Design in theory

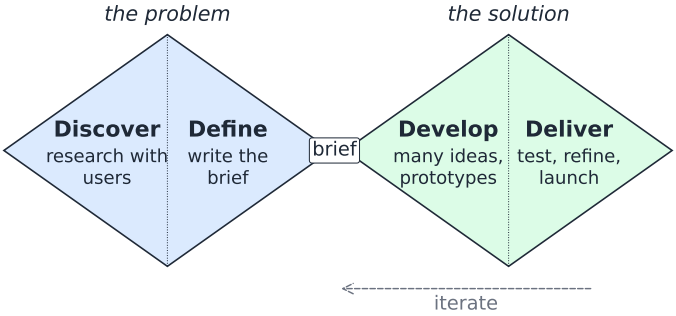
Theme A · SL and HL

A peeler for sore hands

> Design for the users who find a task hardest, and it often works better for all.

- Sam Farber watched his wife struggle with a metal peeler.
- 1990, 15 tools with large, soft, finned handles.
- This unit: process $\rightarrow$ users $\rightarrow$ ergonomics $\rightarrow$ the mind.

The double diamond



- Diverge to explore, converge to decide.
- First the right problem, then the right solution.

The design cycle

> Inquire and analyse → develop ideas → create the solution → evaluate.

- **Iterative**, designers loop back as they learn.
- **Design thinking**, empathise, define, ideate, prototype, test.

Measurable specifications

Vague	**Measurable**
Comfortable	8 of 10 users rate the grip 4 or 5
Strong	Withstands 100 N without damage
Cheap	Below ¥15 per unit at 10 000 units

Factor of safety

1. **Use load.** 40 N
2. **Factor.** 2.5, for misuse and wear
3. **Test load.** $40 \times 2.5 = 100$ N

Decision

A judgement to justify, not a safety review

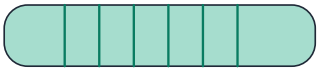
Shape the grip to the hand

small, hard: a tight pinch
painful with arthritis



thin metal handle

open hand, less force:
easier for everyone



large soft oval grip with fins

design for the users who struggle most, and everyone benefits

A grip designed for weak hands works for everyone

Researching users

Observation

Shows what people really do.

Slow; people act differently.

Questionnaires

Quick, many people, numbers.

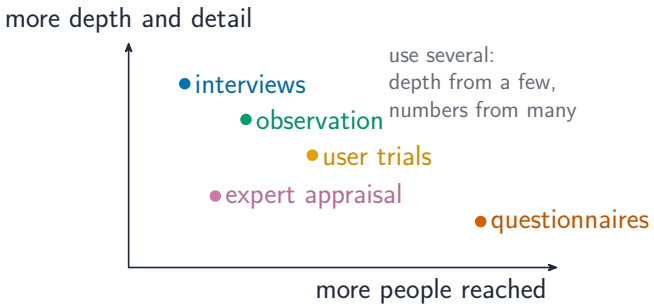
Little depth; honesty.

Inclusive design

> A dropped kerb helps wheelchairs, pushchairs and suitcases alike.

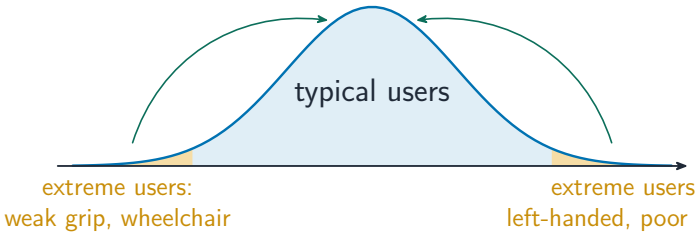
- Equitable, flexible, intuitive, perceptible.
- Tolerant of error, low effort, enough space.

Depth against reach



> Choose the method by what you need to find out

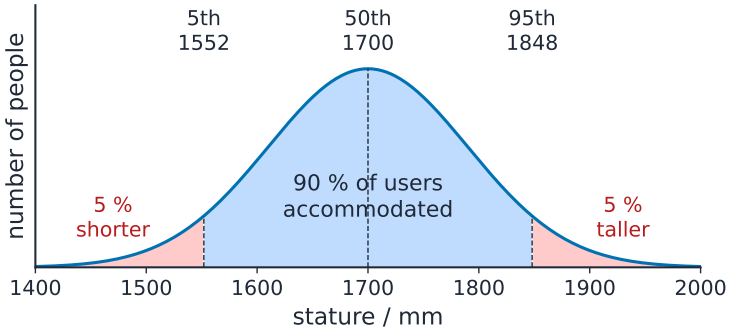
Design for the tails



a dropped kerb serves wheelchairs, pushchairs and suitcases
a fat soft grip helps arthritic hands and everyone else

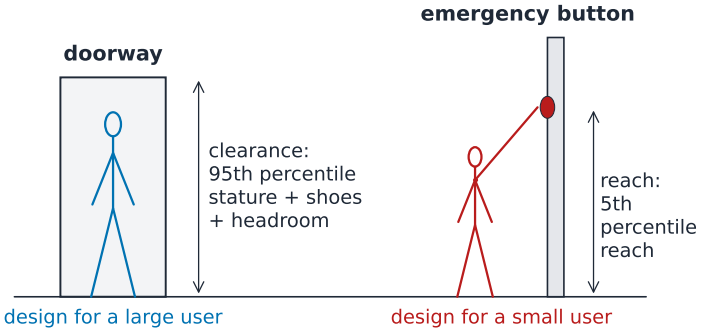
> Solving for extreme users often helps typical users as well

Percentiles



- Mean 1700 mm, SD 90 mm.
- Mean $\pm$ 1.645 SD gives the 5th and 95th.

Reach and clearance



- **Clearance**, the largest users, 95th **percentile**.
- **Reach**, the smallest users, 5th percentile.

Sizing a doorway and a button

1. **Door.** $1848 + 30 + 100 \approx 1980$ mm
2. **Button.** $1950 - 1.645 \times 100 \approx 1786$ mm
3. **Choice.** 2000 mm door; button below 1780 mm

Decision

Each dimension chosen for its task

When one size cannot fit

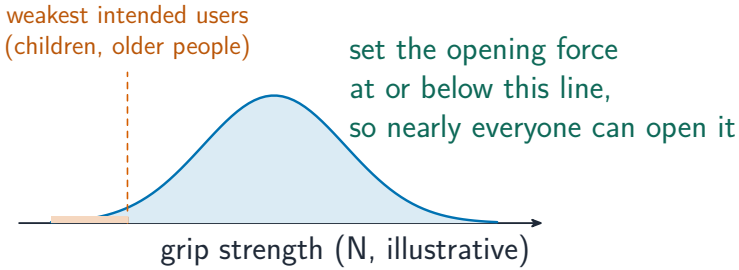
Strategy	**Example**
Adjustability	Office chair, car seat
Range of sizes	Helmets, shoes
Design for extremes	A lever usable by short and tall

Psychological factors

> Light, sound, colour, texture and smell change how people respond.

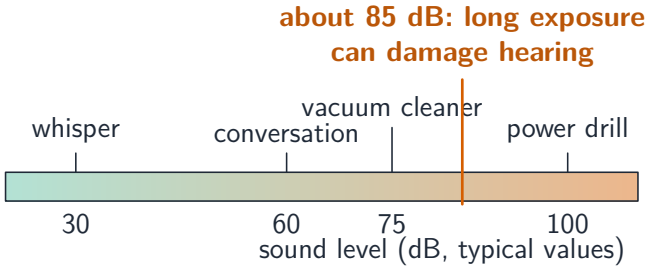
- Offices about 300 to 500 lux.
- Long exposure above about 85 dB can damage hearing.

Set the force for the weakest user



Set the opening force at or below what the weakest intended user can manage

How loud is too loud?



Above about 85 dB, design must limit exposure

Norman's principles

Principle	Example
Affordance	A push plate affords pushing
Mapping	Knobs laid out like the burners
Feedback	A click or a progress bar
Constraints	A plug that fits only one way

Slips and mistakes

Slip

Right goal, wrong action.

Bigger, spaced controls.

Mistake

Wrong goal or plan.

Clear signifiers, **feedback**.

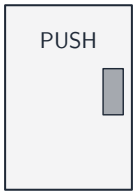
Check: which percentile?

Your turn

Which percentile should set the height of a high shelf in a library?

A. 5th percentile reach
B. 50th percentile reach
C. 95th percentile stature
D. 95th percentile reach

When the shape argues with the label



push plate:
affords pushing



pull handle on
a push door

the shape tells the hand what to do; a label that argues with the shape loses

> The shape should tell the user what to do

Slip or mistake?

slip
right goal, wrong action
presses the button next door
fix: bigger, spaced controls;
confirm important actions

mistake
wrong goal or plan
a poor mental model
fix: clear signifiers, feedback,
consistent interfaces

> Fix slips with layout; fix mistakes with signifiers and **feedback**

Exam tips

> 95th **percentile** for **clearance**, 5th for **reach**, and say why.

- Mean $\pm$ 1.645 standard deviations.
- Name the ergonomic factor with an example.
- Use Norman's terms precisely.

Check yourself

Try these

Sitting height has mean 900 mm and SD 40 mm. Find the 5th and 95th percentiles.

Rewrite "light" and "easy to clean" as measurable specifications.

Explain affordance, mapping and feedback for a microwave oven.