

## **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....

## AUNT-SUE

- ▶ 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 of AUNT-SUE

- ▶ 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.

## Background

- ▶ Industrial Design - Design Ergonomics

## Background

- ▶ Industrial Design - Design Ergonomics
- ▶ Traditionally physical ergonomics

## Physical Ergonomics

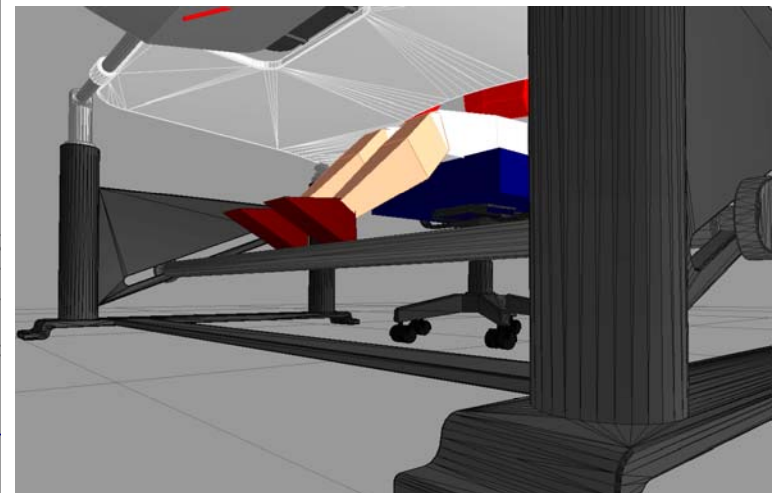
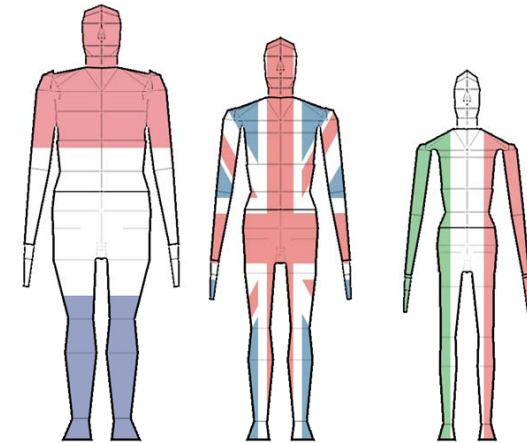
### ► Fit, Posture, Reach, Vision



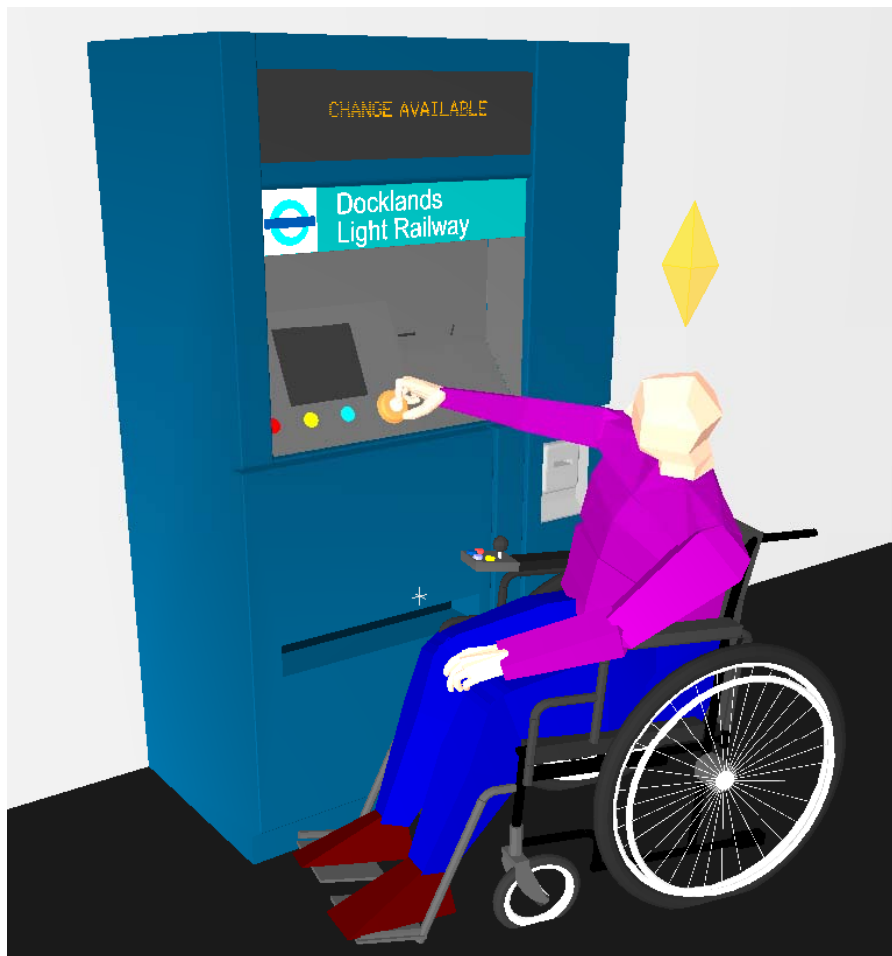
## Background

- ▶ Industrial Design - Design Ergonomics
- ▶ Traditionally physical ergonomics
- ▶ Expertise in (digital) human modelling
  - SAMMIE

## Human Modelling - SAMMIE



## 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  - Availability (not great even for younger able bodied populations – often out of date)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).

## HADRIAN

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

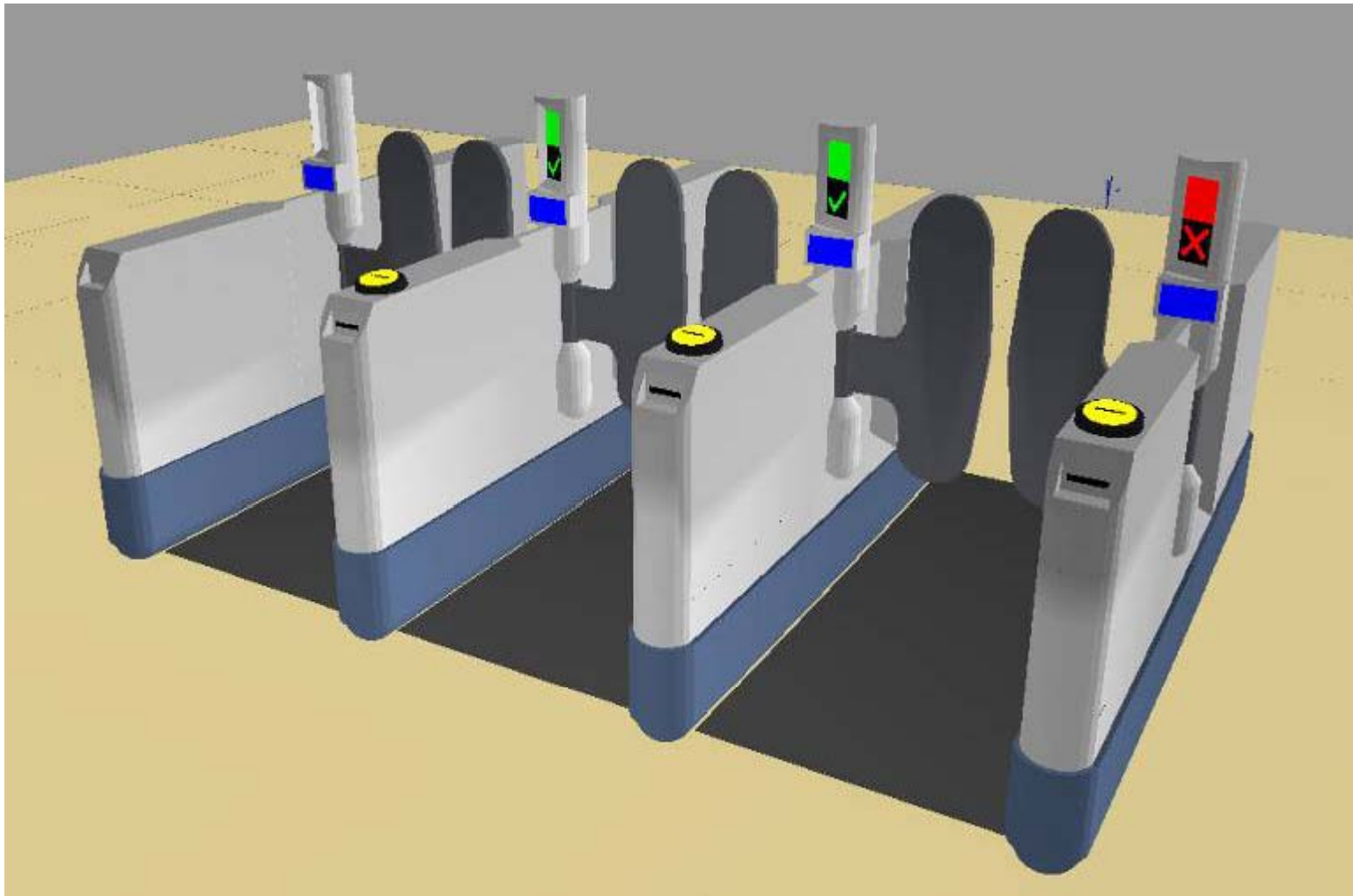
# HADRIAN - Database



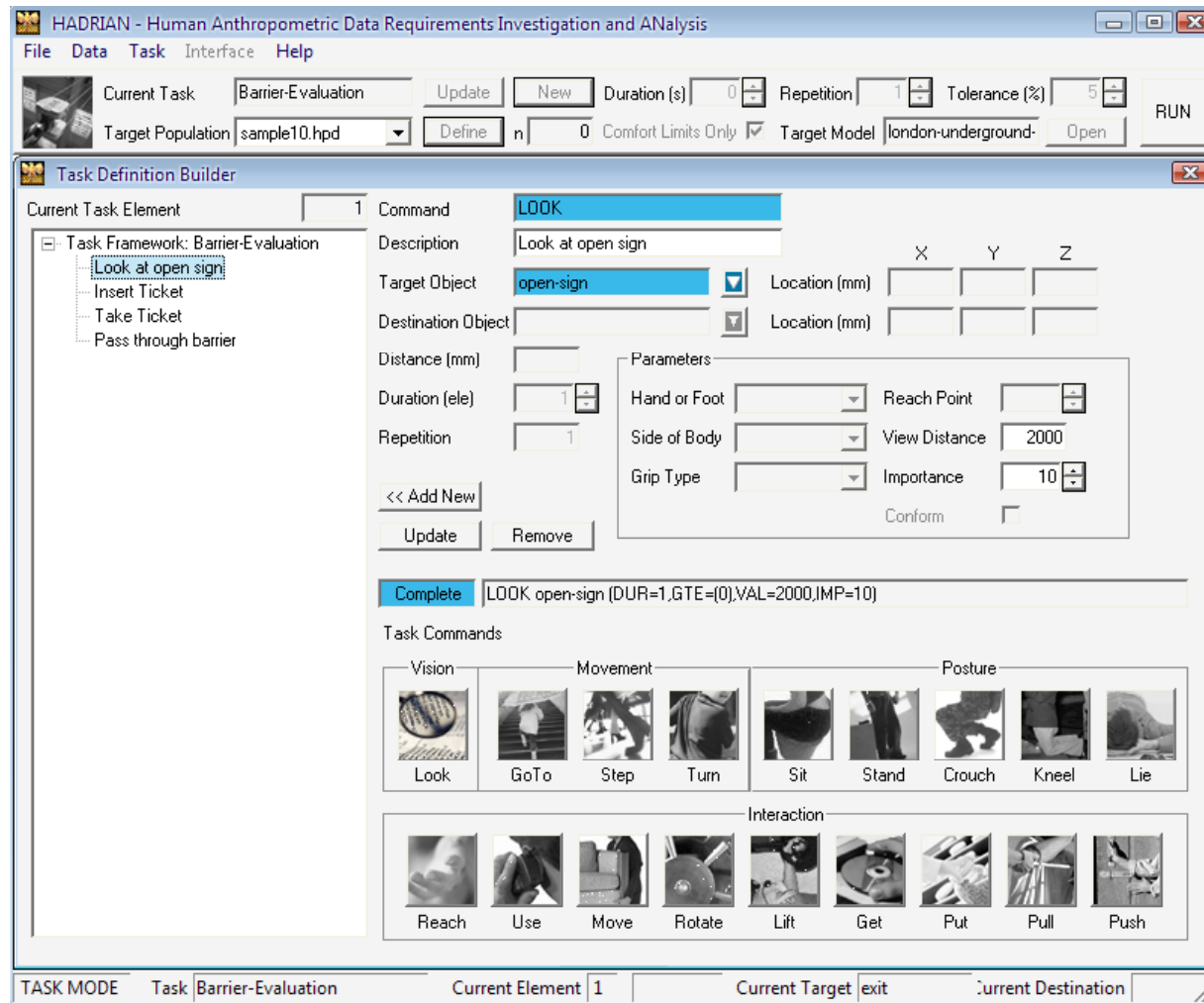
## HADRIAN

- ▶ 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



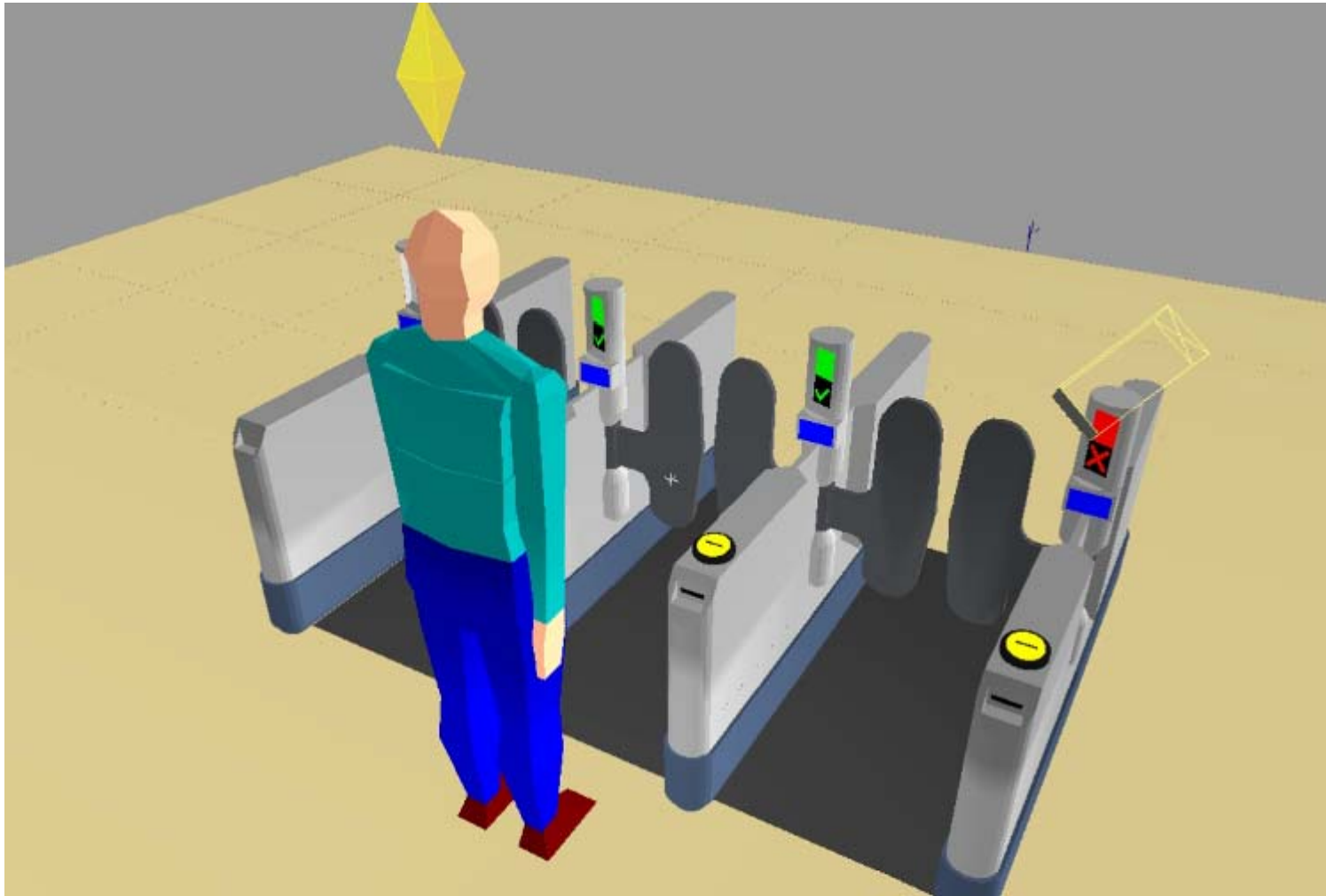
# HADRIAN Task Analysis



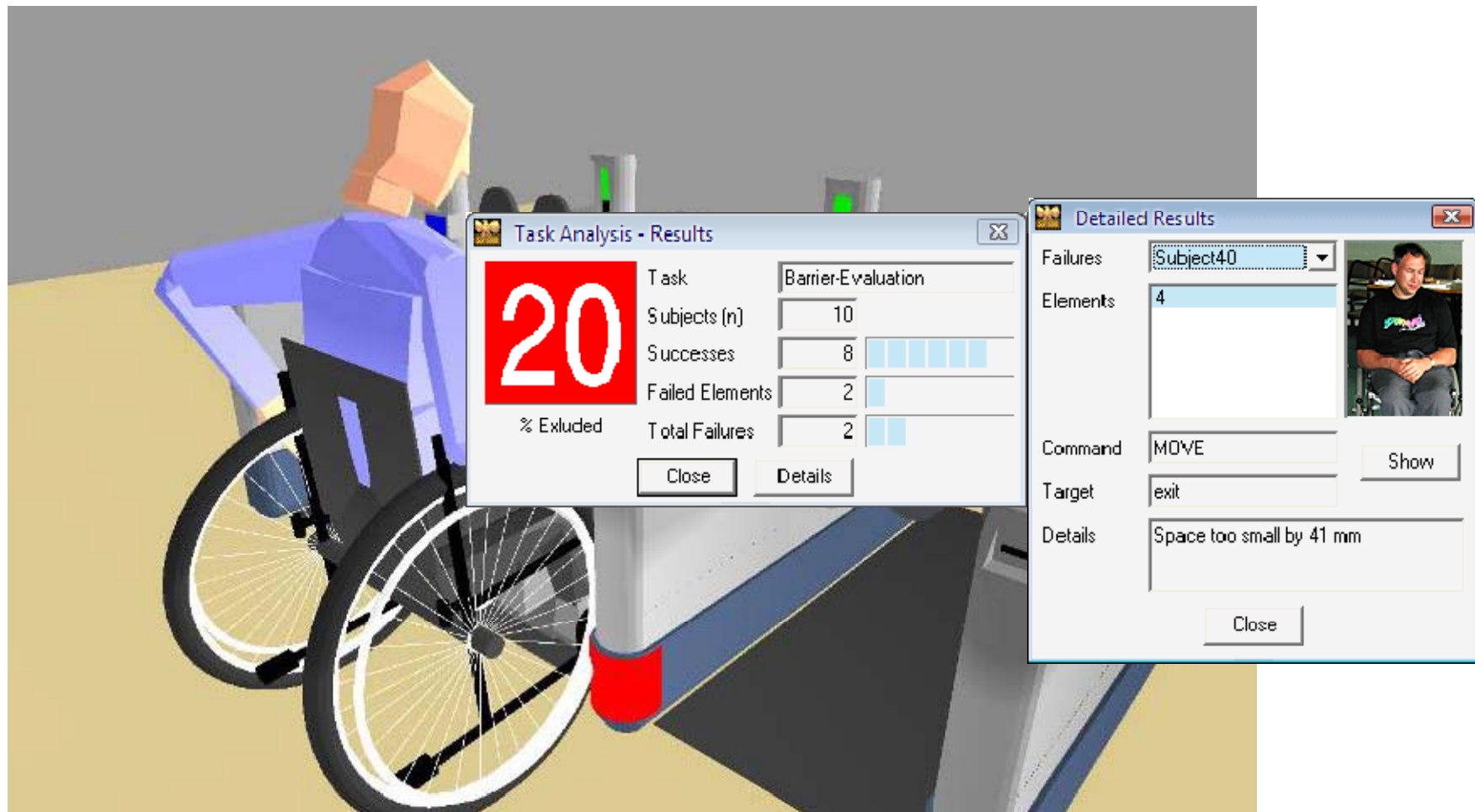
The screenshot displays the HADRIAN software interface, titled "HADRIAN - Human Anthropometric Data Requirements Investigation and ANALYSIS". The main window is divided into several sections:

- Top Panel:** Contains menu options (File, Data, Task, Interface, Help) and a toolbar with buttons for "Current Task" (Barrier-Evaluation), "Update", "New", "Duration (s)" (0), "Repetition" (1), "Tolerance (%)" (5), "Target Population" (sample10.hpd), "Define", "n" (0), "Comfort Limits Only" (checked), "Target Model" (london-underground), "Open", and "RUN".
- Task Definition Builder:**
  - Current Task Element:** 1
  - Command:** LOOK
  - Description:** Look at open sign
  - Target Object:** open-sign (checked), with X, Y, Z location fields.
  - Destination Object:** (empty), with X, Y, Z location fields.
  - Distance (mm):** (empty)
  - Duration (ele):** 1
  - Repetition:** 1
  - Parameters:**
    - Hand or Foot: (dropdown)
    - Side of Body: (dropdown)
    - Grip Type: (dropdown)
    - Reach Point: (spin box)
    - View Distance: 2000
    - Importance: 10
    - Conform: (checkbox)
- Task Framework:** A tree view showing "Barrier-Evaluation" with sub-items: "Look at open sign" (selected), "Insert Ticket", "Take Ticket", and "Pass through barrier".
- Task Commands:** A grid of icons representing different actions:
  - Vision:** Look
  - Movement:** GoTo, Step, Turn
  - Posture:** Sit, Stand, Crouch, Kneel, Lie
  - Interaction:** Reach, Use, Move, Rotate, Lift, Get, Put, Pull, Push
- Complete:** LOOK open-sign (DUR=1,GTE=(0),VAL=2000,IMP=10)
- Bottom Panel:** TASK MODE | Task: Barrier-Evaluation | Current Element: 1 | Current Target: exit | Current Destination: (empty)

## HADRIAN Task Analysis



# HADRIAN Task Analysis



## Whole Journeys

- ▶ 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!

## Whole Journeys

- ▶ 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

[Accessibility](#) [Help & Contact](#) [Sitemap](#)

Search:

Home	Live travel news	Getting around	Tickets	Road users	Corporate	Business & partners
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- Getting around
- Journey Planner
- Add us to your website
- Large text version

## Journey Planner 1 2 3

Travelling from... English

<p><b>From</b></p> <p><input type="text" value="start"/></p> <p><input checked="" type="radio"/> Station or stop in: <input type="text" value="London"/></p> <p><input type="radio"/> Post code</p> <p><input type="radio"/> Address</p> <p><input type="radio"/> Place of interest</p> <p>For location help, try the following: <a href="#">Tube map</a>. <a href="#">Street map</a></p>	<p><b>Travelling to...</b></p> <p><input type="text" value="end"/></p> <p><input checked="" type="radio"/> Station or stop in: <input type="text" value="London"/></p> <p><input type="radio"/> Post code</p> <p><input type="radio"/> Address</p> <p><input type="radio"/> Place of interest</p> <p>For location help, try the following: <a href="#">Tube map</a>. <a href="#">Street map</a></p>
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I need to  on

at:  :  hours

Maps

Mobile Travel Alerts FREE!

**See also**

- [Live travel news](#)
- [Planned works](#)
- [Timetables](#)
- [RSS Feed](#)



Why stand in line when you can buy online?

## Journey Planner Research


- ▶ 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

Changes: Allow at least  minutes at changes

Walking: My walking speed  Very Slow  Slow  Normal is...

I like to walk more if it makes the journey simpler

Access:  I need a wheelchair accessible journey 

I prefer to avoid...  Steps   Escalators 

I prefer to avoid areas that  Crowded  Dark  Quiet are...

Priorities: Search for minimum...  Changes  Cost  Time  Walking

Save my preferences for next time Continue

## 2 Enter locations

## 3 Select time and date

## 4 Choose best journey

## 1 Set my preferences Change

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 Change

From SE3 7DR to Paddington Rail Station.

## 3 Select time and date Change

Depart at 13:30 on 25 May 2008

## 4 Choose best journey

Search by:  Changes  Cost  Time  Walking

A



£7.70

Depart	13:19	13:34	13:49
Arrive	14:30	14:44	15:00
Duration	1:11	1:10	1:11

22 min



View Journey Plan

B



£5.60

Depart	13:16	13:36	13:56
Arrive	14:52	15:03	15:22
Duration	1:36	1:27	1:26

36 min



View Journey Plan

Search should include...

- Train
  Tube
  Tram/Light Rail
  Wheelchair Access  
 Bus
  Coach
  Ferry

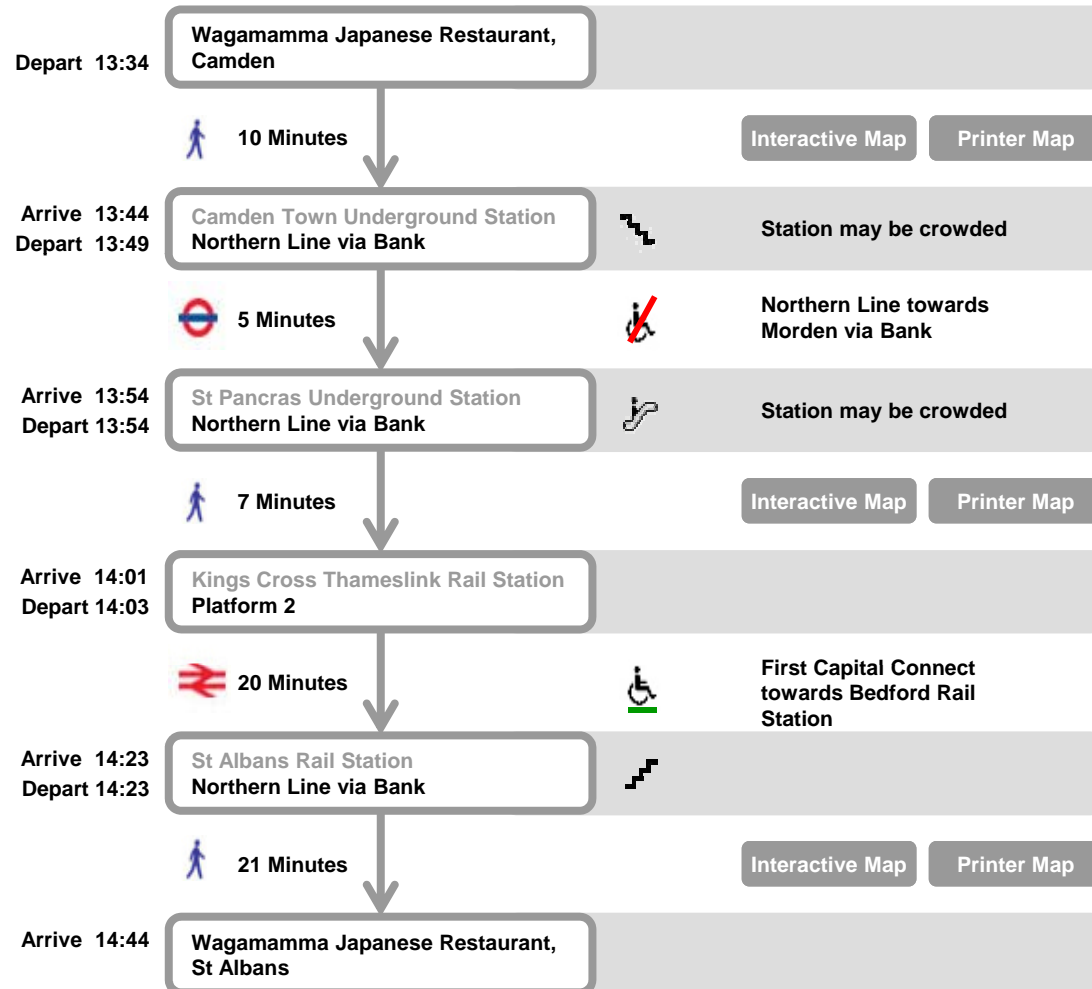
## Journey Plan



£7.70

Depart	13:19	13:34	13:49
Arrive	14:30	14:44	15:00
Duration	1:11	1:10	1:11

22 min



## Improved Walking Routes

- ▶ 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	<b>Easiest</b>	Nicest
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Victoria Street may be quiet and dark and seem unfriendly.  
 Cross Latimore Road without a pedestrian crossing.

## Personalised Journey Planner

- ▶ 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.

## Journey Stress Calculator

- ▶ 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.

## Journey Stress Calculator

- ▶ 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.

## Journey Stress Calculator

- ▶ 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.









## Journey Stress Calculator

- ▶ 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.

## Journey Stress Calculator

- ▶ 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

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

# Journey Stress Calculator



## Journey Stress Calculator

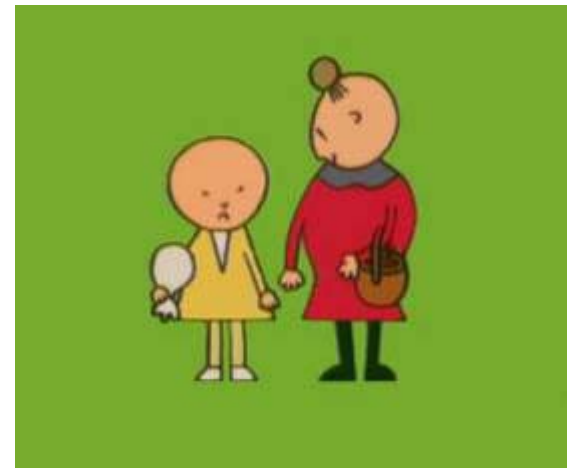
- ▶ Calculate journey stress for any HADRIAN participant
- ▶ Identify points within the journey that cause stress for most people
- ▶ These areas of high stress can then be targeted with design changes, service changes, more investment etc.

## Summing Up

- ▶ 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.

## Contact details

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- ▶ [www.aunt-sue.info](http://www.aunt-sue.info)