

# ▶ **Designing for Inclusion**

Dr Russell Marshall

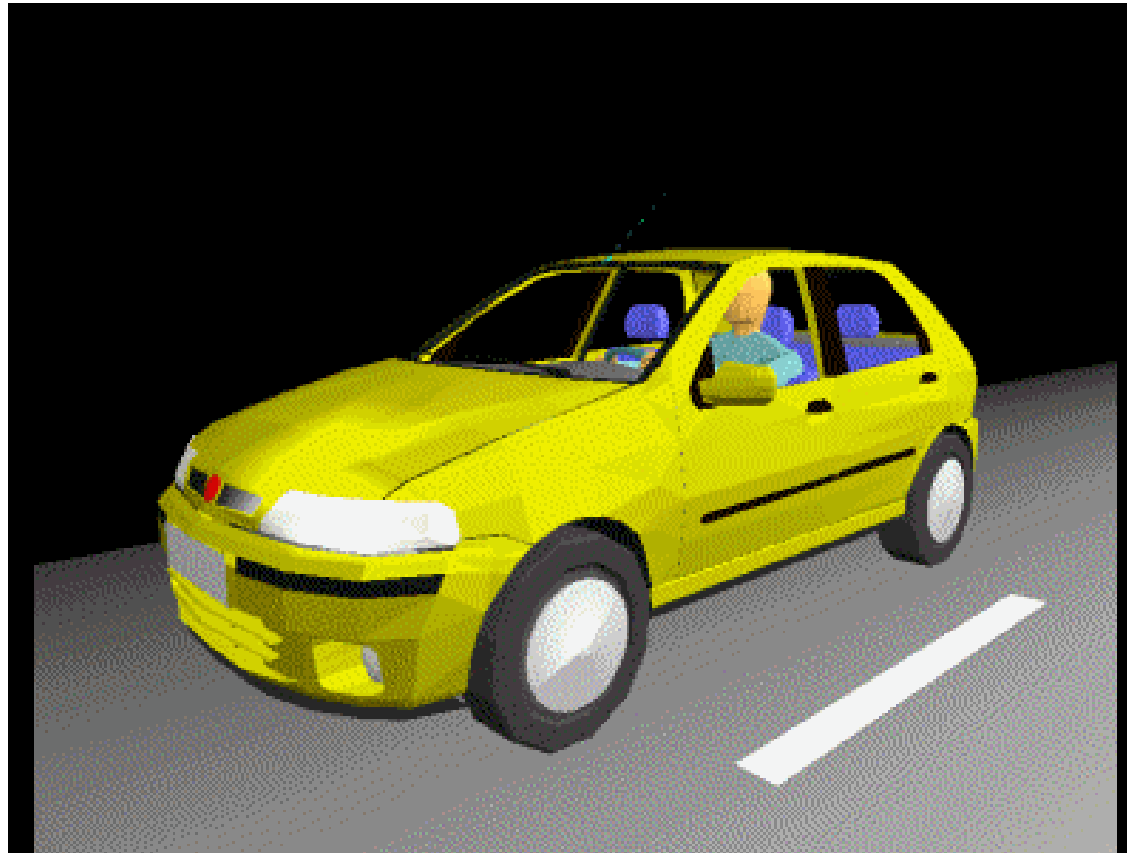
# ▶ Designing for Inclusion

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- ▶ Designing for populations
  - ▶ for example – British adults, aged 19-65
- ▶ Designing for sub-groups
  - ▶ for example – teenagers, wheelchair users, high mileage drivers
- ▶ Designing for individuals
  - ▶ for example – Rob who has paraplegia and uses a wheelchair. He wants to visit his brother and needs to use the underground....

# ▶ Human Modelling - SAMMIE

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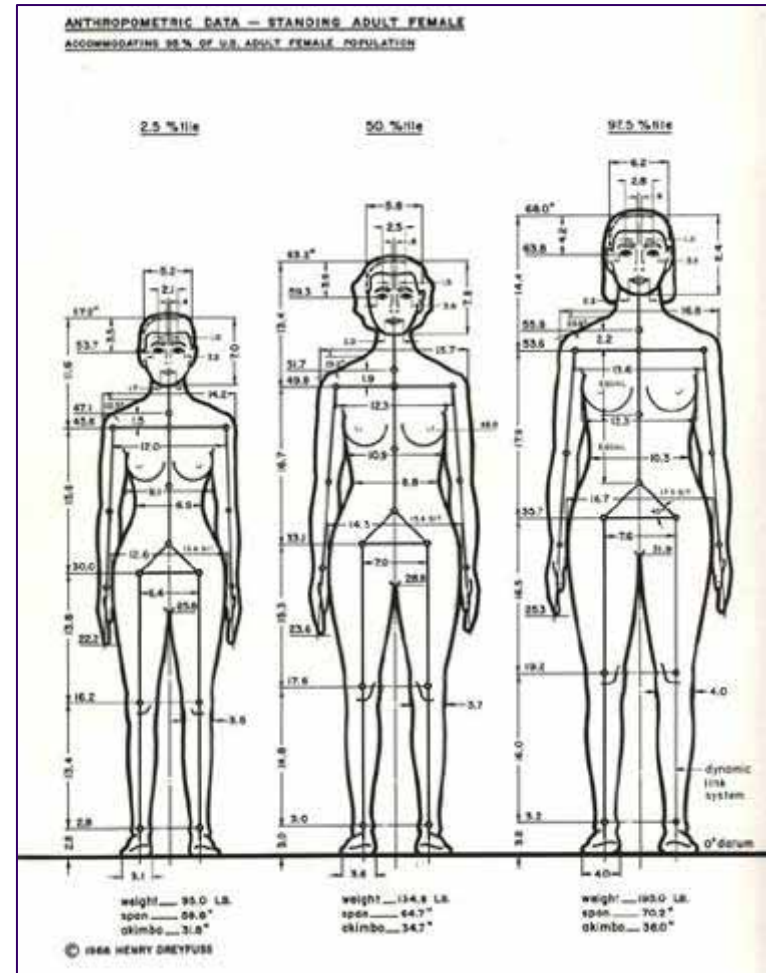
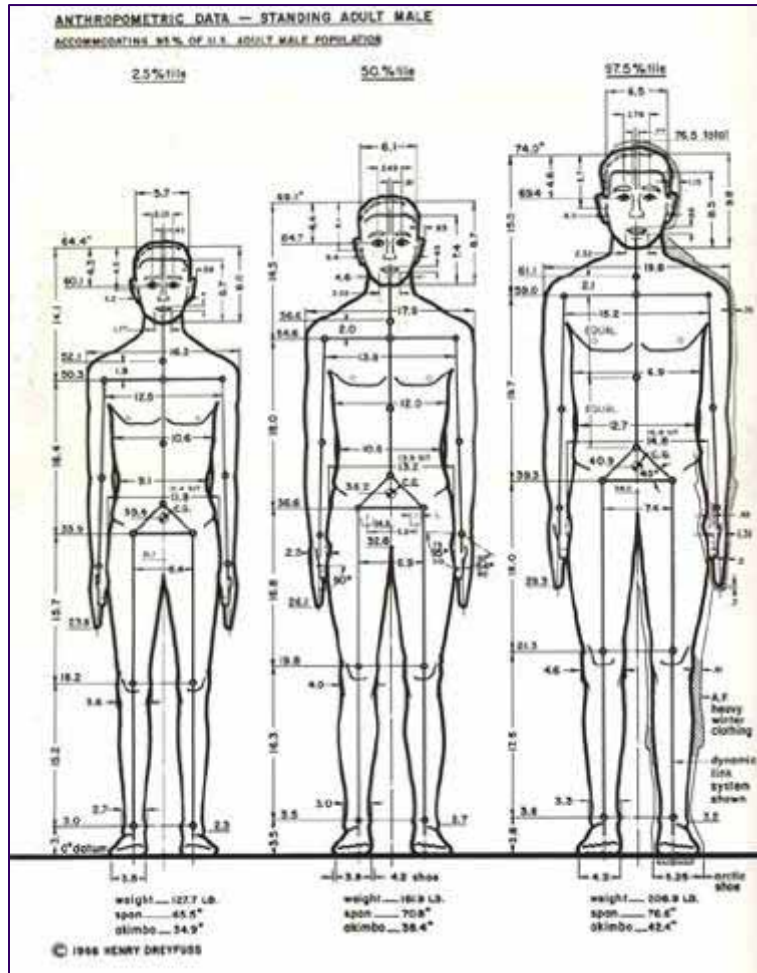
# ▶ The Needs of Designers

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- ▶ Tools such as SAMMIE support designers in developing products that meet the needs of their intended users i.e. inclusive products
- ▶ Quality of the outcome based on two key elements:
  - ▶ data on users – availability, validity, applicability
  - ▶ a means of utilising the data to assess inclusivity

# ▶ Data on Users

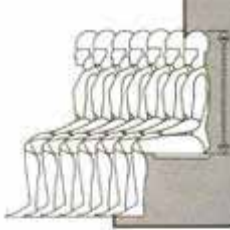
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# ▶ Data on Users

- ▶ 5<sup>th</sup> to 95<sup>th</sup> percentile?
- ▶ 5<sup>th</sup> percentile means 5% of the population have a shorter sitting height

**2D SITTING HEIGHT NORMAL**



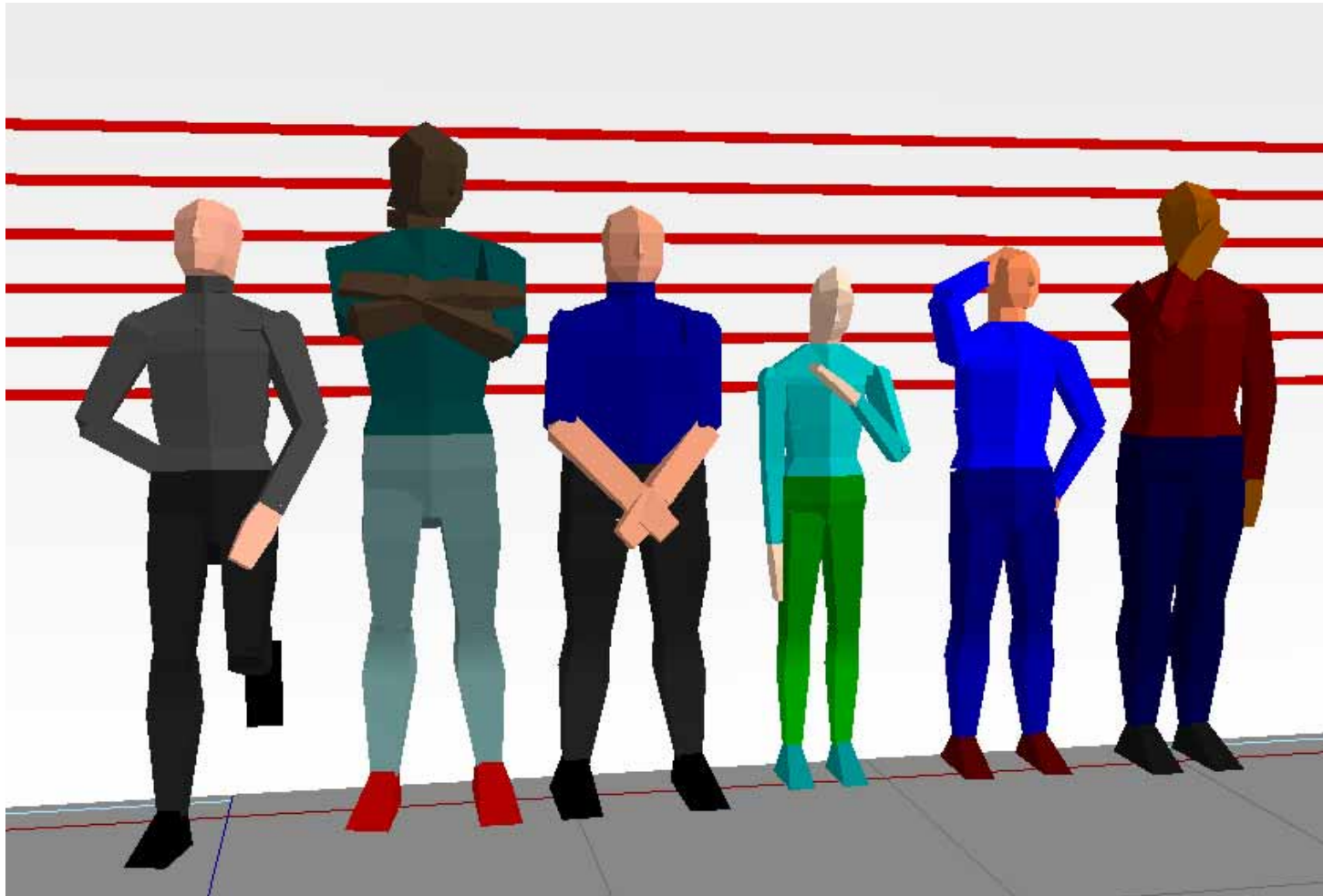
Adult Male and Female Sitting Height Normal: in Inches and Centimeters by Age, Sex, and Selected Percentiles:

		18 to 24 Years		25 to 34 Years		35 to 44 Years		45 to 54 Years		55 to 64 Years		65 to 74 Years		75 to 79 Years			
		in cm	in cm	in cm	in cm	in cm	in cm	in cm	in cm	in cm	in cm	in cm	in cm	in cm	in cm		
99	MEN	37.8	95.0	37.8	95.0	37.8	95.0	37.7	95.8	37.7	95.8	36.9	93.7	36.4	92.5	36.7	93.2
	WOMEN	35.7	90.7	35.7	90.7	35.9	91.2	35.9	90.9	35.5	90.2	35.4	89.9	34.9	88.8	35.0	88.9
95	MEN	36.8	93.0	36.7	93.3	36.8	93.5	36.7	93.2	36.7	93.2	36.0	91.4	35.7	90.7	35.8	90.9
	WOMEN	34.7	88.1	34.8	88.4	34.9	88.6	34.9	88.6	34.6	87.9	34.4	87.4	33.9	86.3	33.4	84.8
90	MEN	35.9	91.2	35.0	91.4	35.3	92.2	35.2	91.9	35.0	91.4	35.8	90.4	35.1	89.2	35.2	89.4
	WOMEN	34.1	86.6	34.3	87.1	34.5	87.6	34.4	87.4	34.0	86.4	33.8	85.9	33.1	84.1	32.8	83.3
80	MEN	35.3	89.7	35.4	89.9	35.6	90.4	35.5	90.2	35.5	90.2	35.0	88.9	34.6	87.9	34.6	87.9
	WOMEN	33.6	85.5	33.7	85.6	33.8	85.9	33.8	85.9	33.5	85.1	33.2	84.3	32.5	82.6	32.3	82.0
70	MEN	34.8	88.4	34.9	88.6	35.1	89.2	34.9	88.8	35.0	88.9	34.6	87.9	34.1	86.6	34.1	86.8
	WOMEN	33.1	84.1	33.4	84.8	33.4	84.8	33.3	84.6	33.0	83.8	32.8	83.3	31.9	81.0	31.8	80.9
60	MEN	34.5	87.6	34.5	87.6	34.8	88.4	34.6	87.9	34.6	87.9	34.3	87.1	33.8	85.9	33.7	85.8
	WOMEN	32.7	83.1	33.0	83.8	33.0	83.8	32.9	83.6	32.7	83.1	32.4	82.3	31.6	80.3	31.4	79.8
50	MEN	34.1	86.6	34.2	86.9	34.4	87.4	34.3	87.1	34.2	86.9	33.9	86.1	33.4	84.8	33.3	84.8
	WOMEN	32.3	82.0	32.6	82.8	32.6	82.8	32.6	82.8	32.3	82.0	32.1	81.5	31.2	79.2	31.0	78.7
40	MEN	33.7	85.6	33.8	85.9	34.0	86.4	34.0	86.4	33.8	85.9	33.5	85.1	33.1	84.1	32.9	83.8
	WOMEN	31.9	81.0	32.3	82.0	32.3	82.0	32.3	82.0	32.0	81.3	31.7	80.5	30.8	78.2	30.6	77.7
30	MEN	33.3	84.8	33.3	84.8	33.6	85.3	33.5	85.1	33.4	84.8	33.2	84.3	32.7	83.1	32.5	82.8
	WOMEN	31.5	80.0	31.9	81.0	31.9	81.0	31.9	81.0	31.5	80.0	31.3	79.5	30.4	77.2	30.1	76.3
20	MEN	32.9	83.6	32.9	83.6	33.2	84.3	33.1	84.1	32.9	83.8	32.6	82.8	32.4	82.3	32.1	81.5
	WOMEN	31.0	78.7	31.3	79.5	31.4	79.8	31.4	79.8	31.1	79.0	30.8	78.2	30.0	76.2	29.2	74.2
10	MEN	32.2	81.8	32.3	82.0	32.6	82.6	32.4	82.3	32.3	82.0	31.8	80.8	31.9	81.0	30.7	78.0
	WOMEN	30.2	76.7	30.6	77.7	30.7	78.0	30.8	78.2	30.3	77.0	30.2	76.7	29.3	74.4	27.6	70.1
5	MEN	31.6	80.3	31.9	81.0	32.1	81.5	32.0	81.3	31.8	80.8	31.3	79.5	31.2	79.2	29.8	75.7
	WOMEN	29.6	75.2	30.1	76.5	30.1	76.5	30.2	76.7	29.7	75.4	29.7	75.4	28.7	72.9	27.1	68.8
1	MEN	30.4	77.2	30.5	77.5	31.0	78.7	30.8	78.2	30.6	78.2	30.2	76.7	30.1	76.5	26.7	67.8
	WOMEN	28.2	71.6	29.2	74.2	28.9	73.4	29.2	74.2	28.7	72.9	28.3	71.9	27.0	68.6	14.8	37.8



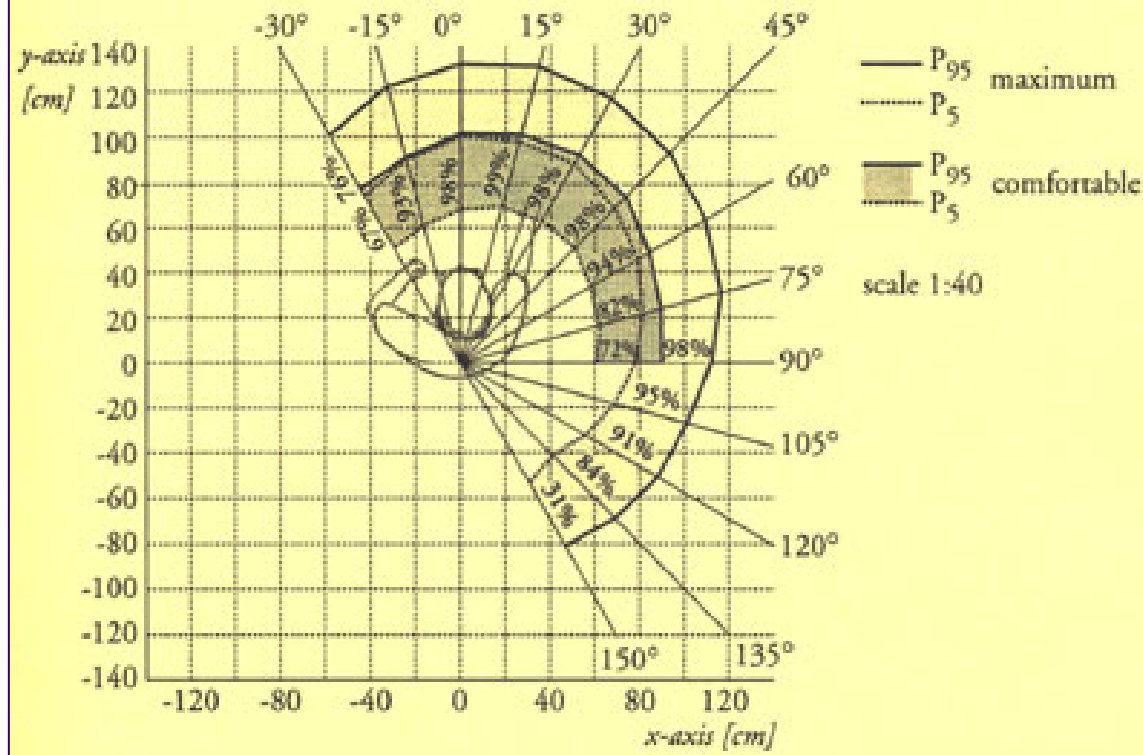
# ▶ Usual Suspects?

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# ▶ Data on Users

## Envelope of horizontal reaching, 50+ years of age, stature $\geq 170$ cm



# ▶ Data on Users

- ▶ commonly accepted view for mainstream design is to cater for only the 5<sup>th</sup> to 95<sup>th</sup> percentile users
  - ▶ this is designing for *numbers*, not *people*
  - ▶ no longer acceptable to ‘*design out*’ people who are in the top or bottom 5% of size, ability, preference ...

- ▶ Introducing AUNT-SUE
  - ▶ accessibility and user needs in transport for sustainable urban environments
- ▶ Consortium of:
  - ▶ London Metropolitan University
  - ▶ University College London
  - ▶ Loughborough University
  - ▶ Camden Borough Council
  - ▶ Hertfordshire County Council
  - ▶ + others.

- ▶ Aim:
  - ▶ to deliver and test sustainable policy and practice that will deliver effective socially inclusive design and operation in transport and the public realm
- ▶ Infrastructure / system through to design of vehicle and facilities

## ▶ HADRIAN

- ▶ human anthropometric data requirements investigation and analysis

# ▶ HADRIAN Database

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# HADRIAN Database

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HADRIAN - Human Anthropometric Data Requirements Investigation and Analysis

File Data Task Database Help

Current Database: Janice10 | Current Dataset: 4 | Comments: Subject of name HADRIAN database containing of 10 individuals selected for validation files

General Data: Data Set 1 | Anthropometry Data: Data Set 20

Gender: Female | Age: 56 | Weight (kg): 82.30 | Height: 170 | Nationality: British | Occupation: Retail telephone | Category: Ambient | Vision: Normal | UPSIS score: | Disability: Admitts breast & shoulder | Character: | Anthropometry: |

Anthropometry Data: Data Set 20

Anthropometry 1 | Anthropometry 2 | Wheelchair

Mobility Data: Data Set 20

Jobs 1 | Jobs 2

Capability Data: Data Set 28

Capability 1 | Capability 2 | Disability

Reach Envelopes

	60"K	60"Y	30"K	30"Y	D.W.	D.Y.	30"K	30"Y	6"
R.1	450	340	270	310	77	34	40	30	
R.2	470	400	320	400	48	40	40	40	
R.3	300	480	390	500	36	50	40	45	
R.4	200	520	300	530	30	54	30	55	
R.5	100	530	200	570	22	60	20	65	
R.6	0	520	100	600	10	65	10	65	
R.7	-100	480	0	670	0	60	0	65	

Task Capability

Hand and High Place

Subjects were asked to select a comfortable one handed weight and to place it as high as possible on the top shelf as was comfortably possible to reach

Mid-Reach

Low-Evil Chair Sit

Subjects were asked to sit in a low evil chair in the room

# ▶ HADRIAN Database

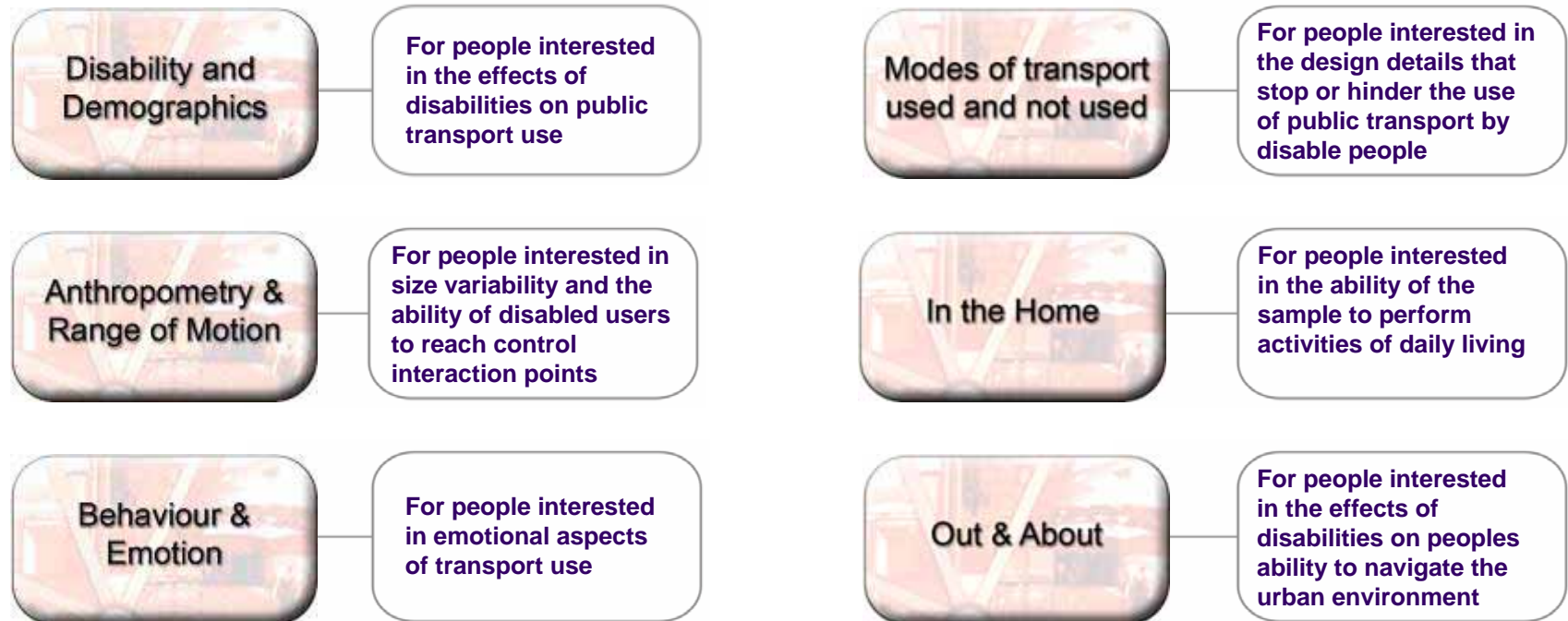
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# ▶ HADRIAN Database

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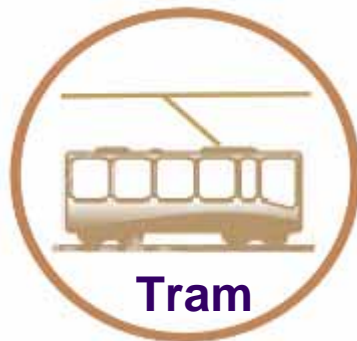
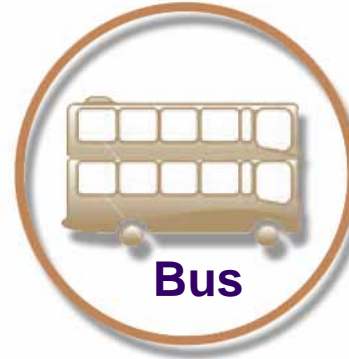
The database of 100 people can be browsed using a number of starting points



# ▶ HADRIAN Database

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Select the mode of transport of interest





## Rail

People who cant access trains

People who can access trains with difficulty

People who can access trains with no difficulty

Able bodied

**0%**

Able bodied

**0%**

Able bodied

**100%**

Older able bodied

**0%**

Older able bodied

**8%**

Older able bodied

**96%**

Older ambulant disabled

**5%**

Older ambulant disabled

**45%**

Older ambulant disabled

**60%**

Ambulant disabled

**9%**

Ambulant disabled

**25%**

Ambulant disabled

**25%**

Wheel chair users

**60%**

Wheel chair users

**100%**

Wheel chair users

**0%**

[View Results](#)

[View Results](#)

[View Results](#)



## Rail

### People who can access trains with difficulty

**Able bodied**

**Ambulant disabled**

**Wheel chair users**

**Older able bodied**

**Older ambulant disabled**





## Rail



**Subject Number:** 78  
**Gender:** Male  
**Age:** 42  
**Category:** Wheelchair user  
**Occupation:** Shop manager

### Kitchen task video



### Interview video

When was the last time  
that you used a train?

Other data for  
this subject

Anthropometry

Reach range

In the home

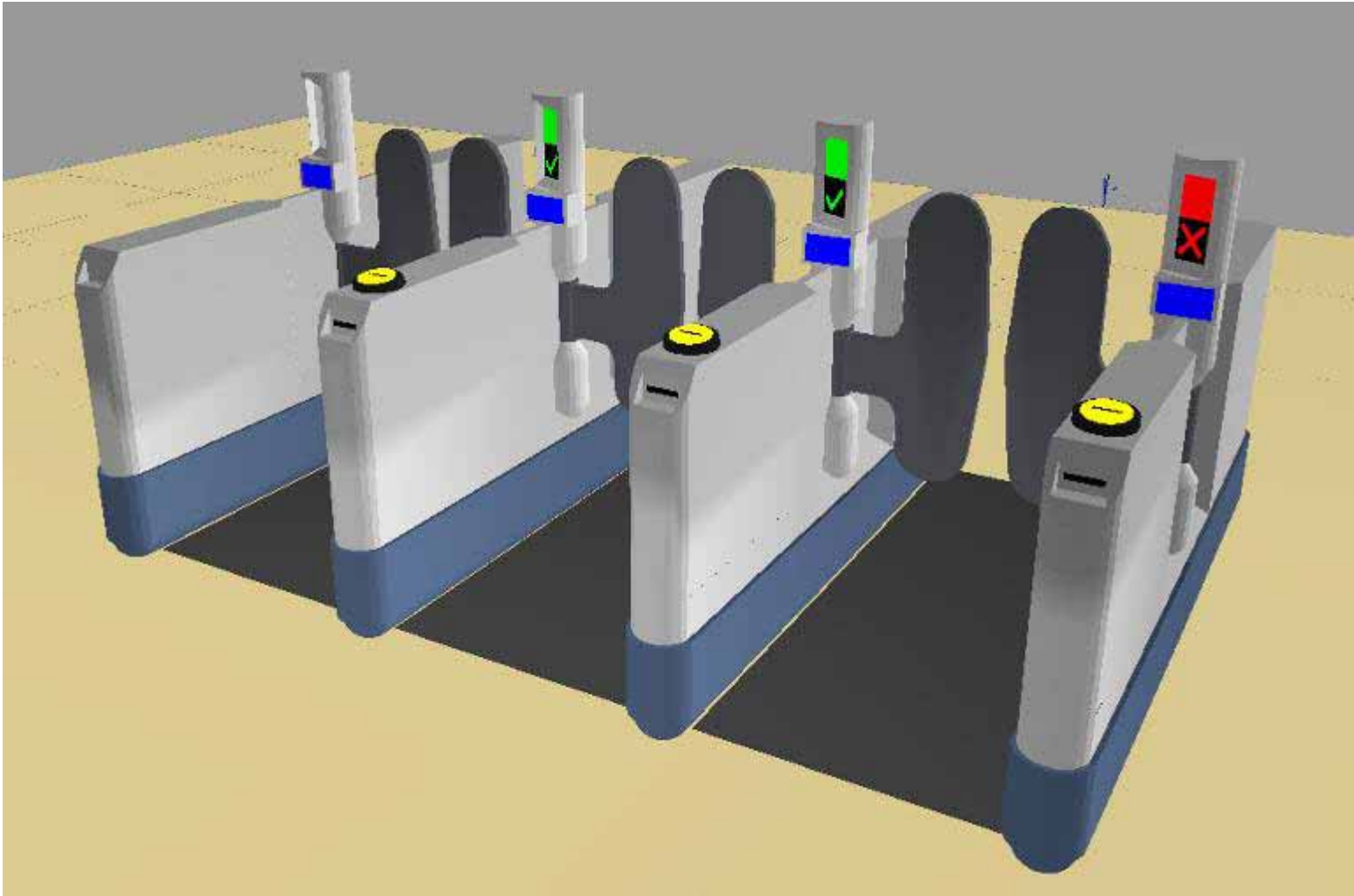
Out & About

CAD DATA

When was the last time  
that you used a train?

# ▶ HADRIAN Task Analysis

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# HADRIAN Task Analysis

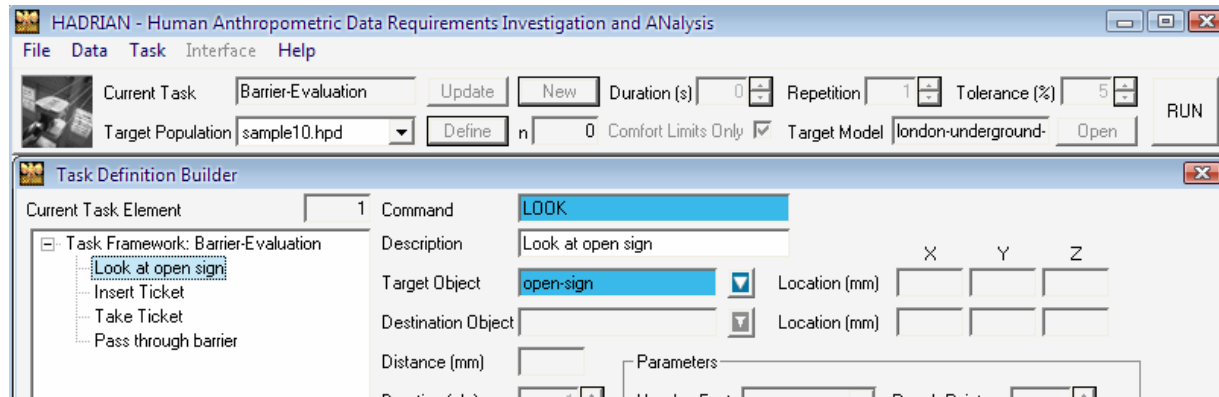
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The screenshot displays the HADRIAN software interface, titled "HADRIAN - Human Anthropometric Data Requirements Investigation and ANalysis". The main window is divided into several sections:

- Top Panel:** Contains menu options (File, Data, Task, Interface, Help) and task configuration fields. The "Current Task" is "Barrier-Evaluation", "Target Population" is "sample10.hpd", "Duration (s)" is 0, "Repetition" is 1, and "Tolerance (%)" is 5. A "RUN" button is present.
- Task Definition Builder:** The central area for defining task elements. It shows a tree view on the left with "Task Framework: Barrier-Evaluation" expanded to "Look at open sign". The main area displays:
  - Command:** LOOK
  - Description:** Look at open sign
  - Target Object:** open-sign (checked)
  - Destination Object:** (unchecked)
  - Location (mm):** X, Y, Z coordinates.
  - Parameters:** Hand or Foot, Side of Body, Grip Type, Reach Point, View Distance (2000), Importance (10), and a Conform checkbox.
- Task Commands:** A section with a "Complete" button and a command string: "LOOK open-sign (DUR=1,GTE=(0),VAL=2000,IMP=10)".
- Task Command Library:** A grid of icons representing various actions:
  - Vision:** Look
  - Movement:** GoTo, Step, Turn
  - Posture:** Sit, Stand, Crouch, Kneel, Lie
  - Interaction:** Reach, Use, Move, Rotate, Lift, Get, Put, Pull, Push
- Bottom Panel:** A status bar showing "TASK MODE", "Task: Barrier-Evaluation", "Current Element: 1", "Current Target: exit", and "Current Destination".

# ▶ HADRIAN Task Analysis

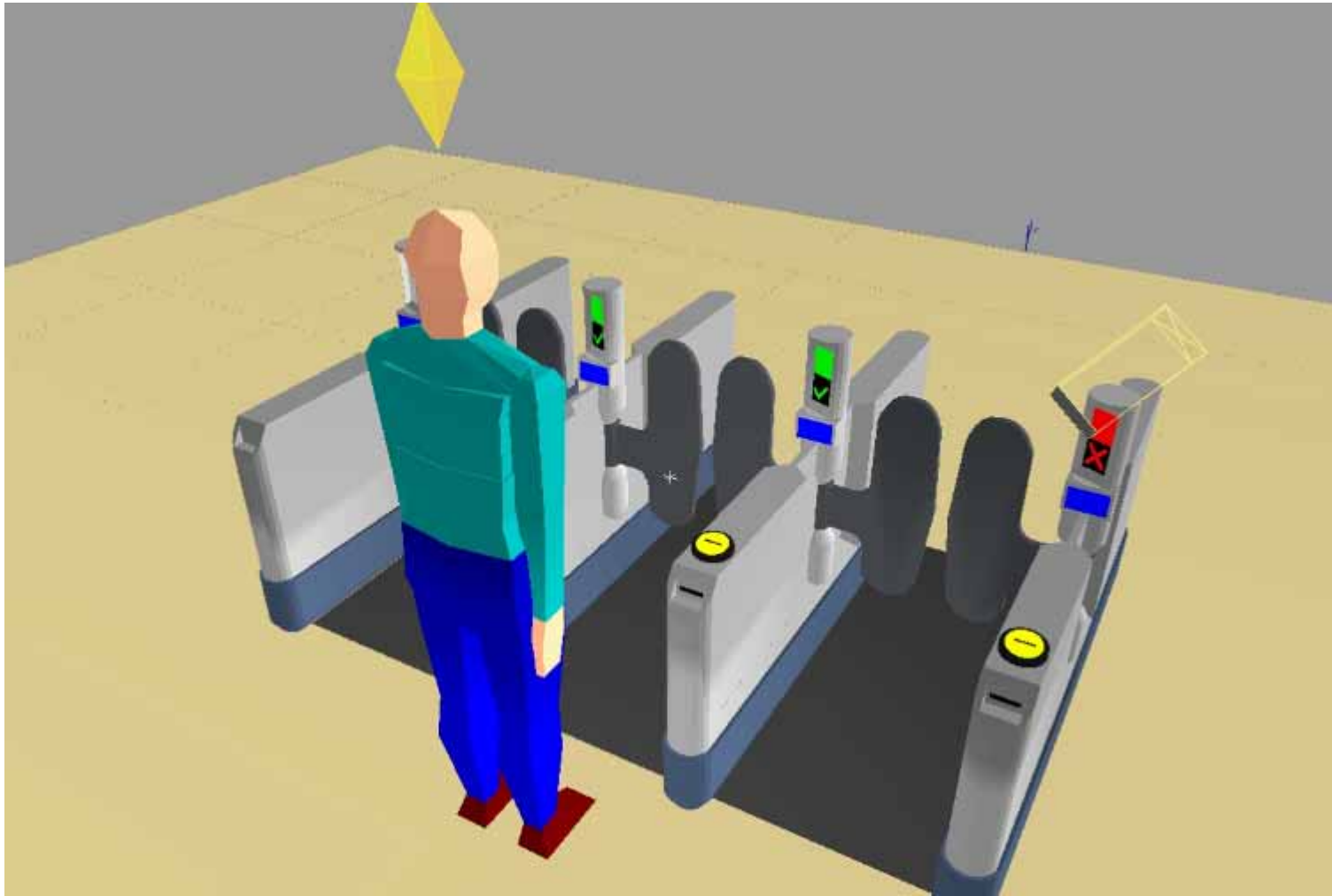
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- ▶ Define a task in terms of activity
  - ▶ look, reach, move etc
- ▶ Some target
  - ▶ part of the design – card slot, handle, screen etc
- ▶ Some optional parameters
  - ▶ hand, grip type, acceptable viewing distance etc.

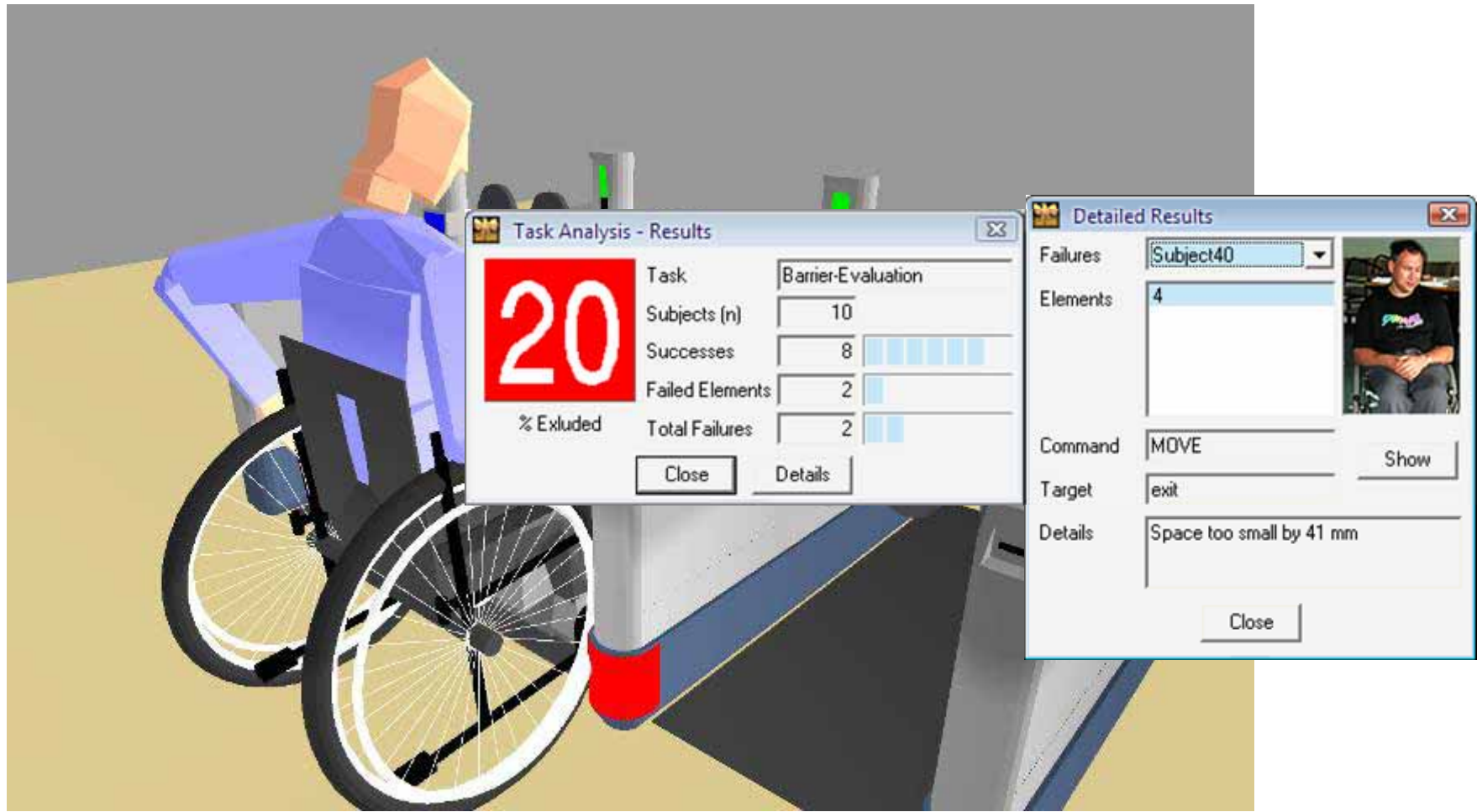
# ▶ HADRIAN Task Analysis

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# ▶ HADRIAN Task Analysis

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# ▶ Whole Journey Environment

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- ▶ The concept of the *whole journey environment* is concerned with the journey from origin, i.e. 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.

# Accessible Journey Planner

The screenshot shows the Transport for London Journey Planner website. At the top, there is a navigation menu with links for Accessibility, Help, Contact, and Sitemap. The Transport for London logo is on the left, and a search bar is on the right. Below the logo is a horizontal menu with options: Home, Live travel news, Getting around (highlighted), Tickets, Road users, Corporate, and Business & partners. On the left side, there is a sidebar with a 'Getting around' menu and a 'Journey Planner' link. The main content area is titled 'Journey Planner' and contains a form for planning a trip. The form includes fields for 'Travelling from...' and 'Travelling to...', both set to 'London'. It also has a 'Travelling from...' dropdown set to 'English' and a 'Go' button. Below these are two columns for 'From' and 'Travelling to...' with radio buttons for 'Station or stop in:', 'Post code', 'Address', and 'Place of interest'. The 'Station or stop in:' option is selected for both. There are also links for 'Tube map' and 'Street map' under each column. At the bottom of the form, there is a date and time selector: 'I need to depart on 06 June 2008 at 16:54 hours'. A 'Search' button is at the bottom right of the form. On the right side of the page, there are links for 'Maps', 'Mobile Travel Alerts FREE!', and 'See also' with links to 'Live travel news', 'Planned works', 'Timetables', and 'RSS Feed'. There is also an advertisement for Oyster cards with the text 'Why stand in line when you can buy online?'.

[www.journeyplanner.org/](http://www.journeyplanner.org/)

# Accessible Journey Planner

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## Journey Summary

**Departing:** Friday 28 September 2007 at: 13:36  
**From:** Wagamama Japanese Restaurant, Camden  
**To:** Wagamama Japanese Restaurant, St Albans

## Choose a Journey

**Journey 1**

**Total Standard Cost: £7.70**

**Access:**

**Longest Walk: 20 min**

Depart	13:19	13:34	13:49
Arrive	14:30	14:44	15:00
Duration	01:11	01:10	01:11

earlier [View](#) later

**Journey 2**

**Total Standard Cost: £5.60**

**Access:**

**Longest Walk: 10 min**

Depart	13:16	13:36	13:56
Arrive	14:52	15:03	15:22
Duration	01:36	01:27	01:26

earlier [View](#) later

**Journey 3**

**Total Standard Cost: £4.20**

**Access:**

**Longest Walk: 6 min**

Depart	13:12	13:27	13:42
Arrive	14:52	15:03	15:22
Duration	01:40	01:36	01:40

earlier [View](#) later

## Find Alternative Journeys

Deselect anything that you want to avoid

Rail
  DLR
  Tube
  Tram
  Bus
  Coach
  River

Stairs
  Escalators
  Large Step
  Narrow Access
  I need a wheelchair accessible journey

### Journey Summary

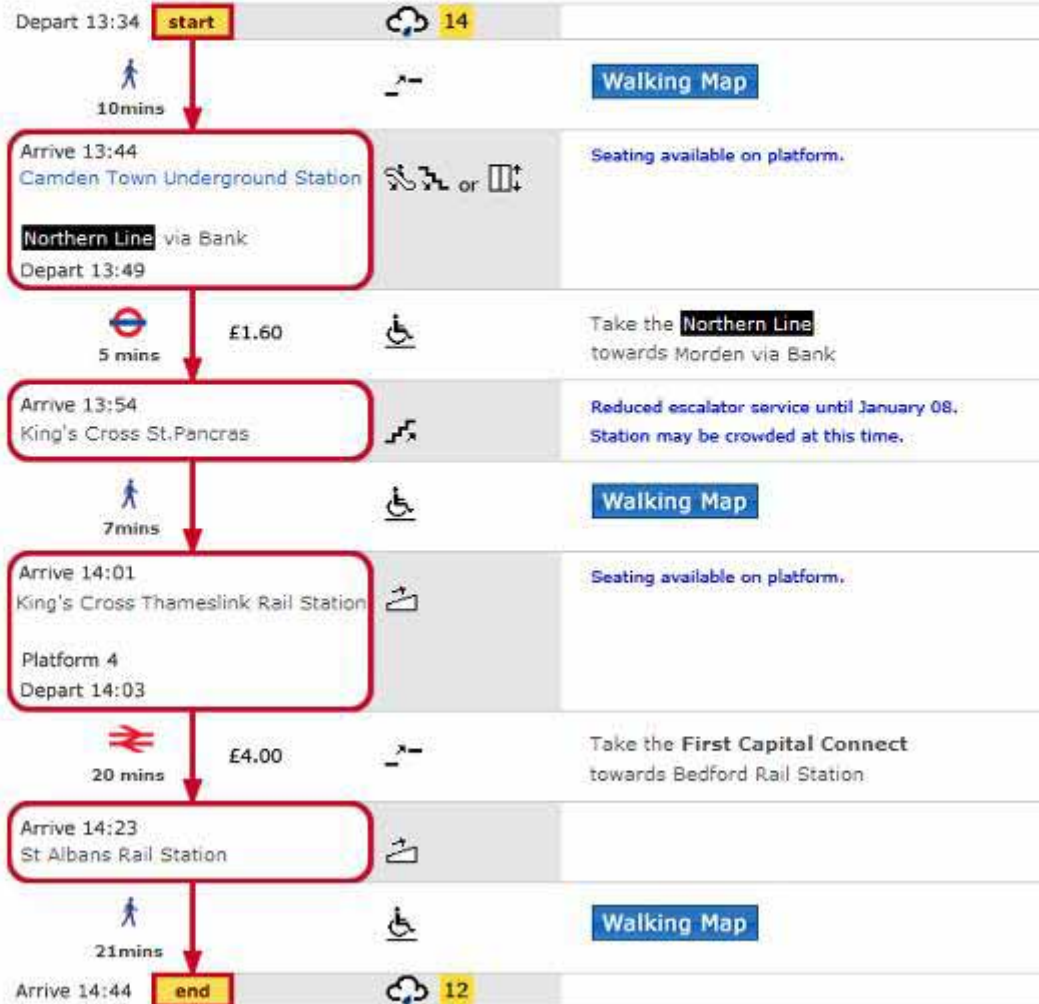
Departing: Friday 28 September 2007

From: Wagamama Japanese Restaurant, Camden

To: Wagamama Japanese Restaurant, St Albans

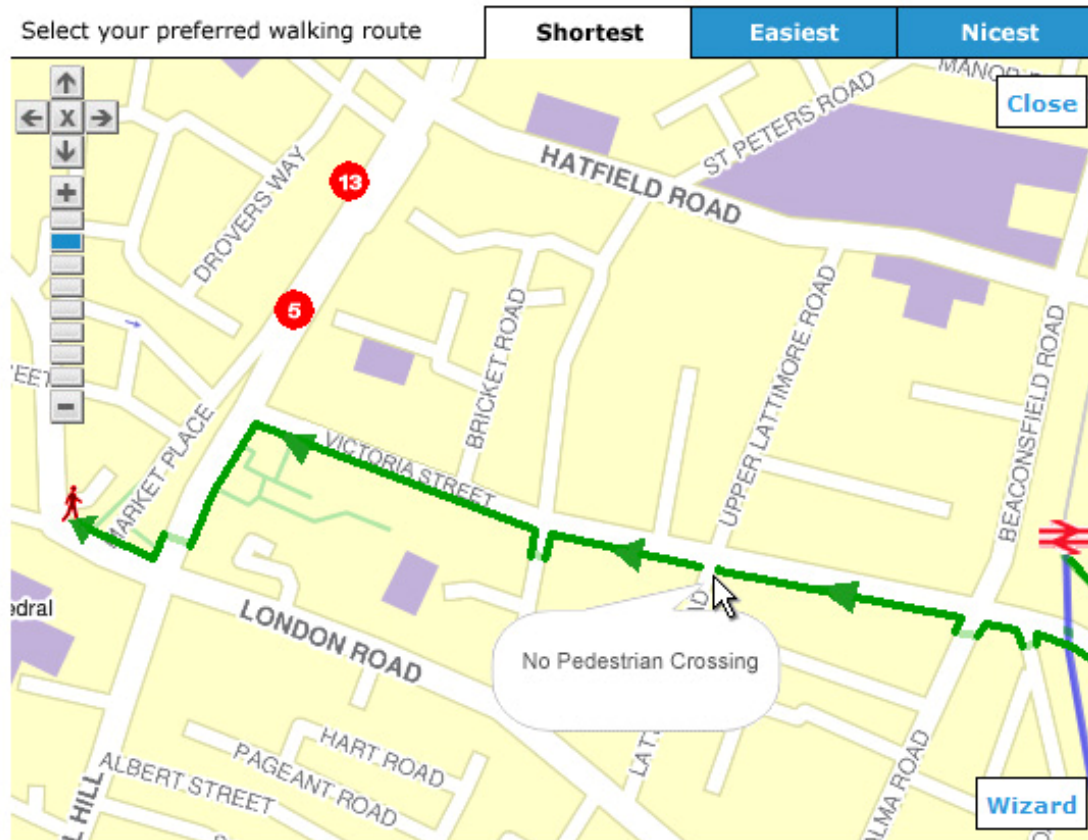
Transport:    

Depart	13:04	13:19	13:34	13:49	14:04	
Arrive	14:14	14:30	14:44	15:00	15:14	<a href="#">earlier</a> <a href="#">later</a>
Duration	01:10	01:11	01:10	01:11	01:10	



# Accessible Journey Planner

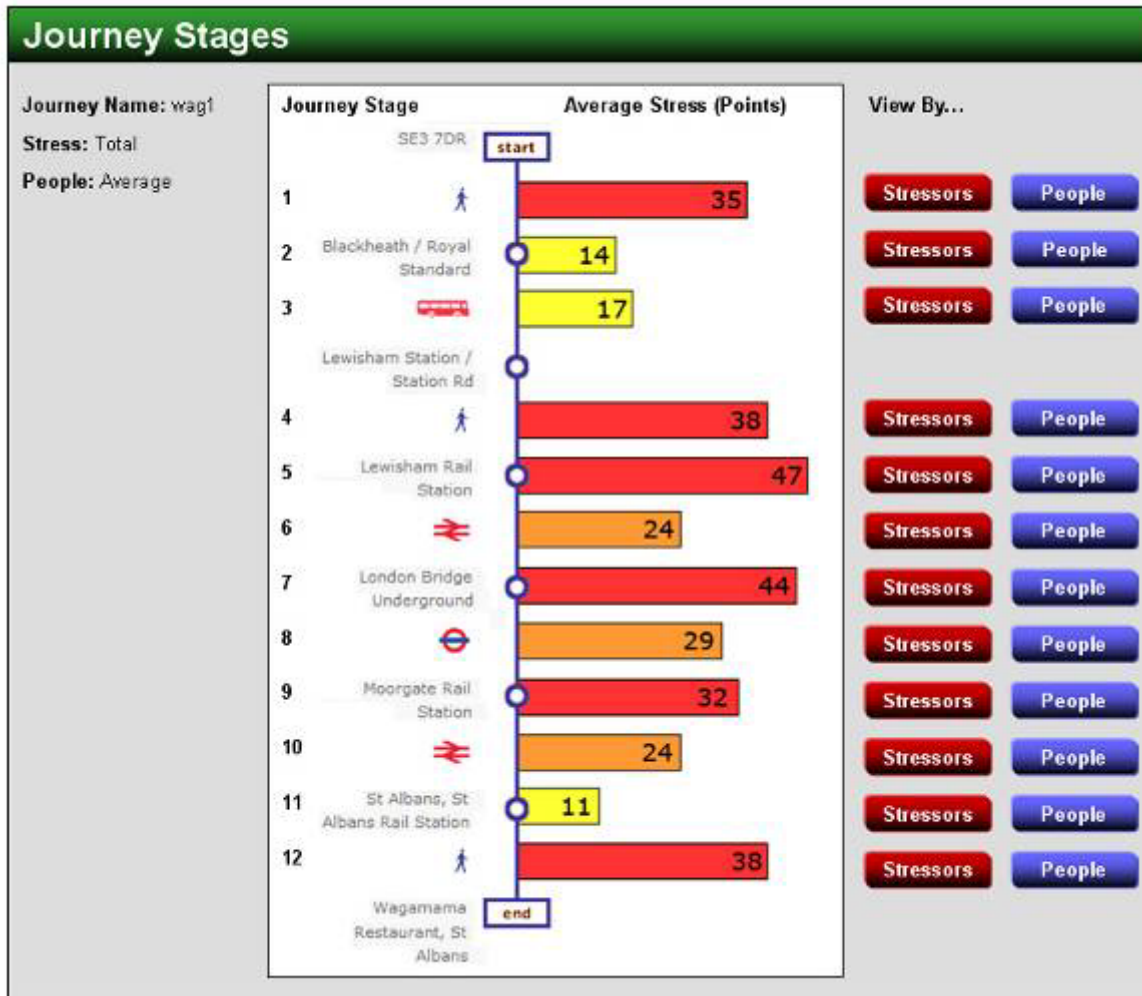
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Victoria Street may be quiet and dark and seem unfriendly.  
Cross Latimore Road without a pedestrian crossing.

# Accessible Journey Planner

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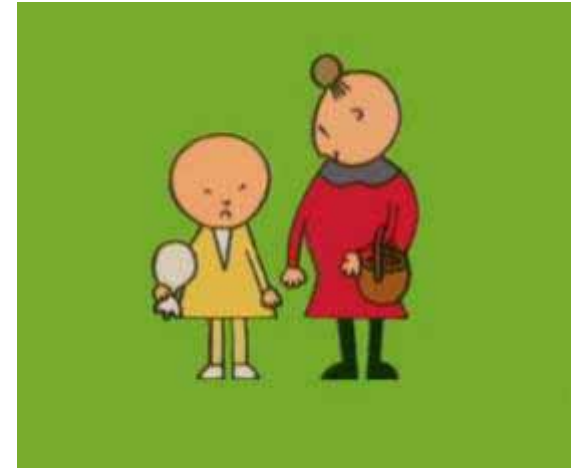


- ▶ Inclusive design is the right approach to design
- ▶ Designers need support
- ▶ AUNT-SUE and HADRIAN working towards proving that support
  - ▶ Data that is more useable, enlightening, and provides empathy with people (especially those who are older or who have some form of impairment)
  - ▶ A means to utilise the data to get a feel for inclusivity of the whole journey environment before implementing a new design, investing in change, or making a journey.

# Contact details

Department of Design and Technology: Design Ergonomics Group

Dr Russell Marshall  
Loughborough University  
[r.marshall@lboro.ac.uk](mailto:r.marshall@lboro.ac.uk)



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