An inclusive approach to reducing the stress of using public transport

Dr Russell Marshall
Introduction

- Inclusive design

- Designing for populations
  - for example – British adults, aged 19-65

- Designing for individuals (within populations)
  - for example – Rob who has paraplegia and uses a wheelchair. He wants to visit his brother and needs to use the underground....
Current research goes by the name of AUNT_SUE:

- Accessibility and User Needs in Transport for Sustainable Urban Environments

Consortium of:

- London Metropolitan University
- University College London
- Loughborough University
- Camden Borough and Hertfordshire County councils
- RNIB etc.
Aim:

- to deliver and test sustainable policy and practice that will deliver effective socially inclusive design and operation in transport and the public realm.

Design and planning of transport system infrastructure / through to design of vehicles and facilities.
Industrial Design - Design Ergonomics
Background

- Industrial Design - Design Ergonomics
- Traditionally physical ergonomics
Physical Ergonomics

- Fit, Posture, Reach, Vision
Industrial Design - Design Ergonomics

Traditionally physical ergonomics

Expertise in (digital) human modelling
  - SAMMIE
Human Modelling - SAMMIE

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Human Modelling - SAMMIE
Our Approach

- Human modelling is a ‘good thing’

- But!

- Poor data
  - Availability (not great even for younger able bodied populations – often out of date)
  - Format (available as univariate measures: height, arm length etc.)
  - Applicability (too standardised for many design applications).
 Addresses data issues with new database of 100 individuals
  - Size, shape, mobility, capability, travelling experiences etc.
HADRIAN - Database

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HADRIAN

- Addresses data issues with new database of 100 individuals
  - Size, shape, mobility, capability, travelling experiences etc.

- Addresses use of these data through a simplified means of driving a human modelling system
  - Task analysis system.
HADRIAN Task Analysis

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Task Analysis Results

- Task: Barrier Evaluation
- Subjects (n): 10
- Successes: 8
- Failed Elements: 2
- Total Failures: 2

Detailed Results

- Failures: Subjec40
- Elements: 4
- Command: MOVE
- Target: exit
- Details: Space too small by 41 mm

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Focus is now the Whole Journey Environment

- From origin (e.g. home) to destination (e.g. work) as well as spaces and facilities in between

In making their travel decisions, passengers do not differentiate between the elements of the journey but on their perception of the whole journey.

No good being able to operate and get past a ticket barrier if you can’t get there in the first place!
Two fields of research and development:

- To enable individuals to make sensible, informed choices about how and whether they can make a journey given their abilities and preferences
  - Personalised journey planner

- To enable transport professionals to model the accessibility of specific journeys for a range of people
  - Journey stress calculator.
Personalised Journey Planner

Transport for London

Journey Planner

Travelling from...
From
- start
- Station or stop in: London
- Post code
- Address
- Place of interest
For location help, try the following: Tube map.
Street map

I need to depart on

Travelling to...
- end
- Station or stop in: London
- Post code
- Address
- Place of interest
For location help, try the following: Tube map.
Street map

Why stand in line when you can buy online?
Often people did not notice the advanced options
- Can’t use stairs option, cycle only routes, exclude certain transport modes etc.

It appears that no change time is allowed by the TfL Journey Planner. This seems to assume that everyone has an Oyster card, knows where they are going and is happy to turn up just in time!
1  Set my preferences

<table>
<thead>
<tr>
<th>Changes:</th>
<th>Allow at least 10 minutes at changes</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Walking:</th>
<th>My walking speed is...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Slow</td>
</tr>
<tr>
<td></td>
<td>I like to walk more if it makes the journey simpler</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Access:</th>
<th>I need a wheelchair accessible journey</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>I prefer to avoid...</th>
<th>Steps</th>
<th>Escalators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I prefer to avoid areas that are...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crowded</td>
</tr>
<tr>
<td>✔</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Priorities:</th>
<th>Search for minimum...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Changes</td>
</tr>
</tbody>
</table>

- ✔ Save my preferences for next time
- Continue

2  Enter locations

3  Select time and date

4  Choose best journey
1 Set my preferences
Allow at least 10 minutes at changes. My walking speed is slow.
I prefer to avoid steps. I prefer to avoid areas that are crowded or dark.

2 Enter locations
From SE3 7DR to Paddington Rail Station.

3 Select time and date
Depart at 13:30 on 25 May 2008

4 Choose best journey

<table>
<thead>
<tr>
<th>Search by:</th>
<th>Changes</th>
<th>Cost</th>
<th>Time</th>
<th>Walking</th>
</tr>
</thead>
</table>

**A**
- Arrive: 14:30, 14:44, 15:00
- Duration: 1:11, 1:10, 1:11
- £7.70
- 22 min
- View Journey Plan

**B**
- Arrive: 14:52, 15:03, 15:22
- Duration: 1:36, 1:27, 1:26
- £5.60
- 36 min
- View Journey Plan

Search should include:
- Train
- Tube
- Tram/Light Rail
- Bus
- Coach
- Ferry

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**Journey Plan**

<table>
<thead>
<tr>
<th>Depart</th>
<th>Arrive</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:34</td>
<td>13:44</td>
<td>10 min</td>
</tr>
<tr>
<td>13:49</td>
<td>13:54</td>
<td>5 min</td>
</tr>
<tr>
<td>13:54</td>
<td>14:01</td>
<td>7 min</td>
</tr>
<tr>
<td>14:03</td>
<td>14:23</td>
<td>20 min</td>
</tr>
<tr>
<td>14:23</td>
<td>14:44</td>
<td>21 min</td>
</tr>
</tbody>
</table>

**Total Duration:** 22 min

**Cost:** £7.70

**Departure:** Camden Station

**Arrival:** Wagamamma Japanese Restaurant, St Albans

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**Stations and Directions:**

1. **Depart 13:34**
   - Wagamamma Japanese Restaurant, Camden

2. **Arrive 13:44**
   - Camden Town Underground Station
   - Northern Line via Bank

3. **Depart 13:49**
   - Station may be crowded

4. **Arrive 13:54**
   - St Pancras Underground Station
   - Northern Line via Bank

   **Note:** Station may be crowded

5. **Depart 13:54**
   - Northern Line towards Morden via Bank

6. **Arrive 14:01**
   - Kings Cross Thameslink Rail Station
   - Platform 2

7. **Depart 14:03**
   - First Capital Connect towards Bedford Rail Station

8. **Arrive 14:23**
   - St Albans Rail Station
   - Northern Line via Bank

9. **Depart 14:23**
   - Station may be crowded

10. **Arrive 14:44**
    - Wagamamma Japanese Restaurant, St Albans

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**Additional Notes:**

- **Camden Station may be crowded.**
- **St Pancras Underground Station:** Station may be crowded.
- **Kings Cross Thameslink Rail Station:** Platform 2
- **St Albans Rail Station:** Station may be crowded.

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**Interactive Map**

**Printer Map**
Most map options only really useful for walking in an unknown environment

People would like:
- Route maps, not node maps
- Walking routes, not vehicle routes
- More representative walking routes with road crossings
- Identifiable landmarks
- Textual descriptions of walking routes.
Improved Walking Routes

- Mapping system specially designed for walking:
  - Accurate – using paths and road crossings
  - Use of street level information to eliminate routes that the user can access (e.g. narrow paths, steps)
  - Provision of warnings about local conditions and barriers
  - Function that gives alternative routes that avoid local conditions or barriers

- This needs to be supported by:
  - New information about streets
  - Improved interface.
Improved Walking Routes

Select your preferred walking route

- Shortest
- Easiest
- Nicest

Victoria Street may be quiet and dark and seem unfriendly.
Cross Latimore Road without a pedestrian crossing.
Improved information, choice and usability have the potential to make a significant difference in the ability for people to plan and make a journey.

However, we are also addressing the needs of the transport planner and urban designer by combining the journey planner with HADRIAN.
If we had some way of identifying the problems with a journey we could target resources to improve it.

One possible unifying and inclusive metric is stress.
People are excluded by anticipatory stress

Anticipatory stress is caused by expectation that stressors will be encountered

People who are likely to encounter extra stressors are most likely to be excluded

Accessibility for all may be realised by the elimination of stressors.
If we had some way of identifying the problems with a journey we could target resources to improve it.

Contributors to stress-inducing ‘bad journeys’ are diverse in nature:

- Unpleasant environments
- Uncertainties
- Practical difficulties
- Slow transport or poor connections.
Different people are affected by different things:
- Low confidence
- Lack of knowledge or understanding
- Physical and sensory impairments
- Time pressure

Makes evaluation of what contributes to a bad journey very complex.
Using a psychological stress model:
- Compile a comprehensive list of stressors found in journeys
- Assign severity levels to each stressor
- Assign coping difficulties to HADRIAN participants for each type of stressor based on our data and knowledge

Use the journey planner to predict the occurrence of each stressor in any given journey.
### Journey Stress Calculator

<table>
<thead>
<tr>
<th>Priority Order</th>
<th>Stressor</th>
<th>Stressor Priority Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overcrowding</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>Unable to get on and off train</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Not having a journey plan</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>Queuing for ticket</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>Difficulty getting on and off vehicle</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>Problems communicating with ticket sales staff</td>
<td>16</td>
</tr>
<tr>
<td>=7</td>
<td>Unable to get on and off bus</td>
<td>15</td>
</tr>
<tr>
<td>=7</td>
<td>Not knowing where to go to catch vehicle</td>
<td>15</td>
</tr>
<tr>
<td>=9</td>
<td>Not knowing if vehicle goes to the required destination</td>
<td>14</td>
</tr>
<tr>
<td>=9</td>
<td>Difficulty using ticket machine</td>
<td>14</td>
</tr>
<tr>
<td>=9</td>
<td>Waiting for or travelling in late vehicles</td>
<td>14</td>
</tr>
<tr>
<td>12</td>
<td>Impeded mobility</td>
<td>10</td>
</tr>
<tr>
<td>13</td>
<td>Noise</td>
<td>8</td>
</tr>
</tbody>
</table>
Journey Stress Calculator

Journey Stages

<table>
<thead>
<tr>
<th>Journey Name: wag1</th>
<th>Stress: Total</th>
<th>People: Average</th>
</tr>
</thead>
</table>

**View By...**
- Stressors
- People

<table>
<thead>
<tr>
<th>Journey Stage</th>
<th>Average Stress (Points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>5</td>
<td>47</td>
</tr>
<tr>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>7</td>
<td>44</td>
</tr>
<tr>
<td>8</td>
<td>29</td>
</tr>
<tr>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>38</td>
</tr>
</tbody>
</table>

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Calculate journey stress for any HADRIAN participant

Identify points within the journey that cause stress for most people

These areas of high stress can then be targeted with design changes, service changes, more investment etc.
Our approach is to help support the experts:
  - designers / ergonomists / planners
    - Through improved data on people
    - Through the provision of a tool (HADRIAN) to assess the accessibility of products

Our recent focus on transport:
  - Started to address the information needs of travellers
  - Provide a means to evaluate journeys or proposed changes before time and money are committed.
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www.aunt-sue.info