. Viewing angle



- A - Upper limit
- B - View angle (standing)
- C - View angle (sitting)
- D - Optimum view angle
- E - Lower limit

2. Viewing distance

Reading
30 - 50 cm





Viewing distances

The viewing distances for comfortable viewing have also been worked out and shown in table

Viewing distance requirements

Type of work	Viewing distance/(inches)
Especially visually demand E.g- Assembly work, inspection	5 to 10
Visually demanding E.g- Sewing, drawing	10 to 14
Normal E.g- Reading, milling	14 to 20
Visually undemanding E.g- Packing, janitorial work	> 20



Lighting Standards

Before electric lights the indoor workers depended on daylight. in modern work places there is much dependence on electric lights for indoor illumination. And the illumination levels are different for different work

Recommended illuminance levels

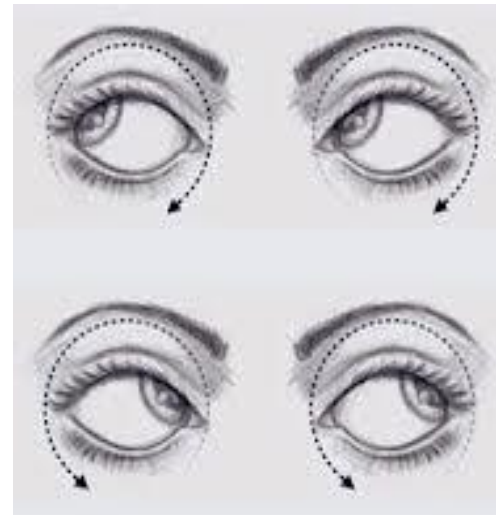
Type of tasks	Range of illuminance (lux)
Where visual tasks are only occasionally performed	100-200
High contrast or large size E.g-Rough bench machine work, ordinary inspection	200-500
Work at visual display terminals for extended periods of time E.g-Computers	300-500
visual tasks of low contrast or small size E.g-Penciled handwriting, difficult inspection, medium assembly	500-1000

20-20-20 Rule

- Every 20 Minutes
- Take a 20 second break
- Look 20 feet away



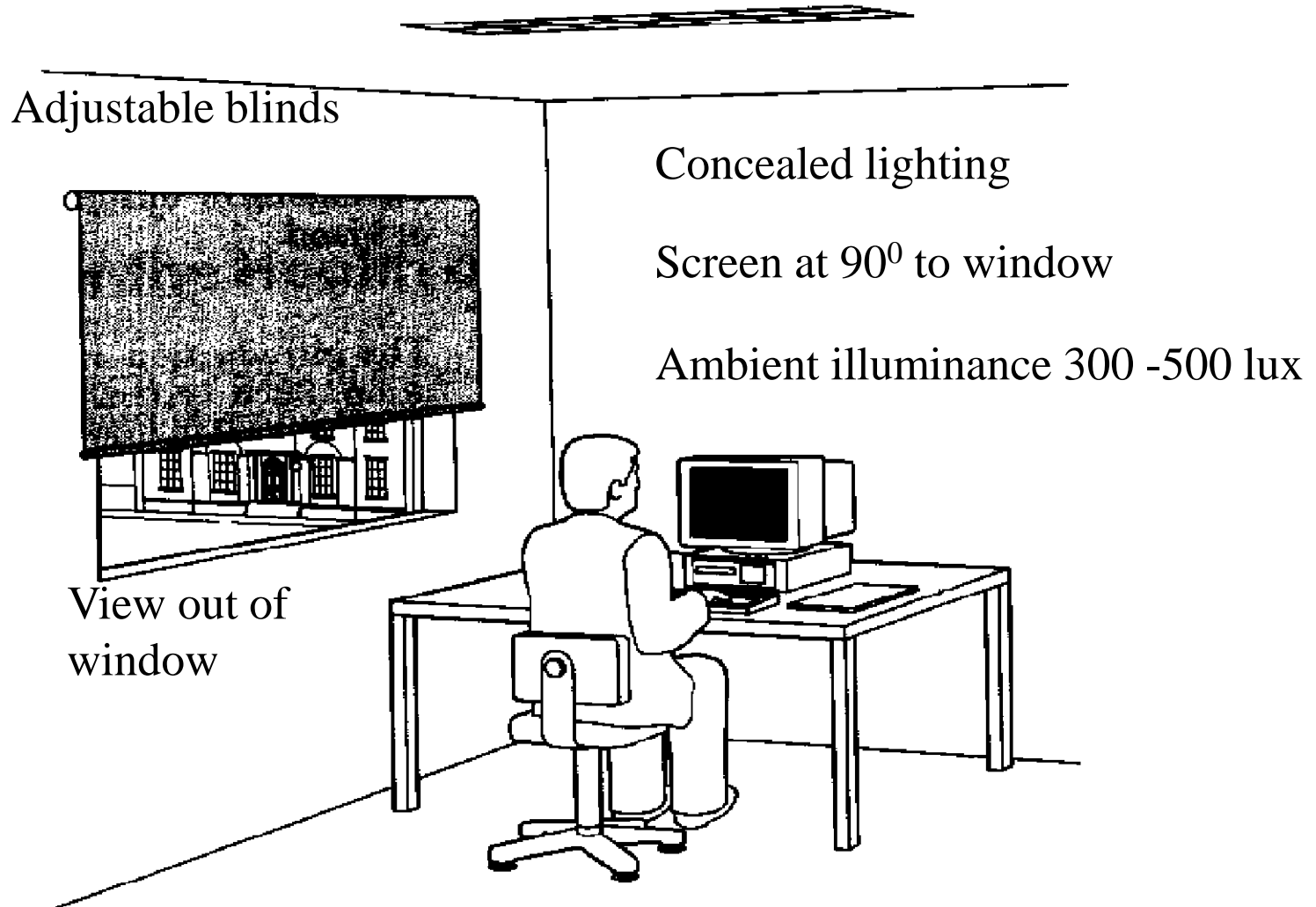
Do the exercise during those 20 seconds

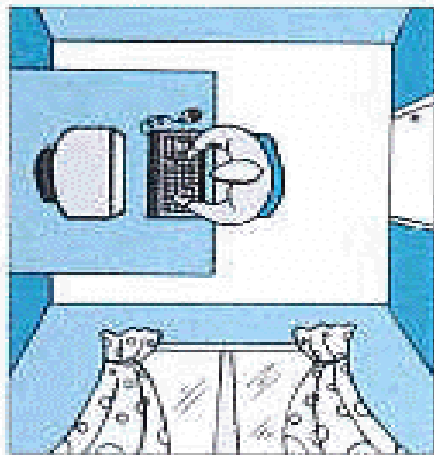


Guidelines for Good Visual & lighting Ergonomics

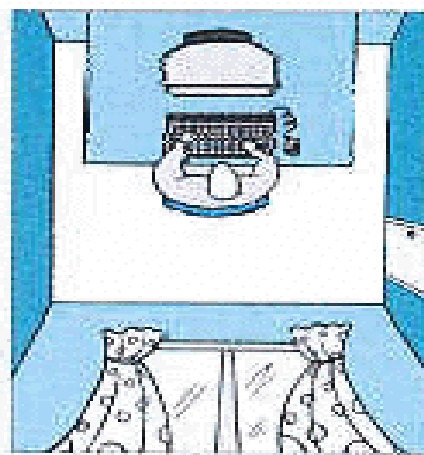


1. Workstation setups

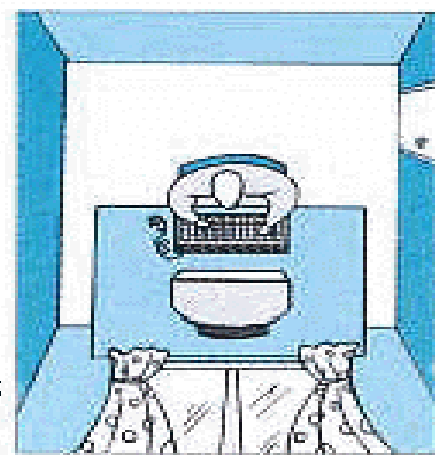




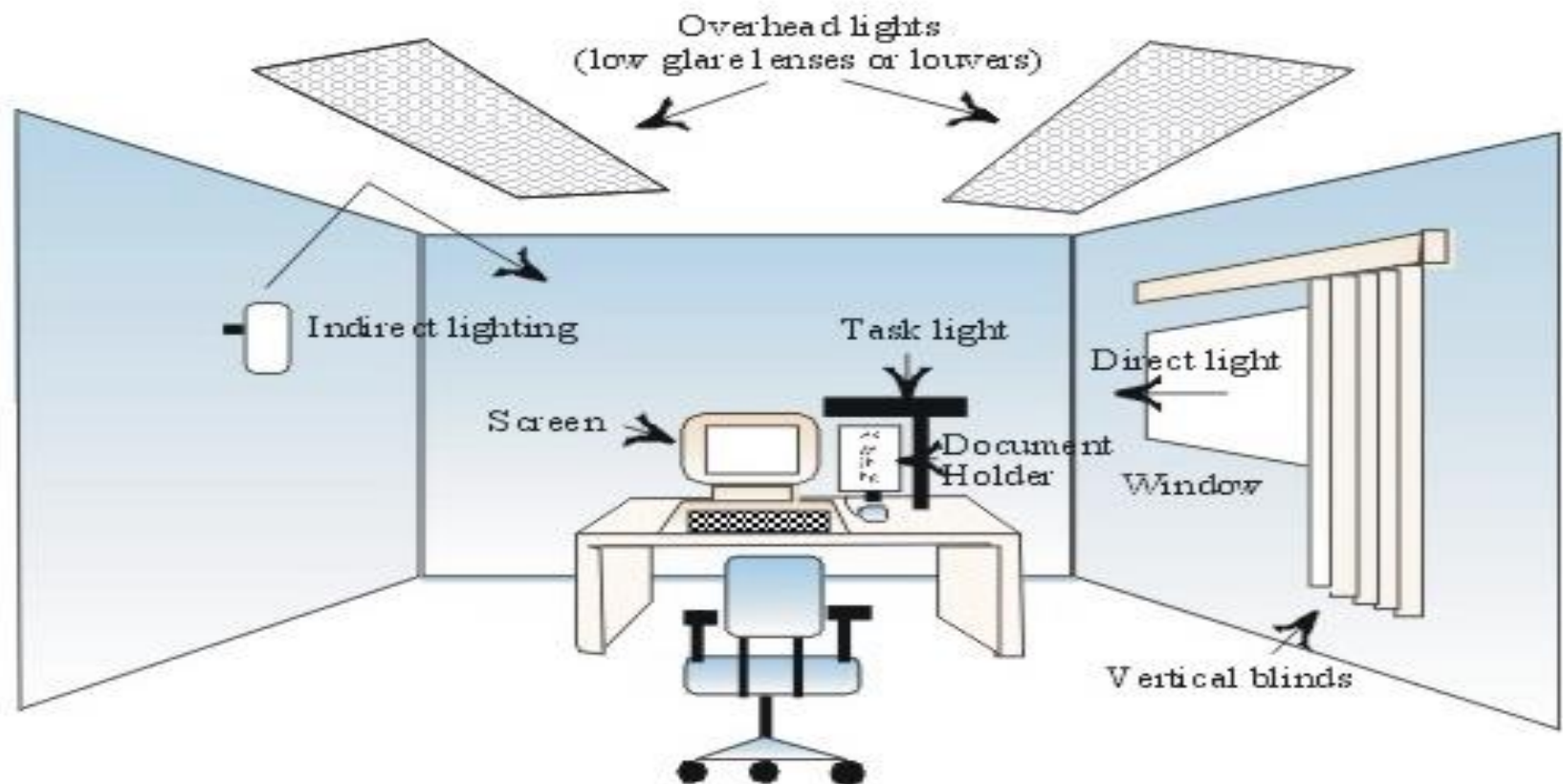
Right



Wrong



Wrong





2. Display screen

- Positioned in front of user - top of screen at eye level or below
- Adjustable screen
- Brightness/ contrast controls easily accessible





Good lighting in the workplace promotes

1. Reduced risk of occupational accidents and health problems
2. Better concentration and accuracy in work
3. Brighter, cleaner workplace resulting in a more active, cheerful environment
4. Improved work performance
5. Better visibility, improved accuracy and increased work speed enhancing production.

