Multilevel Models

Session 1: Introducing multilevel modelling

Outline

- Introducing multilevel modelling
  - What is multilevel modelling
  - Data structures and multilevel questions
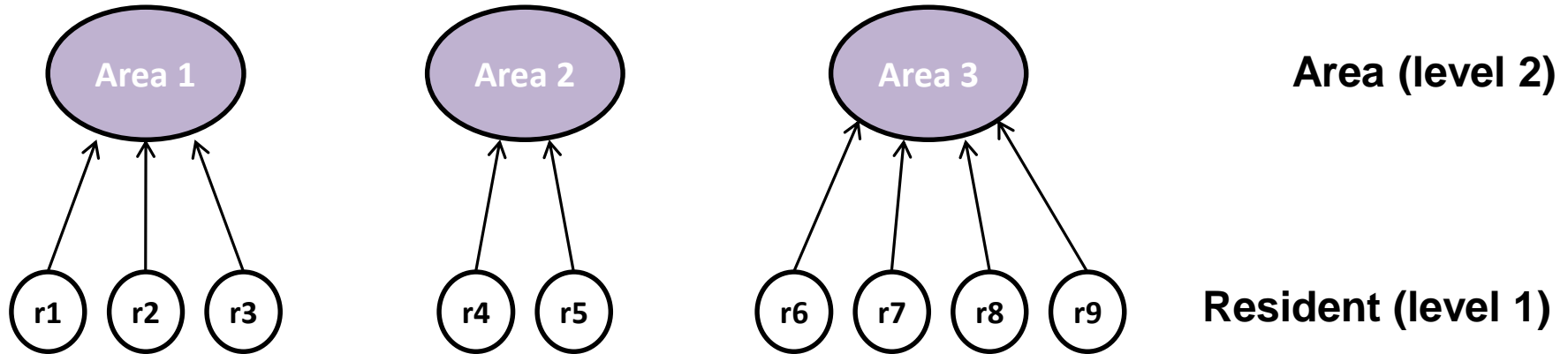 - The benefits of a multilevel approach

What is Multilevel modelling?

Models that explicitly account for the complex (grouped) structure of data

- Model individual relationships, group relationships, and link between them

- Adjust for increased similarities amongst observations from the same group (**dependency**)

- Partition overall variation between individual and group
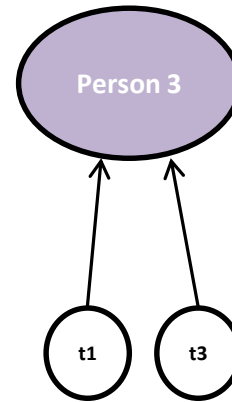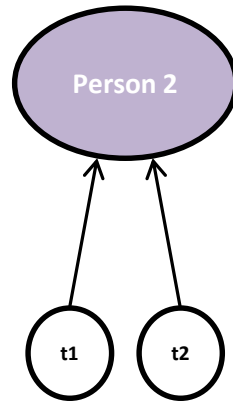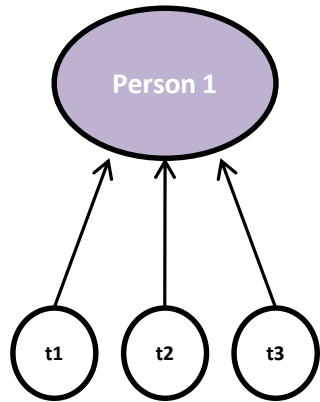
Range of data structures can be accounted for…

Two-level nested structure

Area (level 2)

Resident (level 1)

Area	Resident	Fear of crime
1	1	High
1	2	Very high
1	3	Moderate
2	4	Very low
2	5	Low
3	6	Moderate
3	7	Very low
3	8	Very high
3	9	Low

- Is there between area variability in residents fear of crime?

- Does the effect of victimisation experience on fear vary across areas?

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Two-level Repeated Measures Structure
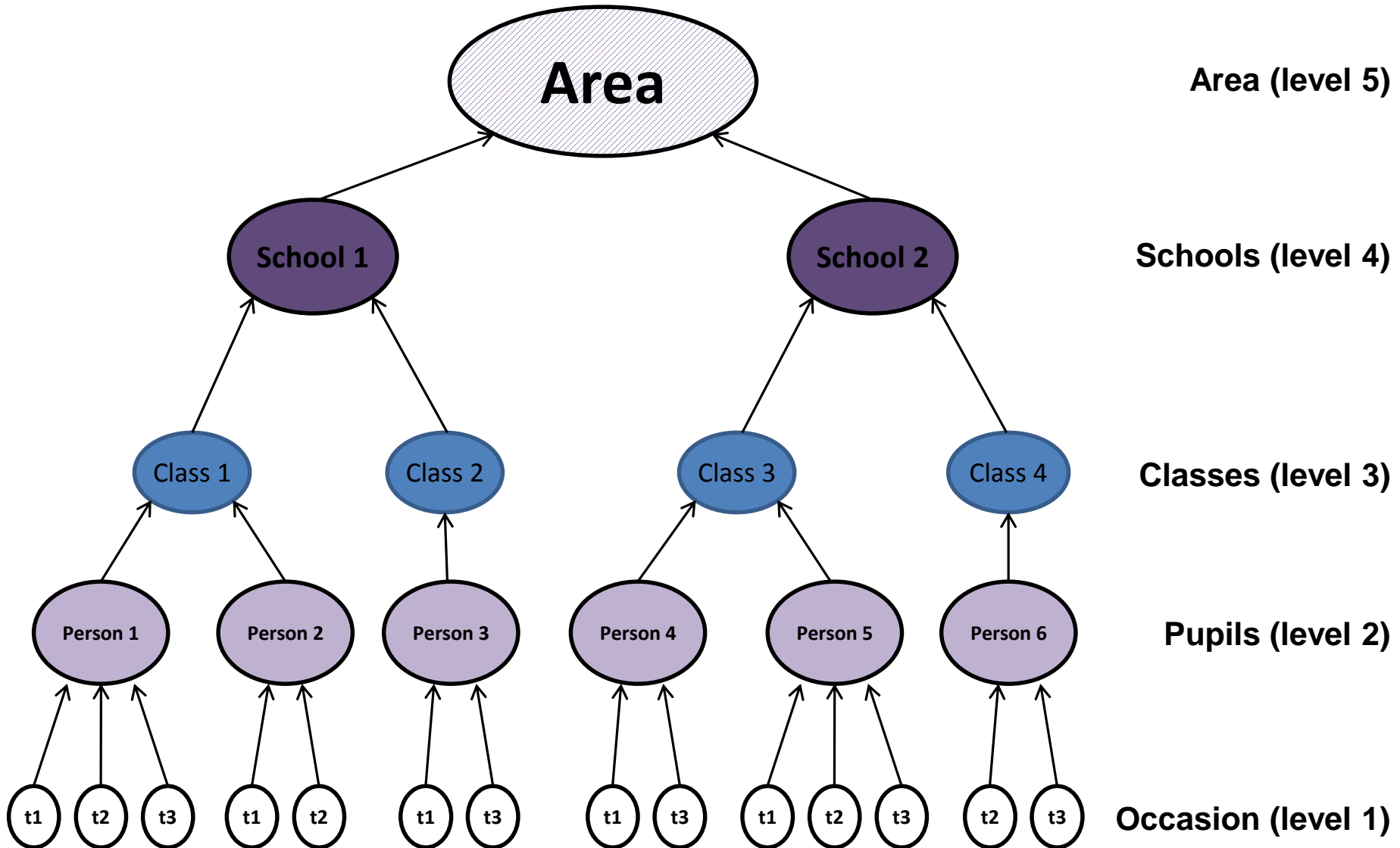

Pupil (level 2)

Occasion (level 1)

Person	Occasion	Test score	Gender
1	1	30	Male
1	2	45	Male
1	3	53	Male
2	1	62	Female
2	2	80	Female
3	1	29	Male
3	3	55	Male

- Do students differ in their level of improvement in tests?

- Can we explain these differences in progress with student characteristics?
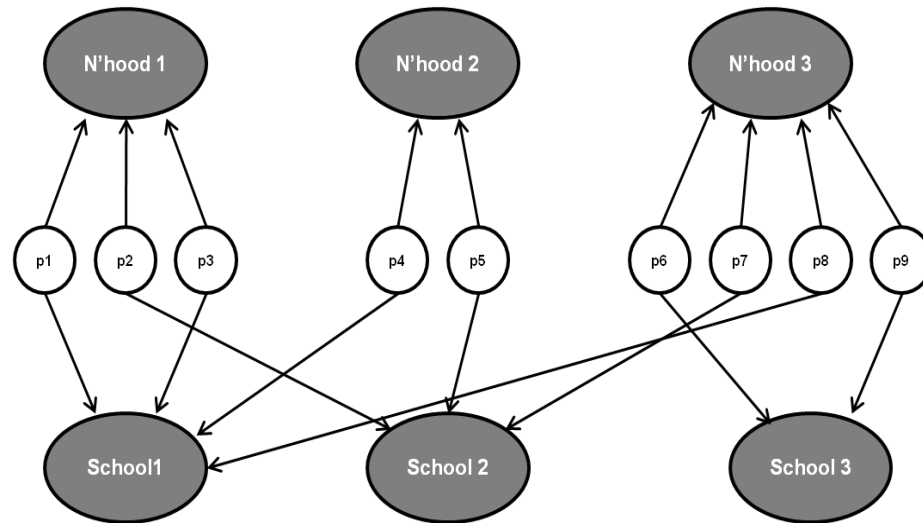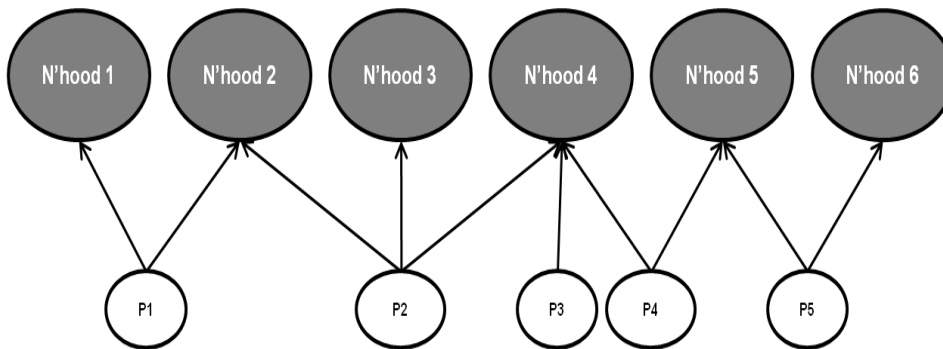
N-level Structure

Country (level 6,7...)

Area (level 5)

Schools (level 4)

Classes (level 3)

Pupils (level 2)

Occasion (level 1)

Other non-nested structures also possible

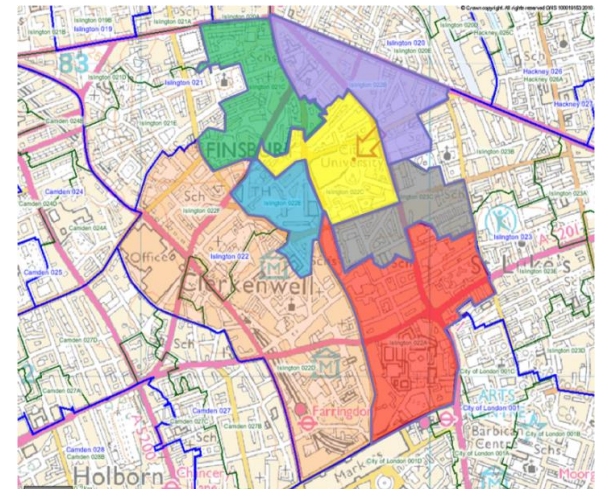- **Cross-classified**

- **Multiple membership**

- **Spatial**

Plus combinations...

Benefits of a Multilevel approach

1. Correctly account for complex data structures

   Where single level regression underestimates standard errors

2. Incorporate information on group level relationships

   Where aggregate analysis only examines group level, and individual analysis can ignore groups (or incorrectly treat group effects as individual effects)

3. Link context to the individual

   How individual relationships are moderated by broader context

4. Modelling heterogeneity

   Moving beyond typical focus on average relationship to also model variances

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www.ncrm.ac.uk