AND NOW FOR SOMETHING COMPLETELY DIFFERENT
Development of an Inclusive Design Tool based on Psychological, Biomechanical & Functional Performance.

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What is Inclusive/Universal Design?

• Inclusive design is a process whereby designers, manufacturers and service providers ensure that their products and environments address the widest possible audience, irrespective of age or ability.

• Good design ENABLES
• Bad design DISABLES
OLDER ADULTDATA (2000) is a comprehensive collection of anthropometric data on older adults (over 60 years of age) for use in the design of products.

155 anthropometric measurements,
22 range of motion measurements,
30 strength measurements
10 measurements of performance
Aims

• To enable designers to assess the functional demands which their product/concept would place on older users

• To inform design without the need for in-depth knowledge of physiology, biomechanics and psychology of ageing.

• To present the information visually

Image courtesy of Helen Hamlyn Inst.
Capability

• physiological/biomechanical
• psychological
Functional capability

\[
\text{Functional capacity} \ (\%) = \frac{\text{Strength required during the task}}{\text{Maximum muscle strength available}} \times 100
\]
Maximal Performance

Estimate MVC strength

- Hip and knee strength over range of movement
- Grip strength
- Range of motion of upper and lower limb joints
Biomechanical Assessment

Full body biomechanics
- Stairs
- Chair
- Door opening/closing
- Lifting/reaching/placing
- Walking

Hand biomechanics
- Remote control
- Turning key
- Opening jar
Biomechanics Laboratory Testing

- 84 healthy older adults

- 3 age groups
  - 60+ (15 ♀ 15 ♂)
  - 70+ (15 ♀ 15 ♂)
  - 80+ (11 ♀ 13 ♂)

- +900 hours of lab testing
Psychological input:

What issues might designers need to consider?

(1) Capability beliefs of older adults

Do older adults acknowledge changing abilities?

• Over-estimation: risk of physical injury
• Under-estimation: risk to independence

(2) Ability of older adults to deal with novel situations
Capability beliefs questionnaire

- Physical flexibility
- Physical endurance
- Walking ability
- Manual ability
- Co-ordinate precise movements
- Motor ability in demanding contexts
- Motor ability in novel contexts
- Confidence in motor ability in face of aging
- Motor ability relative to same-age peers
- Over-cautious and over-confident indicator
capability beliefs

Confidence level (%)

60's 70's 80's

Older age-group

confidence with aging
relative to peers
novel contexts
walking
manual
(1) Level of Capability Belief

<table>
<thead>
<tr>
<th>Over-confident:</th>
<th>Over-cautious:</th>
</tr>
</thead>
<tbody>
<tr>
<td>56% of 60’s</td>
<td>30% of 60’s</td>
</tr>
<tr>
<td>32% of 80’s</td>
<td>49% of 80’s</td>
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</tbody>
</table>

(2) Over-riding inappropriate actions

- Greater failure to ‘over-ride’ in 70’s and 80’s compared to all younger age-groups
- Failure frequency and degree of error increase with extreme old age
Reaching
Lifting
Placing
Remote Control Usage

Single Handed
Remote Control: Style of Usage

Age groups vs. %

- Single Hand
- Both hands
- No Pickup

60, 70, 80 age groups
Visualisation of database

Software generated animation of motion

Joint moment mapping to simple visual scale
Walking
CAD Integration

Integration with designer’s CAD software

Simple massing model of container
Next steps

- Integrate psychological findings
- Expand richness of information
- Add design guidelines and strategies
- Investigation of ways to enable the designer to empathise with the situation of the user
Co-investigators:

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**Psychology**
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**Design**
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