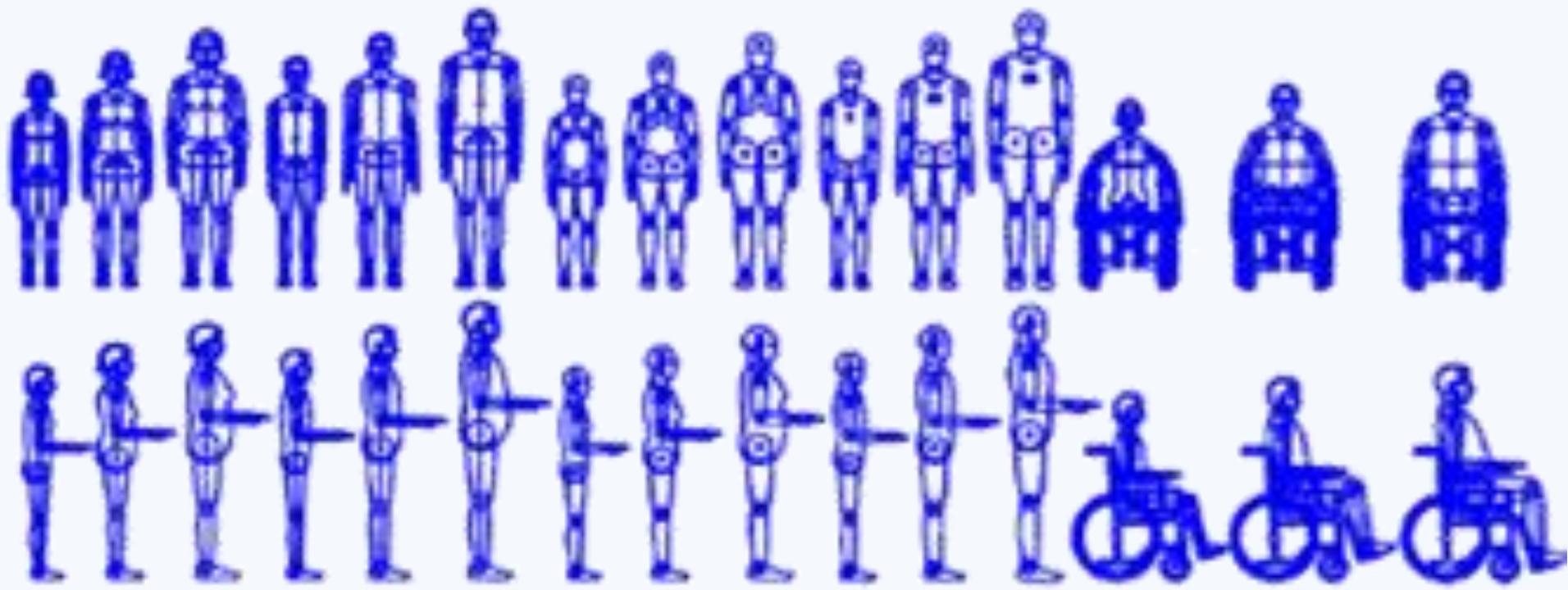


# #2 Anthropometry

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# Diversity in the human body





# Definition of Anthropometry

Anthropos  
= human

Metron =  
measure

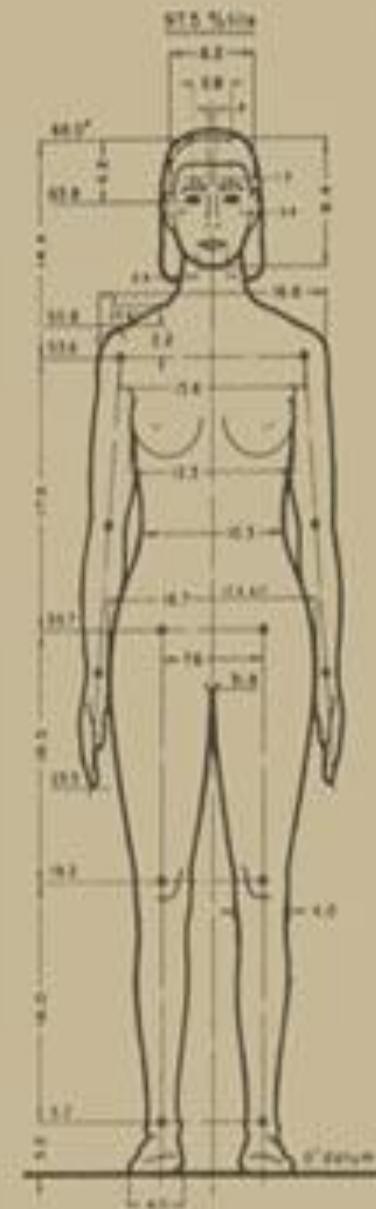
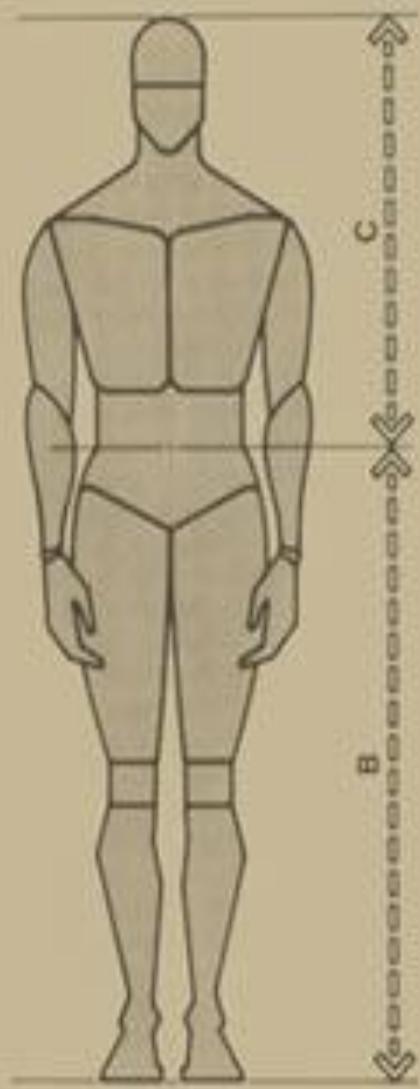
- The part of anthropology (study of humans) having to do with **measurements of the human body** to determine differences in races, individuals, etc… (Webster’s New 20<sup>th</sup> Century Dictionary, 1970).
- Anthropometry is a science that deals with **the measurement of size, weight, and proportions of the human body**. It is empirical (experimentally derived) in nature and has developed quantitative methods to measure various physical dimensions. (Chaffin, 1984)

# **Engineering Anthropometry**

**The application of anthropometric data  
to equipment, workplace, and job design  
to enhance the efficiency, safety and comfort  
of the operator.**



**What is the difference of  
products developed by fashion  
designer and industrial designer ?**



# Application of Anthropometric Data

1. To specify the physical dimensions of :

- ❖ Workspaces
- ❖ Equipment
- ❖ Furniture
- ❖ Clothing
- ❖ So on...



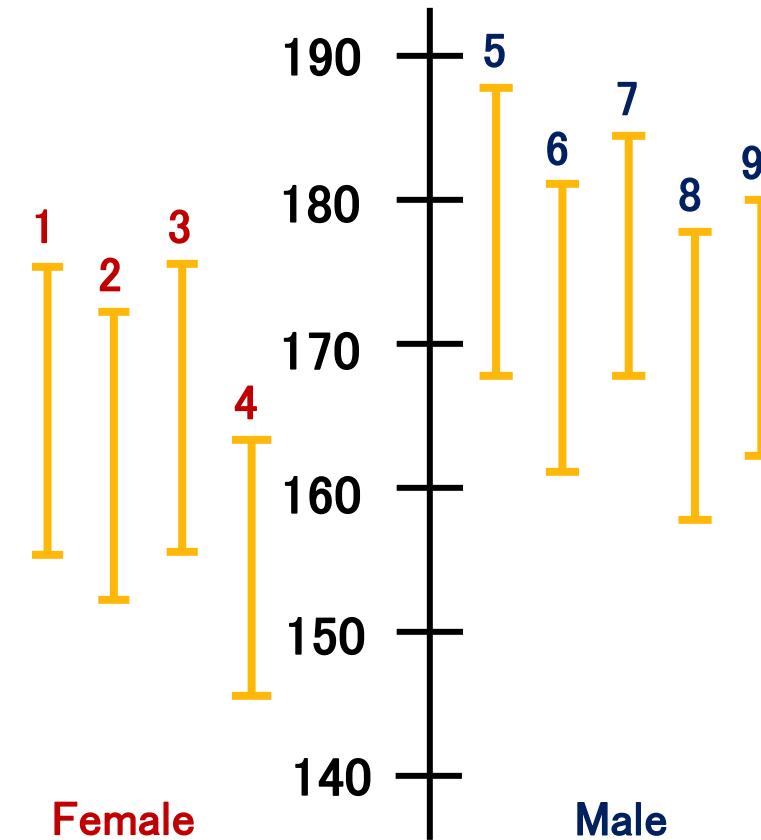
**Fit the task  
to the man  
(Grandjean,  
1980)**

2. To ensure that physical mismatches between the dimensions of equipment / products and the user are avoided.

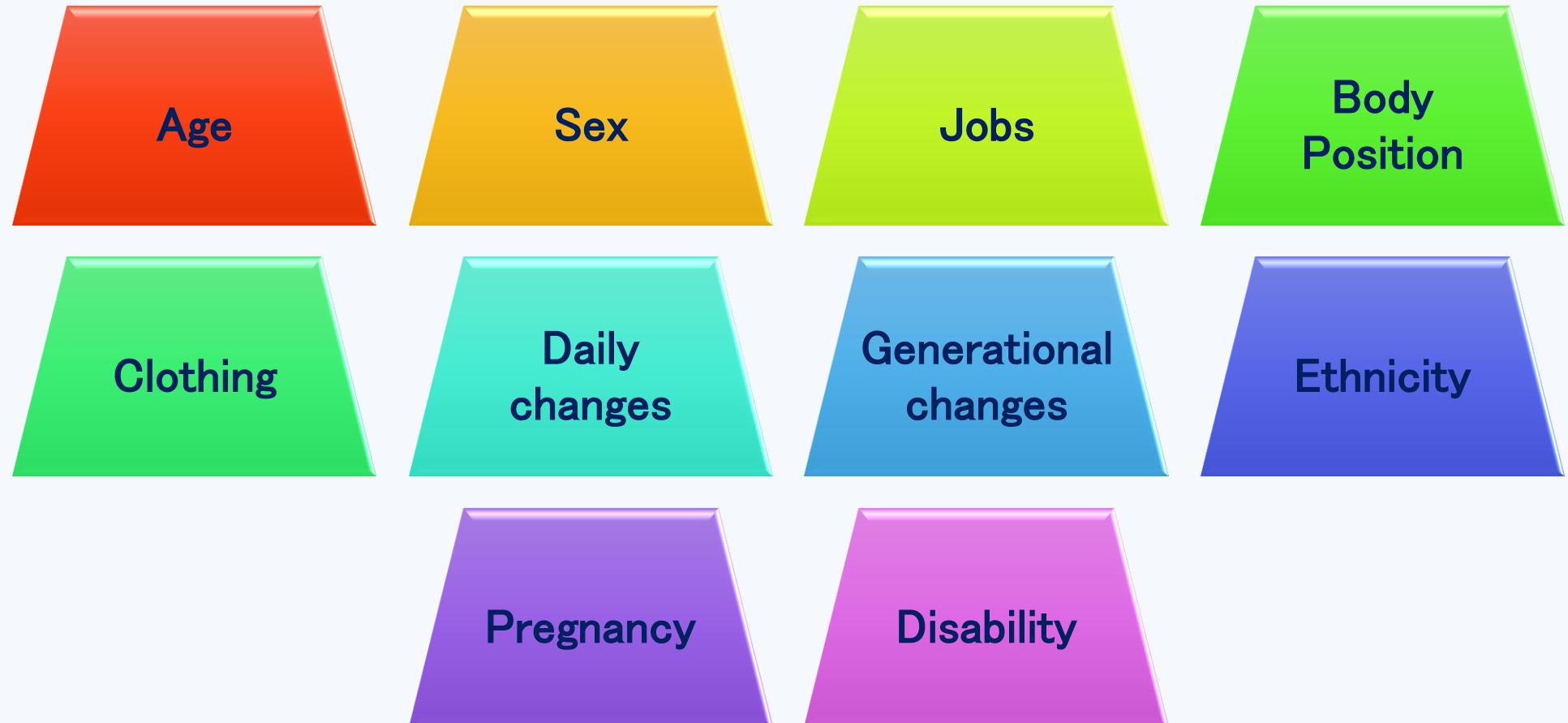
# Human Variability

1. US Civilians
2. British Civilians
3. Swedish Civilians
4. Japanese civilians
5. US Air Force Fliers
6. Italian Military
7. French Fliers
8. Japanese Civilians
9. Turkish Military

Standing Height (cm)



# Factors affecting anthropometry data

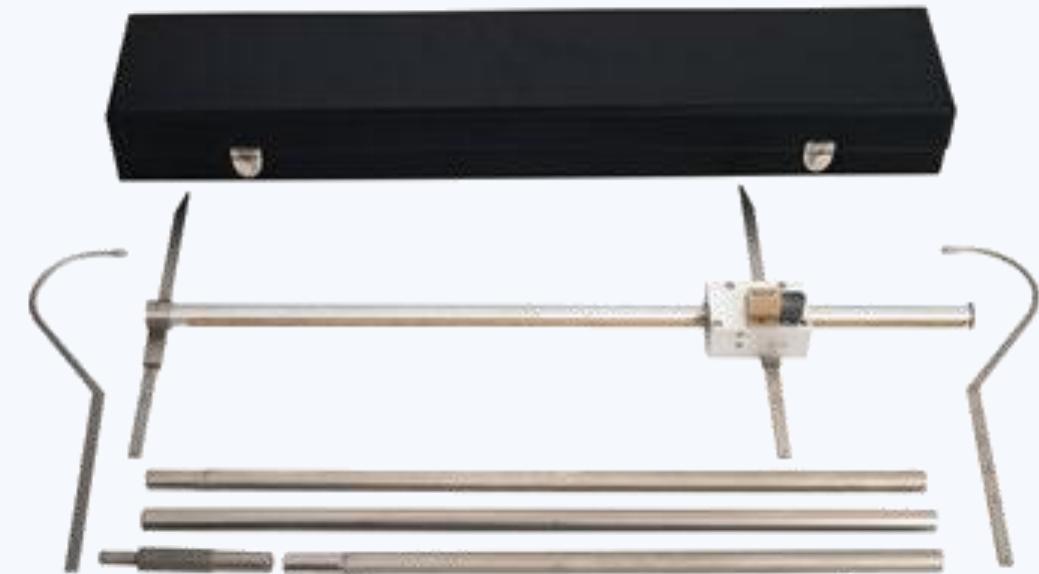


# Type of anthropometric data

- **Structural body dimension**
  - Measure the body dimensions of subjects in **fixed (static) positions**.
  - Measurements are made from one clearly identifiable anatomical landmark to another or to a fixed point in space.
  - Example : height of the popliteal above the floor.
  - What are the applications of structural anthropometric data in design?
- **Functional body dimension**
  - Measure the body dimensions of subjects in **dynamic positions**.
  - Measure the movement of a body part with respect to a fixed reference point.
  - Example : maximum forward reach of standing subjects.
  - What are the applications of functional anthropometric data in design?

# Measurement tools

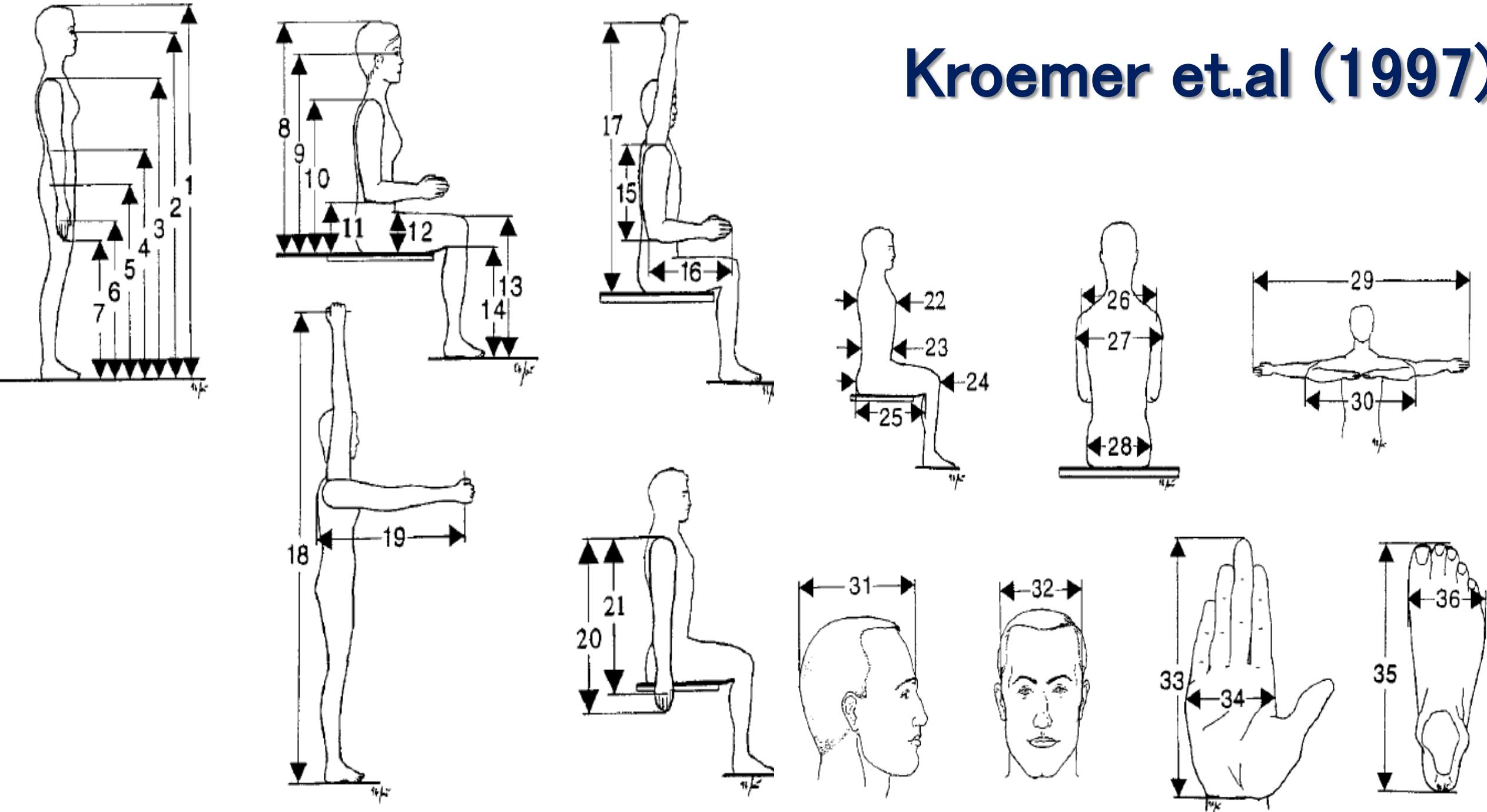
- Spreading and sliding calipers
- Anthropometer
- Segmometer
- Head board
- Anthropometric Tape



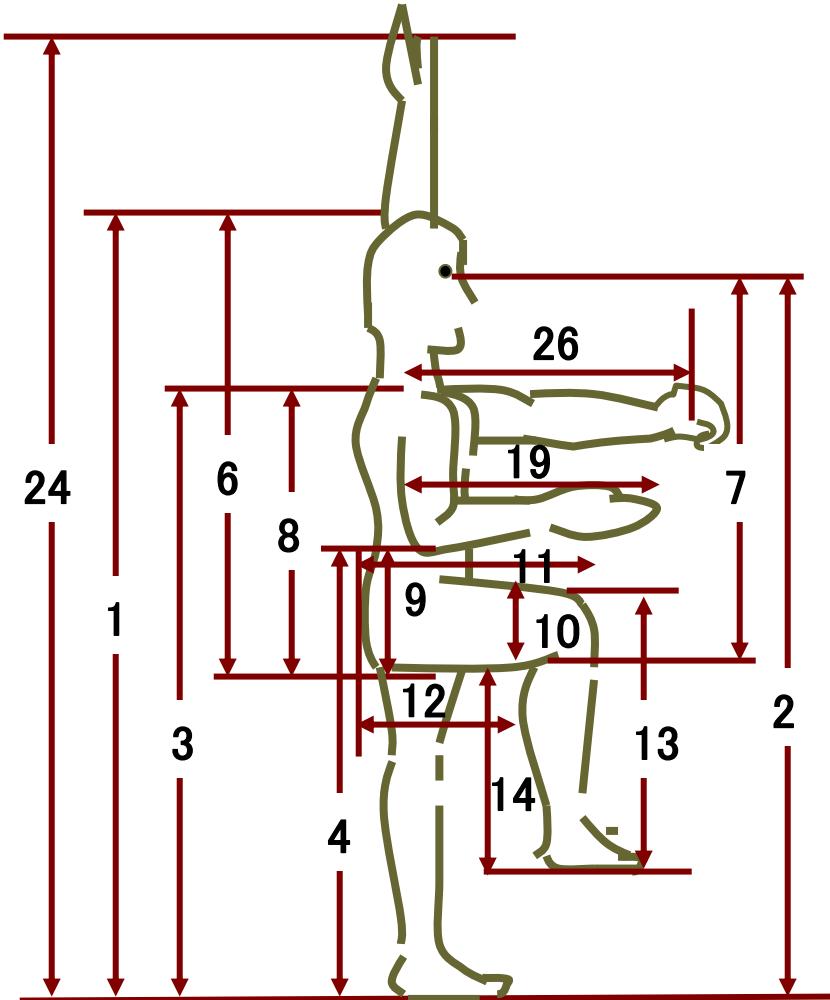
# Body Dimensions in Anthropometry

Author	Book	Measurement
Kroemer et.al (1997)	Engineering Physiology Bases of Human Factors/Ergonomics	Body : 36 dimensions
Pheasant & Haslegrave (2006)	Body Space: Anthropometry, Ergonomics, and the Design of Work	Body : 36 dimensions
Wignjosoebroto (2008)	Ergonomi, Studi Gerak dan Waktu	Body : 26 dimensions Hand : 20 dimensions Head : 14 dimensions
Nurtjahyo (2012)	Technical Note : Anthropometric Study using Anthroscan	Body : 54 dimensions

# Kroemer et.al (1997)

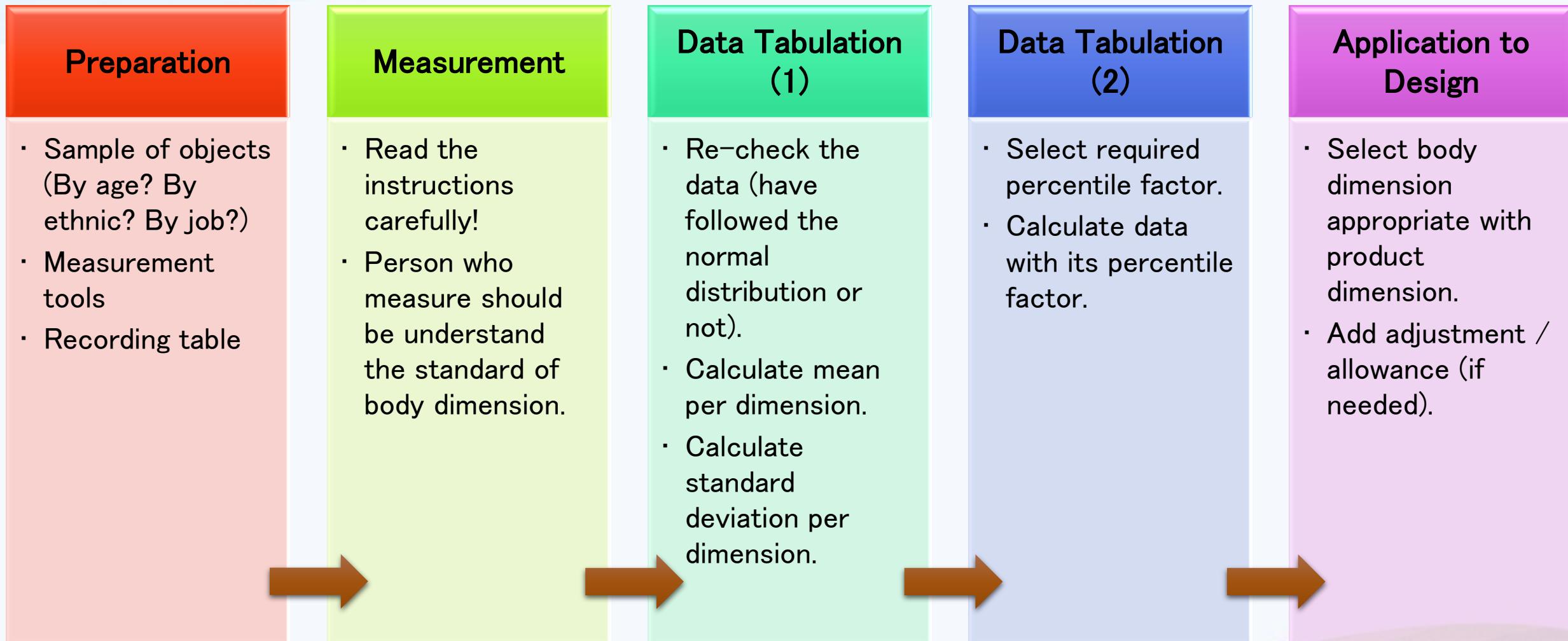


# Wignjosoebroto (2008)

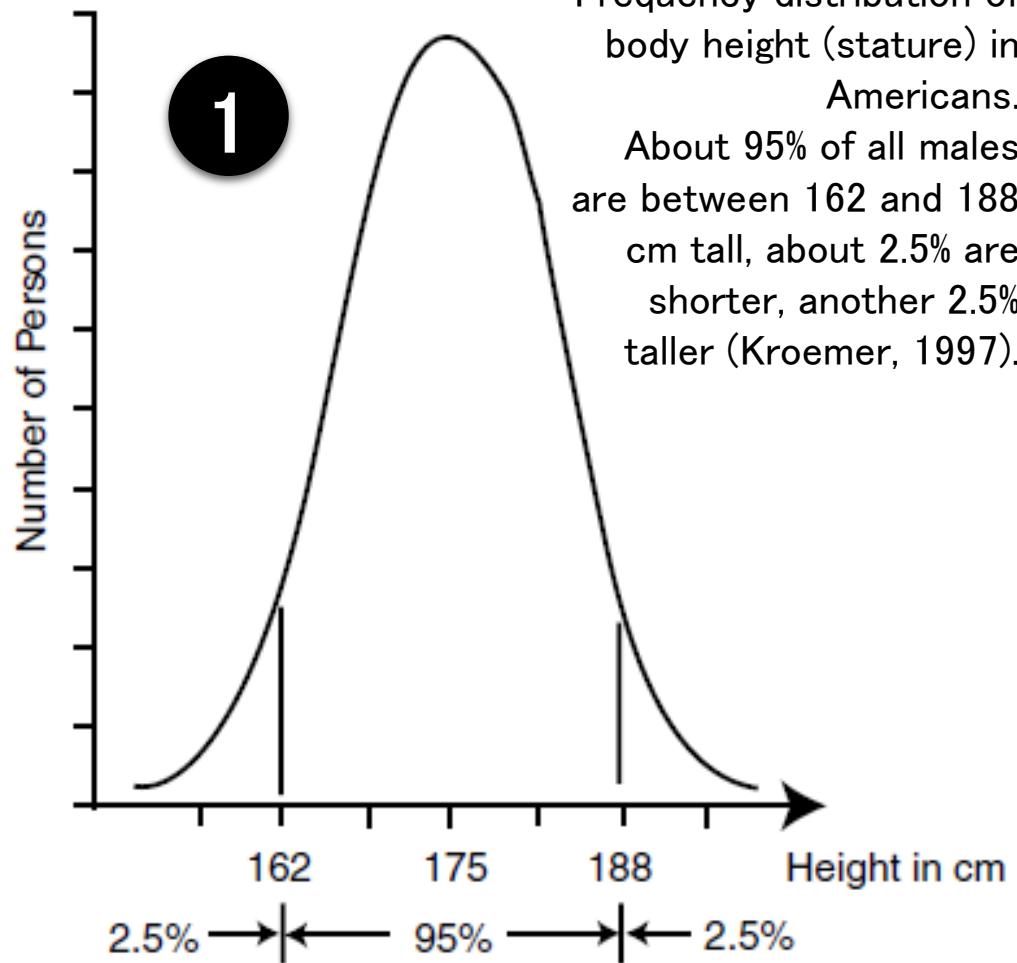


1	Tinggi tubuh posisi berdiri tegak (stature height, standing)	13	Tinggi lutut (knee height, sitting)
2	Tinggi mata (eye height)	14	Tinggi lipat lutut (popliteal height)
3	Tinggi bahu (shoulder height, standing)	15	Lebar Bahu (biacromial breadth) #
4	Tinggi siku (elbow height, standing)	16	Lebar panggul (Hip breadth, sitting)
5	Tinggi genggaman tangan pada posisi rileks ke bawah (knuckle height-normal) #	17	Tebal dada (chest depth) #
6	Tinggi badan pada posisi duduk (sitting height)	18	Tebal perut (abdominal depth) #
7	Tinggi mata pada posisi duduk (eye height, sitting)	19	Jarak ujung siku ke ujung jari (elbow-thumb tip length)
8	Tinggi bahu pada posisi duduk (shoulder height, sitting)	20	Lebar kepala (head breadth) #
9	Tinggi siku pada posisi duduk (elbow rest height, sitting)	21	Panjang tangan (hand length) #
10	Tebal paha (thigh clearance, sitting)	22	Lebar tangan (hand breadth) #
11	Jarak dari pantat ke lutut (buttock-knee length)	23	Jarak bentang dari ujung jari tangan kanan ke kiri (horizontal tip to tip hand) #
12	Jarak dari lipat lutut ke pantat (buttock-popliteal length)	24	Tinggi pegangan tangan pada posisi tangan vertikal keatas, berdiri (vertical reach)
		25	Tinggi pegangan tangan pada posisi tangan vertikal keatas, duduk #
		26	Jarak genggaman tangan ke punggung (grip reach)

# How to get and use the anthropometric data ?



# Data Tabulation (1–2)



2

$$\text{mean} = \bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

$$\text{SD} = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$$

3

Percentile is a value that indicate the percentage of a group who have the same value or under.  
Percentile <50<sup>th</sup> : lower percentile  
Percentile >50<sup>th</sup> : upper percentile

Percentile	Factor
1 <sup>st</sup>	- 2,32
2,5 <sup>th</sup>	- 1,96
5 <sup>th</sup>	- 1,64
10 <sup>th</sup>	- 1,28
50 <sup>th</sup>	0
90 <sup>th</sup>	1,28
95 <sup>th</sup>	1,64
97,5 <sup>th</sup>	1,96
99 <sup>th</sup>	2,32

Percentile	Tabulation
1 <sup>st</sup>	X - 2,32 SD
2,5 <sup>th</sup>	X - 1,96 SD
5 <sup>th</sup>	X - 1,64 SD
10 <sup>th</sup>	X - 1,28 SD
50 <sup>th</sup>	X
90 <sup>th</sup>	X + 1,28 SD
95 <sup>th</sup>	X + 1,64 SD
97,5 <sup>th</sup>	X + 1,96 SD
99 <sup>th</sup>	X + 2,32 SD

## **Case Study :**

Dari hasil pengukuran tubuh manusia Indonesia (dewasa, laki-laki, usia 19 – 40 tahun) diperoleh data yang berdistribusi normal dengan tinggi rata-rata 170 cm dgn standar deviasi 7 cm. Berapakah ukuran 95<sup>th</sup> dan 5<sup>th</sup> percentile?

**95<sup>th</sup> percentile :**

$$= X + 1,64 \text{ SD}$$

$$= 170 + 1,64 (7)$$

$$= 182 \text{ cm}$$

**5<sup>th</sup> percentile**

$$= X - 1,64 \text{ SD}$$

$$= 170 - 1,645 (7)$$

$$= 159 \text{ cm}$$

*What is the meaning of the results?*

A stylized illustration of a tree with a brown trunk and branches. The leaves are large, overlapping circles in shades of purple and pink. The tree stands on a green, rounded hill. In the background, there are light blue horizontal stripes suggesting a sky or water surface.

*Thank you...*

**Have an enjoy study and  
see you next week...**