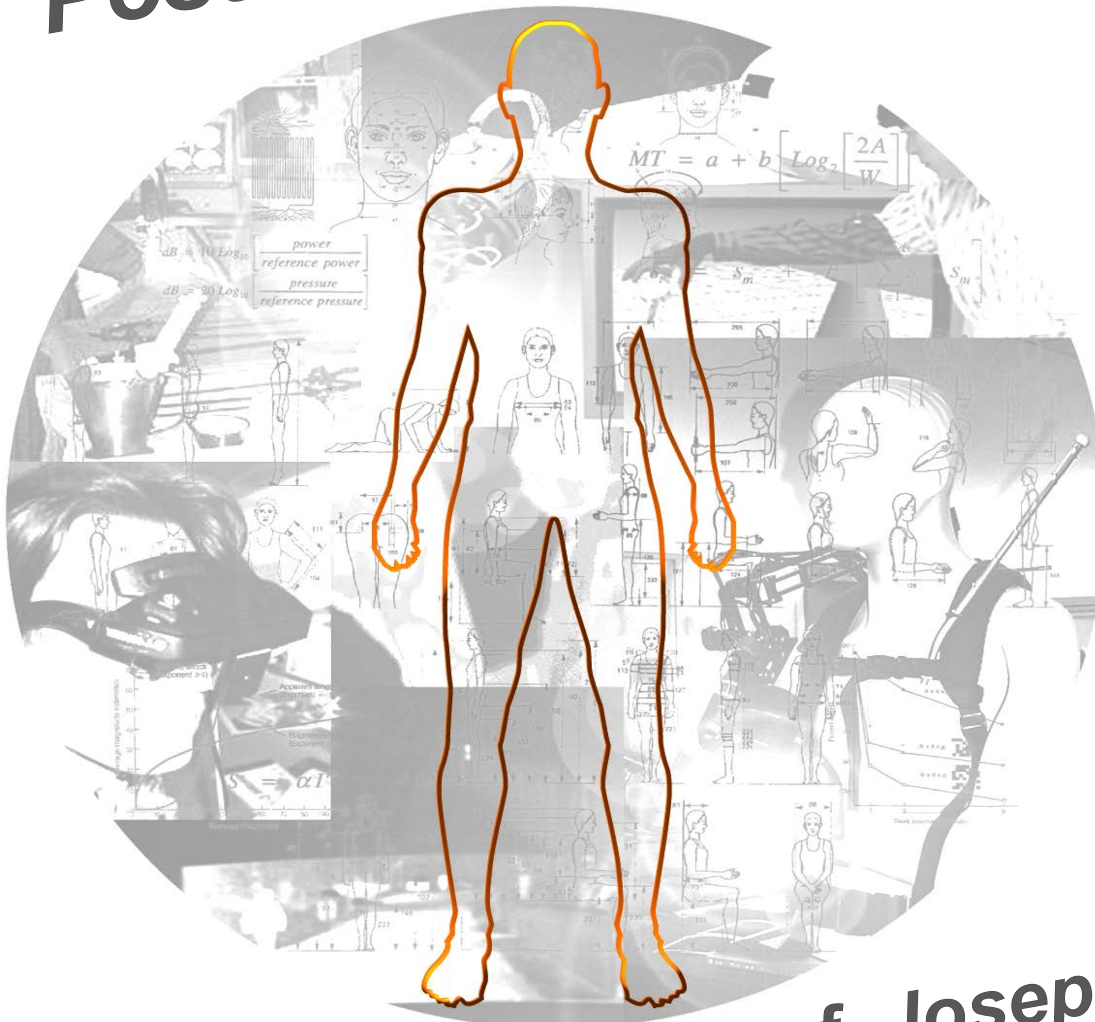
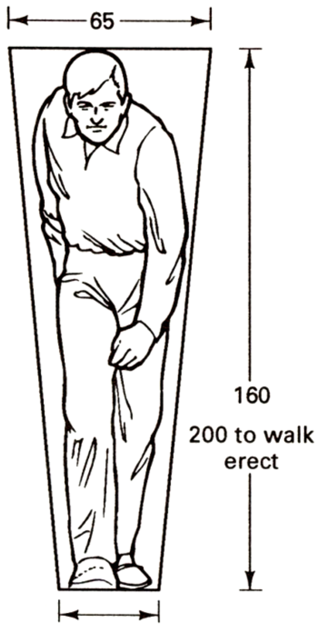
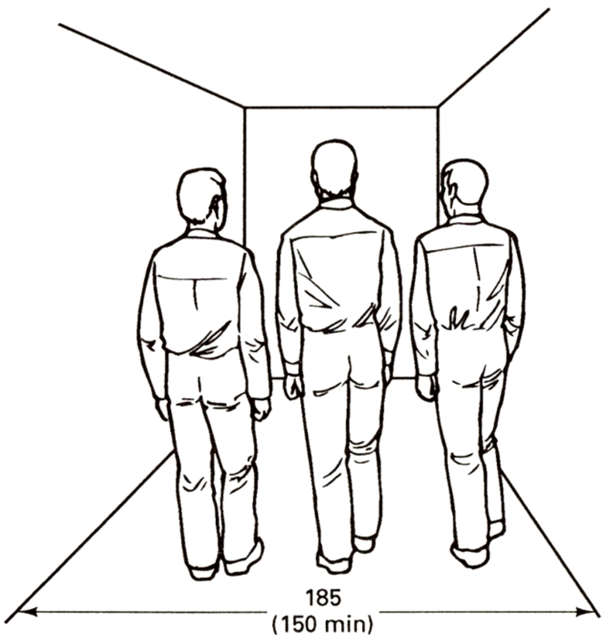
Posture



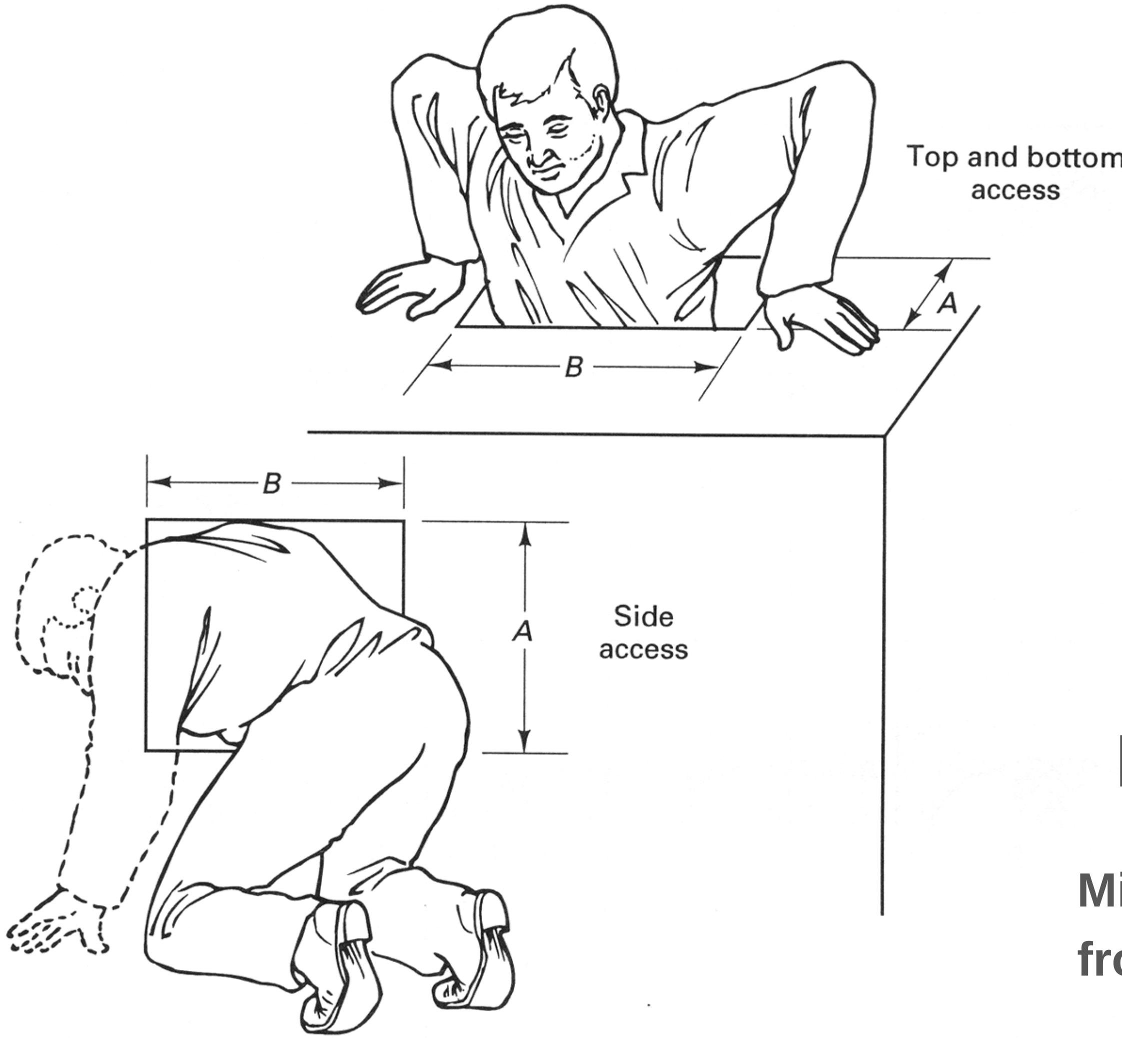
Prof. Joseph Giacomin





Dimensional Requirements

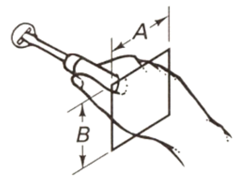
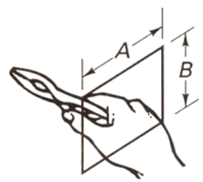
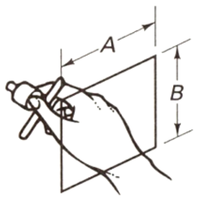
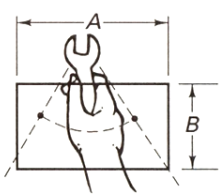
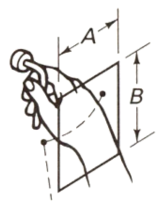
Minimum space requirements for passageways and hallways.



Dimensional Requirements

Minimum access openings from MIL-HDBK 759.

Dimensions	*A,* depth		*B,* width	
Clothing	Light	Bulky	Light	Bulky
Top and bottom access	33 cm	41 cm	58 cm	69 cm
Side access	66 cm	74 cm	76 cm	86 cm

	Approximate dimensions (cm) A	B	Task
	11	12	Using common screwdriver, with freedom to turn hand through 180°
	13	12	Using pliers and similar tools
	14	16	Using "T" handle wrench, with freedom to turn hand through 180°
	27	20	Using open-end wrench, with freedom to turn wrench through 60°
	12	16	Using Allen-type wrench with freedom to turn wrench through 60°
	9	9	Using test probe, etc.

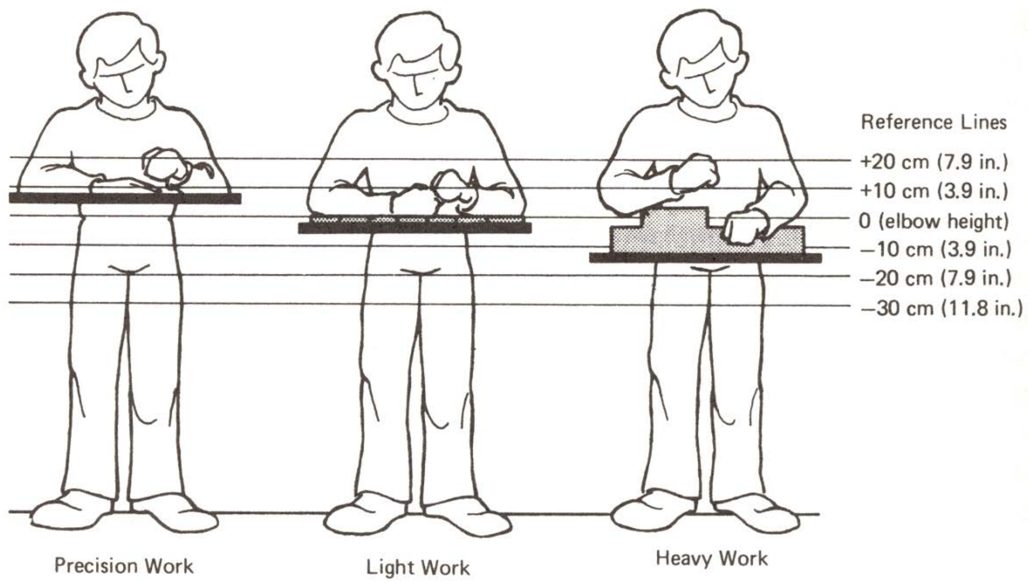
Dimensional Requirements

Minimum access openings to permit one hand holding a tool to pass from MIL-HDBK 759.

The Standing Posture

The standing posture is used in the workplace when sitting is not suitable because the operator has to cover a large work area or because large forces must be exerted with the hands.

The Standing Posture



Precision work requires that the elbows be supported for maximum control.

Light assembly work requires that the work objects be just below elbow level for ease of movement.

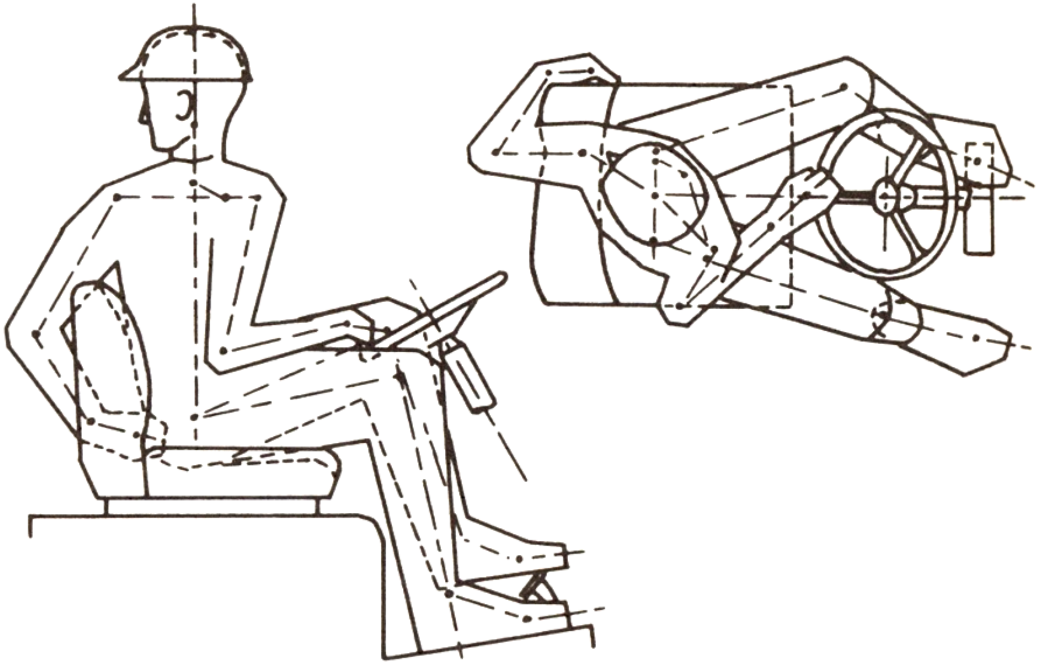
Heavy work requires that objects be placed well below the elbow so as to permit efficient muscle positioning during lifting.

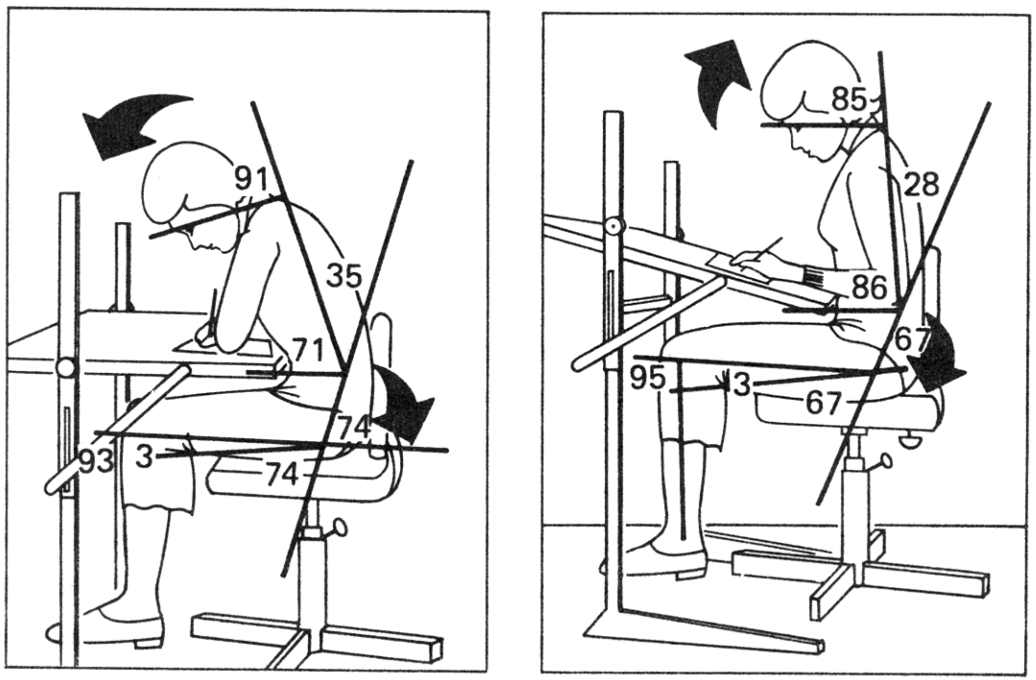
The Standing Posture

RECOMMENDED STANDING WORK-SURFACE HEIGHTS FOR THREE TYPES OF TASKS*

		Fixed height		Adjustable height	
Type of task (standing)	Sex	in	cm	in	cm
Precision work (with elbows supported)	Males	49.5	126	42.0–49.5	107–126
	Females	45.5	116	37.0–45.5	94–116
Light assembly work	Males	42.0	107	34.5–42.0	88–107
	Females	38.0	96	32.0–38.0	81–96
Heavy work	Males	39.0	99	31.5–39.0	80–99
	Females	35.0	89	29.0–35.0	74–89

Work surface heights for the standing posture are determined from the elbow height of the target population and from the type of work activity performed.





(a) Horizontal surface

(b) Slanted surface

The Seated Posture

The seated posture is more comfortable and produces lower strains on the body than the standing posture.

It allows better controlled hand movements but the area coverage is less, as are the maximum hand forces which are achievable.

In the seated posture the feet can, however, be used to exert high forces.

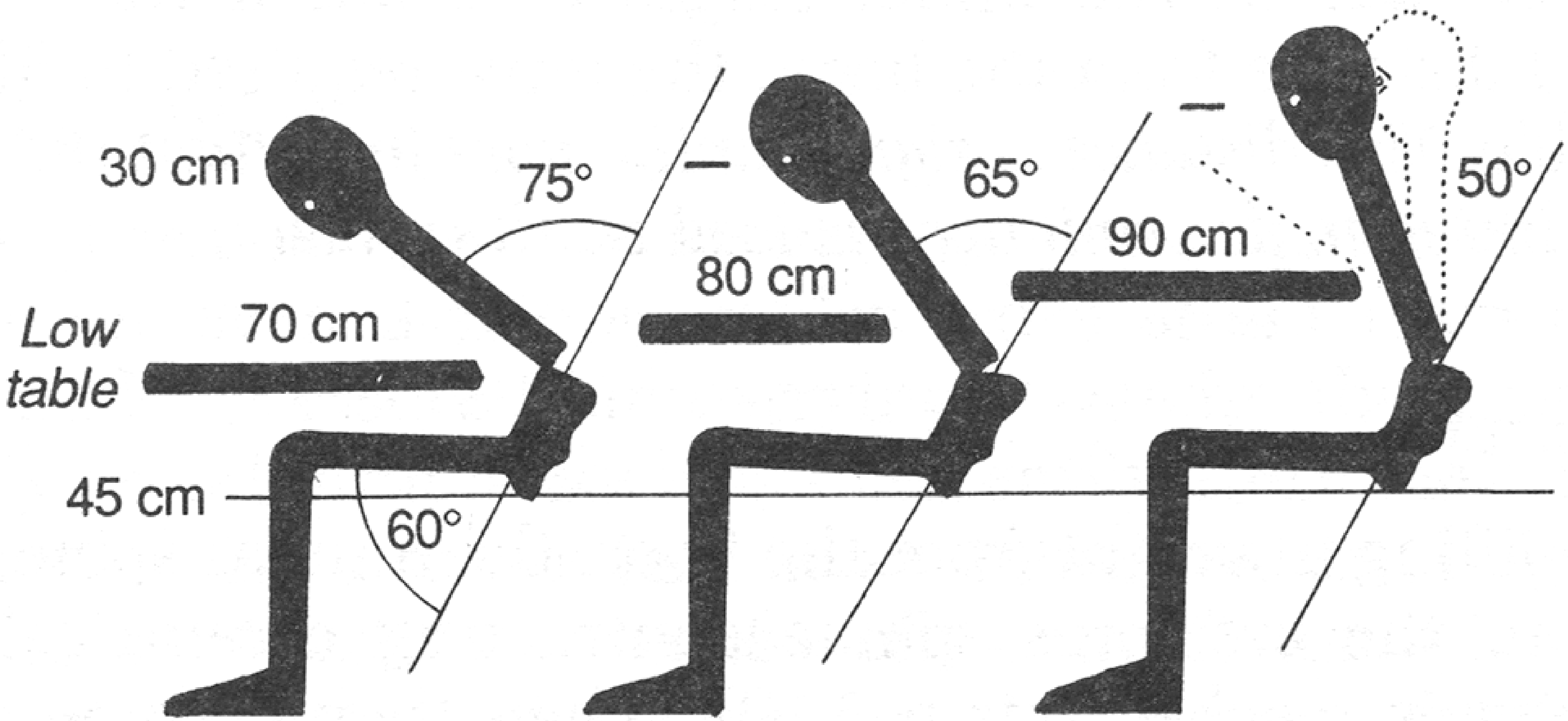
The Seated Posture

RECOMMENDATIONS FOR SEATED WORK-SURFACE HEIGHTS FOR VARIOUS TYPES OF TASKS

	Male		Female	
Type of task (seated)	**in**	**cm**	**in**	**cm**
Fine work (e.g., fine assembly)[1]	39.0–41.5	99–105	35.0–37.5	89–95
Precision work (e.g., mechanical assembly)[1]	35.0–37.0	89–94	32.5–34.5	82–87
Light assembly[1]	29.0–31.0	74–78	27.5–29.5	70–75
Coarse or medium work[1]	27.0–28.5	69–72	26.0–27.5	66–70
Reading and writing[2]	29.0–31.0	74–78	27.5–29.0	70–74
Range for typing desks[2]	23.5–27.5	60–70	23.5–27.5	60–70
Computer keyboard use[3]	23.0–28.0	58–71	23.0–28.0	58–71

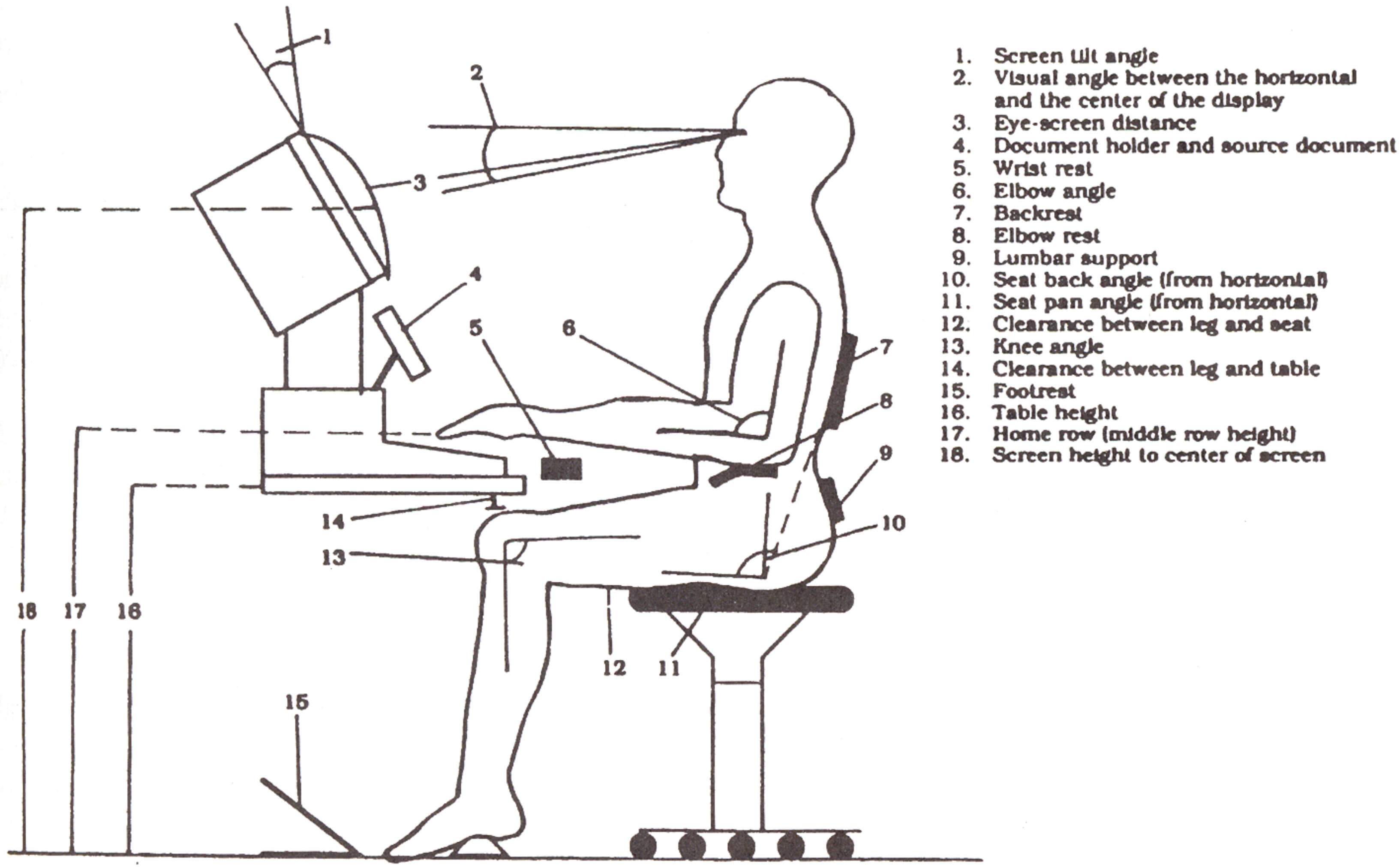
As with the standing posture there are general guidelines for specifying the height of a seated work surface from the elbow height of the target population and the type of work being performed.

The Seated Posture



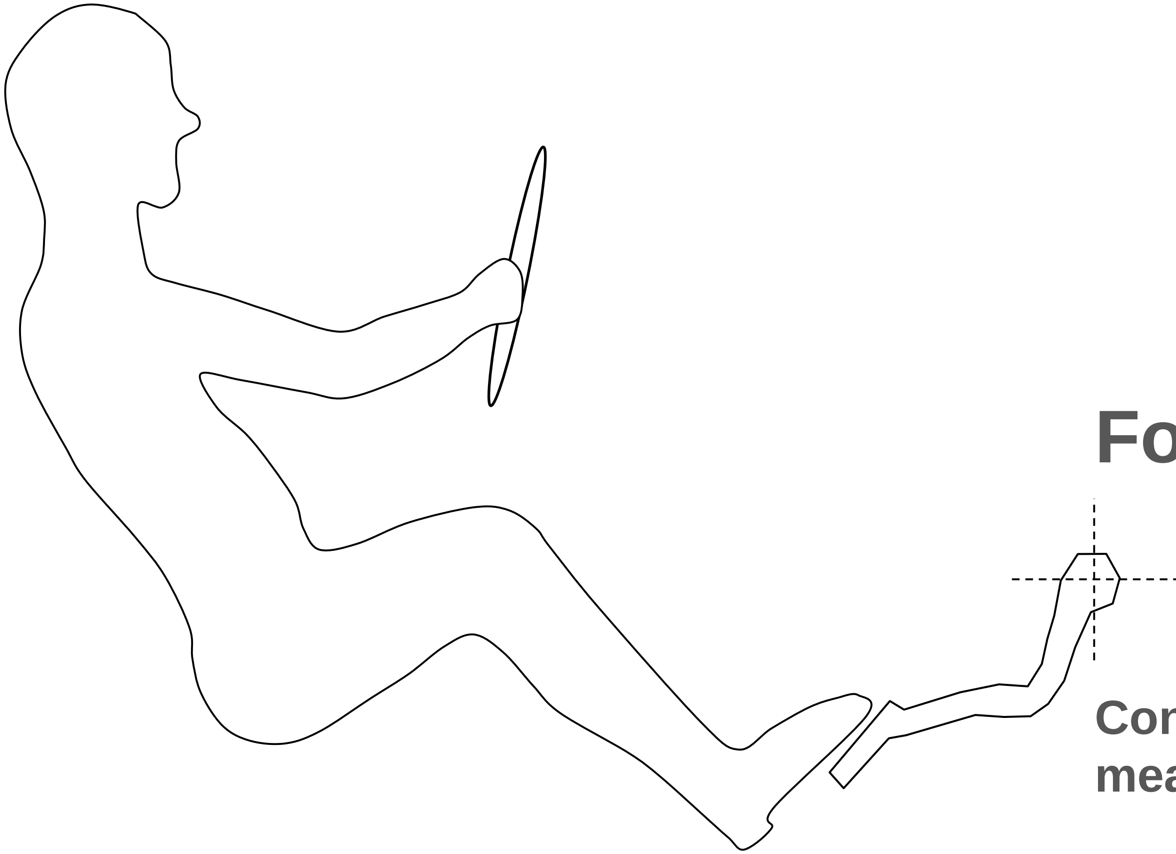
Care must be taken with seated workplaces to avoid low table heights since these increase the flexion of the lumbar region, thus putting the intervertebral disks and back muscles at risk of strain and injury.

The Seated Posture



The choice of surface height for the seated posture also requires consideration of the amount of space available underneath since limited space will lead to uncomfortable leg postures.

Since many types of seated work require the viewing of computer screens or other objects consideration must also be given to the viewing angles that are formed.

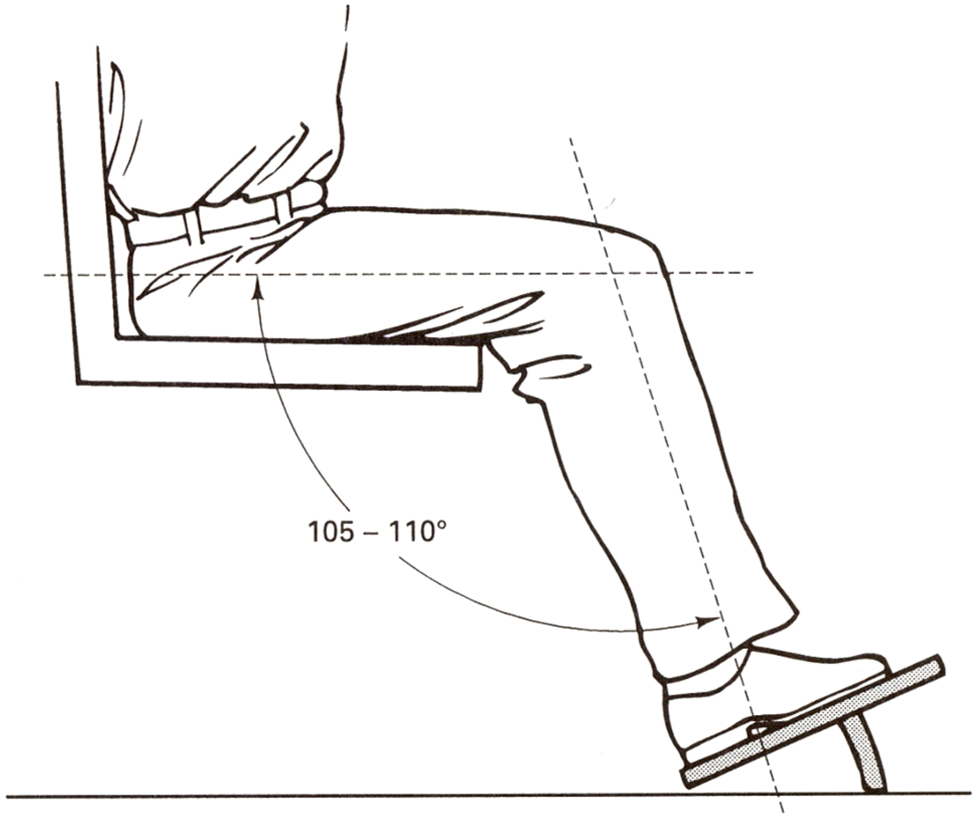


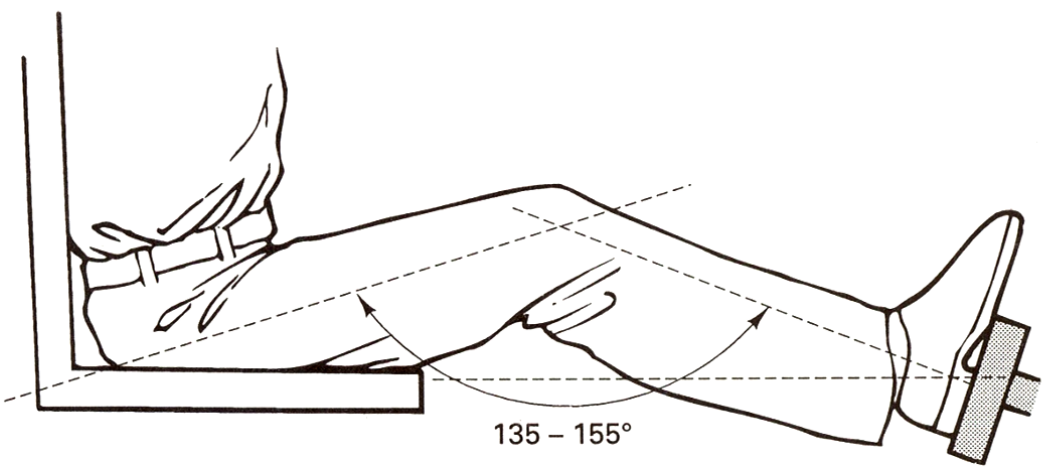
Foot Operation

Controls are traditionally operated by means of hand or foot movement.

Foot movements are slower, less accurate and consume more energy than hand movements.

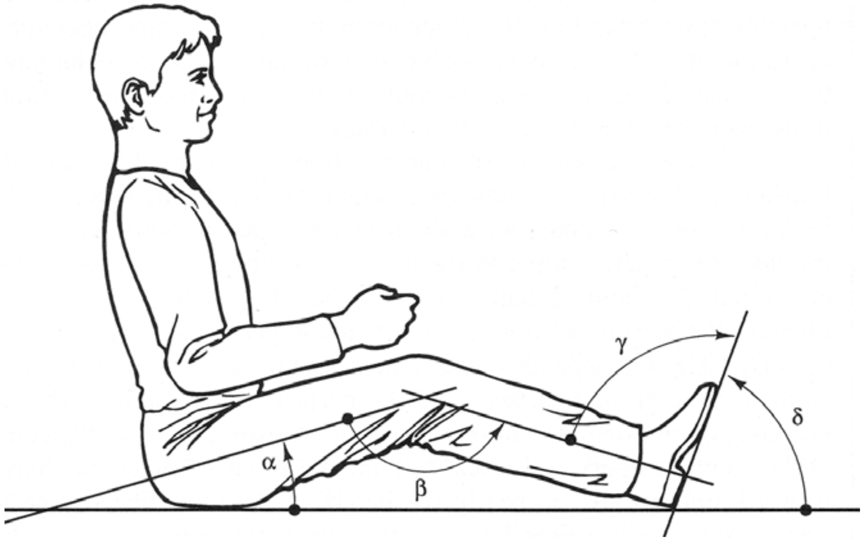
Foot actuation provides, however, higher forces at the control surface.





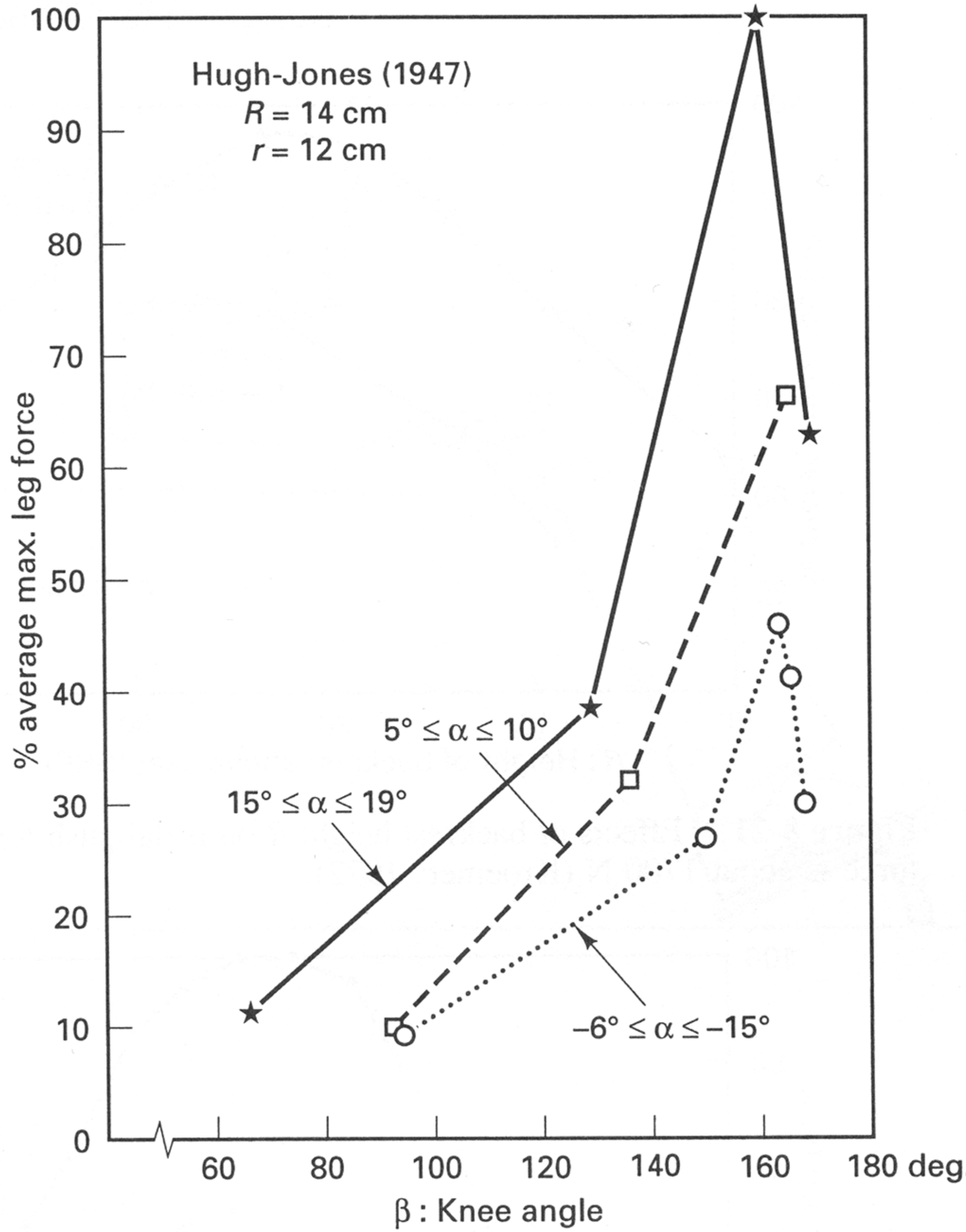
Foot Operation

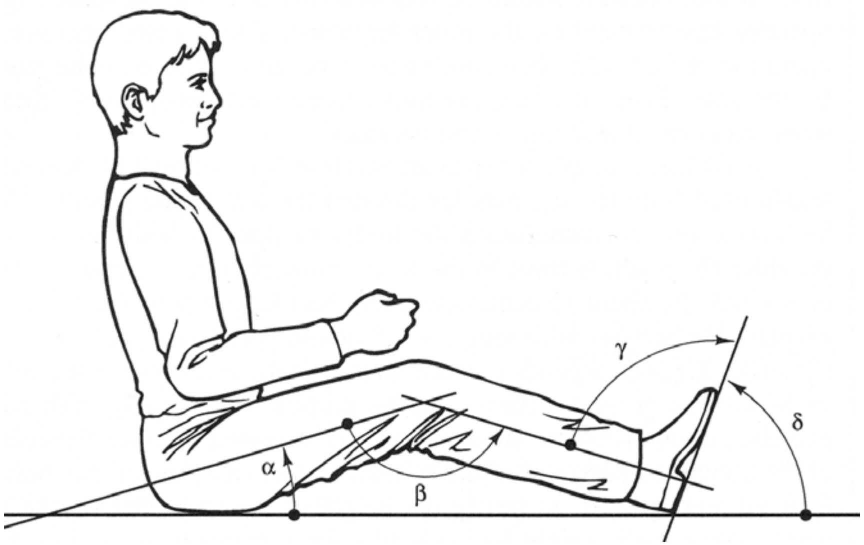
Human comfort considerations suggest that light downward forces are best produced at knee angles from 105 to 110 degrees while strong forward forces require knee angles of 135 to 155 degrees.

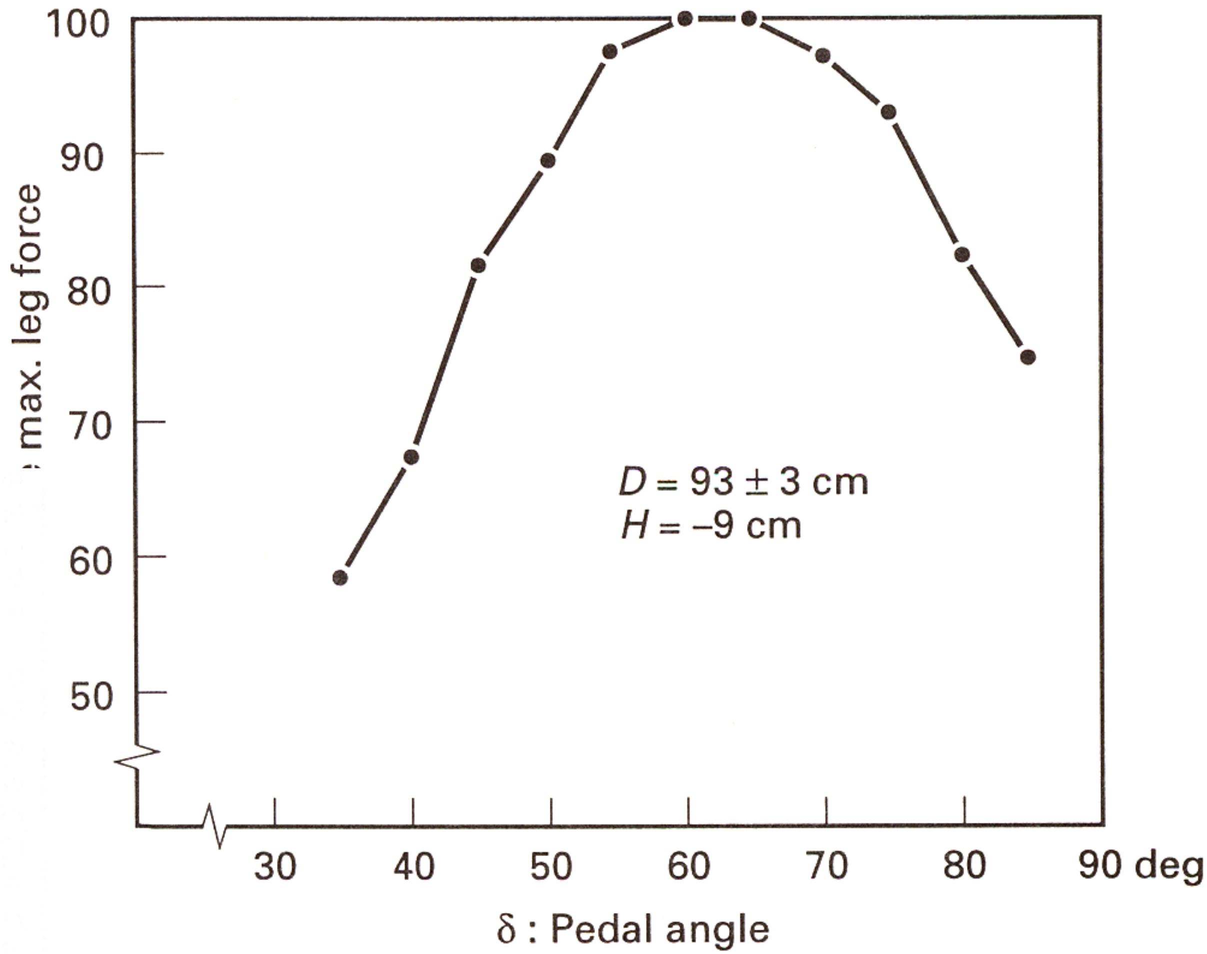


Foot Operation

The force that can be exerted on a pedal depends on the body posture of the individual during actuation.







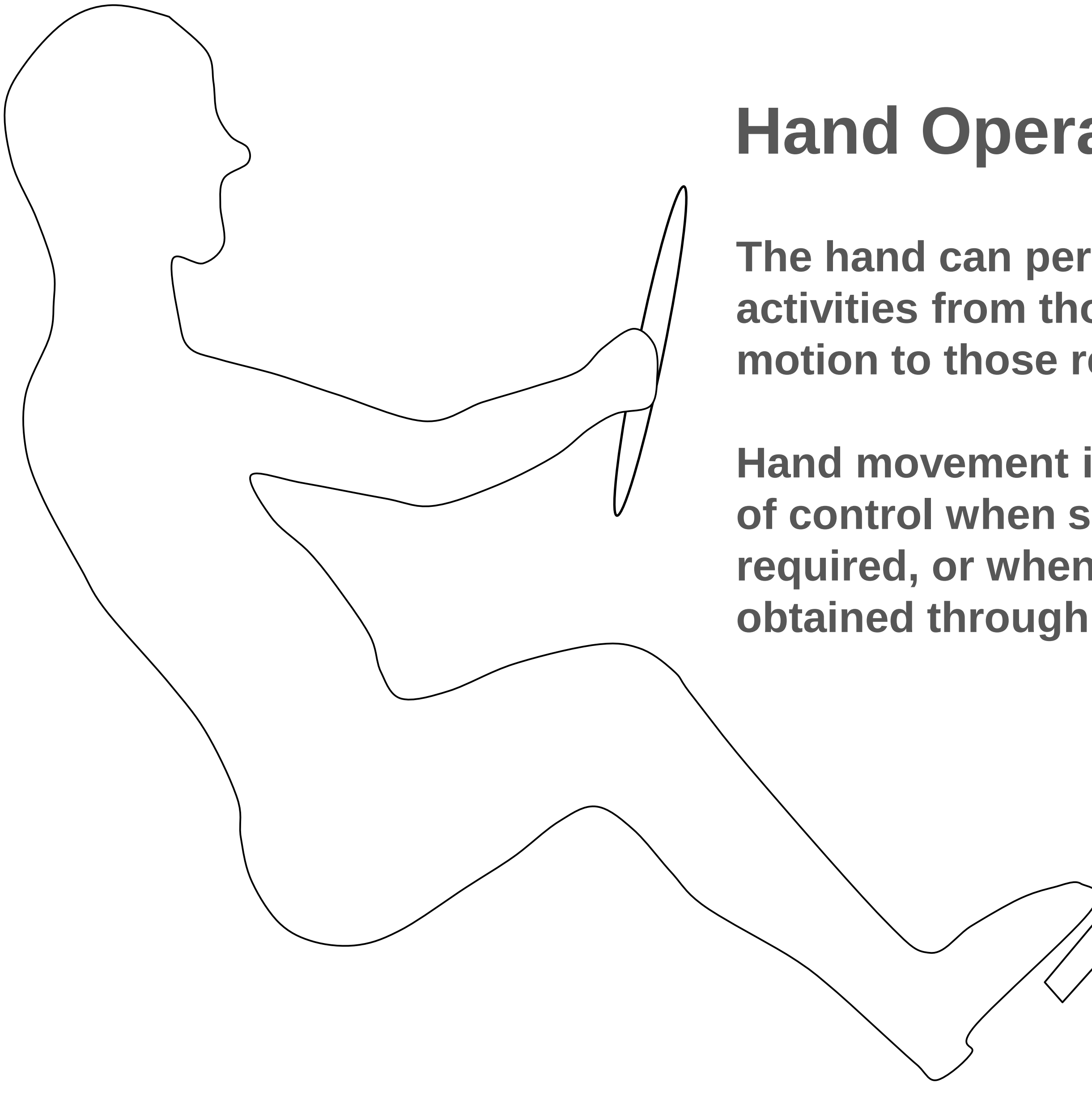
Foot Operation

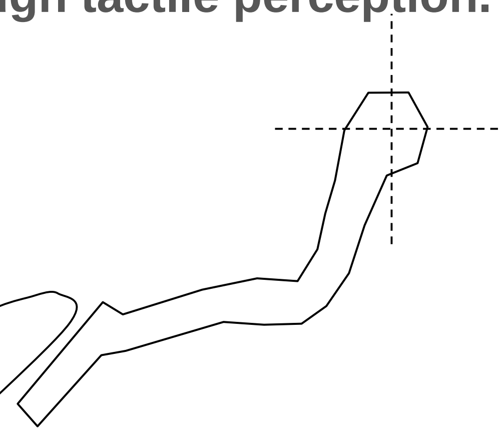
The force that can be exerted on a pedal depends on the body posture of the individual during actuation.

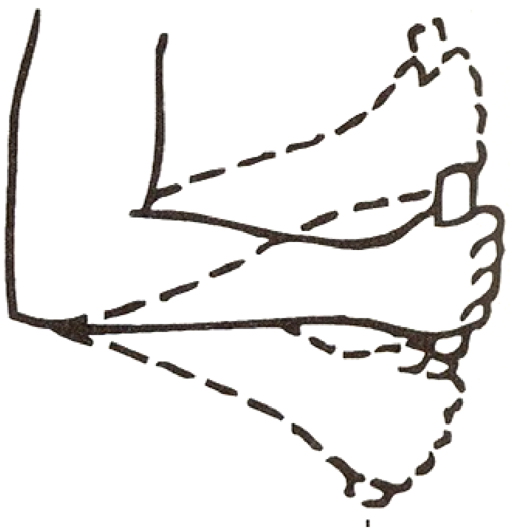
Hand Operation

The hand can perform a wide range of activities from those requiring fine motion to those requiring large forces.

Hand movement is the preferred means of control when speed and accuracy are required, or when information must be obtained through tactile perception.

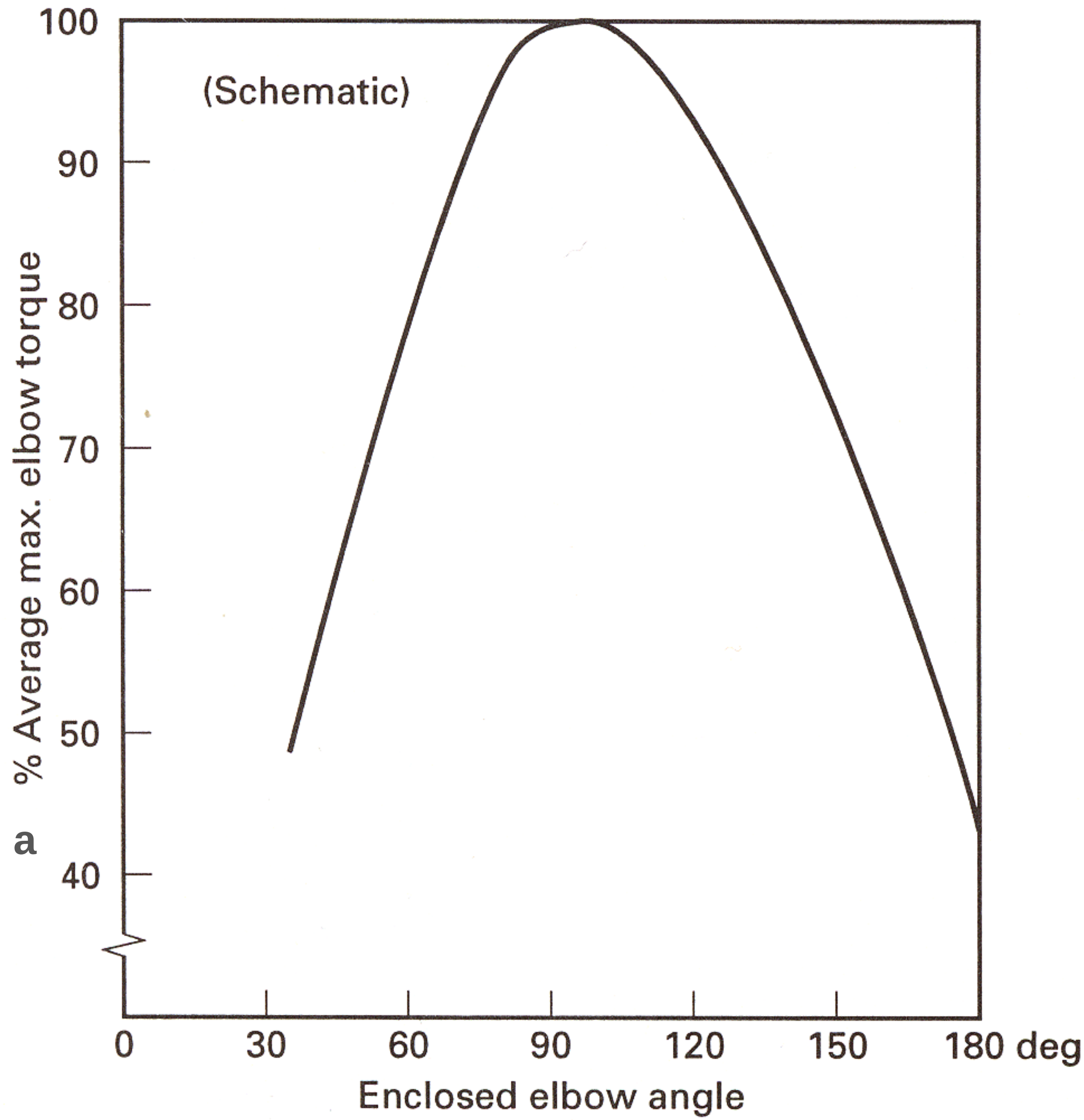






Hand Operation

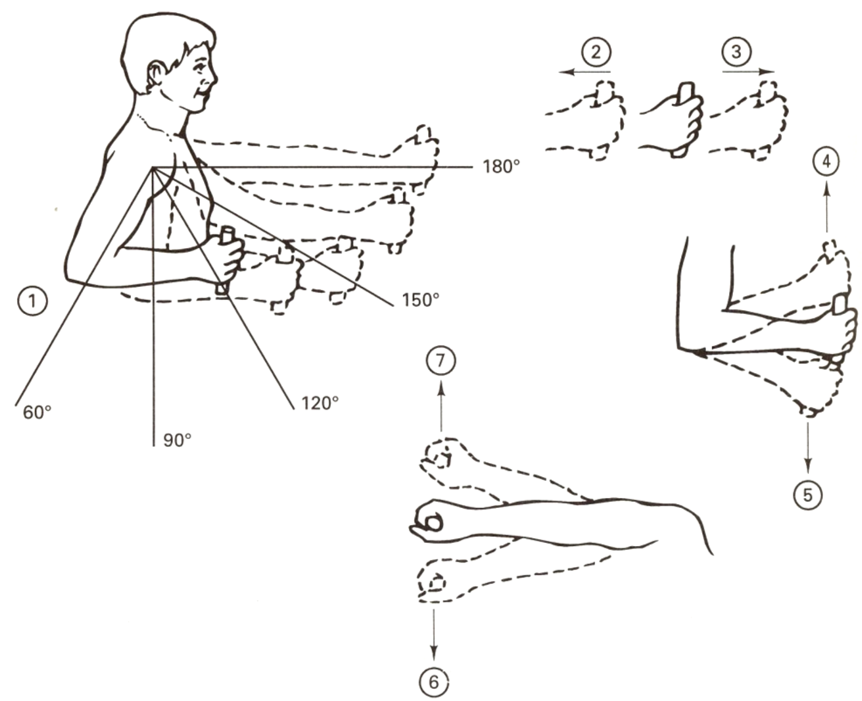
The torque that can be exerted on a handle or wheel depends on the body posture of the elbow during actuation.



Fifth-percentile arm strength (N) exerted by sitting men													
(1)	(2)		(3)		(4)		(5)		(6)		(7)		
Degree of elbow flexation (deg)	Pull		Push		Up		Down		In		Out		
	Left	Right	L	R	L	R	L	R	L	R	L	R	
180	222	231	187	222	40	62	58	76	58	89	36	62	
150	187	249	133	187	67	80	80	89	67	89	36	67	
120	151	187	116	160	76	107	93	116	89	98	45	67	
90	142	165	98	160	76	89	93	116	71	80	45	71	
60	116	107	96	151	67	89	80	89	76	89	53	71	

Hand Operation

The forces that can be exerted on a handle or wheel depend on the body posture of the elbow during actuation.

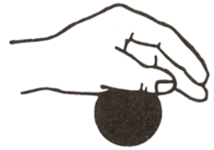


Coupling #1. Digit Touch:

One digit touches an object.

Coupling #2. Palm Touch:

Some part of the palm (or hand) touches the object.



Coupling #3. Finger Palmar Grip (Hook Grip):

One finger or several fingers hook(s) onto a ridge, or handle. This type of finger action is used where thumb counterforce is not needed.

Coupling #4. Thumb–Fingertip Grip (Tip Pinch):

The thumb tip opposes one fingertip.

Coupling #5. Thumb–Finger Palmar Grip (Pad Pinch or Plier Grip):

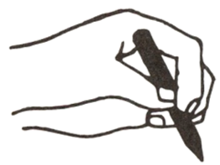
Thumb pad opposes the palmar pad of one finger (or the pads of several fingers) near the tips. This grip evolves easily from coupling #4.

Coupling #6. Thumb–Forefinger Side Grip (Lateral Grip or Side Pinch):

Thumb opposes the (radial) side of the forefinger.

Coupling #7. Thumb–Two–Finger Grip Grip (Writing Grip):

Thumb and two fingers (often forefinger and middle finger) oppose each other at or near the tips.



Coupling #8. Thumb–Fingertips Enclosure (Disk Grip):

Thumb pad and the pads of three or four fingers oppose each other near the tips (object grasped does not touch the palm). This grip evolves easily from coupling #7.

Coupling #9. Finger–Palm Enclosure (Collet Enclosure):

Most, or all, of the inner surface of the hand is in contact with the object while enclosing it. This enclosure evolves easily from coupling #8.

Coupling #10. Power Grasp:

The total inner hand surfaces is grasping the(often cylindrical) handle which runs parallel to the knuckles and generally protrudes on one or both sides from the hand. This grasp evolves easily from coupling #9.

Hand Operation

Common coupling types used in hand operation.

Hand Operation

TABLE 8-5. FORCES OF DIGITS, GRIP AND GRASP FORCES EXERTED BY 21 MALE STUDENTS* AND BY 12 MALE MACHINISTS. MEANS (AND STANDARD DEVIATIONS) IN *N*

Couplings (see Figure 8-26)	Digit 1 (thumb)	Digit 2 (index)	Digit 3 (middle)	Digit 4 (ring)	Digit 5 (little)	
Push with digit tip in direction of the extended digit ("Poke")	91 (39)* 138 (41)	52 (16)* 84 (35)	51 (20)* 86 (28)	35 (12)* 66 (22)	30 (10)* 52 (14)	See also Table 8-4
Digit Touch (Coupling #1) perpendicular to extended digit.	84 (33)* 131 (42)	43 (14)* 70 (17)	36 (13)* 76 (20)	30 (13)* 57 (17)	25 (10)* 55 (16)	—
Same, but all fingers press on one bar	—	digits 2, 3, 4, 5 combined: 162 (33)				
Tip force (like in typing; angle between distal and proximal phalanges about 135 degrees)	—	30 (12)* 65 (12)	29 (11)* 69 (22)	23 (9)* 50 (11)	19 (7)* 46 (14)	—
Palm Touch (Coupling #2) perpendicular to palm (arm, hand, digits extended and horizontal)	—	—	—	—	—	233 (65)
Hook Force exerted with digit tip pad (Coupling #3, "Scratch")	61 (21) 118 (24)	49 (17) 89 (29)	48 (19) 104 (26)	38 (13) 77 (21)	34 (10) 66 (17)	all digits combined: 108 (39)* 252 (63)
Thumb-Fingertip Grip (Coupling #4, "Tip Pinch")	—	1 on 2 50 (14)* 59 (15)	1 on 3 53 (14)* 63 (16)	1 on 4 38 (7)* 44 (12)	1 on 5 28 (7)* 30 (6)	—
Thumb-Finger Palmar Grip (Coupling #5, "Pad Pinch")	1 on 2 and 3 85 (16)* 95 (19)	1 on 2 63 (12)* 34 (7)	1 on 3 61 (16)* 70 (15)	1 on 4 41 (12)* 54 (15)	1 on 5 31 (9)* 34 (7)	—
Thumb-Forefinger Side Grip (Coupling #6, "Side Pinch")	—	1 on 2 98 (13)* 112 (16)	—	—	—	—
Power Grasp (Coupling #10, "Grip Strength")	—	—	—	—	—	318 (61)* 366 (53)

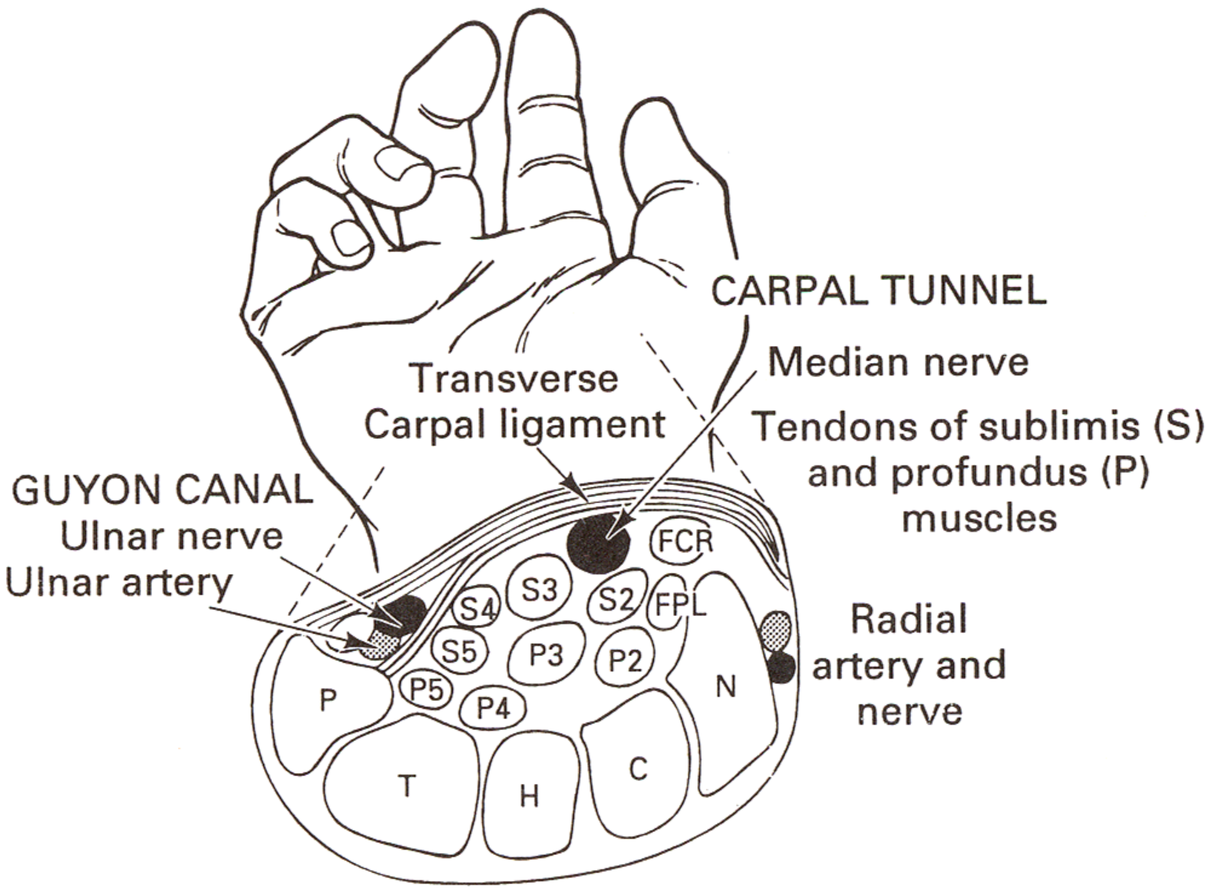
The forces that can be exerted on a button depend on the coupling with the hand.

Carpal Tunnel Syndrome

Poor design and overuse can lead to irritation and damage of muscle, tendons, blood vessels or nervous tissue.

When this occurs with an object or work activity it is described as overuse disorder.

Carpal Tunnel Syndrome

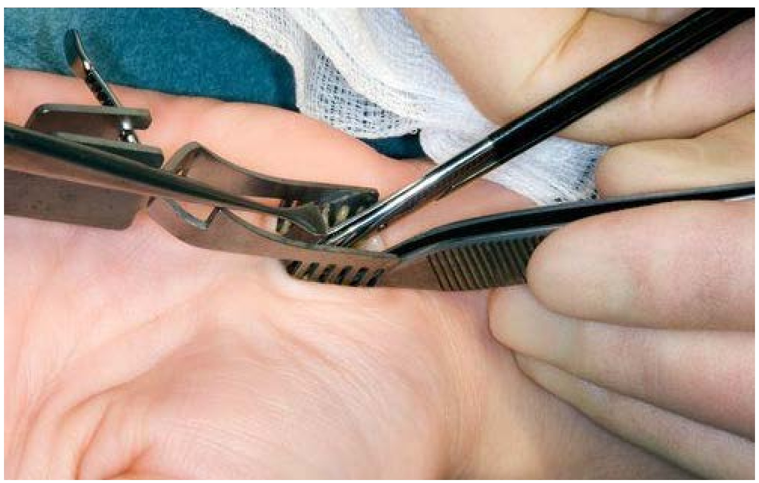


Carpal Tunnel Syndrome (CTS) is one of the most common overuse disorders.

CTS occurs when activities such as computer keyboard use lead to repeated flexing of the wrist.

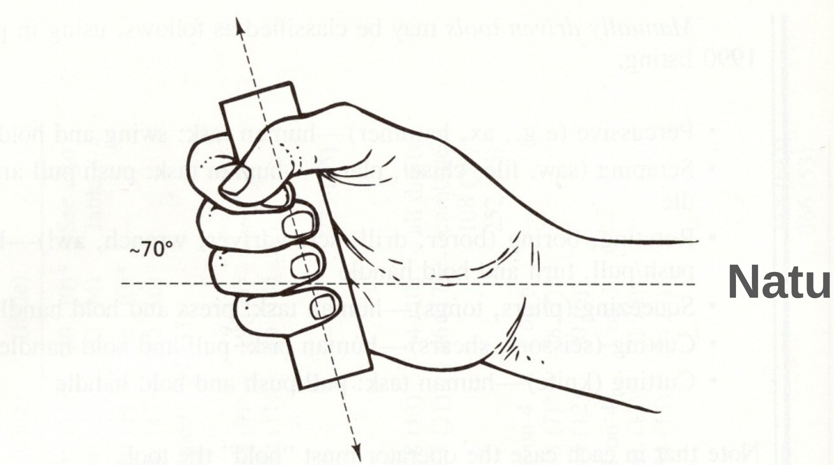
Tissue and tendon swelling occurs which reduces the area of the carpal tunnel.

This causes compression of the median nerve, which produces pain and numbness of the fingers and hand.

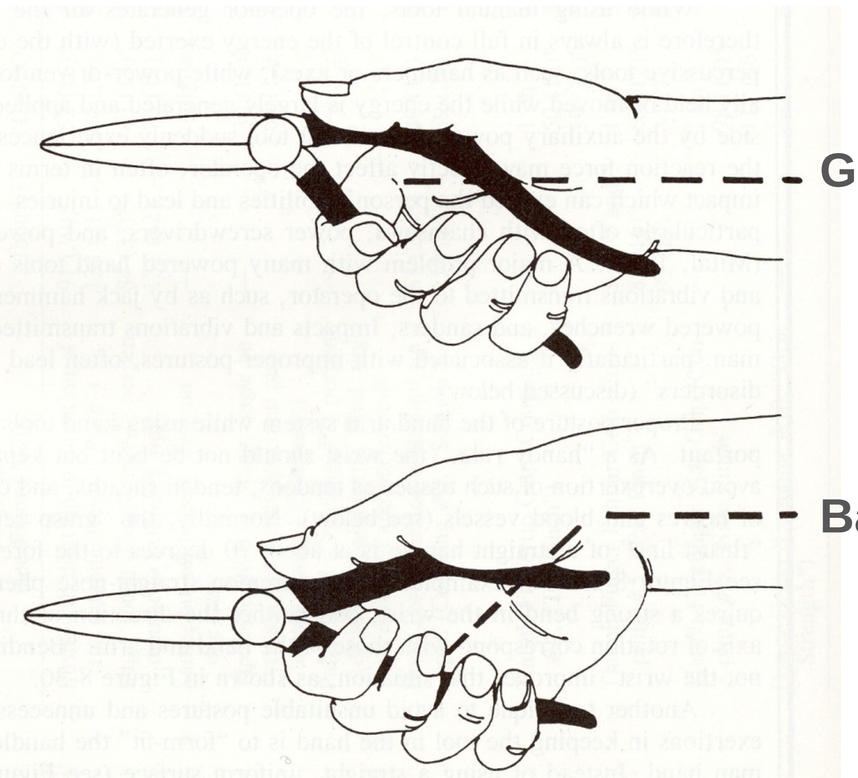


Carpal Tunnel Syndrome

Depending on the severity of the symptoms the medical treatment of CTS can consists of targeted exercises, a wrist brace, steroid injections or surgery.



Natural Wrist Angle



Good Design

Bad Design

Carpal Tunnel Syndrome

Ergonomic hand and power tools are available which minimise the risk of CTS by reducing the wrist flexion required to use the tool.

Carpal Tunnel Syndrome

Ergonomic hand and power tools are available which minimise the risk of CTS by reducing the wrist flexion required to use the tool.

Design Classic: Ergonomic Scissors

1967

Fiskars introduced orange scisors as the world's first plastic-handled scissors.

1972

Fiskars was the first company to begin the mass production of left-handed, ergonomic scissors.

1973

Kitchen scissors were introduced in Europe.

1975

The scissor blades were beveled to improve performance. Cutting angle was also optmized to 60°.

1975 **1979**

Special scissors, such as the thread and manicure scissors were introduced.

1985

The Avanti series added the ability to add color to the scissors selection.

1995

Scissors renewal: the current general purpose scissors model was introduced.

2010

The Cuts+More™ Scissors introduces multiple tools in one high-quality cutting tool.

2012

Fiskars celebrates 45 years of Orange-Handled Scissors.

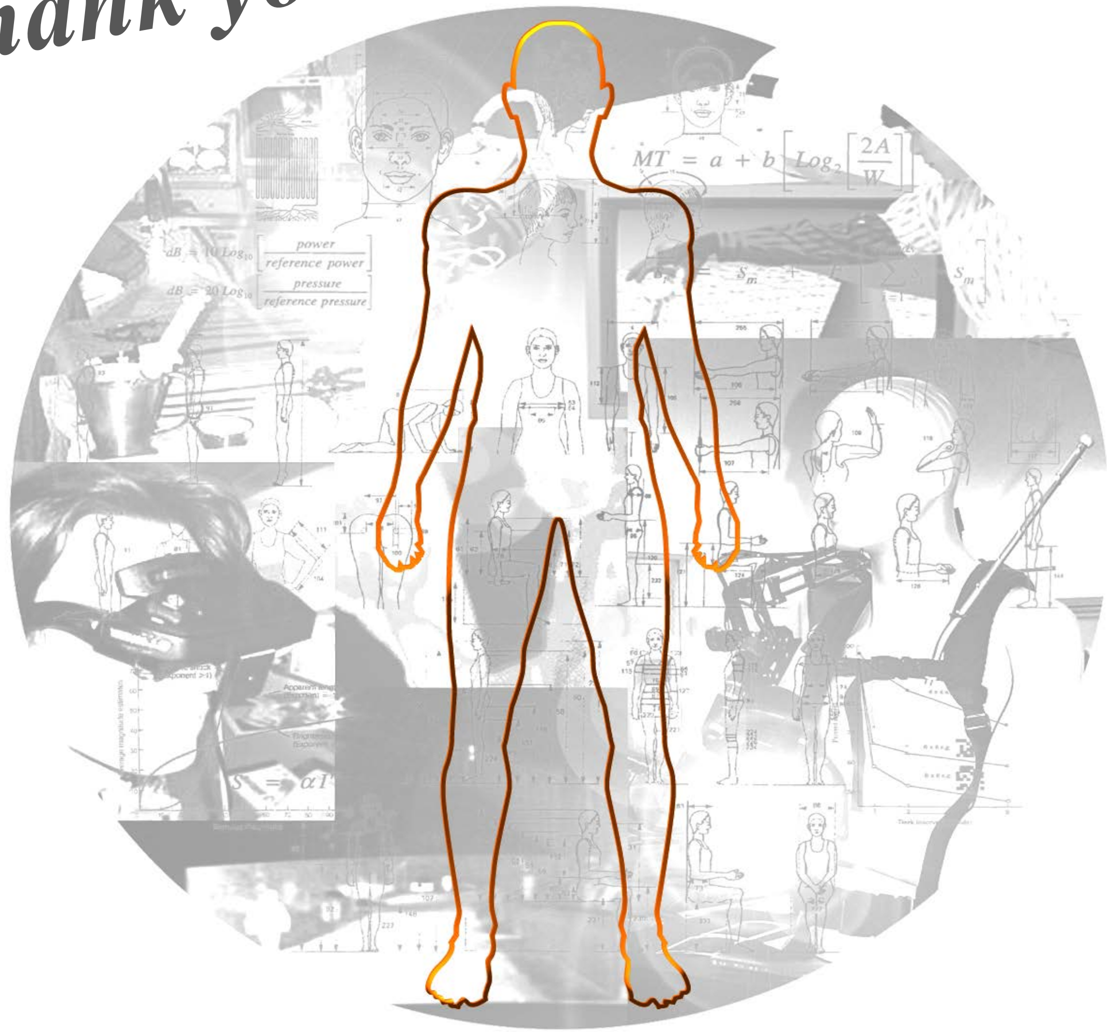
Design Classic: Aeron Chair

Don Chadwick designed the Aeron Chair for Herman Miller in 1994.

Business Week Magazine and the Industrial Designers Society of America selected the Aeron Chair as their Design of the Decade in 2000.

It is on permanent display at MOMA.

Thank you.



MT = a + b [Log2 [2A/W]]
dB = 10 Log10 [power / reference power]
dB = 20 Log10 [pressure / reference pressure]