Experiment 1 : Anthropometry and Workspace Design

Anthropometry = the study of the physical dimensions, proportions and composition of the human body

Types of Dimension → ① Static = the body is in a fixed positions (shoulder height)
② Dynamic = taken under conditions in which the body is engaged in physical activity (such as practical limit of arm reach)

principles of anthropometric data :
① designing for extreme individual
② designing for adjustable range
③ designing for the average

Access → max to Fit
Reach → min to Fit
Strength → weaker to Fit
Weak → stronger no damage to Fit
Fitting design → on body size (hand tools, clothes)

Types of variability in Anthropometric Data
- measurement methodology and protocol
- inner - individual
- intra - individual (youth to old age)
- secular (generation after generation)

Confidence interval & percentile

it is not usually possible to design workplace to suit very biggest or very smallest workers
→ we must be content with meeting the requirements of the majority

Coefficient of Variance (CV) = $\frac{\text{Standard deviation}}{\text{mean}} \times 100\%$
- CV for strength data 10-85 %.
- CV for Body dimension data 3-10 %

* you can get any missing data from : *measurements (experiments) * Similar population

* measuring instruments : Anthropometer / spread caliper / laser measuring devices, photographic anthropometry, stereophotometry and holography / the use of films, videotape
↳ Types of Anthropometer :

① Large Anthropometer = the range (0-60) cm and 0.1 cm increments
the uses : measuring shoulder width, long bone length and chest length for tracking the growth and development of children, uses in motion analysis study

② Small Anthropometer = the range (0-30) cm and 0.1 cm increments
the uses : measuring wrist, elbow, knee and ankle widths, measuring smaller muscle masses like bicep and calf

⇒ both of them Aluminum in construction, they use a spring-loaded ball bearing in a sliding C-shaped arm to provide accurate and precise measurement

Experiment 2 : Measuring Body Strength

→ Grip Strength is widely used for estimating whole body strength due to the portability and practically of grip dynamometry.

Exertion = the tension produced by muscles and transmitted through tendons to produce force . were force should be the observable result of a specific movement or exertion

The muscle activity (based on the exertion or tension and length):

① Isotonic muscle → Dynamic muscle activity where muscle either contracts or elongates

② Isometric muscle → Muscular process where muscle tension increases and the muscle are approximately the same length and have Little or no physical movement.

Strength = the ability of muscles to work against resistance

⇒ measuring grip strength is a good indicator for whole body strength and the muscle providing grip strength are located in the forearm and are connected to the fingers by tendons that pass through the wrist.

the nature of body Strength :

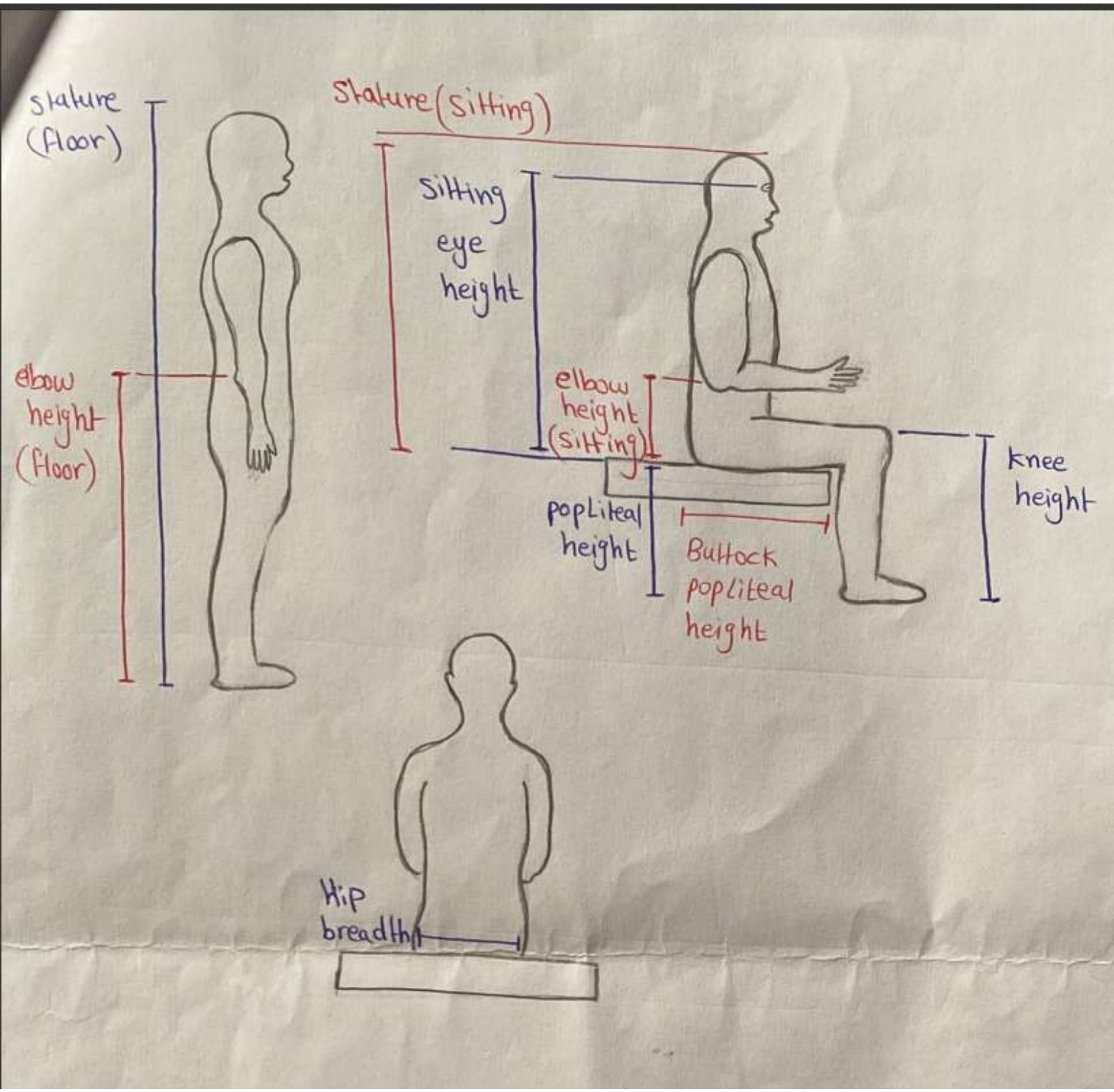
① Static Strength → The maximum voluntary muscular exertion (contraction) of a body part (arms, legs, back) in a restrained position without moving.

→ Static load → is defined as holding the same position for aperied of time and it is especially stressful in combination with:
- high Force - Awkward posture - Duration of time the muscle are contracted

② Dynamic Strength → The maximum voluntary muscular exertion (contraction) of a body part (arms, legs, back) while in motion

* Factors affecting body strength :
- Gender (women have 2/3 the strength of men)
- conditioning (athletic conditioning - weight Lifter Vs marathon runner)
- Size (the leverage of muscles)
- predisposing conditions such as genetic or previous injury

*Non-neutral wrist positions : Bending the wrist creates friction when these tendons move, therefore more muscle work is required to grip an object when the wrist is bent


Stature (floor)
Stature (Sitting)
Sitting eye height
elbow height (floor)
elbow height (sitting)
popliteal height
Buttock popliteal height
knee height
Hip breadth

Experiment 3: Strength evaluation System

In this experiment, we used the Jackson strength evaluation system (simple & accurate) method of measuring maximum body strength.

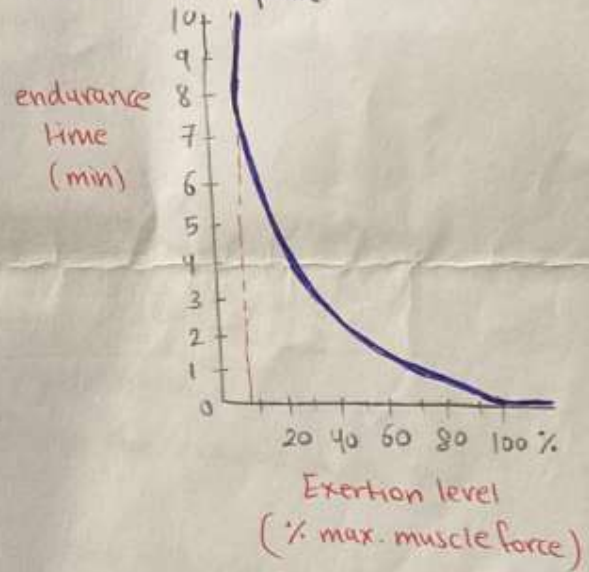
Flexibility = the ability to bend without sustaining any injury

→ Muscles are strongest nearest at the beginning of contraction and weaken as they extend

Muscle Endurance = the ability of muscle to sustain repeated contractions over a period of time without becoming exhausted.

⟹ Static muscle work requires longer recovery times than dynamic work, it requires 12 times longer than the original contraction-duration for complete recovery from fatigue.

⟹ when muscles contract, there is little or no blood flow, build up of waste products (lactic acid) in muscle tissue creates discomfort and pain.



* dominant hand is more strong than non-dominant hand
* Some times non-dominant is stronger because of the exhaustion of the dominant hand as they use it alot.
* the muscles of non-dominant hand is weaker than dominant hand
* males are stronger than females due to : males have larger muscles than females
* males have grip strength greater than females (due to hormonal reasons)
* grip strength is affected by grip size (size 35cm has lower grip strength than 5cm) it is affected by number of fingers in grip half or full (the grip strength of the half size is smaller than the full grip size)
* results of grip strength affected by (dynamometer due to human errors in reading) (the neutral posture)