

---

# Towards Reasoning About Context in the Presence of Uncertainty

Dan Chalmers, Naranker Dulay, Morris Sloman

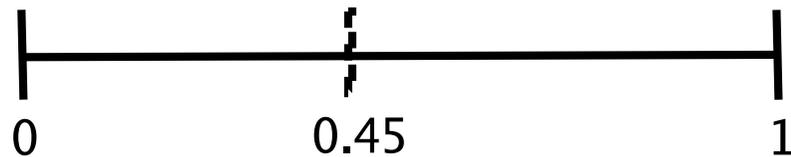
Imperial College London

`d.chalmers@sussex.ac.uk`

`http://www.doc.ic.ac.uk/~dc/`

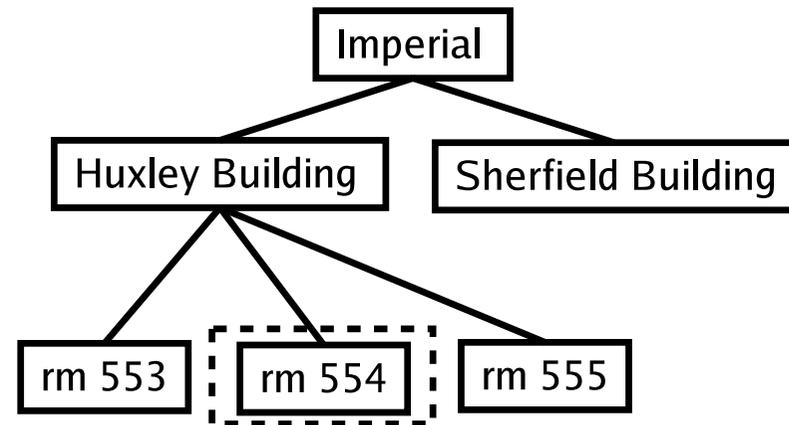
# Simple Types and Values

Numbers ( $\mathbb{N}$ )



A number equal to 0.45

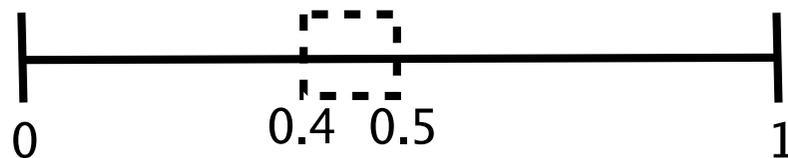
Trees ( $\mathbb{T}$ )



A room called "rm554" within "Huxley Building"

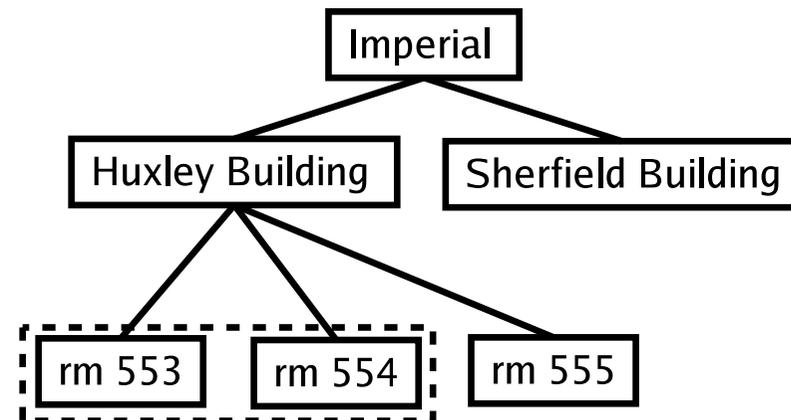
# Uncertain Types and Values

Numbers ( $\mathbb{N}$ )



A number between 0.4 and 0.5

Trees ( $\mathbb{T}$ )



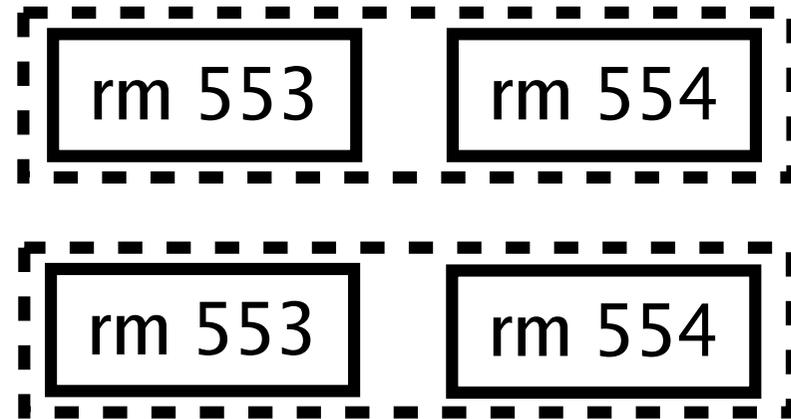
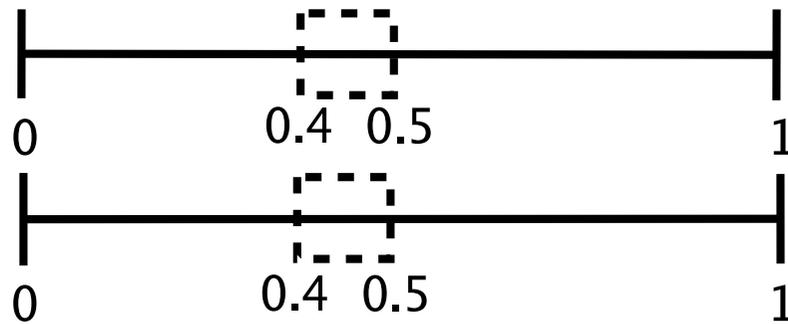
A room which is either "rm553" or "rm554" within "Huxley Building"

# What

---

- Typed values for context
- Common concept of uncertainty
  - Many sources of uncertainty
  - Trade uncertainty for effort
  - Request data with a given confidence
- Functions to evaluate relations between context values

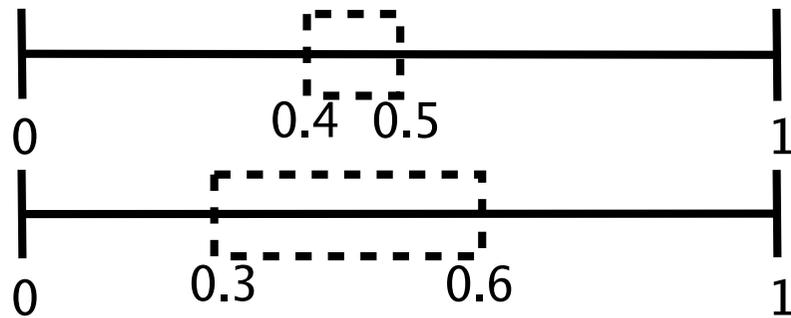
# Equals



*top = bottom*

- Works for simple values
- Unlikely to make a match for noisy data

# Within



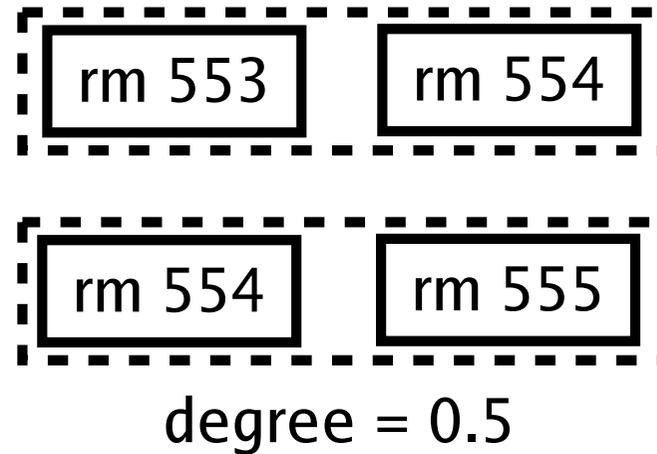
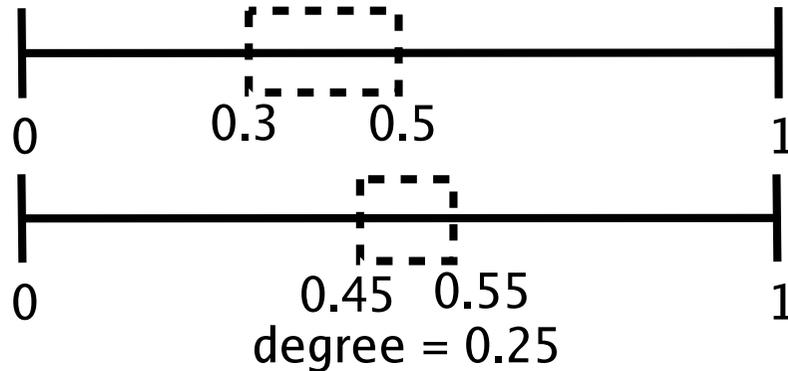
Huxley Building

Imperial

*top*  $\sqsubset$  *bottom*

- Works for simple values
- Easy to make a match for ranges despite noise in data

# Overlaps



*degree = top  $\cap$  bottom*

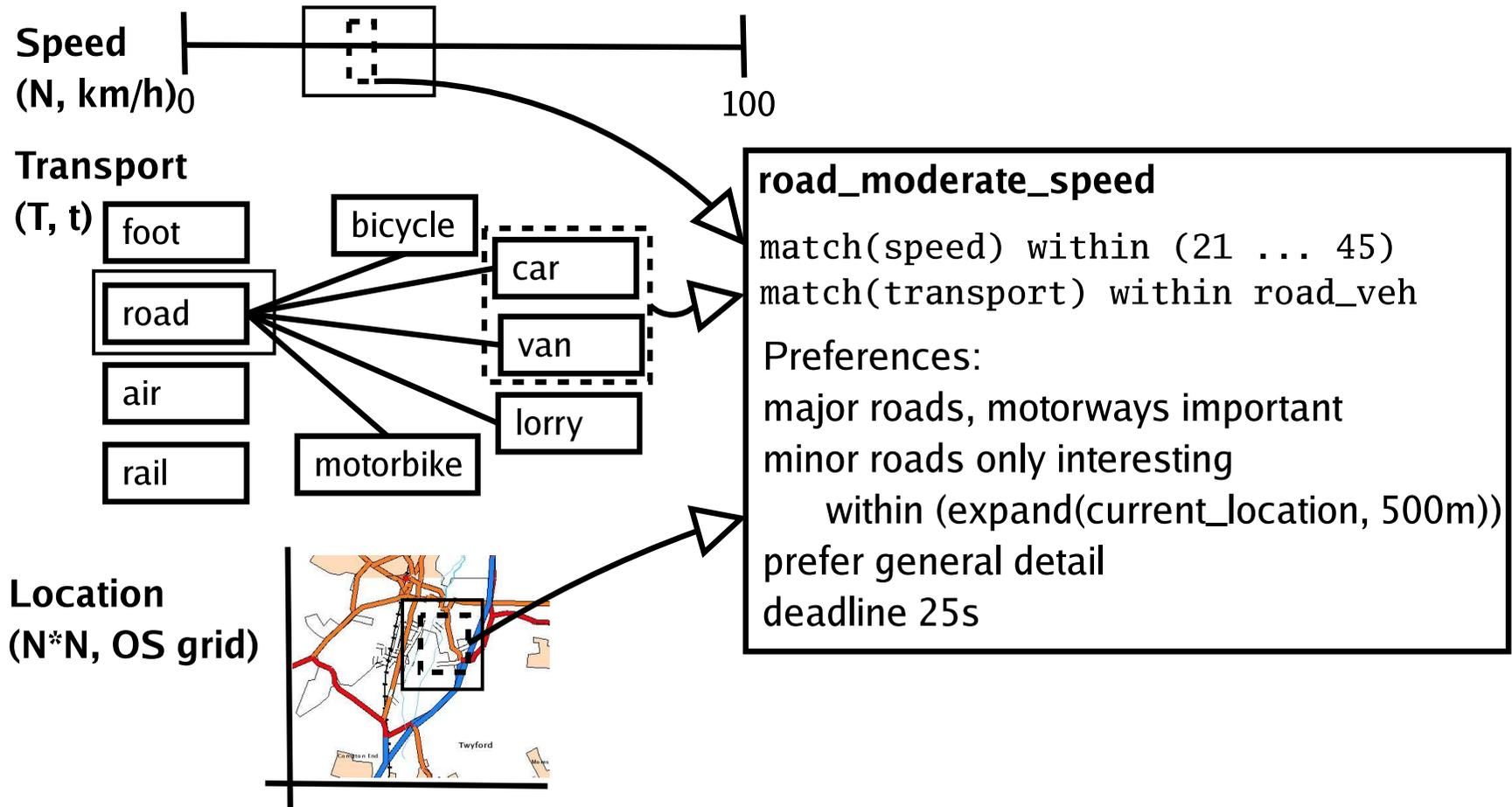
Overlaps is not reflexive – overlap of one is equivalent to within

# How Good A Match?

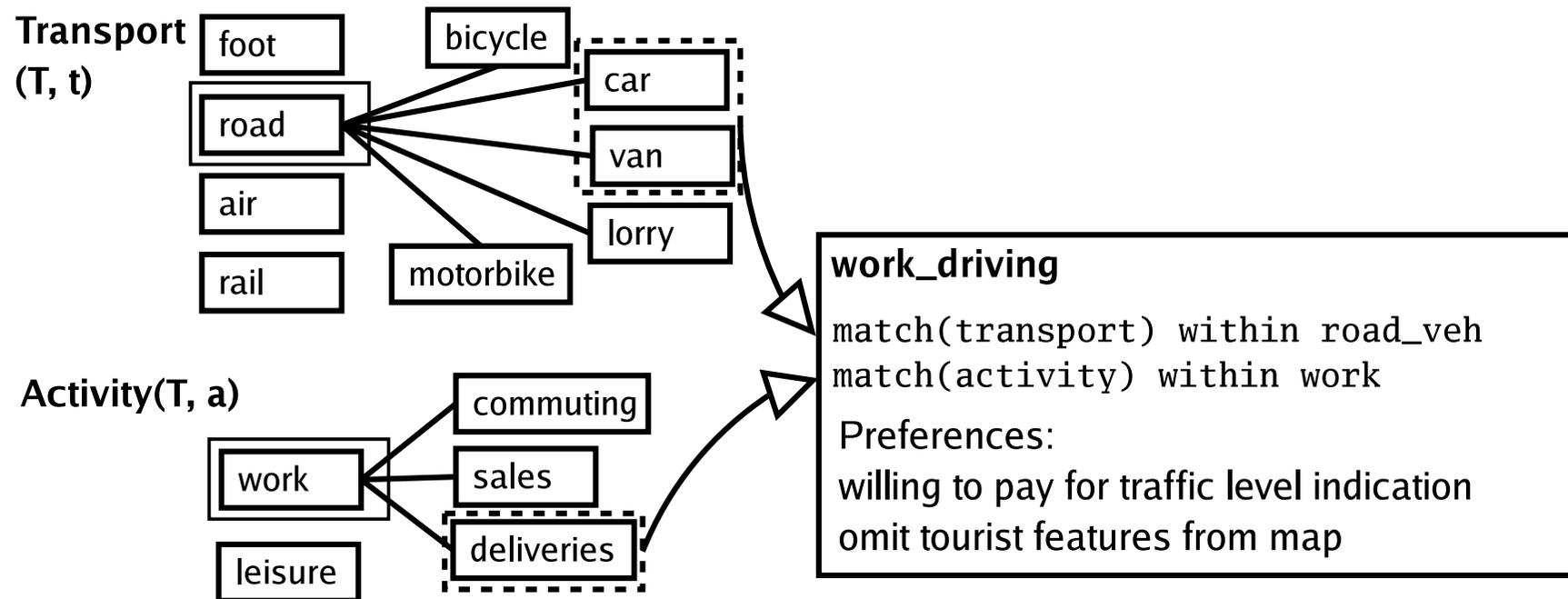
---

- Two test contexts:  $\mathcal{C}_{a,p,o_1}, \mathcal{C}_{a,p,o_2}$
- Measurement within both:  
 $\mathcal{C}_{a,q,o'} \sqsubset \mathcal{C}_{a,p,o_x}$
- Best match can be found by the degree of overlap
- $\mathcal{C}_{a,q,o'} \sqcap \mathcal{C}_{a,p,o_x}$ , highest in the case with the closest match
- Useful for selecting the most appropriate action

# Applied to Mediation (1)



# Applied to Mediation (2)



# Future Work

---

- Extending the types treated
  - Weighted trees
    - Semantic weight
    - Certainty of correctness
  - Ordered trees
  - Compound numerical values
- Specifying further functions such as difference
- Considering the effect of time

# Conclusions

---

- A typed model of context
  - numerical
  - ontology-trees
  - uncertainty in the values
- Key functions
  - within
  - overlaps
- General over many aspects of context