

## 1.2 Ergonomics: fit a range of users

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 10 marks

**KEY WORDS** anthropometry • ergonomics

### Objective

Ergonomics: fit a range of users. Supported HL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

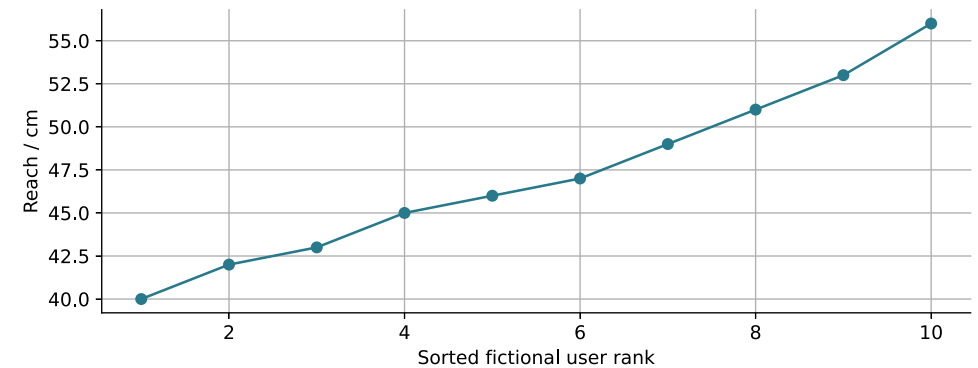
### 1 Key knowledge and worked examples

#### ■ What would explain this observation?

- A handle sized for the average hand can exclude many intended users. Design decisions need a user range, task and context rather than one average.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

#### ■ Build the model

- **Anthropometry** measures body dimensions; **ergonomics** considers interactions between people, tasks and products. A percentile locates a value within a specified distribution. Choosing a lower or upper percentile depends on whether the dimension concerns reach, clearance or another function. Adjustable design may accommodate a broader range than a single fixed dimension.
- anthropometry: Measurement of human body dimensions for a specified population and method; ergonomics: Study of interactions between people, tasks and systems to inform design.



#### ■ Choose evidence that can test it

- A clearance dimension often needs to consider larger relevant body dimensions, while reach can require smaller relevant dimensions. Neither principle automatically selects a universal percentile. The measured population, posture, clothing, capability and task determine relevance. Consider physical, perceptual and cognitive demands together rather than assuming body size explains every usability issue.
- Define a consenting user group and task. Use attributed data or anonymous teacher-approved measurements, record measurement posture and units, and test safe low-fidelity models before construction. Include users whose access needs differ. Set measurable acceptance criteria and retain qualitative feedback about grip, visibility and comprehension alongside dimensions.

#### ■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: sorted fictional reach measurements are 40, 42, 43, 45, 46, 47, 49, 51, 53 and 56 cm. Under a stated nearest-rank classroom convention, the 10th percentile uses rank  $\text{ceil}(0.10 \times 10) = 1$ , giving 40 cm; the 90th uses rank 9, giving 53 cm. A 53 cm control distance is beyond the recorded reach of eight users. The small fictional sample does not define a product standard.

#### Example:

A stated nearest-rank method uses  $\text{ceil}(p \times n)$ . For  $p=0.90$  and  $n=20$ , find the rank. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

## ■ Check the conclusion and its limits

- Percentile methods differ, especially for small samples. A percentile is not a percentage of a body dimension. An average dimension and a successful test by one user do not establish accessible design.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

### Warn:

A product dimension based on the mean automatically accommodates every intended user. This claim is false: Percentile methods differ, especially for small samples. A percentile is not a percentage of a body dimension. An average dimension and a successful test by one user do not establish accessible design.

### Key:

Ergonomics: fit a range of users: A clearance dimension often needs to consider larger relevant body dimensions, while reach can require smaller relevant dimensions. Neither principle automatically selects a universal percentile. The measured population, posture, clothing, capability and task determine relevance. Consider physical, perceptual and cognitive demands together rather than assuming body size explains every usability issue.

## 2 Practice

**2.1** Which decision is most defensible when a fixed control is unreachable for some intended users? Choose one answer.

- **A** Test a closer or adjustable position against the specified user range
- **B** Use only the largest measured reach
- **C** Assume the average guarantees access

[1]

**2.2** A stated nearest-rank method uses  $\text{ceil}(p \times n)$ . For  $p=0.90$  and  $n=20$ , find the rank. Show the relation, substitution and units.

[2]

**2.3** Decide whether this claim is true and justify: A product dimension based on the mean automatically accommodates every intended user.

[2]

**2.4** Measurement of human body dimensions for a specified population and method: write the technical term.

[1]

## 3 Exam-style questions

**3.1** Sorted fictional reaches are 40,42,44,46,48 cm. Under nearest rank, find the 20th and 80th percentiles. Which end of the range matters for maximum control reach?

[4]

## Solutions

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**2.1 A** A clearance dimension often needs to consider larger relevant body dimensions, while reach can require smaller relevant dimensions. Neither principle automatically selects a universal percentile. The measured population, posture, clothing, capability and task determine relevance. Consider physical, perceptual and cognitive demands together rather than assuming body size explains every usability issue.

**2.2**  $\text{rank} = \text{ceil}(0.90 \times 20) = 18$ ; rank is not the measurement value.

**2.3** False. Percentile methods differ, especially for small samples. A percentile is not a percentage of a body dimension. An average dimension and a successful test by one user do not establish accessible design.

**2.4** anthropometry. anthropometry means Measurement of human body dimensions for a specified population and method.

**3.1** Ranks 1 and 4 give 40 and 46 cm. A lower reach accommodates more short-reach users; a 46 cm control exceeds three of five observed reaches. This small fictional sample is not a product standard.