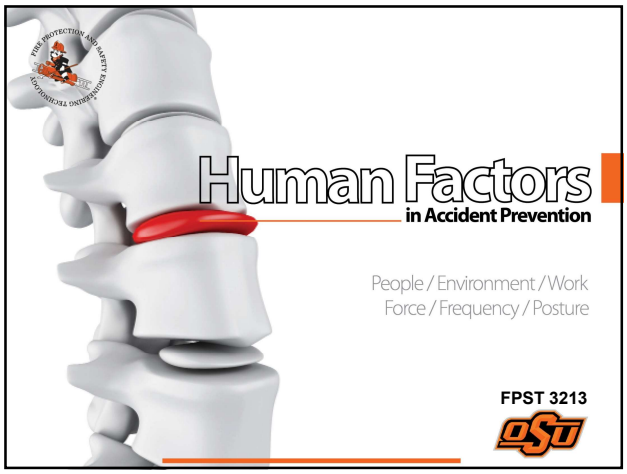


1

Workplace Design

2

Objectives

- Be able to set up a workstation for an individual
- Understand the field of vision
- Know how to select the appropriate way to deal with a change in elevation
- Conveyors

3

Workplace & Workstation

- Workplace is a location where a person or people perform tasks for a relatively long period
- Workstation is one of a series of workplaces that may be occupied or used by the same person sequentially when performing his or her job

4

Workplace Design

- Purpose
  - Reduce job stress
  - Reduce MSDs
  - Increase Safety
  - Increase Productivity
  - Accommodate individual differences in size and strength.

5

General Workplace Layout and Dimensions

- Criteria
  - Reaches
  - Size
  - Muscle strength ...

6

General Workplace Layout and Dimensions

- Well-designed
  - Audience
  - Anthropometric measurements
  - Mock-up for trial

7

General Workplace Layout and Dimensions

- When a special design should be considered?
  - Repetitive actions

8

Original design

9

Prototype

10

General Workplace Layout and Dimensions

- Avoided Static loads – Biomechanics
- Change posture
  - Sitting
  - Standing
  - Sit/stand
  - Reclined
  - Leaning

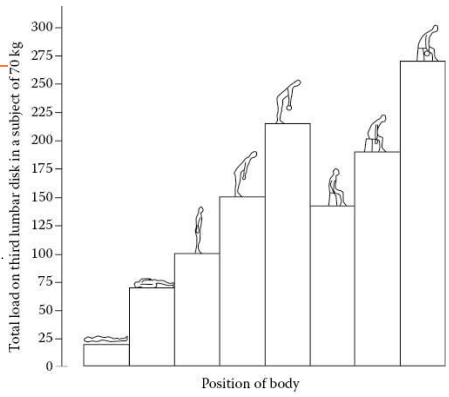
11

TABLE 3.1
Choice of Workplace by Task Variables (developed from information in Ely, Thomson, and Orlansky 1963b; Murrell 1965; Rehnlund 1973; Woodson 1981).

Parameters	Heavy Load or Forces	Intermittent Work	Extended Work Envelope	Variable Tasks	Variable Surface Height	Repetitive Movements	Visual Attention	Fine Manipulation	Duration > 4 hrs
Heavy Load or Forces		ST	ST	ST	ST	ST	ST	ST	ST/C
Intermittent Work			ST	ST	ST	S or ST	S or ST	S or ST	S or ST
Extended Work Envelope				St	ST	ST	ST	ST	ST/C
Variable Tasks					ST	ST	ST	ST	ST/C
Variable Surface Height						S	S	S	S
Repetitive Movements							S	S	S
Visual Attention								S	S
Fine Manipulation									S
Duration > 4 hrs									

Note: S = sitting; ST = standing; ST/C = standing, with chair available
Job and workplace characteristics are looked at, two at a time, in relation to the preferred workplace choice: sitting, standing, or standing with a chair provided. More than one type of workplace may be acceptable for these task combinations; the most appropriate choice is indicated.

12



Bridger, R. S. (2018). Introduction to human factors and ergonomics. Boca Raton, FL: CRC Press, Taylor & Francis Group.

13

SITTING WORKPLACES

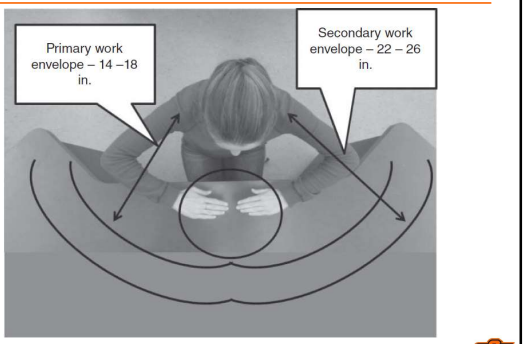
14

Sitting

- Items easily located
- Less than 6 in above work surface
- Objects weight less than 10 lb
- Precision work or visual inspection
- Well-designed chairs

15

Working envelope



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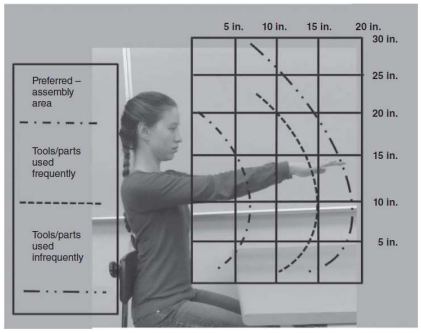
Working envelope



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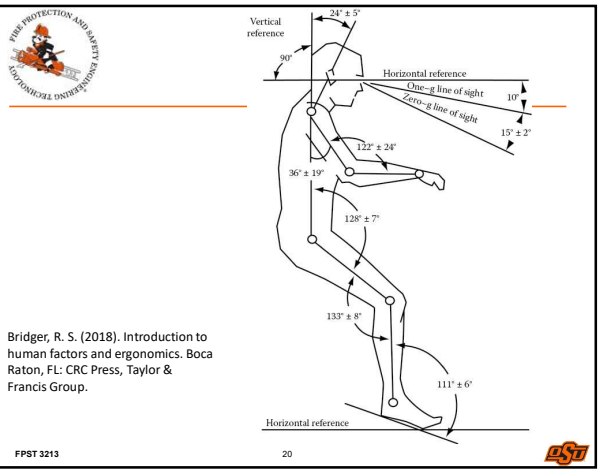

Bridger, R. S. (2018). Introduction to human factors and ergonomics. Boca Raton, FL: CRC Press, Taylor & Francis Group.

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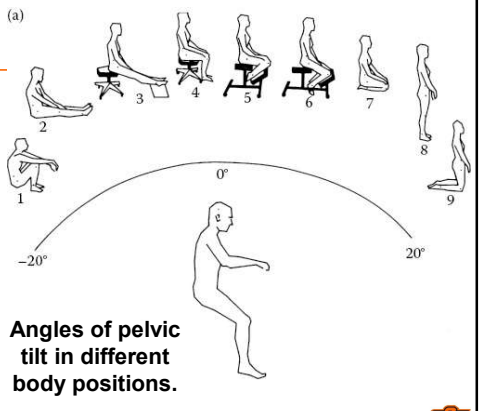

Bridger, R. S. (2018). Introduction to human factors and ergonomics. Boca Raton, FL: CRC Press, Taylor & Francis Group.

Angles of pelvic tilt in different body positions.

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FIRE PROTECTION AND SAFETY ENGINEERING TECHNOLOGY
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FPST 3213
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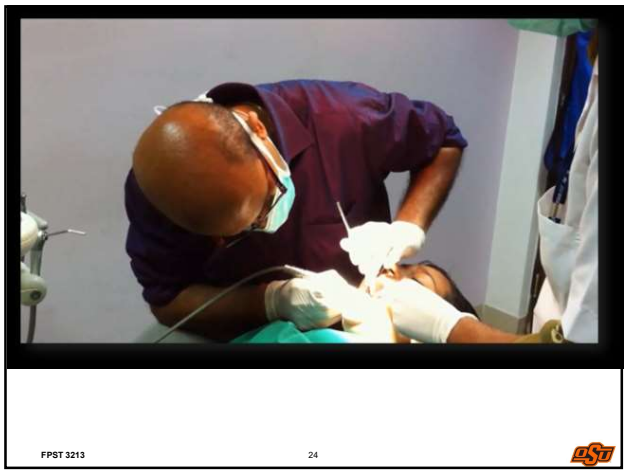
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Sitting is the New Smoking

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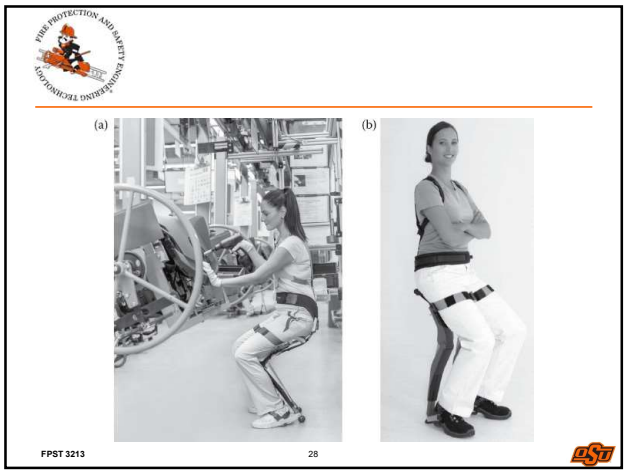
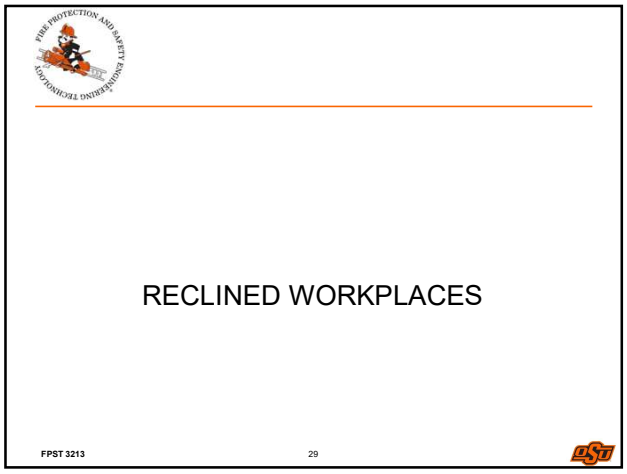

(a)
(b)
FPST 3213
28

28


RECLINED WORKPLACES
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29

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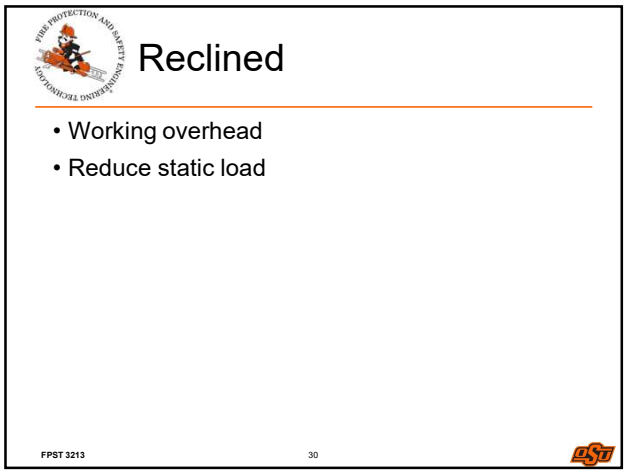
Reclined
• Working overhead
• Reduce static load
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30

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STANDING WORKPLACES

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Standing

- High, low, or extended reaches
- Frequent movement between workstations
- Downward forces must be exerted on the work
- Wrapping and packing operations
- Should include use of floor mats

37

People Are Different

Age Differences

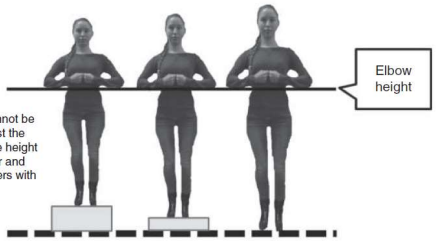
Height Differences

38

39

Height-adjustable platform

If the workstation cannot be adjusted then adjust the working surface to the height of the tallest worker and provide smaller workers with platforms



40

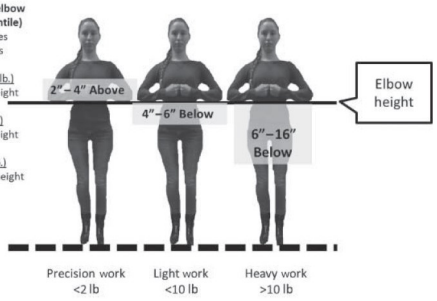
Standing work height guidelines

The reference line is elbow height (5th–9th percentile)
37 – 43" for females
40 – 46" for males

Precession work (<2 lb.)
2 – 4" above elbow height

Light work (<10 lb.)
4 – 6" below elbow height

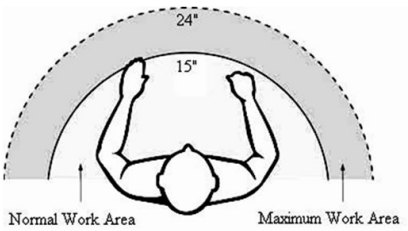
Heavy work (>10 lb.)
6 – 16" below elbow height



41

Standing Workplace Design

- Adjusting the workplace shape



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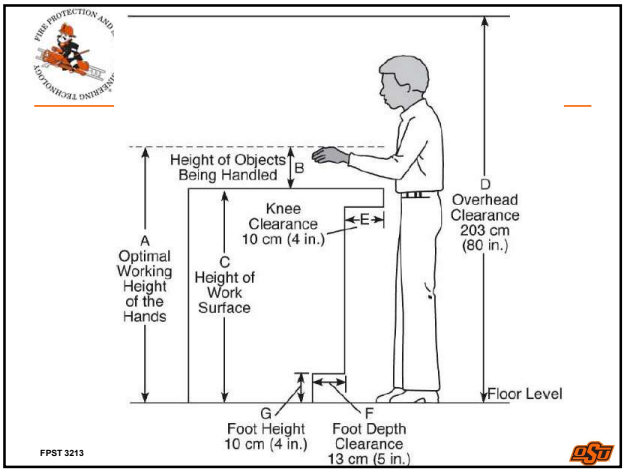

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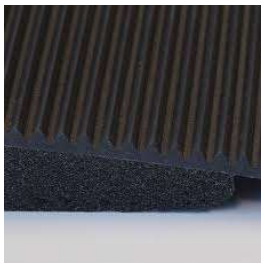
Standing Workplace Design

- Drafting board
- What's missing?

44

Anti-fatigue mats

- Anti-fatigue mats



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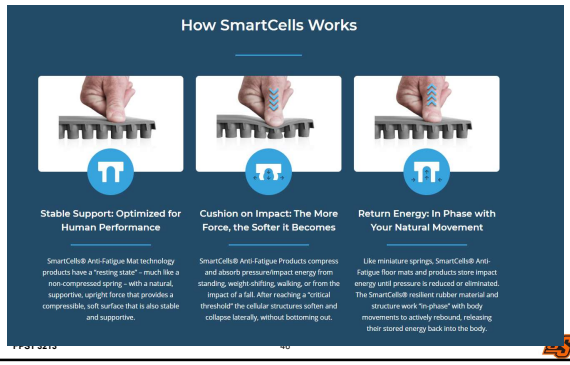
Safe Cells



46

- $300

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- $2,000

49

Footwear

-

- Floor surface
- Standing requirements
- Nature of the work
- Environmental hazards

50

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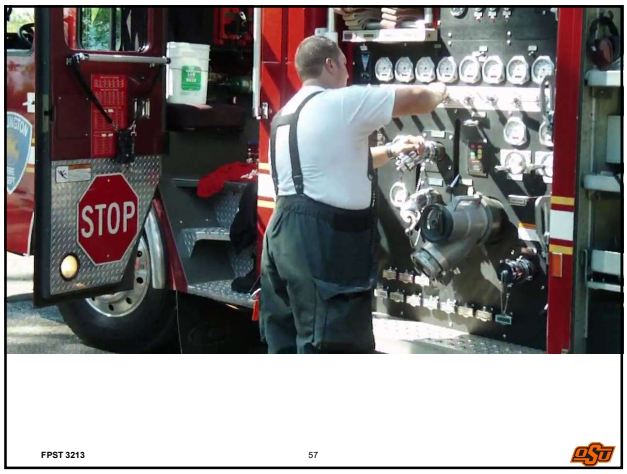

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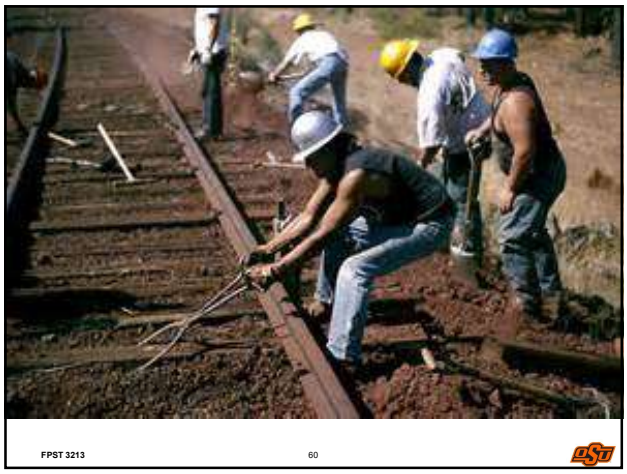

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https://www.bing.com/videos/search?q=sitting+work+&&view=detail&mid=D9450A5E81E66B4D6CC5D9450A5E81E66B4D6CC5&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dsitting%2Bwork%2B%26FORM%3DHDRSC4

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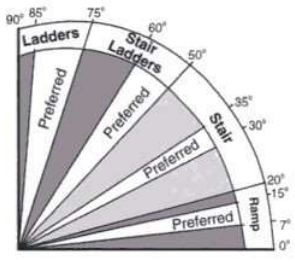
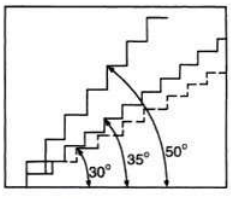
RAMPS, STAIRS, AND AISLES

65

Ramps, and stairs



(a) Slope and Type of Structure



(b) Fixed Stair Slope

66

Stair-ladder

- "Alternating tread-type stair"

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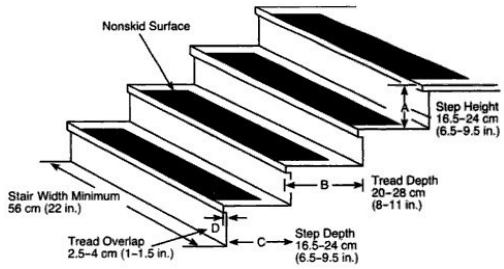
Stairs and ladders

- OSHA 1910.23 and 1910.25



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Fixed Stairway Design

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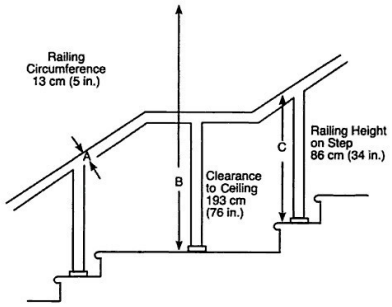
Handrail Design Guidelines
- 29 CFR 1910.29



70

Aisles

- Avoid blind corners
- Mark them
- Avoid having doors open into corridors
- Keep aisles clear

71

Aisles

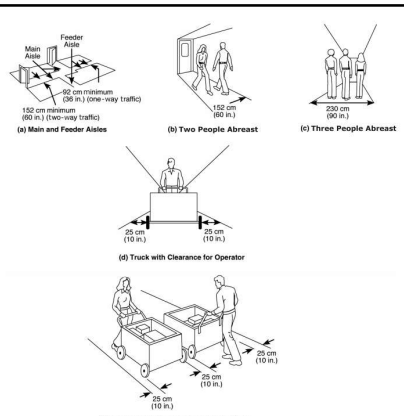


FIGURE 3.23 Minimum Clearances for Aisles and Corridors (adapted from Thomson et al. 1963; Woodson, Tillman and Tillman 1992; Access Board 1998)

72

CONVEYORS

73

CONVEYORS

- Should be accessible from both sides
- Provide crossovers
- Assembly task rate should be average of most and least skilled operator
- Provide space to temporarily place parts or trays after sliding them from the conveyor

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CONVEYORS

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CONVEYORS

https://www.youtube.com/watch?v=Dzek1XniYiQ

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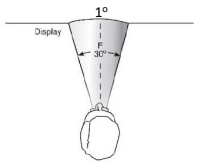
Visual Work Dimensions

- Visual field
- Viewing angle
- Viewing distance
- Size of the visual target

83

Visual field

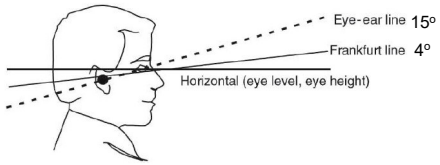
- Center of the fovea
  - a small depression in the retina of the eye where visual acuity is highest. Viewing distance



Visual Cone

84

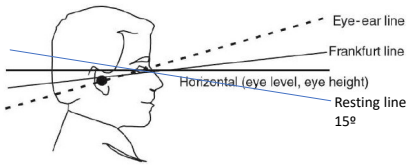
Viewing Angle



- Standing eye height ranges 52.2-75.3 in
- Seated eye height ranges 25.2-35.6 in
- Shoe height (1.2 in) added to standing eye height
- Slump factor (1.5 in) subtracted from the seated eye height

85

Resting line



This is the best location for important information

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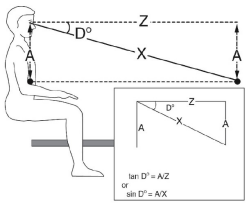
Viewing Distance & Angle



- If an object is 10 in below eye level and the horizontal distance from the eye to the object is 27 in, then what is viewing angle?
- Is this a good angle?
- What can we do?

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Size of Visual Targets

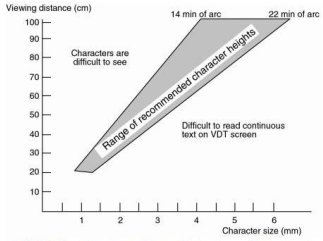

FIGURE 3.21 Size of Visual Target at Different Viewing Distances (based on material developed by Inger M. Williams, 1989)

- If the visual angle of an object is less than 3 minutes of arc, magnifiers should used

θ = tan–1 (size of visual object / viewing distance to object)
To obtain minutes of arc, multiply θ by 60

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Lab Workstation Ergonomics

89

Lab Workstation Ergonomics - Problems

- Extremely flexed neck
- Body leaning forward
- Hunched upper body
- Arms held up without support
- Bent wrists to use controls
- Insufficient leg clarence

90

Lab Workstation Ergonomics - recommendations

- Stand when working on high surfaces or with high objects; sit when working on low surfaces
- Plan work area layout to avoid long reaches
- Keep under-counter area clear
- Use low containers and waste bins
- Adjust chair, work bench or microscope to avoid bending your head forward

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Lab and Bench Padding Options

Keep your elbows off the table!!

Tabletop padded wedges

Adjustable clamp-on pads

Padded 'sleeves' worn under lab coat

Gel arm and elbow pads

Closed-cell foam edge protector

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Reverse tweezers

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93

Magnification systems

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Adjustable Workstations

- No one design can be optimal for all people

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Administrative Controls

- Training – working in neutral position
- Breaks/Microbreaks – at least once per hour
  - Reduce injuries, won't decrease productivity
  - Can be as short as 30 to 60 seconds
  - Focus on an object 20 feet away
  - Not required to stop work, can change task
- Stretching – at least once per hour

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The Future of Workstation Design

https://www.youtube.com/watch?v=eHdShyF9x7U

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Ergonomic Assessments

- Conduct Workspace Inspections Quarterly
- What are the current conditions?
- How do we achieve desired conditions?
- Can be performed by:
  - Industrial Hygiene Office
  - Individual
  - Co-worker

98

Tasks for Managers/Employers

- Conduct On Job Training (OJT) and maintain documentation of it
- Provide:
  - Adjustable, adjustable, adjustable

99

How do we Prevent Injuries?

- Change behaviors
- Change the environment
- Change the person???
- Non-work Activities

100

Ergonomics Programs

- Chapter 6 in your textbook!

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Resources

- Computer Workstation Ergonomics, NASA pamphlet
- Cornell University Ergonomics Web. http://ergo.human.cornell.edu/
- National Institute for Occupational Safety and Health: Ergonomics and Musculoskeletal Disorders. http://www.cdc.gov/niosh/topics/ergonomics/
- Healthy Computing
  - http://www.healthycomputing.com/health/

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To do list

- HW 6

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The Future of Workstation Design

If we're not careful….

https://www.youtube.com/watch?v=s-kdRdzxdZQ

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