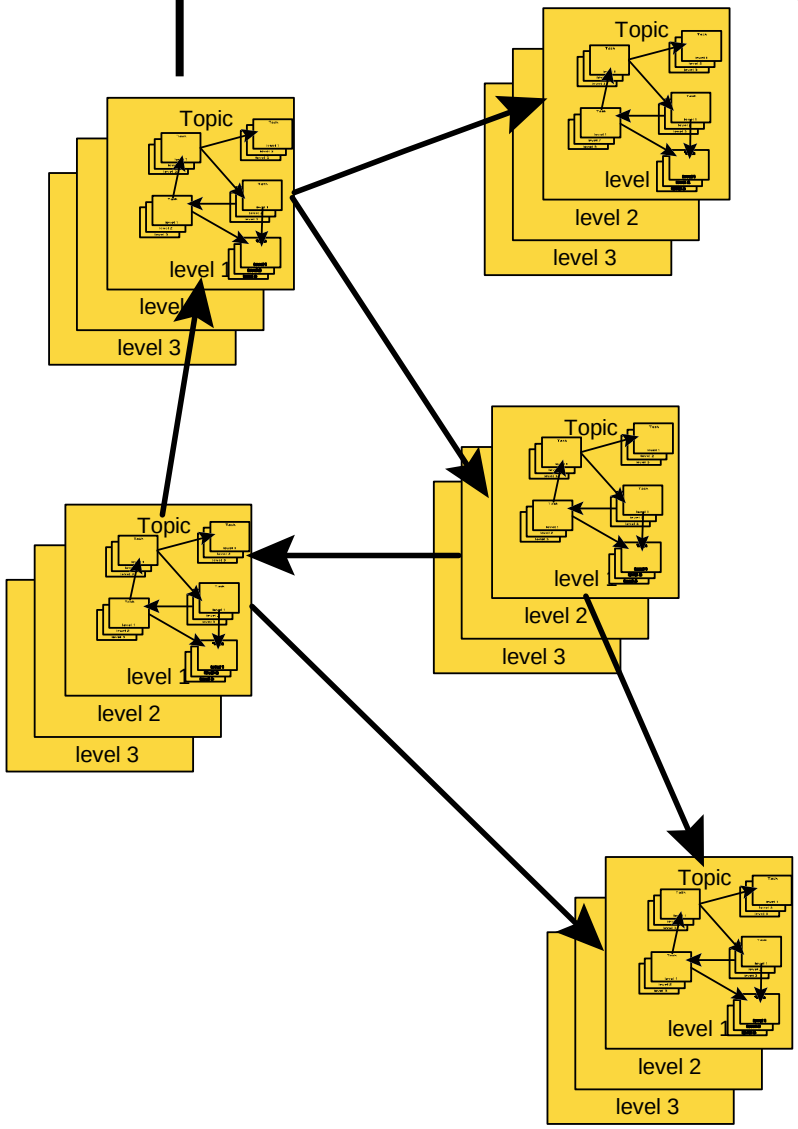
The Design and Instantiation of an Ontology for Teaching

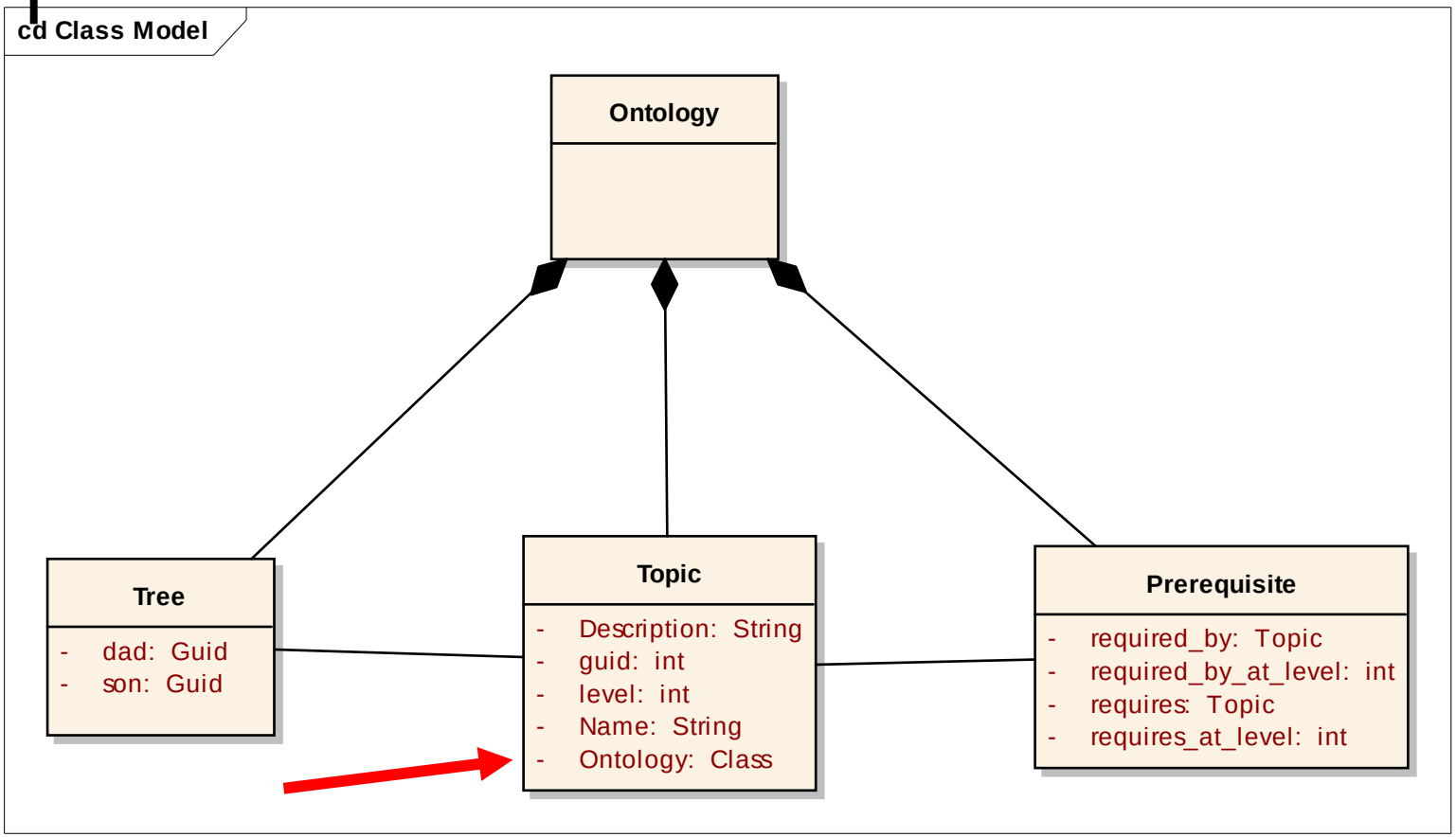
George Kuk & Dave Elliman
University of Nottingham

The Ontology



- *Topic* is the main entity
- *Topics* have levels
- *Pre-requisite* is an ordering relation
- The graph is directed (no loops) within a level but can *spiral up*
- Topics contain lower level nested ontologies to any depth

The Class Model is Recursive



A Syllabus: Making English Tea

1. How to boil water
2. Heating the pot
3. Adding Tea
4. Adding Water
5. Brewing
6. Pouring
7. Adding Milk and Sugar
8. Polite drinking practice

These topics from an ontology together with their pre-requisites

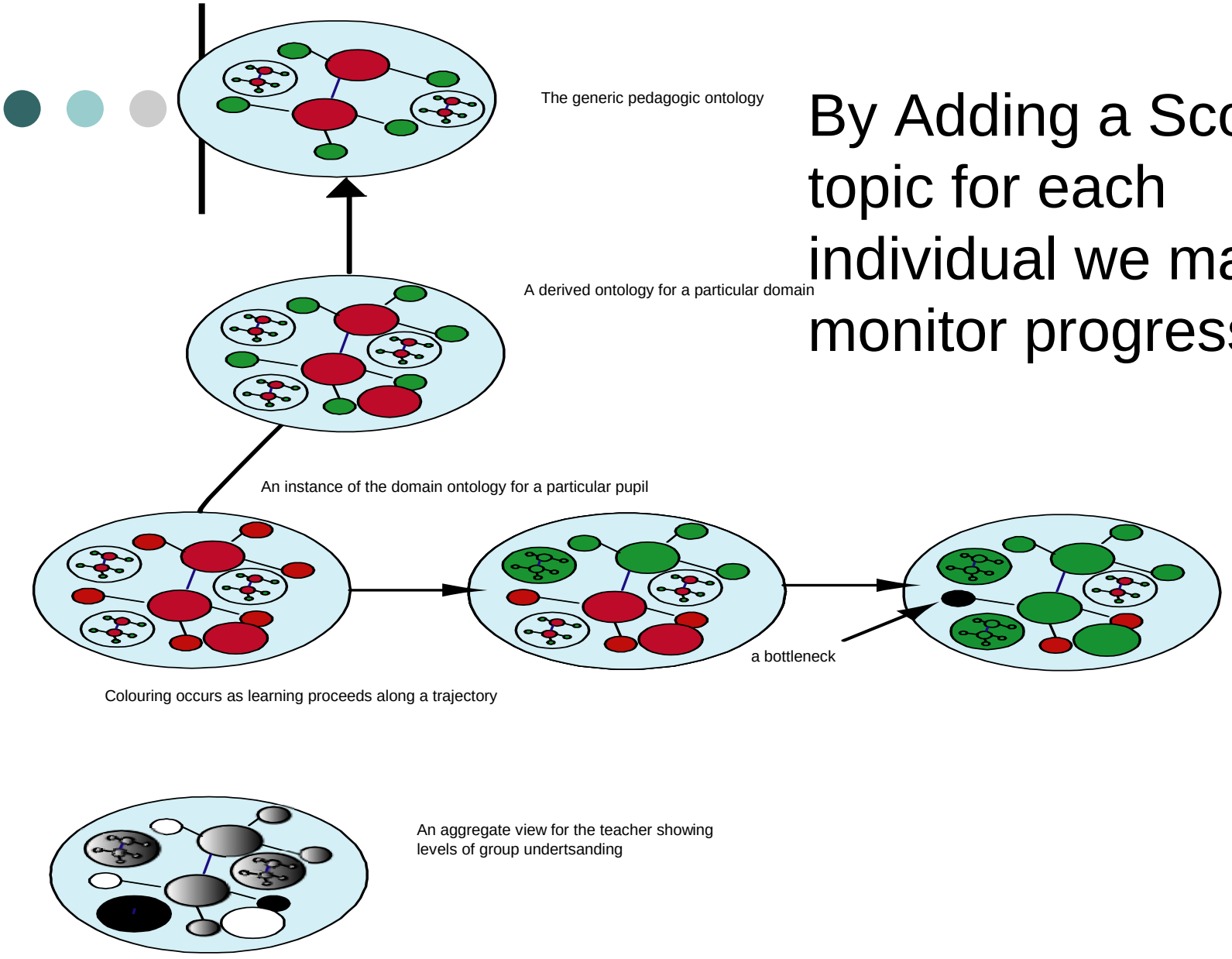
- We can data-mine the ontology from the syllabus which will be at a defined level (loosely GCSE, A-Level, 1st Year degree, Finalist etc.)
- It helps to go via XML but not essential
- Pre-requisites need attention by hand as most are implicit
- Sub ontologies likely within each topic

A sub-topic ontology

- 3 Adding Tea
- 3.1 The choice of breakfast, speciality or fruit teas (only in Germany).
- 3.1 The pros and cons of tea-bags
- 3.2 Calibration for strong or weak preferences
- 3.3 The “one for the pot” rule
- 3.3 Measuring – Decorative spoon or metric scales?

The level reflects the characersitics of the learners

- Level 1: Pre-school tea-making. Very simple instructions, strong emphasis on safety. Success is anything drinkable
- Level 2: Ordinary tea-making. A number of sophistications taught with the goal of making “A good cuppa”
- Level 3: For hotels and good restaurants. A precise and detailed art is taught with the aim of delighting the connoisseur



By Adding a Score to a topic for each individual we may monitor progress

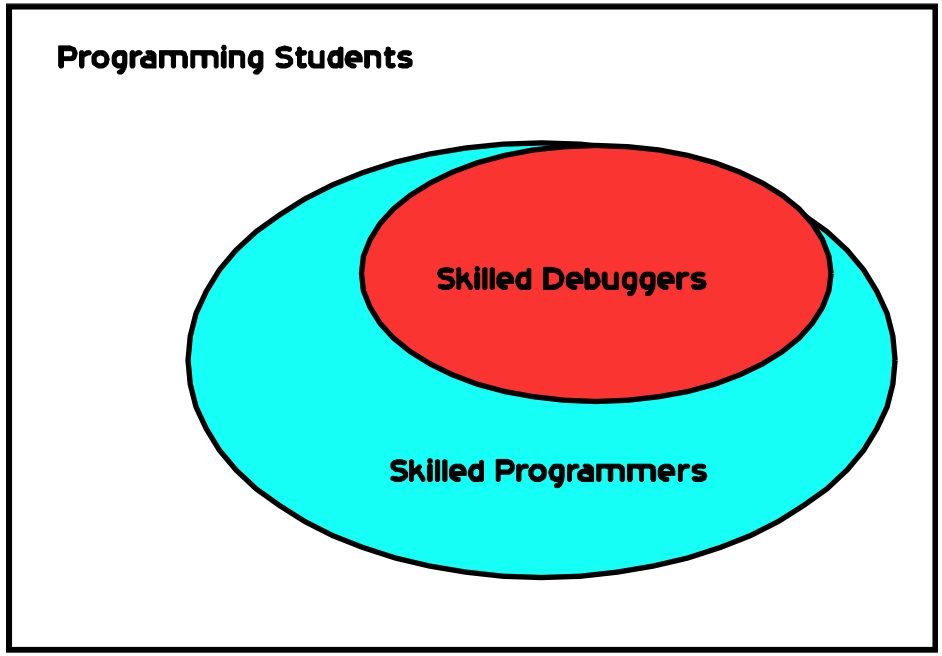
Progress can be Data-Mined

- From online tests – easy obvious
- From coursework – harder but very powerful idea especially if automatic
  - We noted constructions used in programs (e.g. while loops, if the else etc. & noted competent usage)
  - We noted debugging strategies (e.g. commenting out, print statements added)
  - We noted success at a program (e.g. for sorting)
- All done using fairly simple text searching tools

We discovered things!

- Where people were stuck and realised our teaching was often to blame – for example:
- A variable is not a pigeon hole!
- You can’t easily correct your program without a knowledge of debugging. Our pre-requisite structure (order of teaching was wrong)

An interesting fact we had not appreciated



Conclusions

- The idea works
- It gives back a lot of information
- Our tools are ad-hoc and prototypes but we now know how to do this properly
- Students really appreciate being monitored and are easily amazed at how much we have learned about them
- Once set up needs minimal effort from the teacher to keep it working

We think…

- An ontology (or rather a tree of ontologies) is an excellent structure for teachers to represent knowledge
- A relational database is perfect for storing the data
- Data mining is what makes it all work with an acceptable level of effort
- The resulting system is to education what computer-based accounts has been to commerce

Any Questions