Learning about and learning through Empirical Modelling

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Empirical Modelling

THE UNIVERSITY OF WARWICK

Papert (1993)

- "I am convinced that the best learning takes place when the learner takes charge"
- "The role of the teacher is to create the conditions for invention rather than provide ready-made knowledge"

S. Papert (1993). The children's machine: Rethinking schools in the age of the computer. New York: Basic Books.

Papert (1991)

- Constructionism is the idea that learning occurs "in a context where the learner is consciously engaged in constructing a public entity"

S. Papert, I. Harel (1991). Situating constructionism. In Constructionism: Research reports and essays.

Riley (1990)

- "These experiences [from Computers in the Curriculum Project] have led to the belief that students too, would learn more or understand better if they researched and developed their own computer models."

David Riley (1990). Learning about systems by making models. Computers & Education, 15, 255-263.

Learning about EM

- What is EM and where did it come from?
  - Using computers for sense-making activities (e.g. model building and exploration)
  - Principles and tools developed at Warwick by Meurig Beynon, Steve Russ and many others
- What are the applications for EM?
  - Software engineering, concurrency, graphics, artificial intelligence, and… education

The basics of EM

- Construction of models leads to personal understanding
- Correspondence between world and computer – models with meaning

- Key ideas:
  - Exploratory environment for model building, extension and refinement
  - Observables, dependency and agent actions

EM module

- Computer Science 4th year module: "Introduction to Empirical Modelling"
- Started in October 2002
- Module assessment is through examination and coursework
- Changed the style of coursework in 2004 to include the publication of an online journal requiring students to submit papers and models

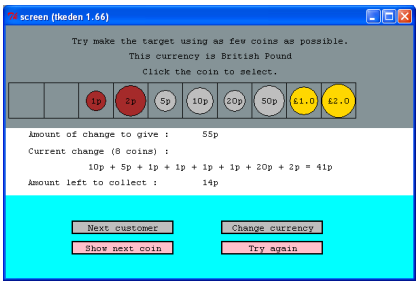
The coursework: WEB-EM

- Warwick Electronic Bulletin on Empirical Modelling
- Issued a Call for Papers requiring two submissions:
  - a paper title and abstract (part 1)
  - full paper and accompanying model (part 2)
- Requested that "students submit original and high quality papers relating to EM and its applications supported by a relevant documented modelling study"

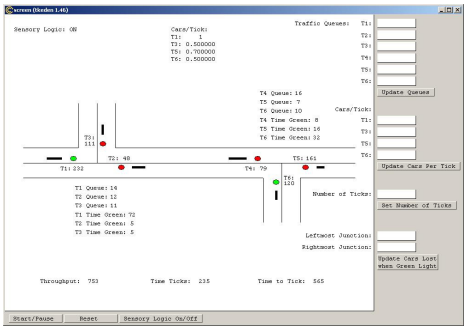
WEB-EM objectives

- To assess the students' understanding of Empirical Modelling through written and modelling exercises based on a common theme of the students' own choice
- To equip the students with basic research skills that would be useful in further education

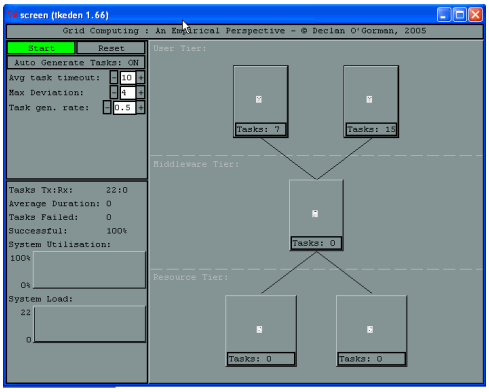
Example: Non-decimal bases



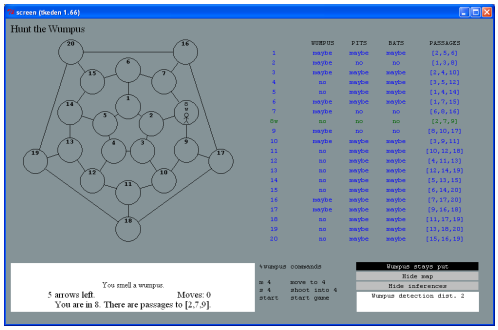
Example: Traffic lights

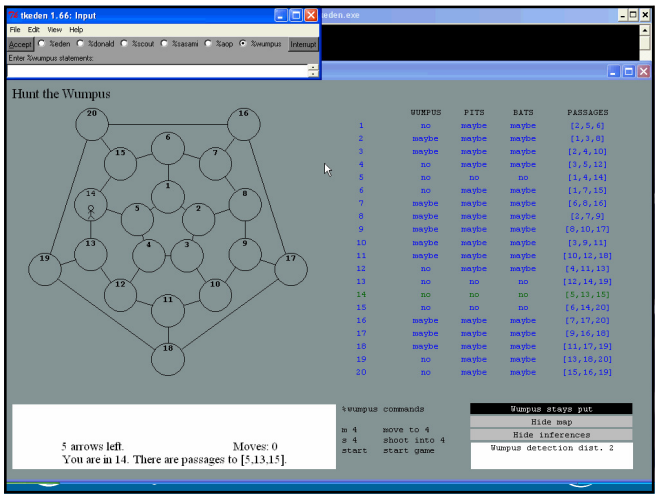


Example: Grid computing

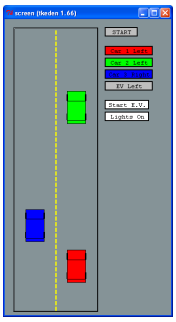


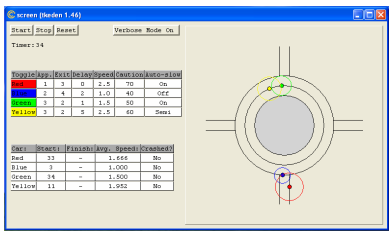
Example: Hunt the wumpus





Examples: Over-taking and roundabouts





Analysis

- The coursework has shown that:
  - Learning can occur and skills can be developed without a preconceived objective
  - Learning is stimulated by personal interest
  - Learning is reinforced when practice and principles are combined
  - Learning is aided by exploration

Concluding remarks

- Did the coursework meet the objectives?
- Answer: Probably
- But what else did the students learn?

Concluding remarks

- Questions to be asked:
  - Did students only learn about Empirical Modelling?
  - What learning occurred in domains other than Empirical Modelling?
  - What role did the journal style of coursework play in encouraging learning in other domains?
  - What role did the tools play in enabling learning in other domains?
  - Can EM be used more generally for learning?