

Construction Hazards and Risks Control

Lecture Title: – Human Factors Safety in construction

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Undergraduate Diploma in
Occupational Health and Safety

What are human factors?

- Human factors refer to the traits and abilities of individuals that affect their interactions with their work environment, tasks, tools, and coworkers. These factors encompass physical attributes (like body size, strength, vision, and hearing), cognitive abilities (including attention, memory, decision-making, and problem-solving), and emotional elements (such as motivation, stress, fatigue, and mood). Additionally, human factors take into account the social and organizational dimensions of work, including communication, teamwork, leadership, culture, and policies..



Why are human factors important for construction safety?

- Human factors play a crucial role in construction safety because they influence how individuals carry out their tasks, how they react to hazards and emergencies, and how they learn from incidents and feedback.
- For instance, human factors can improve safety by allowing workers to leverage their skills, knowledge, and experience to identify and manage risks, collaborate effectively with others, and adapt to evolving situations.
- Conversely, human factors can jeopardize safety by contributing to human errors, such as slips, lapses, mistakes, and rule violations, which may result in accidents, injuries, and fatalities.



Structural Anthropometry

Deals with body measurements

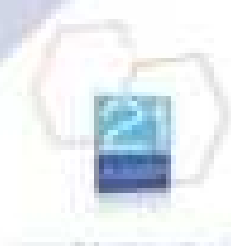
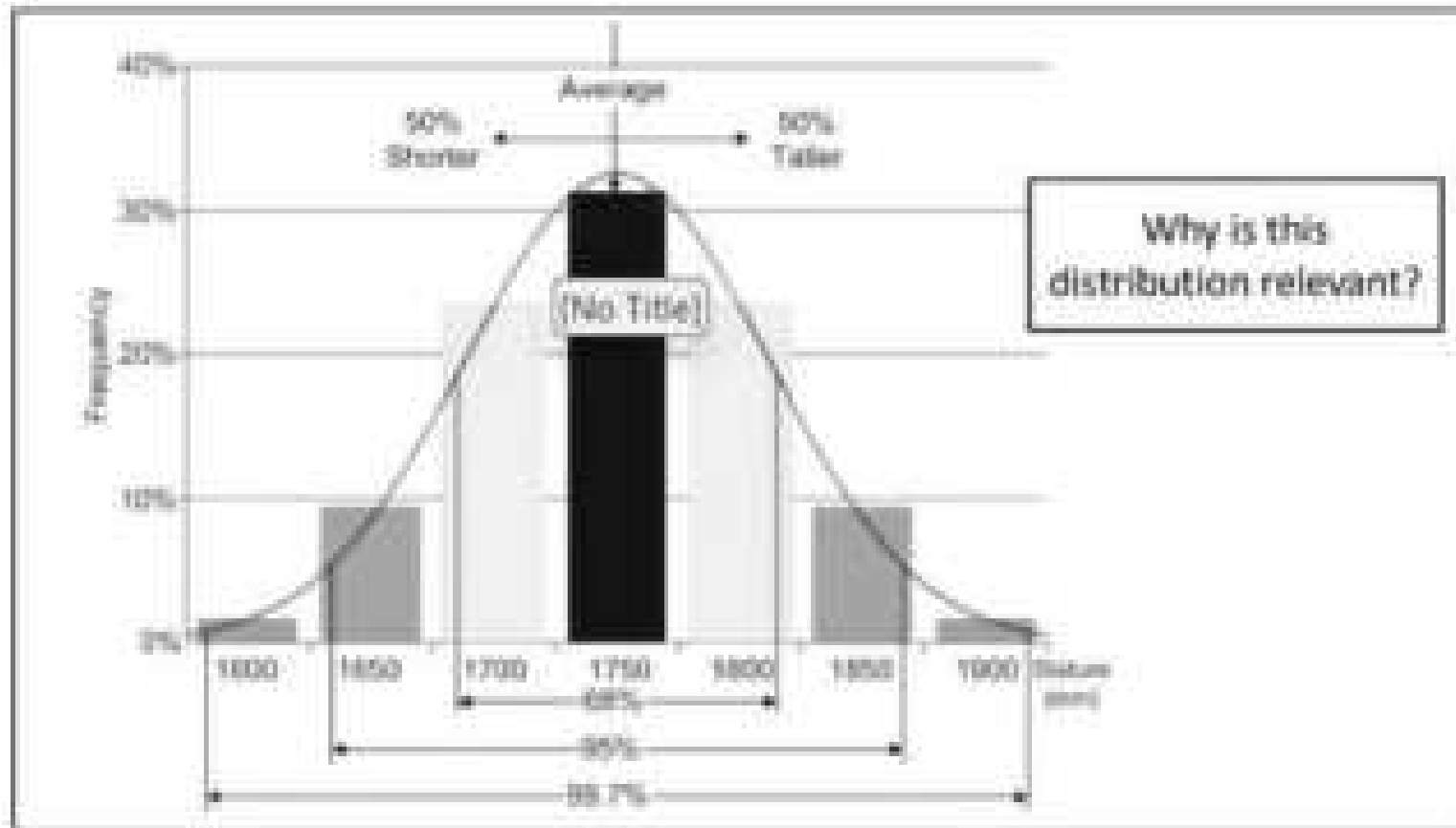
- Size
- Shape
- Body composition



Structural Anthropometry – A few examples

- Body Weight
- Stature
- Eye height
- Shoulder Height
- Forward reach
- Knee height
- Hand length





Parameters

- Two most important variables:
 - Mean
 - Standard deviation (SD)
- Mean or average – The central tendency of the data in question. It is determined by adding all the data points in a population and then dividing the total by the number of points.
- The standard deviation is an index of the degree of variability in the population concerned



Calculating the Standard Deviation

- Step 1: calculate the mean
- Step 2: For each number in your dataset, subtract the mean and square the result
- Step 3: work out the mean of the obtained squared differences
- Step 4: Obtain the square root of your result



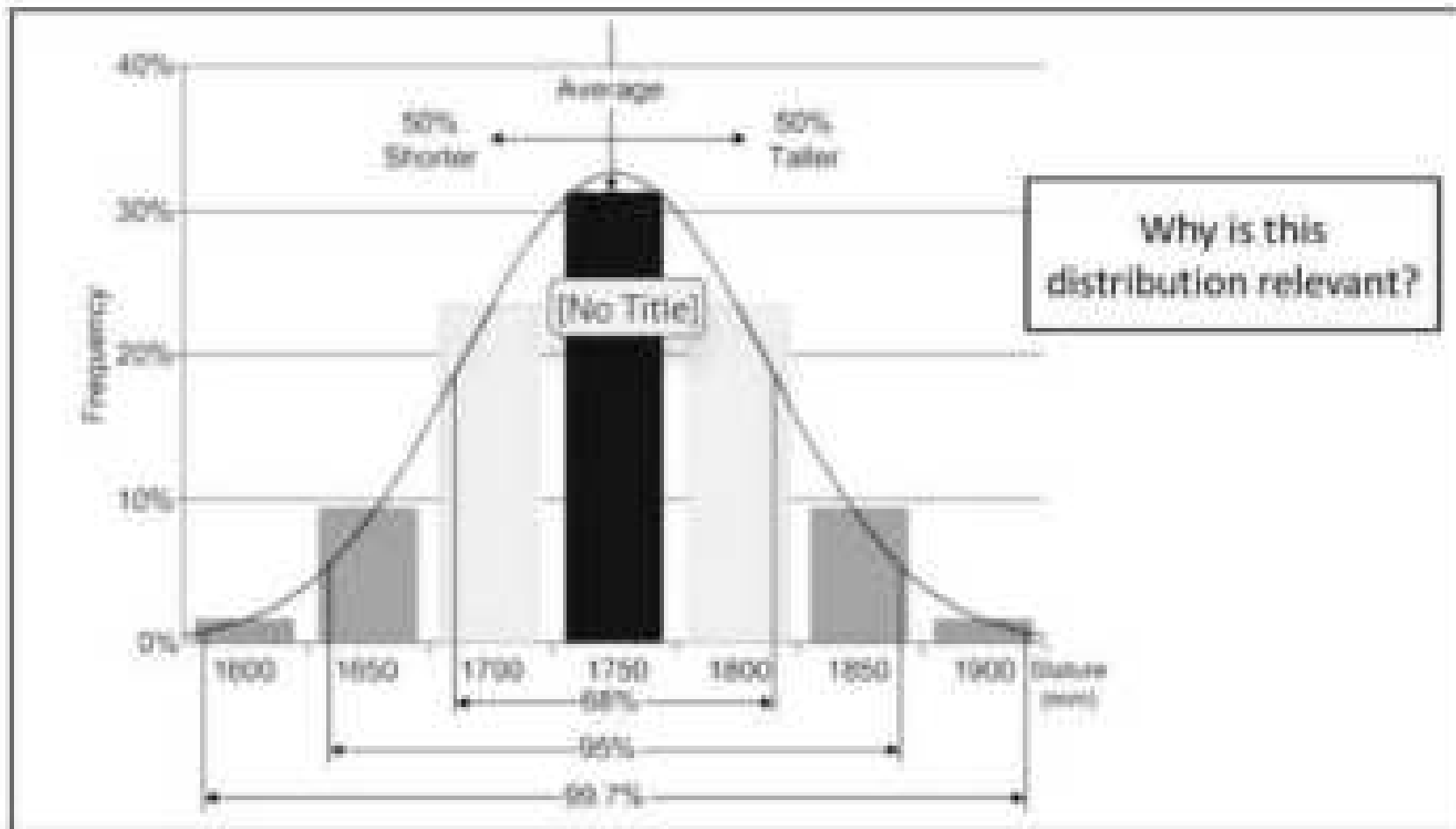
If we were designing a stone cutting machine, how would the numbers we just calculated (mean and standard deviation) be of use to a designer?



If height adjustable by 10 cm therefore, it would fit 68%

- If height adjustable by 20 cm, it would fit 95%
- If height adjustable by 30 cm, it would fit 99.7%





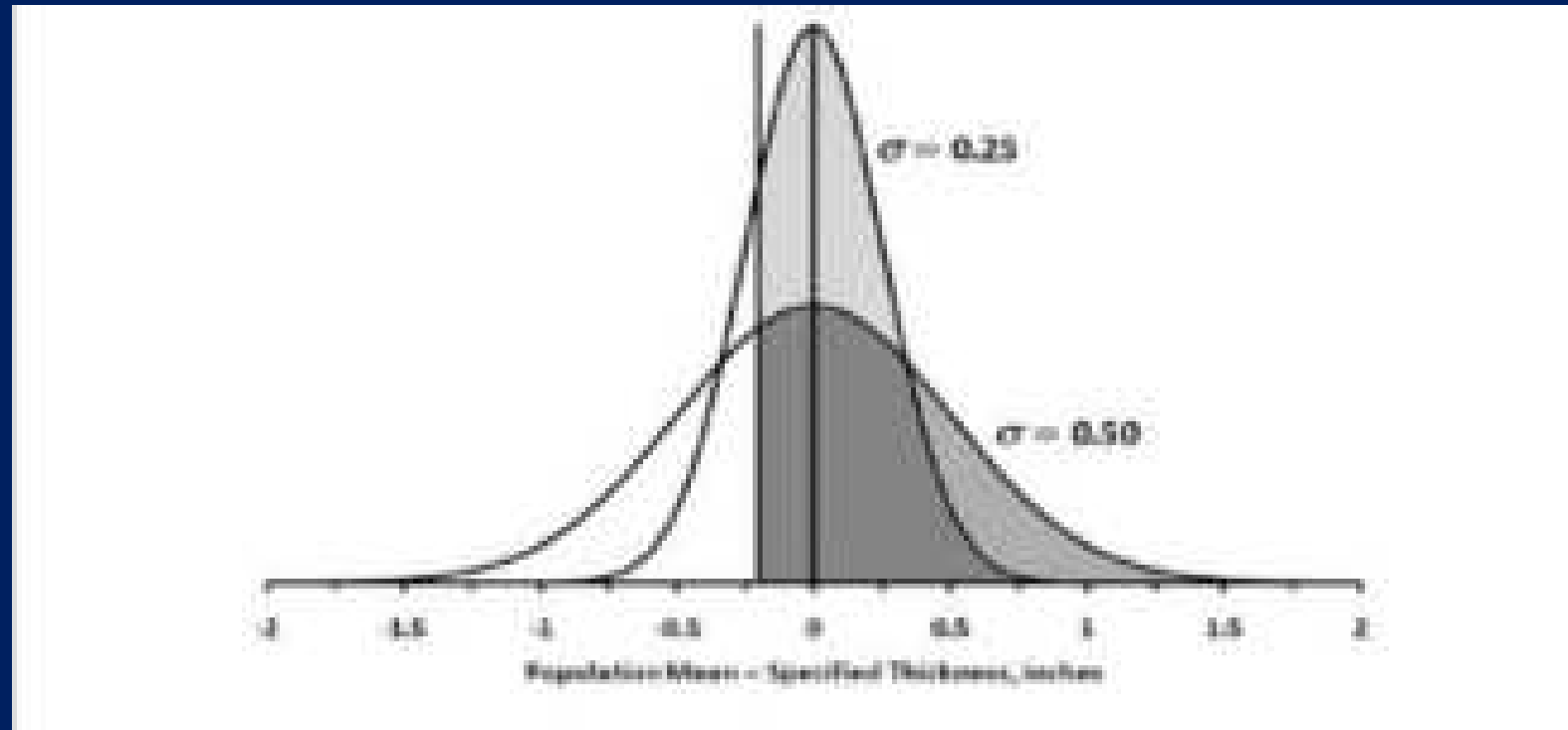
Anthropometrics

- In most cases aiming to accommodate 95% of users is the ideal design limit
- In certain cases, however, we will need to set wider limits



How would the mean (average) height and the standard deviation vary in a population of basketball players vs the general population?





Anthropometrics vary between people, what factors do you think will influence them the most?



A look at anthropometrics

- Gender
- Age
- Ethnicity
- Occupation



In most adult populations a difference of about 7% between the average heights of men and women



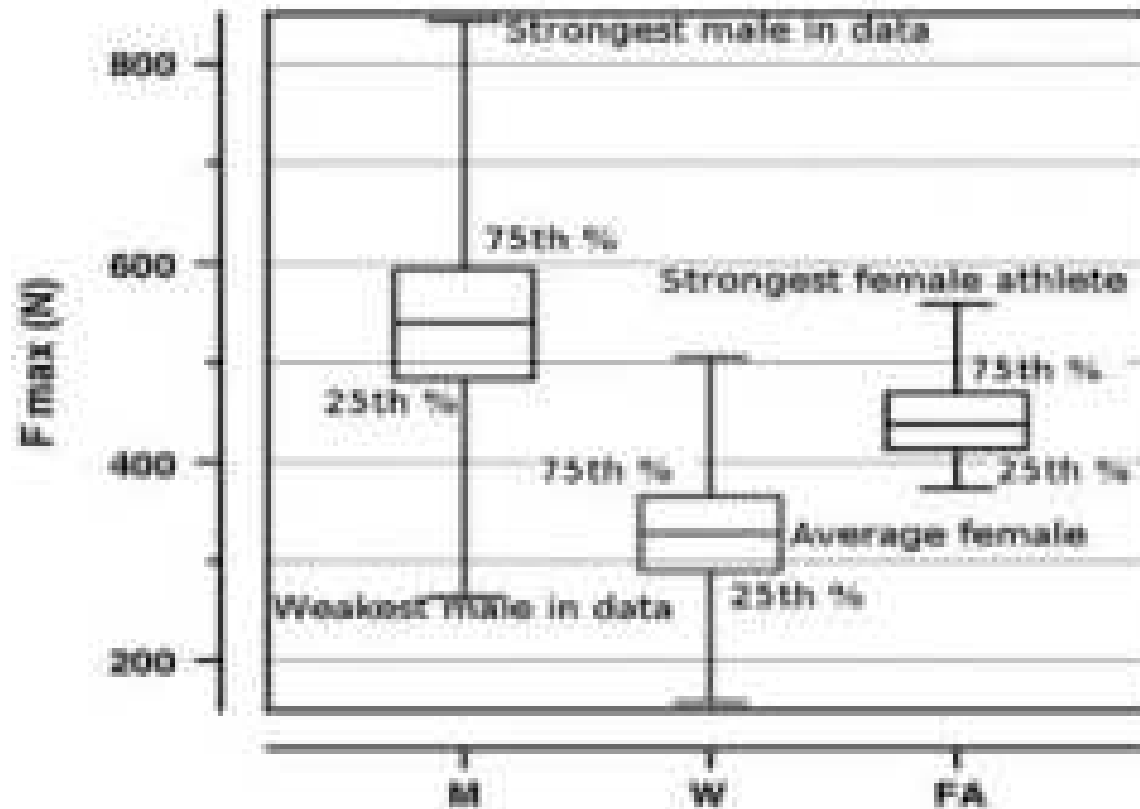


Fig. 6 Maximum hand-grip forces (F_{max}) of young adult men (M , $n = 1,654$), women (W , $n = 533$) and female elite athletes (FA , $n = 60$). Values are median \pm interquartile (25th and 75th percentile) and absolute range

Leyk et al (2007)



Aging and anthropometrics



- Why is it important?
- What changed can we expect?

bones tend to shrink in size and density. This weakens them. Age-related bone changes also might cause you to become a bit shorter. Muscles tend to lose strength, endurance and flexibility



Ethnicity and anthropometrics



Ethnicity and anthropometrics

If a piece of equipment was designed to fit 90% of Americans it would also fit:

- 90% of Germans
- 80% of French
- 65 % of Italians
- 45% of Japanese
- 25% of Thais
- 10% of Vietnamese



Other considerations

- Pregnant workers
- Disabled workers



Human Information Processing

- **Input from Environment (via senses)**
- Stores into Temporary sensory Register/Memory
- Sight & Sound



- **Processing**

- Working/Short – Term Memory (STM)

- a) Visio-Spatial Sketchpad (The visuo-spatial sketchpad is the component of working memory that processes visual information)

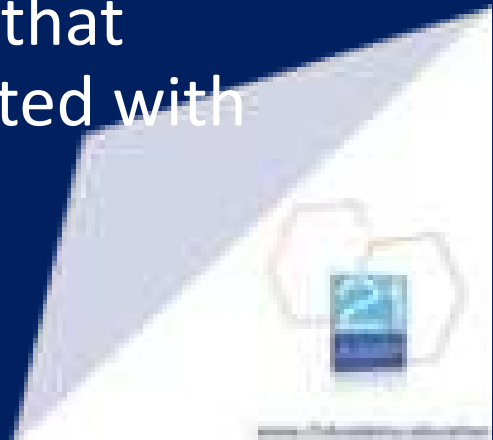
- b) Phonological Loop - the speech- and sound-related component of working memory and holds verbal and auditory information.



Learning 1/2

- The relatively permanent change in behaviour or knowledge as a result of Experience
- Conditioning – the Ability to connect stimuli with responses
- Classical – Learning by Association (Pavlov)

Pavlov had identified a fundamental associative learning process called classical conditioning. Classical conditioning refers to learning that occurs when a neutral stimulus (e.g., a tone) becomes associated with a stimulus (e.g., food) that naturally produces a behaviour.



1. Before conditioning



Unconditioned stimulus

Unconditioned response

2. Before conditioning



Neutral stimulus

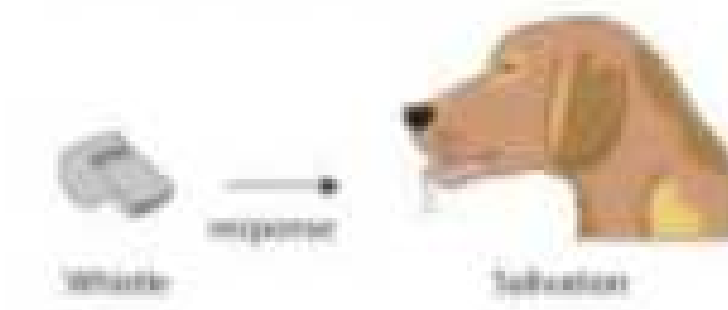
No-conditioned response

3. During conditioning



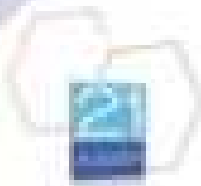
Unconditioned response

4. After conditioning



Conditioned stimulus

Conditioned response



Learning

Insight

- Sudden understanding of a solution to a problem

Latent Learning

Is not reinforced and not demonstrated until there is motivation to do so..

Observation

Watching and modelling the behaviours of others

Applied Behaviour Analysis

Positive reinforcement-based interventions:



Bias/Error	Description
Source Monitoring	Uncertainty about the source of a memory may lead to mistaken judgements.
Confirmation Bias	Once beliefs become set, they self-repeat and become resistant to change
Functional Fixedness	Schemas(expectancy-based thinking) prevent us from seeing & using information in new non-traditional ways.
Misinformation Effect	Errors in memory occur when new but incorrect information influences existing correct memories.
Overconfidence	We think of our memories & judgement as correct



Stress and Fatigue

Stress at work

- The awareness of not being able to cope with the demands of the work environment and when this realisation is of concern to the person so that s/he has a negative emotional response.

Fatigue

- Temporary inability /decrease in ability/strong disinclination to respond to a situation due to previous overactivity (mental, physical or emotional)



Safety & Job Burnout (1/2)

- The result of an individual's attempt to cope with excessive & prolonged stress.
- Caused by both individual & work/life factors. Coping strategies must address personal skills & organisational issues

Characteristic Traits of Burnout:

- Emotional Exhaustion - Often also physical & cognitive
- Depersonalization - shown as social withdrawal, flat emotions/irritable response to others
- Inefficacy - efforts are felt as having no value/not making any difference



Safety and Job Burnout

- Impact of Burnout

Severe Injury

Errors

Absenteeism, turnover, Low satisfaction



State of Consciousness

- Psychoactive Drugs:
- Chemical that changes our states of consciousness, especially our perception and moods.
- Commonly found in food & beverages and over the counter eg. Aspirin
- Frequently prescribed eg. Sleeping pills, anti anxiety medications & tranquilizers
- Negative effect through continued use accompanied by increased doses leading to abuse



OIRA Website

- <https://oira.osha.europa.eu/en/oira-tools>

