

Chapter 13

APPLIED ANTHROPOMETRY, WORK-SPACE DESIGN, AND SEATING

Terms/Concepts:

Engineering anthropometry	Work surface height
Static dimensions	Working height
Dynamic dimensions	Lordotic arch
Somatography	Kyphotic arch
Design for extreme	Lumbar support
Design for adjustable range	Forward tilting seat
Design for the average	Postural fixity
Kinetosphere	Ischial tuberosities
Strophospheres	Dynamic seat design
Barnes, Farley, and Squires work areas	

Review Questions:

1. Body dimensions vary as a function of what major demographic variables?
2. Define the three principles for applying anthropometric data. When is each appropriate to use?
3. Discuss and describe the similarities and differences between the horizontal work surface areas recommended by Barnes, Farley, and Squires.
4. What factors must be considered when selecting a work-surface height for seated tasks? For standing tasks?
5. Discuss the five general principles of seat design discussed in the text. How can each be achieved?

Activities:

1. Measure the heights of various work surfaces such as kitchen counters, bathroom counters, work benches, grocery store checkout counters, desks, etc. How do they compare with the recommendations presented in the text?
2. Try the little standing reach test described on page 427 of the text.
3. Mark off the normal and maximum working areas shown in Figure 13-11, page 432, on a desk. Try working within these limits.
4. Use a large piece of cardboard or plywood and construct a slanted work surface on a desk. Try reading and writing on the slanted work surface. Is it more comfortable than the flat desk surface?
5. Try performing precision work, light work, and heavy work while standing at work-surface heights above, at, and below elbow height. For each task, which work-surface height was more comfortable? Do your preferences match the recommendations in Figure 13-13 on page 430?
6. Try sitting in a forward-inclined seat such as shown in Figure 13-16 on page 440. Was it more or less comfortable than a conventional seat? What type of posture did you assume, erect or slumped?
7. Observe several people using computer terminals (including yourself!). Compare the postures to the posture shown in Figure 13-23, page 450. How do the postures compare?

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Project 13

EVALUATION OF A COMPUTER WORKSTATION

Reading Assignment

Text: Chapter 13, pages 431-435, 437-451.

Purpose

The purpose of this project is to provide an opportunity to evaluate a computer workstation and seat according to guidelines contained in the text.

Problem

To complete this project, you will need to obtain access to a computer workstation with an adjustable chair. The workstation can be either in an office or a home. The workstation must consist of a fixed-height desk, computer, and adjustable height chair. The workstation must also contain other tools and devices as well, such as: telephone, stapler, dictionary, and/or pen holder. A tape measure or yard stick is also needed to complete this project.

Part A. Compare the work-surface area of the computer workstation with recommendations made by Squires and shown in Figure 13-11 on page 432 of the text.

1. Mark, on the front edge of the desk, the center line of a person seated at the workstation.
2. Place marks 8 in. left and right of the center line on the front edge of the desk. These represent the shoulder pivot points as shown in Figure 13-11.
3. From the respective pivot points measure the distance to the furthest objects on the desk.
4. Compare this to Squires recommendation in Figure 13-11.

Were any objects outside of the recommended work-surface area?

_____ Yes _____ No

If so, what objects were outside the area? How far outside of the area was each object?

Part B. Compare the desk and placement of the computer screen and keyboard to recommendations in the text.

1. Measure the height of the underside of the desk and compare it to the recommended range:

Measured height: _____
 Recommended range (see page 434): _____
 Is it acceptable? _____

2. Measure the height of the home row of the keyboard from the floor and compare it to the recommended range:

Measured height: _____
 Recommended range (see page 451): _____
 Is it acceptable? _____

3. Estimate the angle of the computer screen below the horizon. Horizon is taken as the eye height of a seated operator. (Use Figure 1 of this project to estimate the angle.)

Estimated angle: _____
 Recommended range (see page 451): _____
 Is it acceptable? _____

Part C. Check off from the list below, those accessories present at the workstation you are evaluating.

Foot rest	_____	Glare screen	_____
Wrist rest	_____	Hood over screen	_____
Task lighting	_____	Keyboard drawer	_____
Document holder	_____	Keyboard support arm	_____
Other: _____			

Part D. For each of the seat dimensions listed below, record the dimension for the seat you are evaluating, record the recommendations (see page 442-444), and indicate whether it is acceptable or not. (Use Figure 1 of this project to estimate angles.)

Dimension	Actual	Recommended	Acceptable?
Seat height highest	_____	_____	_____
Seat height lowest	_____	_____	_____
Seat pan angle	_____	_____	_____
Seat pan depth	_____	_____	_____
Seat pan width	_____	_____	_____
Seat cushion thickness	_____	_____	_____
Seat back height	_____	_____	_____
Seat back width	_____	_____	_____
Seat back angle	_____	_____	_____
Lumbar support protrusion	_____	_____	_____
Lumbar support height above seat pan	_____	_____	_____

Name _____ Course _____ Seat Number _____ Date _____

Part E. Evaluate the ease of adjustability of the various seat adjustment features using the criteria on page 441 of the text. For each adjustment feature listed below, indicate whether it is adjustable (YES) or not (—) and if it is, whether or not it meets each of the eight criteria listed.

(OK = meets criteria; "—" = does not meet criteria).

	Seat Height	Seat Pan Angle	Back Rest Height	Back Rest Angle
Is this dimension adjustable?				
Controls easily reached & adjusted from seated position.				
Labels/instructions easy to understand.				
Controls easy to find and interpret.				
Tools not necessary.				
Controls provide immediate feedback.				
Direction of operation is logical and consistent.				
Few motions required to operate.				
Require use of only one hand.				

Part F. Based on the results of Parts A to E, what is your overall evaluation of the workstation and seat? What are the major strengths and deficiencies in the designs?

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

Part G. What would you recommend to improve the workstation and seat?

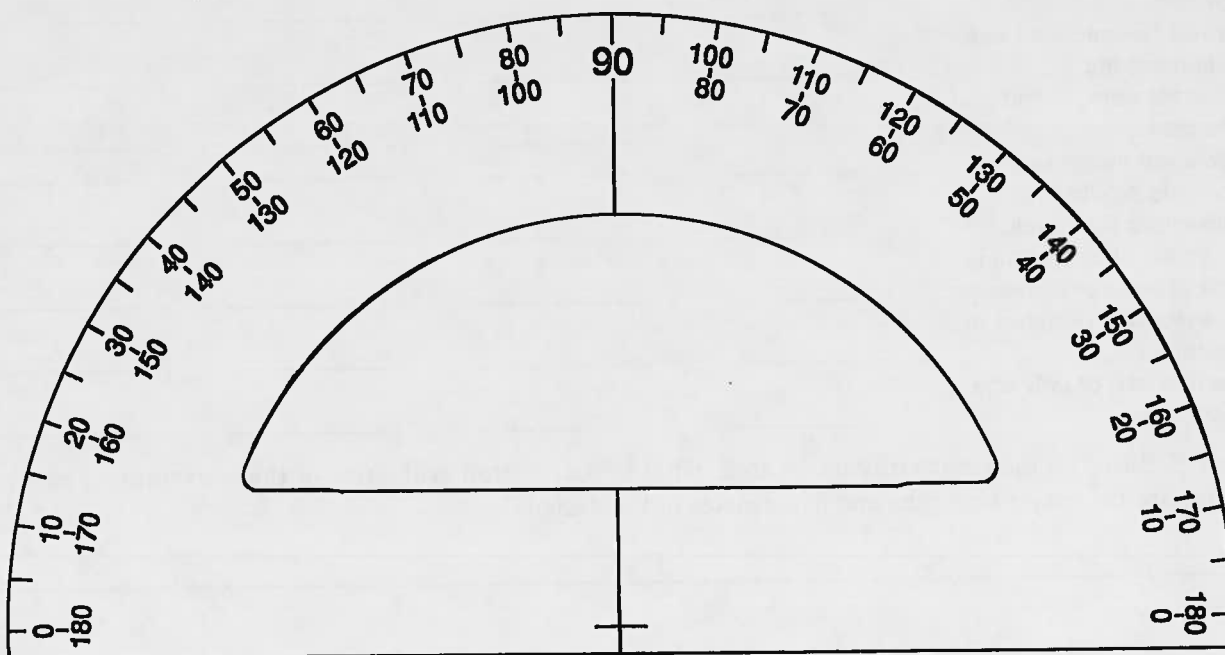


Figure 1. Protractor to aid in the estimation of angles.

Chapter 14

ARRANGEMENT OF COMPONENTS WITHIN A PHYSICAL SPACE

Terms/Concepts:

Importance principle
Frequency of use principle
Functional principle
Sequence of use principle
Control accessibility index
Links

Link table
Adjacency layout diagram
Linear programming
Utility cost
Isoresponse time regions
Mirror-image arrangement

Review Questions:

1. What are the four principles for arranging components? Give an example of each. How should they be applied?
2. In arranging components, what types of information are needed that deal with the components individually and that deal with the relationships between components?
3. Compare and contrast adjacency layout diagrams and spatial operational sequence diagrams. Discuss the strengths and weaknesses of each.

Activities:

1. Observe someone preparing dinner in a kitchen. Count the number of times the person moves from each component to every other component (e.g., stove, sink, can opener, refrigerator, pantry, table) as they prepare the meal. Construct an adjacency layout diagram.
2. Make a diagram of your bedroom and construct a spatial operational-sequence diagram of your movements in the morning when you get up and get dressed.

Project 14

ARRANGEMENT OF DISPLAYS BY PHYSICAL SIMULATION

Reading Assignment

Text: Chapter 14, pages 456-469.

Purpose

The purpose of this project is to illustrate the principles and tradeoffs involved in arranging dials on a console.

Description

An operator in a petroleum processing plant must watch and report on the condition specified by six dials on his work station console during a complex switching task.

Figure 1 is the configuration of the present console. The link values indicate the frequency with which the eye shifts from one display to another (expressed as percent of eye movements made). Values less than 2% are omitted. Table 1 indicates for each dial, the proportion of time spent on each dial (expressed as percentage of total time), and the importance of each dial as rated by the operator (1 = most important, 6 = not important).

Problem 1

On page 462 of the text, several ways are discussed for combining index values, such as those given in Table 1, into a composite or combination index of priorities.

Part A. For the data in Table 1, combine the "time spent" and "importance" indices into a composite index using addition and multiplication. Convert the "proportion of time spent" on each dial to a rank (1 = most time, 6 = least time), and use the following table to record the data and compute the composite indices.

Dial	Proportion of Time : Rank (1)	Importance Rank (2)	Composite Index by	
			Addition (1) + (2)	Multiplication (1) × (2)
A	_____	4	_____	_____
B	_____	2	_____	_____
C	_____	3	_____	_____
D	_____	6	_____	_____
E	_____	5	_____	_____
F	_____	1	_____	_____

Part B. What differences, if any, exist between the two methods of combining indices?

Part C. Which composite index would you recommend using? Why?

Problem 2

Part A. Based on the information in Figure 1 and Table 1, rearrange the dials in a more optimum configuration. Assume that:

1. Neither the size, orientation, nor face of the dials can be altered.
2. The controls that the operator uses, are separate from the console and will be rearranged *after* the dials are rearranged (i.e., do not be concerned with controls or compatibility).
3. The operation requires more than simple "check reading."
4. The specific sequence in which the operator views the dials is variable and depends on the condition of the other dials (i.e., no specific sequence can be described).
5. The solid line "oval" in Figure 2 represents the preferred area for placing dials, but the area within the square border represents the total space available to place the dials.

The last page of this project can be detached and the dial shapes cut out. Arrange these cutouts on Figure 2 and, either trace or attach them to Figure 2 in an optimum configuration. Figure 2 and the dials on the last page represent a one-quarter scale at a viewing distance of approximately 23 in.

Part B. Defend your arrangement of the dials. Note any tradeoffs between arrangement principles you made.

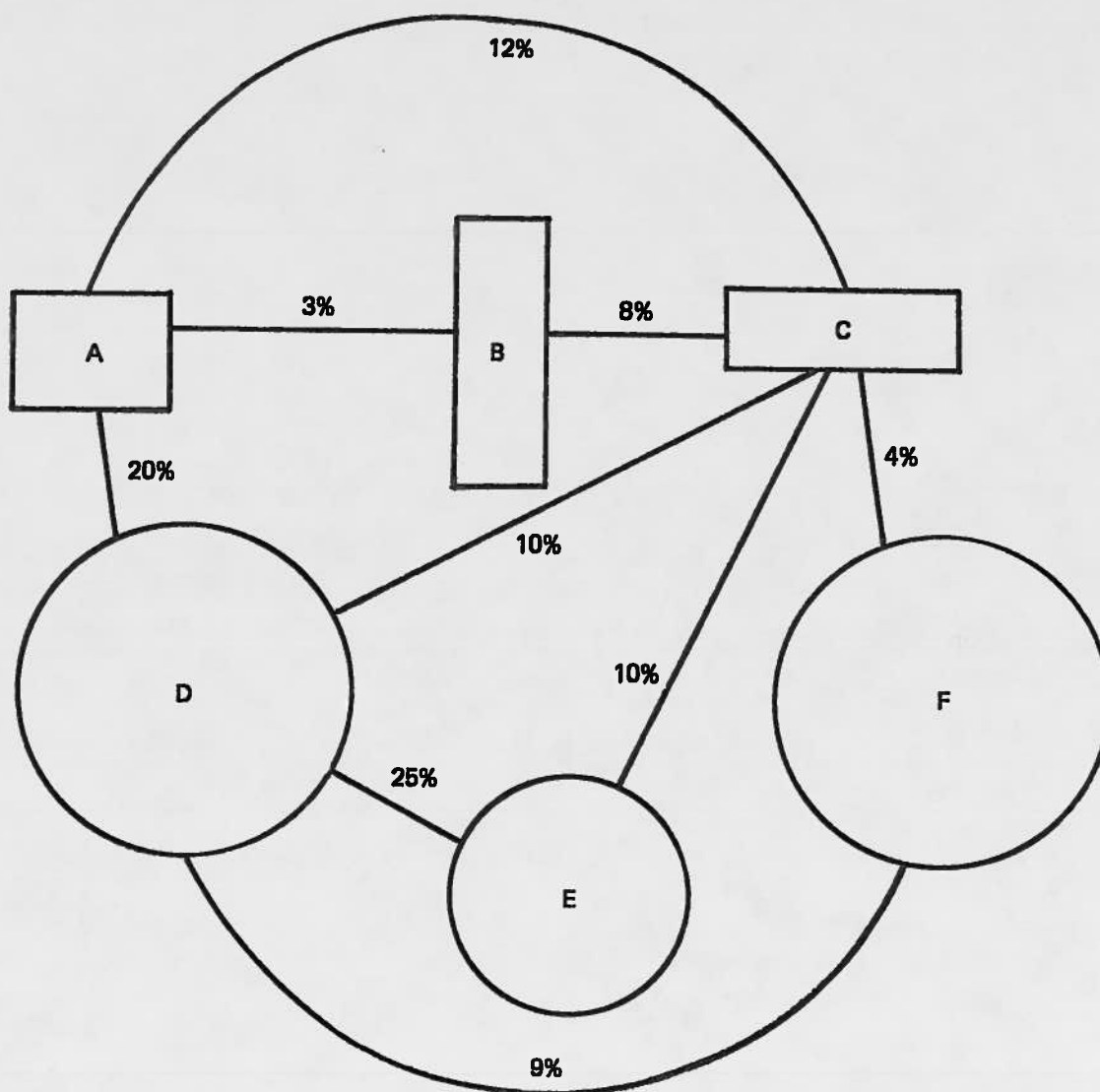


Figure 1. Present configuration of the dials with link values indicating the frequency with which the eye shifts from one display to another.

TABLE 1
Data Required to Rearrange the Dials in Figure 1

Dial	Proportion of Time Spent	Importance
A	7%	4
B	3	2
C	30	3
D	45	6
E	10	5
F	5	1
	100	



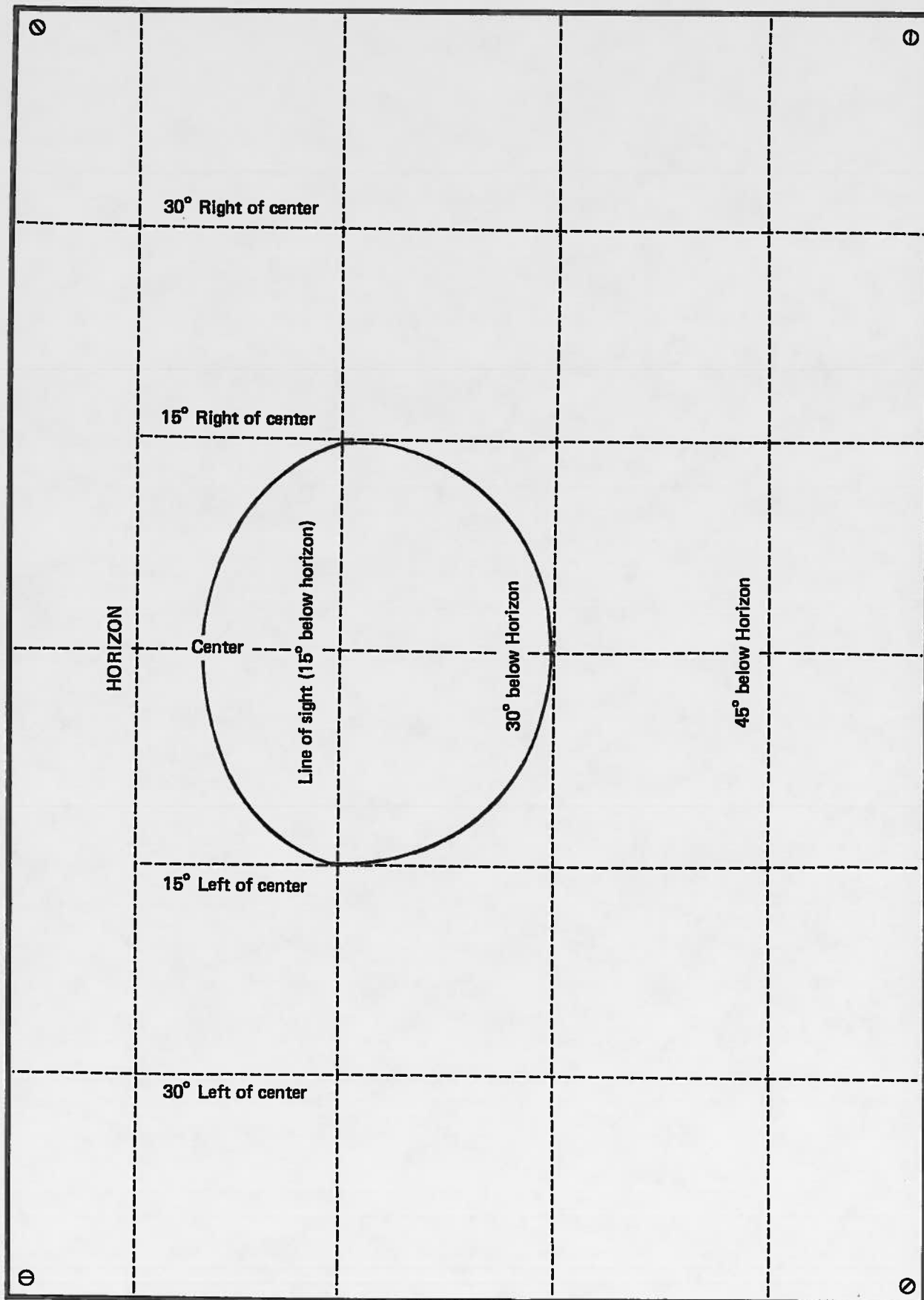
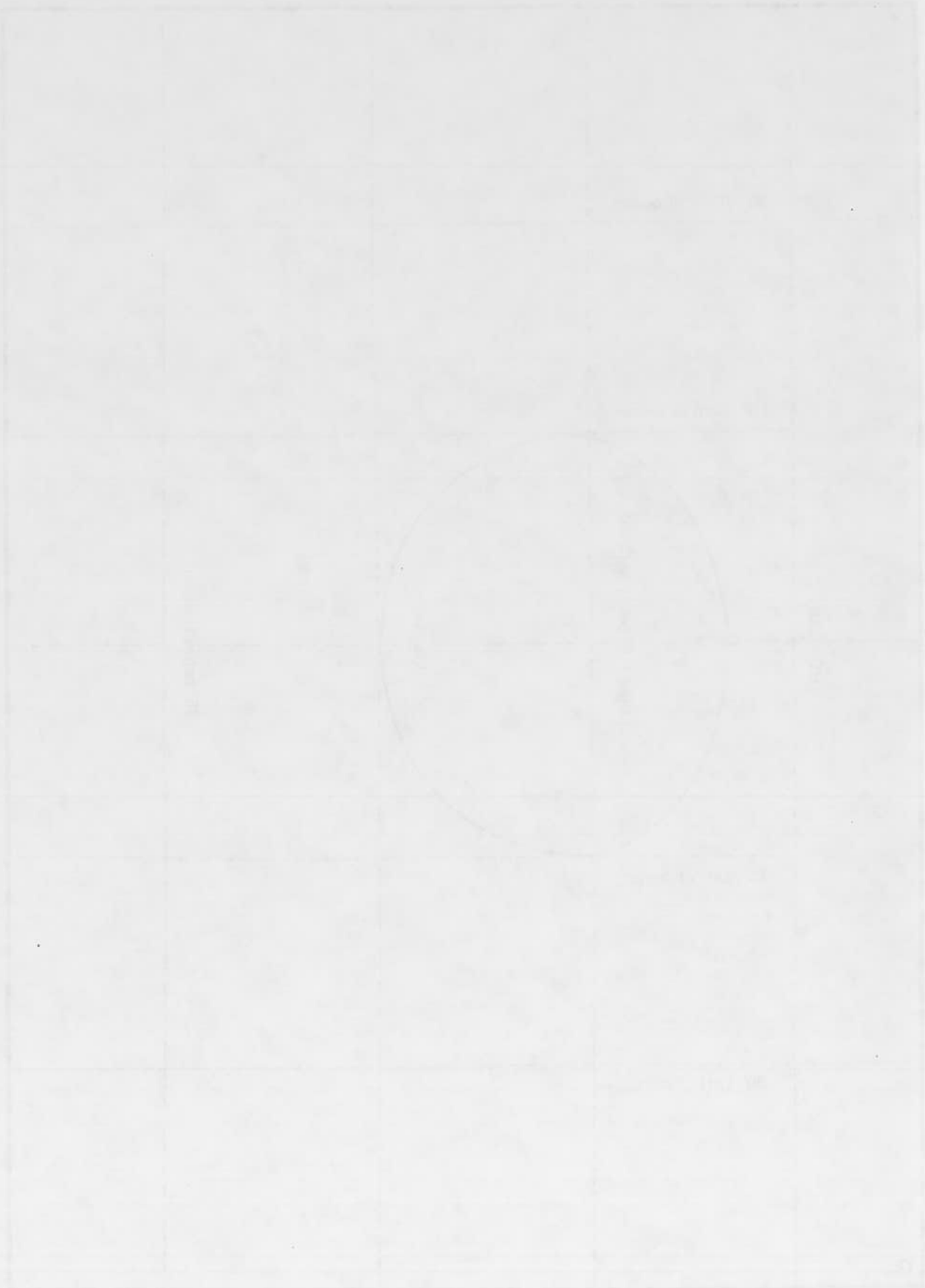


Figure 2. Space on which dials are to be arranged. The solid oval represents the preferred area for placing dials. The boarded area represents the total space available to place the dials.



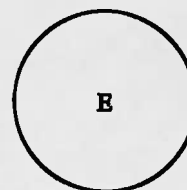
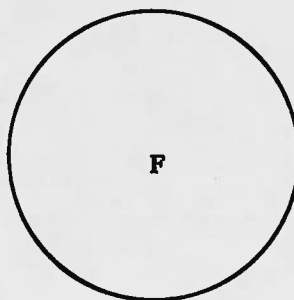
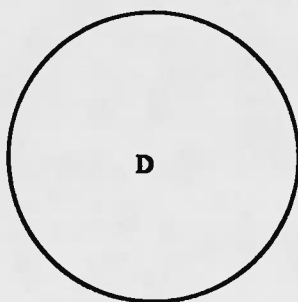
Name _____ Course _____ Seat Number _____ Date _____

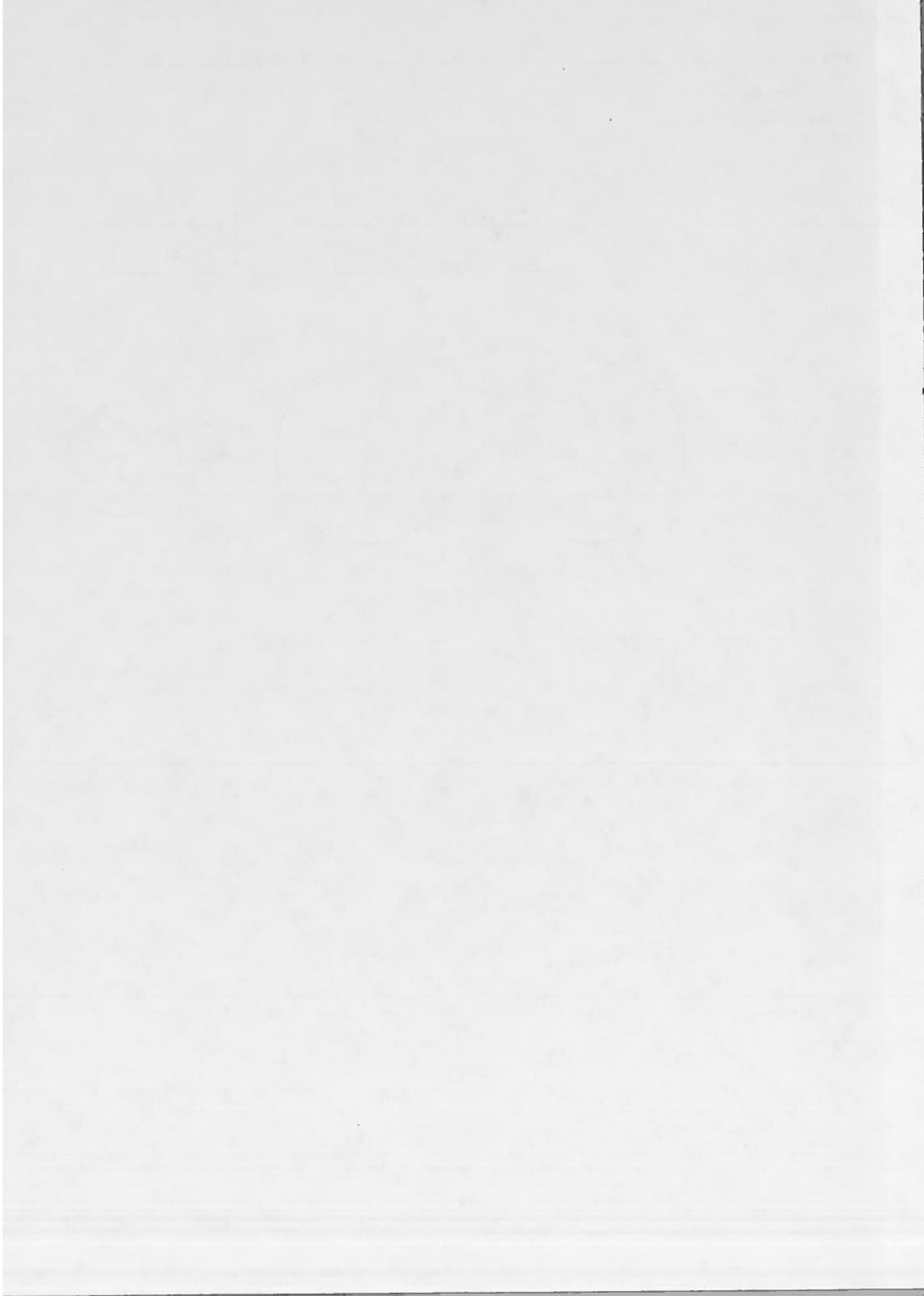
Cut out and use for
rearrangement in
Figure 2

THIS END
UP
A

THIS
END
UP
B

THIS END UP
C





Chapter 15

INTERPERSONAL ASPECTS OF WORKSPACE DESIGN

Open plan office
Cellular office
Bull pen office
Landscaped
Burolandschaft
Personalization

Status markers
Action office
Computer-supported cooperative work (CSCW)
Persons per room (PPR)
Square feet per person (SFPP)

Review Questions:

1. What are some of the methodologies used to assess the affective response of people to an environment? What are the strengths and weaknesses of these methodologies?
2. What are some advantages and disadvantages of landscaped and bull-pen offices?
3. What are some guidelines for designing open offices?
4. What are some considerations in the design and layout of dwelling units?

Activities:

1. Visit office buildings that employ open office plans and observe the behavior and working environment. Talk to some of the workers about their perceptions of the office and the advantages and disadvantages of the particular design.
2. Do a survey of friends and neighbors as to what activities they perform in their kitchens. Measure the size of the kitchen area. Compare the results to Table 15-8 on page 499 of the text.
3. Visit a retirement home and discuss with the staff and residents what special design considerations are involved in housing for the elderly and handicapped.

INTERPERSONAL EFFECTS OF WORKPLACE BULLYING

The purpose of this chapter is to examine the interpersonal effects of workplace bullying. It will discuss the impact of bullying on the victim, the bully, and the workplace as a whole. The chapter will also explore the role of bystanders and the importance of organizational support in addressing bullying.

Workplace bullying is a pervasive problem that affects millions of people worldwide. It is characterized by repeated, harmful actions by one or more individuals in the workplace against a victim. The effects of bullying can be severe, leading to physical and mental health problems, decreased productivity, and high turnover rates.

Research has shown that victims of workplace bullying experience a range of negative effects, including increased stress, anxiety, and depression. They may also experience physical symptoms such as headaches, stomach problems, and sleep disturbances. In addition, victims often experience a decline in their self-esteem and confidence, which can further exacerbate their psychological distress.

Project 15

EVALUATING A PRIVATE DWELLING UNIT

Reading Assignment

Text: Chapter 15, pages 496–502.

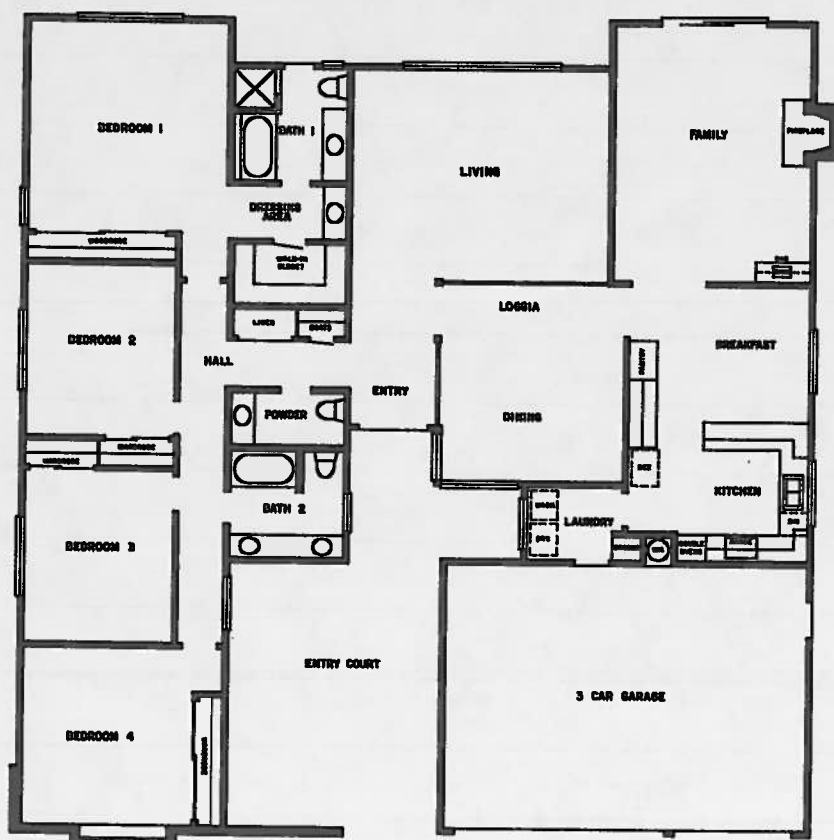
Purpose

The purpose of this project is to provide an opportunity to critically evaluate and apply human factors concepts discussed in the text to an actual private dwelling floor plan.

Problem

Below is an actual floor plan¹ for a residential single family house with no basement or attic. It has approximately 2,600 square feet of living space. A house like this is usually sold to a couple with at least one small child. Such families usually do a lot of entertaining in their homes, including giving moderate sized dinner parties. Rarely would a family who buys such a home have live-in help.

Critically evaluate this floor plan, noting both desirable and not-so desirable features. (Use additional paper if you wish.) Consider *among other things*, probable traffic flow, convenience of facilities, closet and storage space, facilities and traffic flow for such activities as entertaining, child care, and nighttime emergencies, and overall use of available space.



1. From Metropolitan Development Corporation, Brightwood Development, 1976. Reprinted by permission.

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