

## A video-based investigation into driver's (re-)orientation strategies

PhD title: Ready, Steady, Drive! How do we prepare the disengaged driver to resume navigation after a period of automated driving?

Research theme: HMI design for navigation systems in future highly automated vehicles

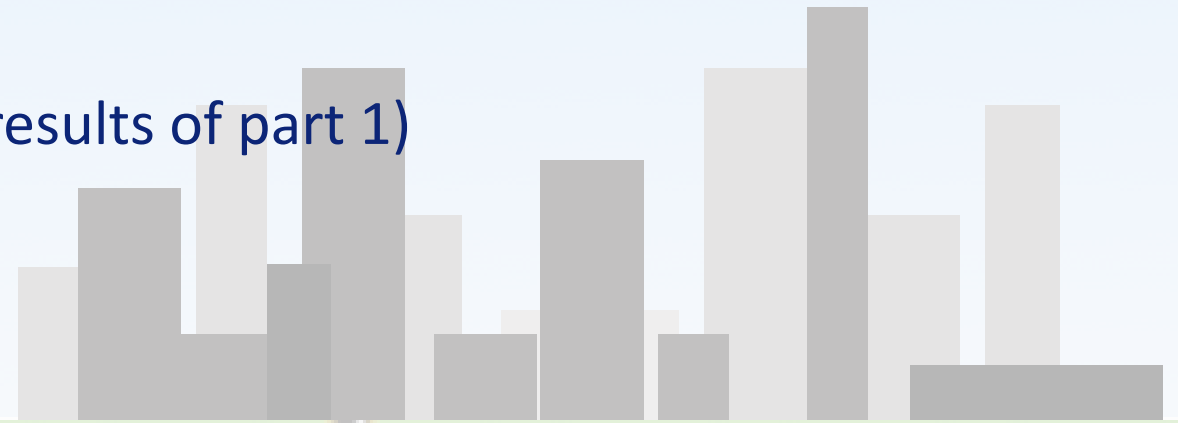
Supervision team:

Professor Gary Burnett (Human Factors Research Group)

Dr Gary Priestnall (School of Geography)

\* Dr Holger Schnädelbach (Mixed Reality Lab)

- Introduce myself and the context of my research
- Overview of one PhD study (procedure & results of part 1)
- Where next?



# My background

- Archaeology / Archaeozoologist (UCL)
  - Pre-Pottery Neolithic B (9,500 B.P.) Kefar Hahores, Israel
  - Iron Age France, Auvergne Archaeological Survey
  - African Archaeology, Mali, West Africa
  - Post-graduate research associate (Cambridge Field Archaeology Unit)
- Publishing, music business, rail
- MSc in GIS and Spatial Analysis (UCL)
  - Roman, Volubilis, Morocco
- Technical Consultant in GIS/Logistics, MapMechanics
  - CILT – Associate member
- Teacher, English for Special Purposes
  - Torbay, Antalya, Madrid, London, Berlin, Cheney Court
- PhD Candidate – University of Nottingham



# Ready, Steady, Drive!

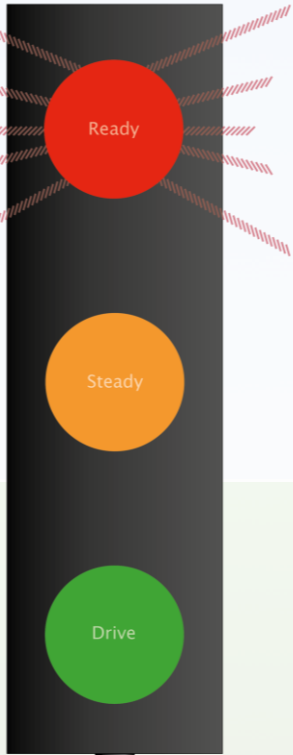
Ready,



How do we prepare the disengaged driver to resume NAVIGATION of their vehicle after a short/medium/long period of automated driving?

How does the driver know where they are:

- in their whole journey
- in relation to their immediate surroundings



The levels of vehicle automation



Simulate a handover or takeover scenario where participant:

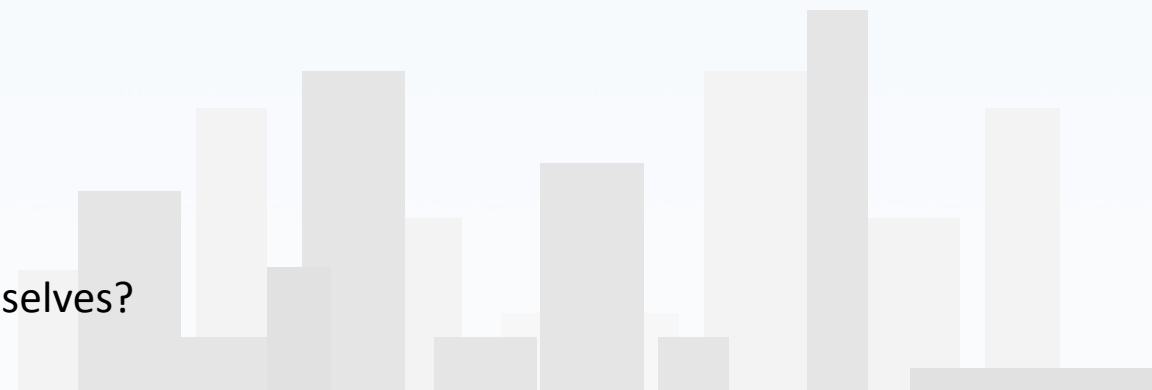
- Knows/doesn't know the area
- Has/has not been paying attention to their surroundings

Are participants able to locate themselves?

What strategies do participants adopt to (re-)orientate themselves?

## Methodology

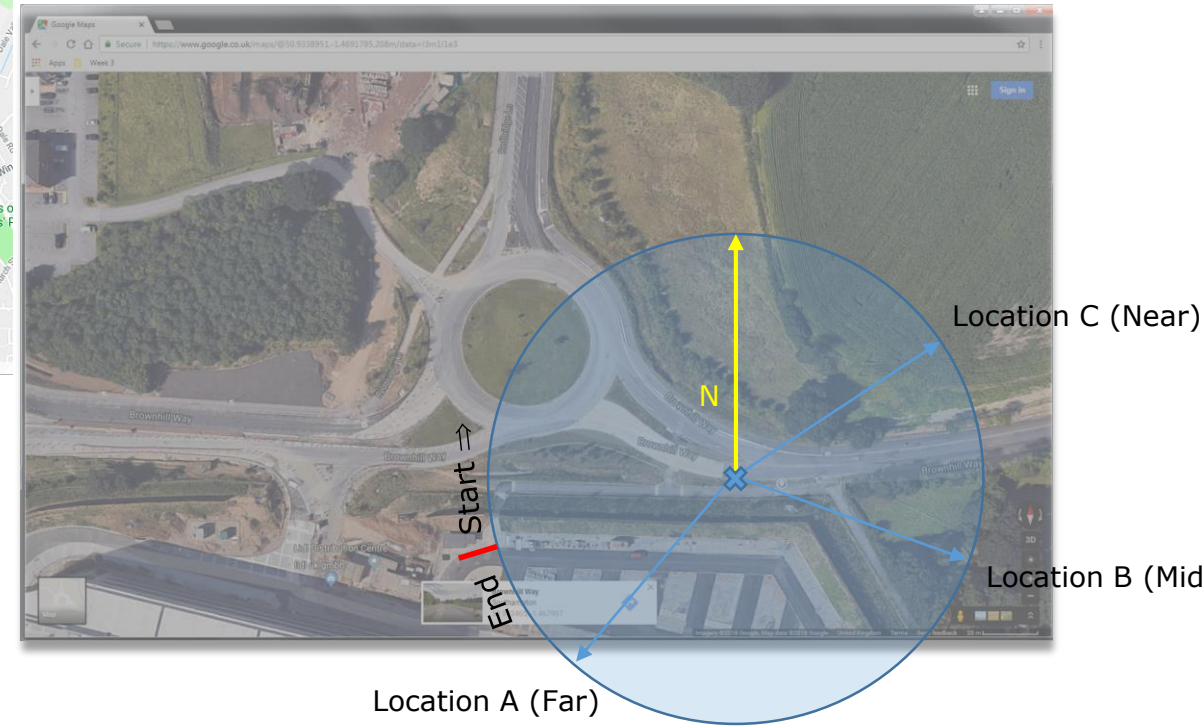
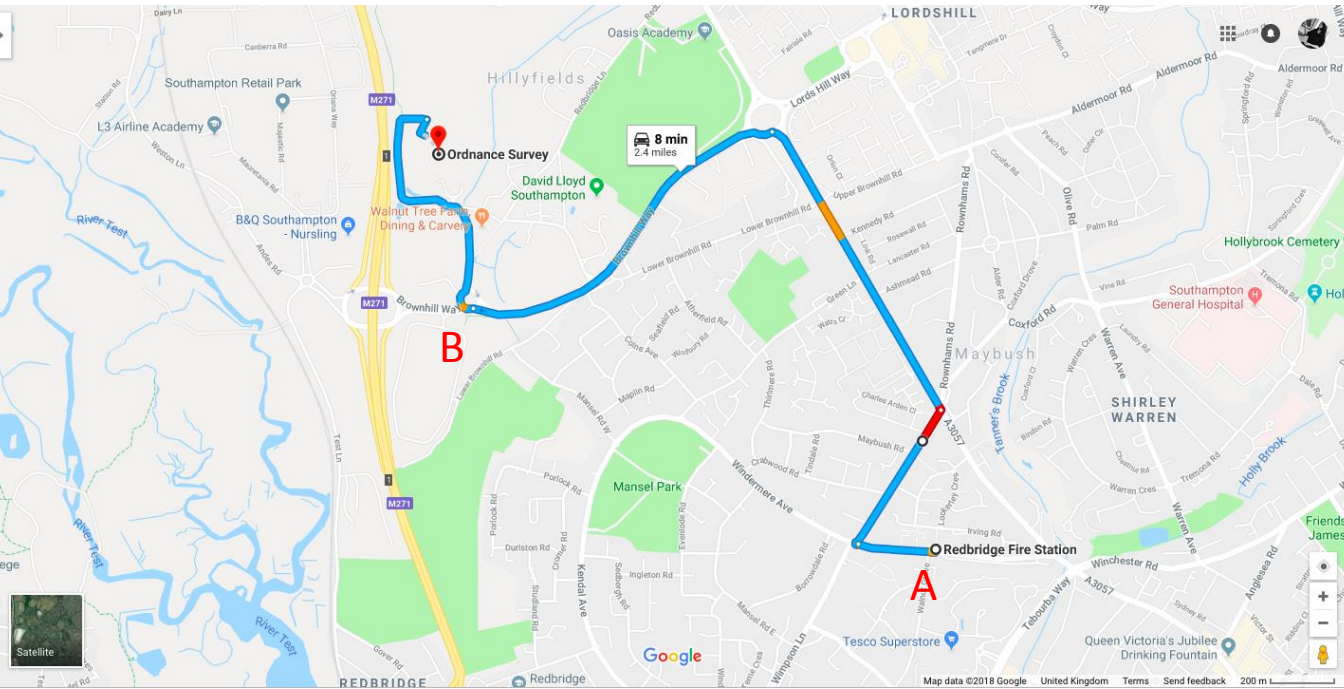
- Santa Barbara Sense Of Direction Scale (adapted)
- Video
  - Video 1: A to B route video
  - Video 2: 360° video at Location B (destination)
- Navigation tasks (Questions 1 – 7)
- Map drawing task (Question 8)
- Interview questions (Questions 9-20)



	Observation opportunity	No observation opportunity
Known area	GROUP 1 <ul style="list-style-type: none"><li>• Route video</li><li>• 360° video of destination</li></ul>	GROUP 2 <ul style="list-style-type: none"><li>• 360 video of destination</li></ul>
Unknown area	GROUP 3 <ul style="list-style-type: none"><li>• Route video</li><li>• 360 video of destination</li></ul>	GROUP 4 <ul style="list-style-type: none"><li>• 360 video of destination</li></ul>

# Where am !?

## Study 2 – Where am I? A video-based investigation into driver's orientation strategies



## Navigation tasks:

Question 1: Do you know where you are?

Question 2: Which (compass) direction are you heading in here?

Question 3: Where are you heading? / What is in this direction?

Question 4: Was it easy or difficult to locate yourself?

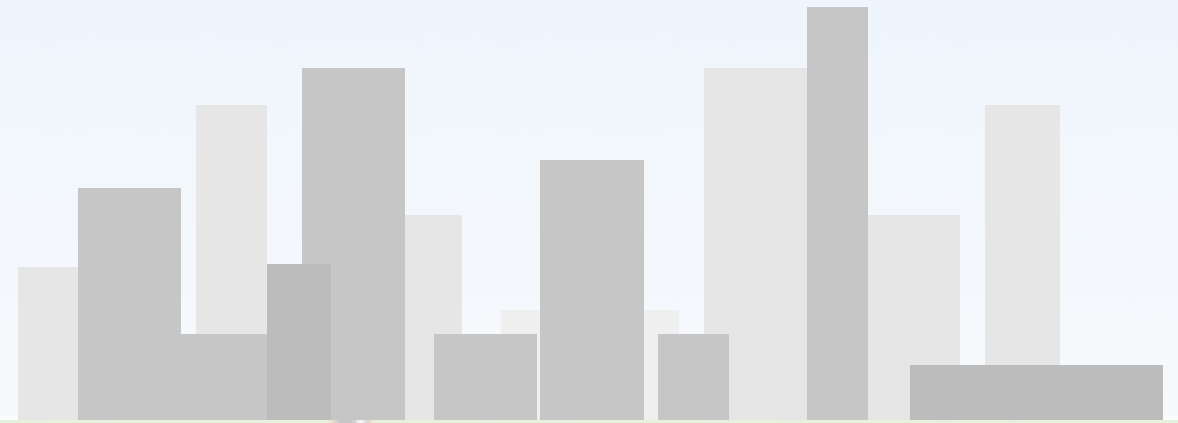
Question 5: What made it easy or difficult?

Question 6: Can you point the camera so that the following landmarks are in the centre of the screen?

Question 8: Could you draw me a map of the immediate area, including a couple of landmarks.

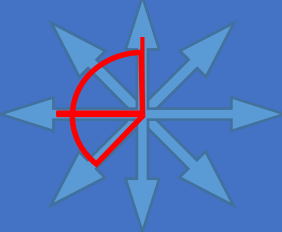
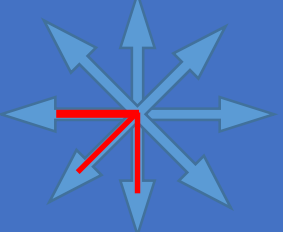
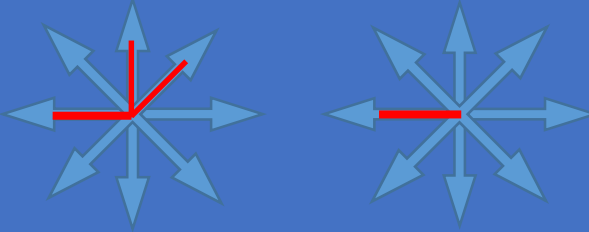
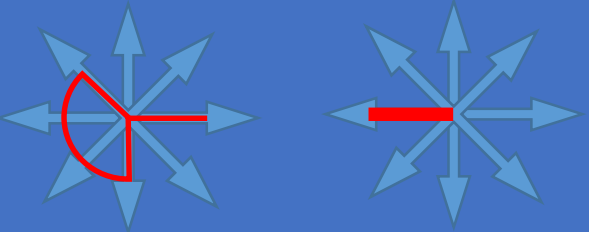
## Results:

- Questions 1 to 3 – by group
- Questions 4 & 5 together
- Question 6 – in more depth
- Question 8 – in overview



# Where am !?

## Results: Questions 1 - 3

	Group 1 Known Area Condition 1	Group 2 Known Area Condition 2	Group 3 Unknown Area Condition 1	Group 4 Unknown Area Condition 2
1. Do you know where you are?	80% correct/quickly 20% correct/hesitant	33% correct/quickly	Without map: 60% no idea, 20% England in the South, 20% local/Nottingham  With map: 20% Southampton, near OS, 60% somewhere in Southampton, 20% on Brownhill Way, Southampton	Without map: 40% no idea, 20% described what seen, 40% UK/local area (Nottingham)  With map: 60% correct, 20% on side of road in UK, 20% not sure
2. Which direction are you facing here?				
3. What is in this direction?	50% correct/quickly 25% correct/hesitant 25% alternative answer	50% correct/quickly 16% correct/hesitant 34% not certain	Out of a town, to a motorway, no idea, a roundabout, away from a town, LIDL, home?	Out of a town, junction, roundabout, traffic lights, motorway, LIDL Distribution Centre

# Where am !?

Results: Questions 4 and 5 – Was it easy/difficult to locate yourself? What made it easy/difficult?

## Group 1 – Known area & Condition 1

- 100% said it was easy

Easy:

- Knowing the area
- ‘Welcome to Southampton’ sign

Difficult:

- ‘If I hadn’t seen the route before, I wouldn’t be able to work out where I was’

## Group 2 – Known Area & Condition 2

- 20% said it was easy
- 80% said it was difficult

Easy:

- LIDL Distribution Centre
- Top-down view
- Familiarity with area/route

Difficult:

- Lack of defining features
- Unable to turn head
- Vehicles block view

## Group 3 – Unknown Area & Condition 1

- 40% said it was easy, with the maps
- 40% said it was difficult
- 20% said it was impossible

Easy:

- The maps (see what is ahead/around, labels, road names)

Difficult:

- Assumption/local bias
- Static image
- ‘symmetry of the circle’

## Group 4 – Unknown Area & Condition 2

- 60% said it was easy, with the maps
- 40% said it was difficult

Easy:

- Shape of the road, what is around, building on the left (LIDL)
- Combination of video 2 and map
- Map: text labels, bird’s eye view, seeing ahead of where you are, assumption that North is up (allocentric map)

Difficult: rotation of video, assumption/local bias, false confirmation from ‘familiar landmarks’



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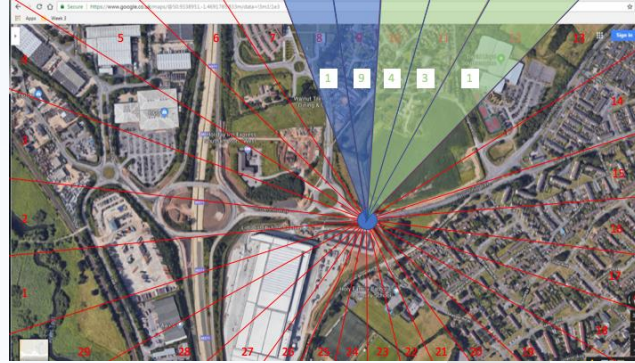
# Where am I?

Question 6: Can you point the video to the following landmarks?

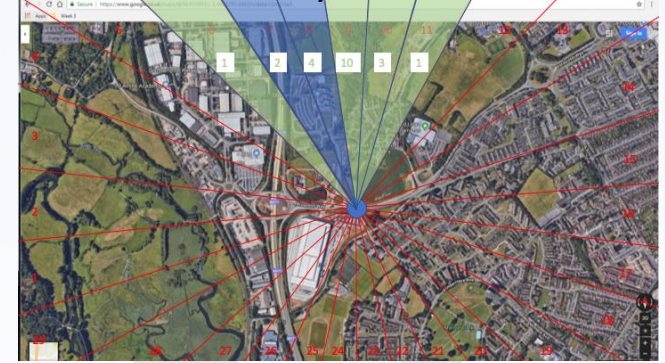
Holiday Inn Express



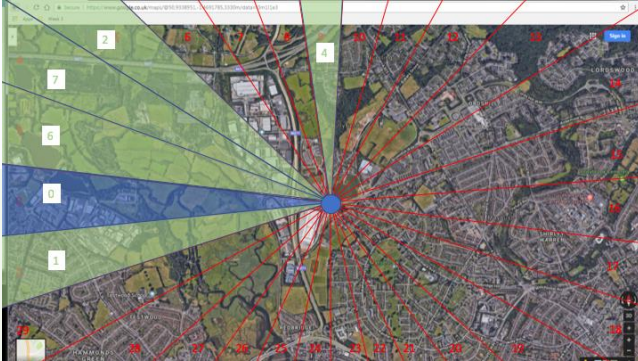
Walnut Tree Farm



Ordnance Survey



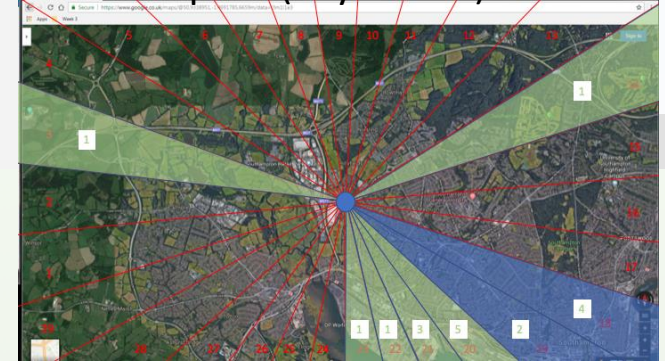
M271



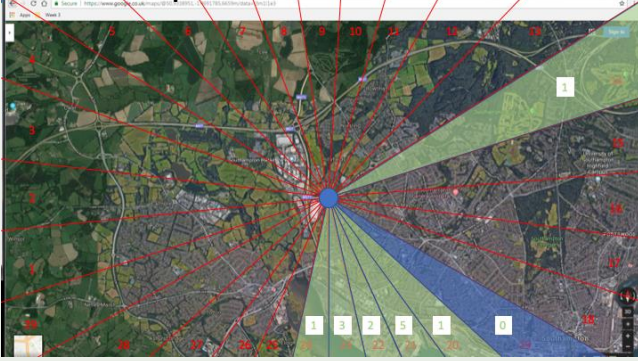
M27



Southampton (city centre)



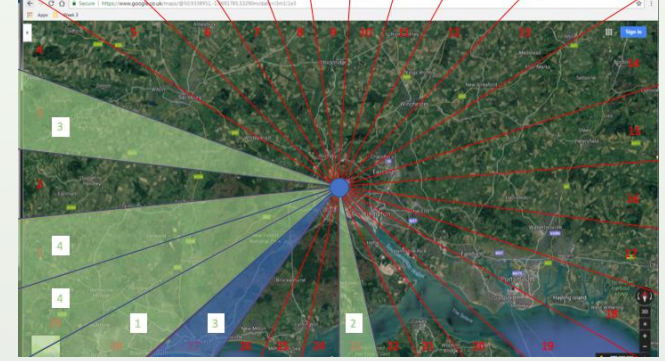
Southampton Central Train Station



Romsey

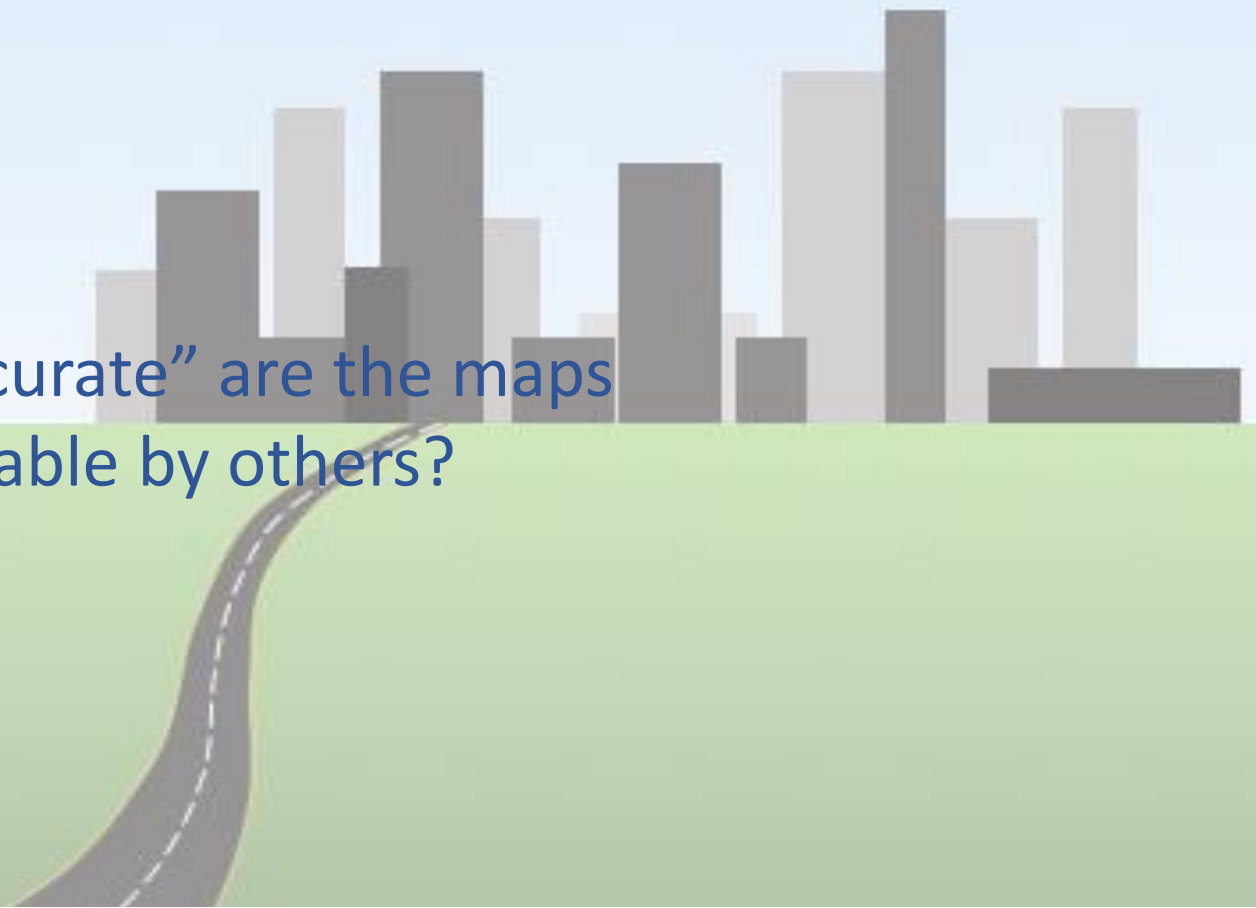


Christchurch



## Question 8: Map drawing task

- Pass 1: Individual
- Pass 2: By group
- Pass 3: By condition
- Pass 4: 'Ground truth' – how “accurate” are the maps
- Pass 5: Are the maps understandable by others?
- Pass 6: What have I missed





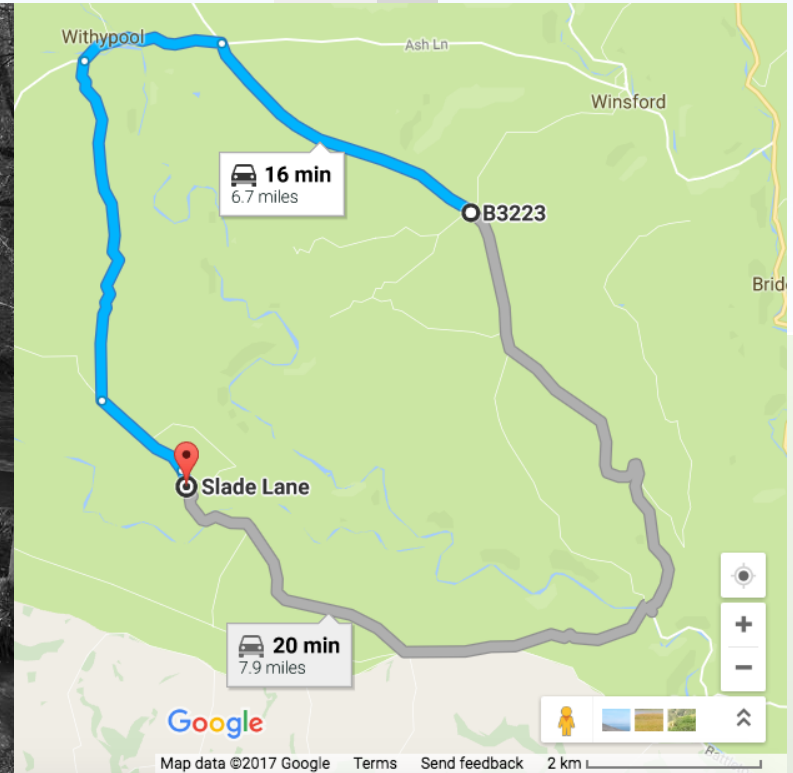
## Interesting overall findings:

- How well do you know your local area (presented with unexpected position/place/direction of travel)?
- Road-based bias in orientation/direction-giving in known area
- Road-name bias (known area)
- Greater accuracy in compass direction (unknown groups, with maps)
- Unknown area – tendency to explain what you can see
- Assumptions and bias to the 'local'
- False confirmation from landmarks that seem familiar
- Driver or passenger? (see more/different detail)
- Who is in the vehicle with you?

## Next steps:

- Complete analysis of interview questions
- Focus groups (Dec/Jan)
  - to develop scenarios
  - further development of taxonomy of handover scenarios
  - develop design options
- 'Wizard-of-Oz' prototype design and testing

Remember the human ...  
... so we can avoid this.



# Where am I!?

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Thank you for listening

Any questions?

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University of  
Nottingham

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Ordnance  
Survey



Engineering and  
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