

# The Human Factor (THF)

## Week 5: Anthropometrics and Error

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THE UNIVERSITY  
of EDINBURGH

# Week 5 Outline

- CW1 Presentations and Group Work
- Anthropometrics
- Error and Safety

# Notes on group work

- All groups have been formed
- All groups have been matched with another group to act as participants
  - Group A will conduct user study with members of Group B as participants
  - Group B will conduct user study with members of Group A as participants
  - Acting as a participant will get you 5% of the course grade
- All groups have been assigned a mentor
- Check out Learn > Groups

Group 4 (Paired with Group 16, Mentor Sarah)

 Add a group description

# Join Miro

- Project pitch & progress

**Group 1** Add the title of your project here  
Add the names of group members here

**Topic area**  
What is/are the general topic area(s) of your project?

**What problem/questions do you aim at addressing?**

**Technology in Focus**  
Please briefly describe the technology your project focuses on and provide some images/figures below.

**What methods will you apply as part of your project?**

SAY Methods	DO Methods	MAKE Methods

**What questions/challenges have you encountered so far?**

**Comments & Questions from the teaching team and class**

Main contact tutor: Sarah Dunn



# Join Miro

- Project pitch & progress
- Follow the Miro invitation link OR
- Go to Learn > Groups, and check your group's mentor
- Enter your mentor's Miro board using the link below

Tara



[https://miro.com/app/board/uXjVGFxWnX8=/?share\\_link\\_id=303641329390](https://miro.com/app/board/uXjVGFxWnX8=/?share_link_id=303641329390)

Sarah



[https://miro.com/app/board/uXjVGFwMSwc=/?share\\_link\\_id=519970412096](https://miro.com/app/board/uXjVGFwMSwc=/?share_link_id=519970412096)

Uta



[https://miro.com/app/board/uXjVGHckjoo=/?share\\_link\\_id=335706162111](https://miro.com/app/board/uXjVGHckjoo=/?share_link_id=335706162111)

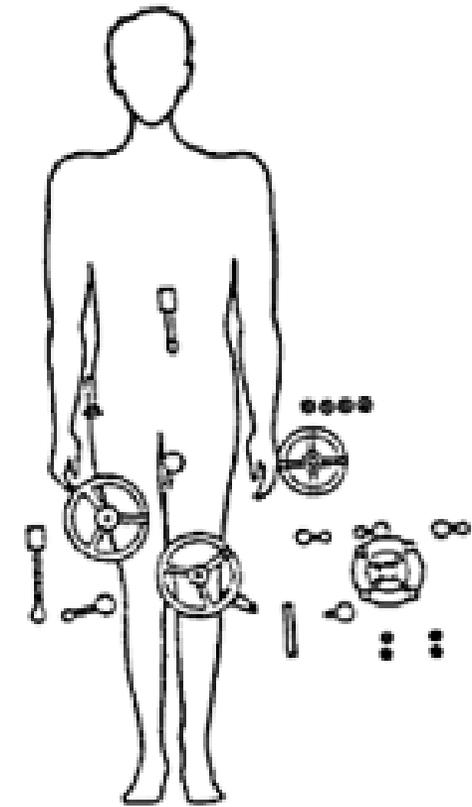
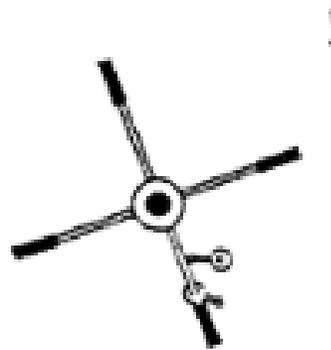
# Anthropometrics

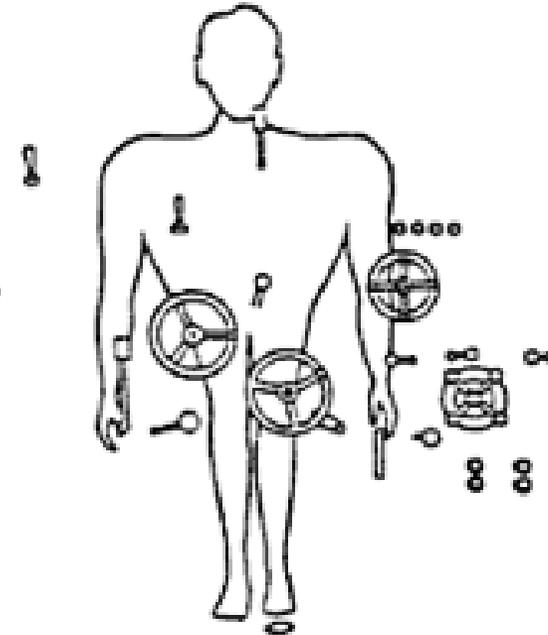
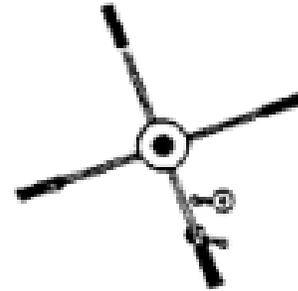
# Think – Pair – Share

- Think of a time you used a device or technology that felt physically uncomfortable?
- What made it uncomfortable?

# What is Anthropometrics?

- Anthropometrics is the study of the physical measurements of the human body and how these influence the way people interact with technology
- Includes:
  - Height
  - Arm reach
  - Hand size
  - Strength
  - Range of motion
  - Posture





The controls of a lathe in are not within easy reach of the average man, but are so placed that the ideal operator should be 137 cm (4.5ft) tall, 61cm (2 ft) across the shoulders and have an arm span of 234cm (8ft). (Pheasant, 1986)

Technology-centric design --> **human-centred design**

# Why it matters

- Poor anthropometric design leads to:
  - Discomfort
  - Fatigue
  - Injury
  - Strain
  - Reduced performance
  - Exclusion
- Good anthropometric design leads to:
  - Comfort
  - Improved safety
  - Enhanced efficiency
  - Inclusion

# Human Variation

- Humans vary in height, arm length, hand size, reach and strength
- Important to avoid “one-size-fits-all”
- Use percentile data to ensure most people can interact comfortably

# Human Variation: VR Headsets

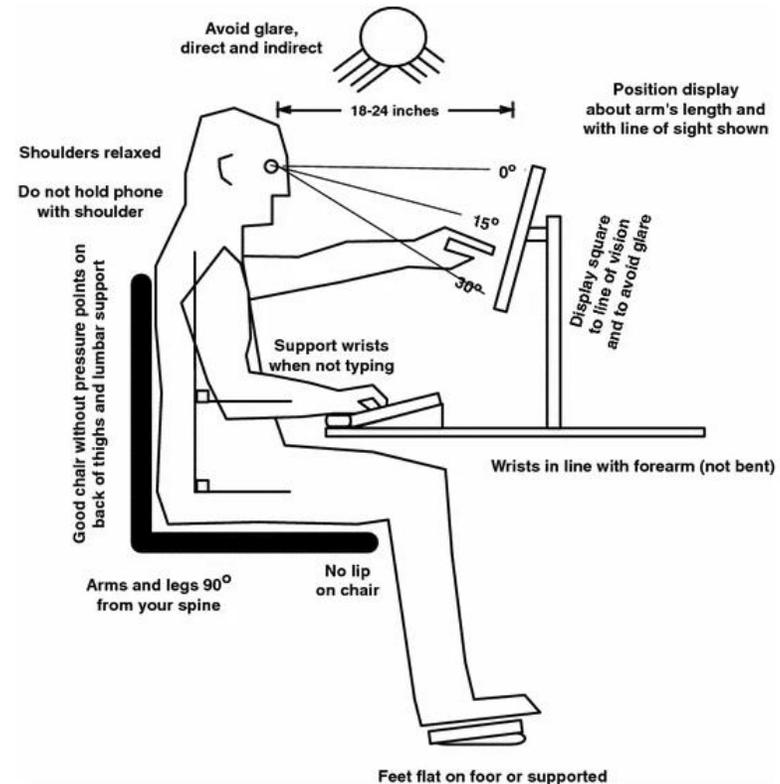
- VR headsets are largely designed and tested on male-average body measurements
- Leading to higher rates of discomfort, injury and motion sickness for others



Heinrich-Böll-Stiftung/flickr

# Physical Setup and Workspace Design

- Importance of setup:
  - The physical placement of keyboards, monitors, mice, screens, seats, etc
- Examples:
  - Monitor height
  - Keyboard position
  - Seating and support



# Touch and Haptics

- Touch Interaction:
  - Mobile and touch-screen devices are common
  - Important to consider touch zones, gesture, button spacing, thumbing
- Haptic Feedback:
  - Tactile feedback such as vibrations, textures or resistance to help users confirm or avoid actions
  - Smartphone/smartwatch vibrations, video game controller rumble, VR suit sensations



<https://osxdaily.com/2019/12/15/how-lock-screen-orientation-iphone-ipad/>  
<https://blog.hubspot.com/marketing/how-to-use-instagram>

# Implications

- Measure: use data on human body dimensions where possible
- Design for variability: consider variations in height, arm length, reach, strength, etc
- Adaptivity: systems should be adjustable
- Test with users: validate your designs with people of varied body types

# Activity

- In groups, return to the devices or technologies that you felt were physically uncomfortable and what made them feel that way
- Discuss how you would re-design the device or technology you felt was uncomfortable in the initial think-pair-share from an anthropometric perspective

# Error and Safety

# What is Human Error?

- Human error refers to actions or decision that deviate from what was intended or planned, leading to unintended consequences
- Error does not mean incompetence
- Error often reflects system design

# How Errors Contribute to Accidents

- Errors can range from minor slips to catastrophic failures
- Accidents often result from multiple small errors compounding
- Post-hoc analyses can misattribute causes
- Errors emerge from interactions between people, technology and context

# How Errors Contribute to Accidents

- An infusion pump was incorrectly programmed to deliver a 4-day dose of a chemotherapy drug in 4 hours
- Analysis revealed multiple contributing factors:
  - Miscalculation
  - Confusing pharmacy labelling
  - Device limitations
  - Double check process failed



<https://www.ismp-canada.org/download/reports/FluorouracilIncidentMay2007.pdf>

# Types of Human Error

- Slips and Lapses: correct intention but wrong execution
  - Pressing the wrong button
- Mistakes: incorrect intention due to misunderstanding
  - Misinterpreting a field
- Mode Errors: system state cause unintended action
  - Sending a message you meant to save as a draft

# Why do errors occur?

- Errors arise from multiple interacting factors
- Human factors:
  - Anthropometric
  - Behaviour
  - Cognition
  - Social
- System Factors:
  - Poor feedback
  - Ambiguous interface states
  - Complex workflows
- Errors reflect a mismatch between how people think and how systems behave

# Designing for Error

- Design for error, not just against error
- Anticipate likely errors
- Provide clear feedback
- Allow easy recovery
  
- For example:
  - Error tolerance: undo capabilities, confirmation options
  - Prevention: clear labels, constraints
  - Recovery: helpful error messages and guidance

# Implications

- **Context is important:** people interact with technology within specific contexts, which must be considered when designing systems
- **Sources of error:**
  - People, context and technology can each contribute to errors
  - Systems should be designed to consider errors
- **Interdependencies:** errors can arise not just from individual components but also from their interactions
- **Design limitations:**
  - The design limitations of the system must be acknowledged
  - Humans should not have to compensate for poor system design

# Activity

- Think of a time you made an error using technology
  - What happened?
  - What was the immediate consequence?
- Discuss these in your groups, then analyse one example for the human factors that contributed:
  - Anthropometric
  - Behavioural
  - Cognitive
  - Social
- Propose design changes that reduce the likelihood of that error

**Any questions?**