

School of Cognitive and Computing Sciences

First year School Course — CG019

COGNITIVE MODELLING

Course Outline: Summer Term 2003

Course notes by **Benedict du Boulay** and **Steve Torrance**

<http://www.cogs.susx.ac.uk/users/bend/cogmod>

Introduction

This course addresses a central theme of modern cognitive science: the idea that computational processes provide powerful models of mind. The course will examine the role of artificial intelligence and its contributions to cognitive science.

Topics include

- What is computer modelling
- Symbol manipulation and connectionism
- Modelling areas such as problem-solving, learning, language and perception
- The limits of computer modelling

Lectures will be given by Chris Taylor (email: christay@cogs.susx.ac.uk; office: 5C16; tel: 677216; office hour: Fridays at 15.00).

Computer classes will also be taught by Christ Taylor. Seminars will be taught by Steve Torrance (email: stevet@cogs.susx.ac.uk), Hanneke de Jaegher (email: hdj20@cogs.susx.ac.uk) and Giovanna Colombetti (email: giovc@cogs.susx.ac.uk).

Aims

You will acquire knowledge of the techniques and approaches used in artificial intelligence, and some understanding of its contributions to cognitive science. You will learn some of the fundamental principles that govern computational processes; in the course you will be introduced to elementary programming concepts, but will *not* be expected to become programmers. The course will provide a foundation for second and third year School courses, and will help you (including AI majors) to take a broader perspective on the material of your major course.

The educational philosophy of the course is to give you the chance to study a number of existing systems in detail rather than to provide a broad overview of the whole field.

Lectures

There is **one** lecture per week (normally on Tuesdays), over the five teaching weeks of the summer term. **Note that Friday 25th April is on a different day, time and location from the**

others. Also note that not all the online lecture slides on the course website have yet been updated from last year's versions.

The first lecture is in the first week of term, 25 April 2002.

Week	Day	Date	Time	Place	Topic	Lecturer
1	Friday	25/4	11.30	EDB 121	Introduction: Types of Models	Taylor
2	Tuesday	29/4	10.15	ARTS C133	Production Systems	Taylor
3	Tuesday	6/5	10.15	ARTS C133	Modelling Language	Taylor
4	Tuesday	13/5	10.15	ARTS C133	Neural Networks	Taylor
5	Tuesday	20/5	10.15	ARTS C133	Behaviour-based Modelling	Taylor

The lectures will be used both to lay out the territory of the course in broad outline, as well as explain some topics in detail.

Computer Classes — Pevensey 2D12

You will take part in one 50 minute computer class per week. starting in week 2, and work in pairs. Working on pairs maximises the chance that you will learn something useful and (for one of the classes) reduces the load on the system thus giving better computer response time. This should be timed to occur (for each of you) earlier in the week than the seminar. There will be material to study prior to the computer class (available on the course website) and participants will be assumed to have studied it. During the class you will run a variety of programs to observe their behaviour. You will **not** learn to program, but you will vary program parameters (values) to see how they affect the program's behaviour. **Note that not all the computer class handouts on the website have yet been updated from last year's versions.**

Week 2 — Introduction (as html, as pdf)

1. **Controlling a blocks world by typing questions and commands.** Aim: to observe the various stages involved in this model of the transitions from text input to simulated robot action. (Graphic version of TEACH * MSBLOCKS)
2. **Running a simulation of children's subtraction behaviour.** Aim: to observe in outline how different subtraction errors can be modelled. (TEACH * BUGGY)

Week 3 — Production Systems (as html, as pdf) Examining in detail how a production system can be used to model children's subtraction behaviour. Trying out the system with different collections of rules on different subtraction sums. (revamped graphic version of TEACH * SUBTRACT)

Week 4 — Neural Networks (as html, as pdf) Examining the behaviour of a word-recognition neural network (David Young's neural network programme).

Week 5 — Behaviour-based Modelling (as html, as pdf) Examining a model of sensors and effectors in a dynamic simulated robot world. (Chris Thornton's Java-based BugWorks programme).

Depending on which group you are allocated to, your class will be either on Tuesdays or Fridays each week, starting in Week 2 — check on the First Year Noticeboard or the course website. The cohort is divided across 6 computer class groups of roughly 16 students per group.

Seminars

You will also take part in one 50 minute seminar per week, starting in week 1. There will be material to study prior to the seminar (on the course website) and participants will be assumed to have studied it. The seminars will provide a chance to discuss issues in detail and to prepare for the computer classes. Each week some of you will be allocated particular tasks in relation to either preparing for, or conducting the seminars. **Note that not all the seminar handouts on the course website have yet been updated from last year's versions.**

Week 1 — Introduction (as html, as pdf) The aims of this seminar are

- to go over the main points of the first lecture and lab class of the course;
- to provide students with an opportunity to ask any questions about the structure and organization of the course; and
- to discuss some basic issues concerning artificial intelligence, cognitive science and the computer- based approaches to cognitive modelling studied in this course (see [14]).

Week 2 — The Modelling Enterprise (as html, as pdf) Explanation and Simulation in Cognitive Science, Chapter 2 of [10]. You will be expected to read this chapter carefully and also find one other chapter/paper (e.g. that you studied in the Term 1 course Approaches to Cognitive Science) on some aspect of modelling and be prepared to describe it to the seminar class.

Week 3 — Production Systems (as html, as pdf) Errors in Children's Subtraction, [16]

Week 4 — Connectionism (as html, as pdf) Sections in Chapters 2, 5, 6 and 10 of [10].

Week 5 — Modelling Behaviour (as html, as pdf) The Control of Thought and Action, Chapter 12 of [10].

Depending on which group you are allocated to, your seminar will be sometime on Tuesdays or Wednesdays or Fridays each week, **starting in Week 1** — check on the First Year Noticeboard or the course website. The cohort is divided across 6 seminar groups of roughly 16 students per group.

Peer Assisted Learning Scheme

There will be extra guidance through the Peer Assisted Learning Scheme scheme: details from Therie Hendrey-Seabrook, CASA Projects Assistant, School of Cognitive and Computing Sciences (email: therieh).

Assignment

Each pair will keep a (single) written log of work in the computer classes. A log of the first three classes should be compiled into a report for submission by 4pm Thursday 15th May 2003 (week 4) to the COGS School Office. This coursework is not formally assessed, but it will be marked and feedback provided.

Assessment

There will be two formal assessments.

1. A 2000 word coursework essay (counts 50%) to be handed in to the COGS School Office by 4pm Thursday May 29th 2003 (week 6).

The topic of the essay is “A Cognitive Model of ????”, where you will choose the topic for “????” (a list of suggestions will be provided). The idea of the essay is that you should locate paper(s), book chapter(s), and web page(s) that describe a cognitive model and the modelling paradigm it has used. Your job is to choose a reasonably detailed cognitive model (excluding those explored in the computer classes) and describe it. This description should include a descriptions of *what is being modelled*, an indication of the *data* on which the model is based and *how these data are represented within the model*, a description of *how the model works*, an indication of how the *output of the model is to be interpreted*, any *interesting insight* about the phenomena being modelled that the model shows up, and a list of the bibliographic/web-based sources used in your research.

Please pay particular attention to rules about plagiarism, especially when using web-based sources.

Plagiarism is the use, without acknowledgement, of the intellectual work of other people, and the act of representing the ideas or discoveries of another as one’s own in written work submitted for assessment. To copy sentences, phrases or even striking expressions without acknowledgement of the source (either by inadequate citation or failure to indicate verbatim quotations), is plagiarism; to paraphrase without acknowledgement is likewise plagiarism. Where such copying or paraphrase has occurred the mere mention of the source in the bibliography shall not be deemed sufficient acknowledgement; each such instance must be referred specifically to its source. Verbatim quotations must be either in inverted commas, or indented, and directly acknowledged.

2. A one and half hour unseen exam (counts 50%) on *date and time to be notified*. This will be a 90 minute paper in which you have to answer two out of the three questions provided.

Reading List

The main textbook is the same as for the Approaches to Cognitive Science Course that you took in Term 1, namely [10]. The rest of the reading for that course is also very useful.

In addition to the web-based search pointers provided by the Approaches to Cognitive Science course, a further useful starting point for web-based enquiries is the COGSWEB page on the COGS web site, namely <http://www.cogs.susx.ac.uk/local/help/cogsweb-index.html>

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