

## The ATM rig used during the validation study

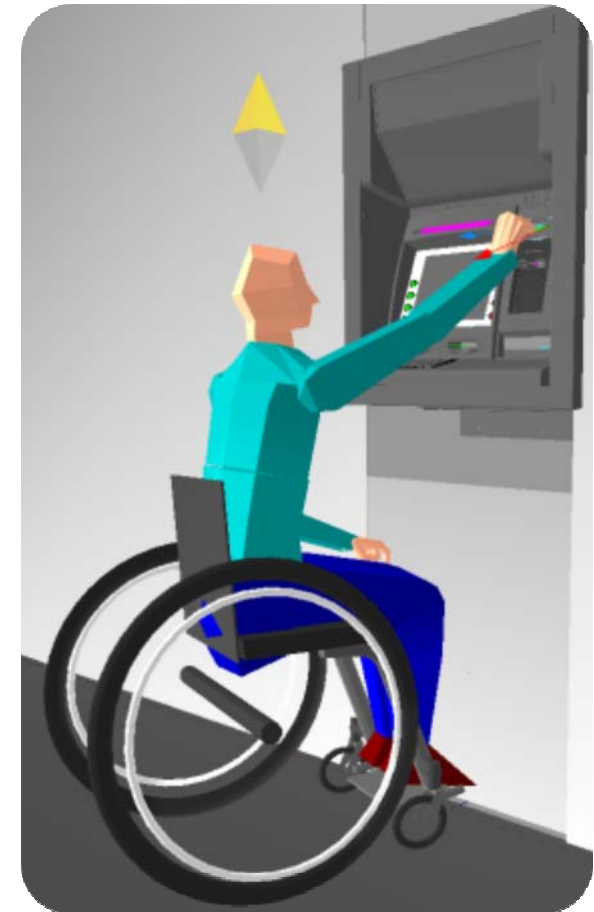


The two NCR ATM designs used for the first validation study



## Study 1: Virtual analysis of the ATMs by an expert SAMMIE user

- ▶ The data gathered from the HADRIAN participants was added to human models in the SAMMIE system
- ▶ An expert user of SAMMIE performed an analysis of the reach-ability and view-ability of the interaction points with both ATMs
- ▶ The experience of the SAMMIE expert in interacting with older and disabled people was used to orientate and posture each human model



## Study 2: The ATM rig was used by 10 of the HADRIAN sample members

- ▶ Each participant was asked to reach and view each of the interaction points on each ATM
- ▶ The highest and lowest ATM heights were used
- ▶ Video recordings of the process were captured



## Study 3: The HADRIAN automated analysis

- ▶ Study 3: The HADRIAN automated analysis
- ▶ The HADRIAN system automatically orientates each user and performs reaching tasks limited by the gathered joint constraint data



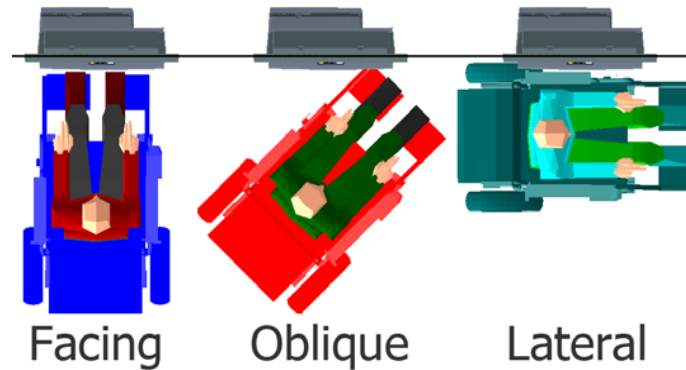
## Results

- ▶ The results of these three studies were compared
  - The differences in the following variables were analysed
    1. Orientation of the user to the ATM
    2. The ability to reach to the interaction points
    3. The postures adopted

## Results

- ▶ The orientation, and ability to perform tasks for the ambulant disabled participants were all correctly predicted by HADRIAN
- ▶ The automated HADRIAN system results differed from the SAMMIE study and the study performed with the ATM rig for **wheelchair users**

## A comparison between the three studies in terms of orientation



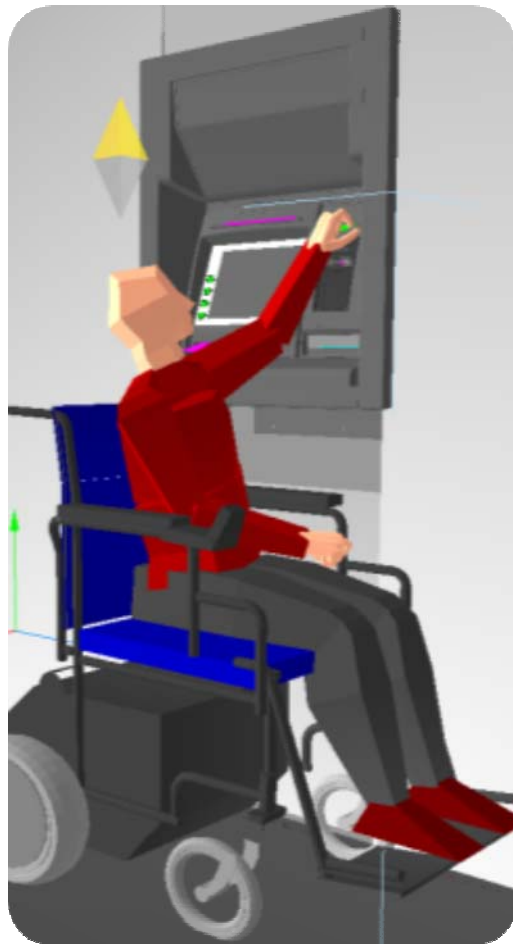
Wheel chair subject	ATM Height	Study 1. Expert user	Study 2. User trials	Study 3. HADRIAN
1	Low	oblique	oblique	Facing
	High	oblique	oblique	Facing /Lateral
2	Low	lateral	Face	Facing /Lateral
	High	lateral	Face	Facing /Lateral
3	Low	lateral	lateral	Facing /Lateral
	High	lateral	lateral	Facing /Lateral
4	Low	oblique	oblique	Facing
	High	oblique	oblique	Facing /Lateral

## A comparison between the three studies in terms of task completion

- ▶ 160 tasks were performed by 10 participants in each study
- ▶ In study 1 and 2, only one task failure was noted
- ▶ In study 3, the automated HADRIAN analysis, 9 task failures were noted
  - Why did HADRIAN predict more task failures than in reality?

An example of a task failure

SAMMIE Study



ATM rig study



Automated HADRIAN study



## Recommendations for the revision of HADRIAN

- ▶ 1. The 'standard' sitting posture used for each HADRIAN participant in the analysis needs to be replaced by a posture that more closely matches reality
- ▶ This can be done using photographs taken during the data collection



## Recommendations for the revision of HADRIAN

- ▶ 2. The prototype HADRIAN system works on the assumption that a facing orientation to the product interaction points will be used
- ▶ If a failure occurs in the facing orientation a lateral orientation is used
- ▶ A oblique orientation needs to be added to this process to replicate the behaviour of some wheelchair users

## Recommendations for the revision of HADRIAN

- ▶ 3. The prototype HADRIAN system does not use the data collected that quantifies the ability of the user to twist the upper body
- ▶ This was highlighted a reason for task failures in lateral wheelchair orientations in all cases
- ▶ This data should be used by the HADRIAN system

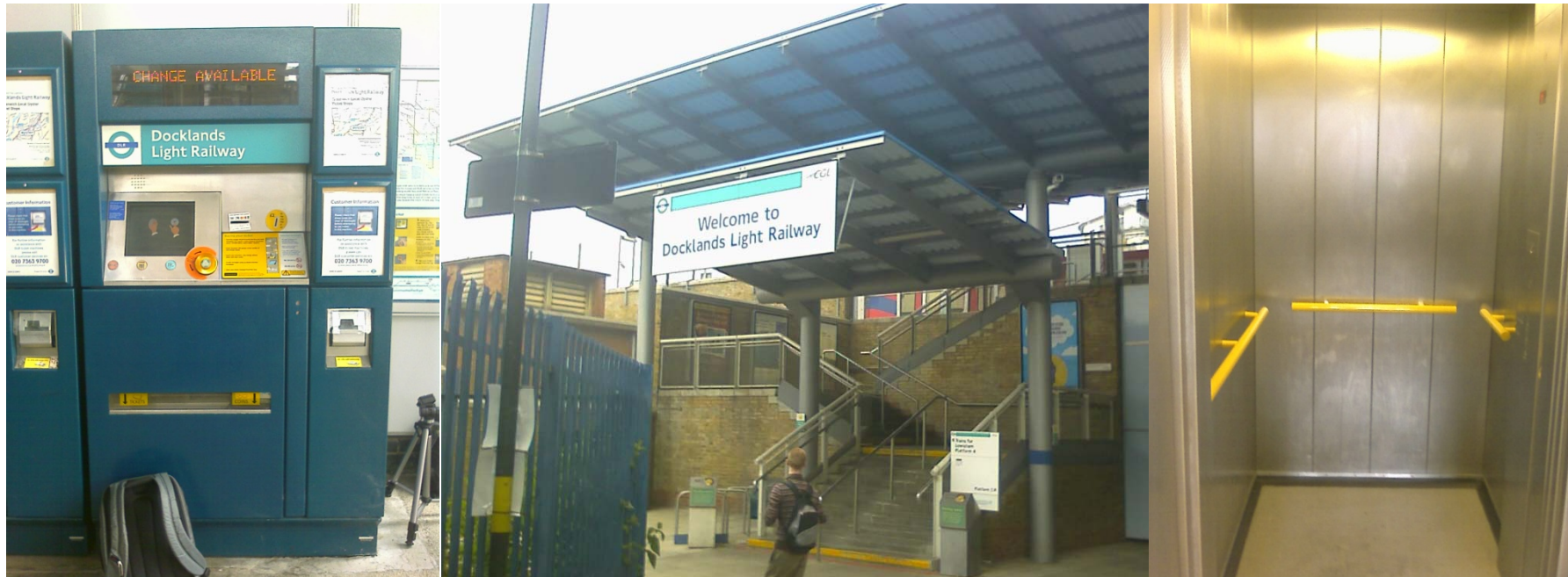
## Recommendations for the revision of HADRIAN

- ▶ 4. The prototype HADRIAN system does not use a CAD model of the specific wheelchair used by each participant
- ▶ Instead the wheelchair user is placed at the correct sitting height for the specific wheelchair used
- ▶ The correct wheelchair model should be used for each automated analysis to allow for clash issues

## Summary for the first validation process

- ▶ The first validation process has identified areas for improvement in the automated HADRIAN analysis
- ▶ These recommendations will be implemented
- ▶ The second validation process has now been completed

## Validation study 2: Access to the Greenwich DLR train station



## Aims of the second validation study

- ▶ To compare the accessibility issues identified by HADRIAN and a new sample of disabled people for the Dockland Light Railway station at Greenwich
- ▶ A sample of 6 disabled people who live in London were asked to make a journey on the DLR
- ▶ Three wheelchair users and three ambulant disabled people took part

## The London sample



**Wheelchair user:  
Cerebral Palsy**



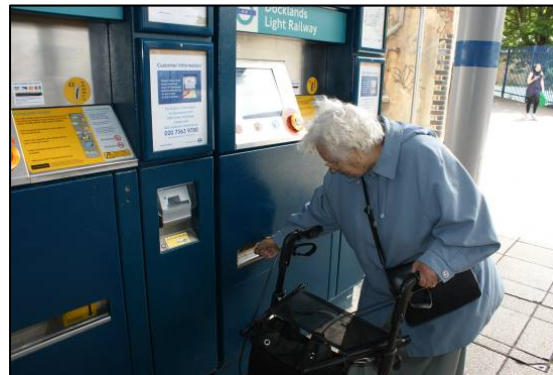
**Wheelchair user:  
Spinal Tumour**



**Wheelchair user:  
Multiple Sclerosis**



**Stick user:  
Multiple Sclerosis**



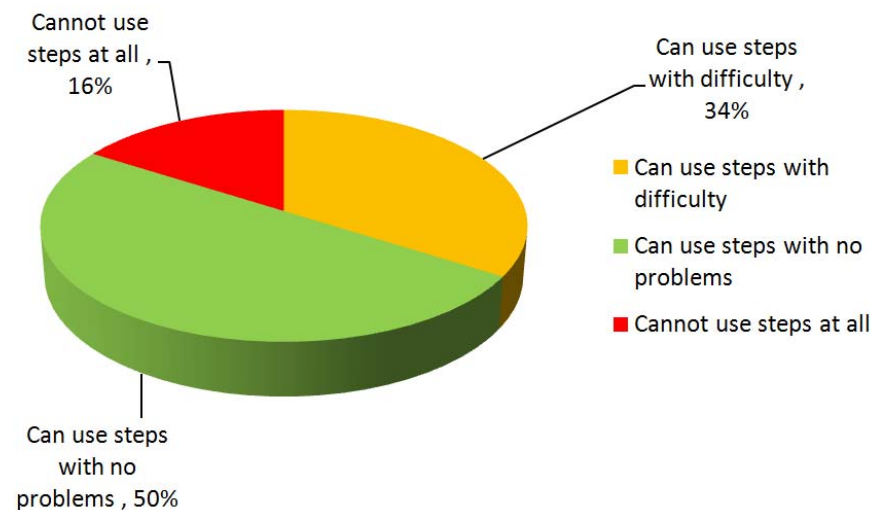
**Walking frame user  
Arthritis**



**Walking frame user  
Prolapsed disc**

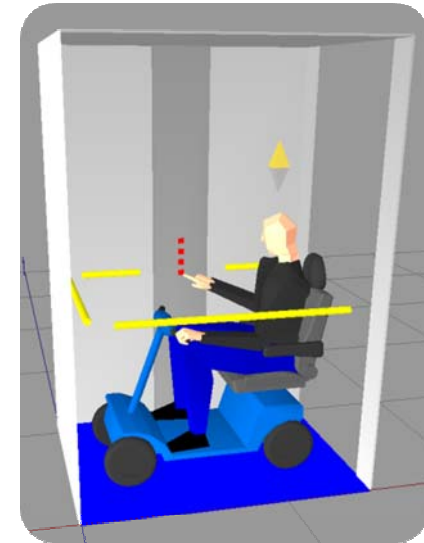
## Test 1: Access to the platform

- ▶ All of the London sample users were able to access the platform with either the steps or the elevator
- ▶ All HADRIAN sample members were able to access the platform using the steps or the elevator (based upon data on walking ability etc.)
- ▶ 50% of the HADRIAN sample would be unable to access the platform if the lifts were not working or would have difficulty



## Problems with the lift for the London and HADRIAN samples

- ▶ The HADRIAN sample member that used a mobility scooter demonstrated that the size of the lift causes difficulty
  - Reversing the scooter was difficult for this participant
  - The lift forced the user to reverse out
  
- ▶ The London sample member with Multiple Sclerosis struggled to enter the narrow lift door



## Test 2: Using the Ticket machine

- ▶ Reaching to the coin slot
  - Two participants from the London sample were not able to reach to the coin slot of the ticket machine
  - This was confirmed in the HADRIAN analysis with 4 wheelchair users being unable to reach the coin slot
  
- ▶ Using the controls
  - The rotating control used to select a destination could not be effectively reached by 3 members of the London sample
  - This was confirmed by 6 members of the HADRIAN sample
  
- ▶ Screen visibility
  - The viewing angle of the screen made it hard to read for three members of the London sample
  - This was confirmed by 10 of the HADRIAN sample members



## Potential for testing new ticket machine designs

- ▶ HADRIAN has shown that it can identify the same accessibility issues as a sample of real users
- ▶ HADRIAN could be used to analyse new ticket machine designs to determine accessibility
- ▶ HADRIAN could also be used to improve new ticket machines at an early stage in the design process

## Conclusions

- ▶ The ‘user centred’ design approach used by the HADRIAN team has utilised data gathered from real people
- ▶ The virtual people created from this data have been shown to be a valuable tool in the assessment of travel interaction points and interchanges
- ▶ The validation studies have provided information for the improvement of the HADRIAN automated analysis

Thank you for listening. Any Questions?

