

Burapha University Faculty of Informatics June-July 2013

Introduction to Empirical Modelling

Lecturers: Steve Russ, Krisana Chinnasarn, Antony Harfield

This course is being delivered as part of the course 301463 'Selected Topics in Computing'. *Empirical Modelling (EM)* is a new approach to computing that has been developed by Meurig Beynon and Steve Russ and numerous students in Computer Science at the University of Warwick (UK) over many years.

EM emphasises the fundamental and distinctive role that empirical knowledge plays in conceiving and implementing computer-based systems. It also teaches practical skills that are relevant to the individual and team work that typically precedes the explicit specification and design of such systems. Over and above this, it introduces ways of thinking about computing and ways of using computers that are topical in relation to current and emerging technologies and applications.

The course will present the key concepts and principles of EM, as well as some of the associated software tools and applications. It is a shorter version of a similar course (CS405) taught at Warwick and it makes extensive use of materials on the [EM website](#). The course will be assessed by examination and coursework.

Comments, questions and suggestions are welcome by email (russ.steve@gmail.com) or in person in SD317.

Schedule and Resources

Labs are at 10.00am Wednesdays in SD319. Lectures are at 8.00am Fridays in SD319

The whole [Projects Archive](#) (up to about 2011) is available. It's a good idea to make your own local copy of this. Most of the EMPE models are not in the Projects Archive but are available in the [UsingEMPE](#) folder.

The [coursework details](#) are given here. Here are some [resources](#) useful for the coursework. Details of the submission of coursework are now given in the [coursework details](#).

The examination has been re-scheduled - unofficially - to take place on Saturday 27th July at 1.00pm - 3.00pm in room SD318. I think the official time of the exam will remain as Wednesday 31st July at 10.00am - but there will NOT be any exam at that time for Empirical Modelling.

As described in the lecture on Friday (19th July), we have given some exam guidelines which you should read carefully. Here is an example of an exam used in the Warwick CS405 course. NOTE that course covered much more material than we have been able to cover in this short course. But you should recognise a good deal of the material.

Lectures

Lec 1 (7th June) : *Introduction to EM: Construal and the ODA framework*
Slides for EMintro, Faraday pictures and drawings,
roomdemoShao2013 from the UsingEMPE folder.
room.d

Lec 2 (14th June) : *Modelling with Definitive Scripts: Construal, Construction and Principles*
Making Construals
Modelling with Definitive Scripts(1)
Modelling with Definitive Scripts(2)
Overview and Principles

Lec 3/Lab 3 (21st June) : *Introducing the JS-EDEN family of notations*
Use of the canvas version of JS-EDEN was described and illustrated. For links to handouts see Lab 3/Lec 3 below.
Guest lecturer Antony Harfield from Naresuan University

Lec 4 (28th June) : *Proof by Induction*
Discussion of regions of a circle, some series, and Towers of Hanoi.
More resources for coursework (Labs 4 and 5 from CS405).

Lec 5 (5th July) : *Interpretation, Interaction and Human Computing*
Presentation and discussion of the model *prescabinetdigitBeynon2007* in UsingEMPE folder
Here are the slides of the lecture on Human Computing. And here's another version.
Downloads of papers referenced in lecture by Licklider* and by Cantwell-Smith.
Another important paper is Human Computing*. [* These are important for the exam question.]

Lec 6 (12th July) : *The Story so Far*
Summary of the material covered to this point. Slides used. A useful reference for learning about EM in general is the MSc thesis by Karl King (under Publications on EM webpage).

Lec 7 (19th July) : *Advice on coursework writing and examination*
Mainly given over to further individual work on coursework models, and advice on what to include in coursework writing. Example of 'cognitive layering' in the

racingcars model is shown. Looking ahead to lecture 8 on EM and learning. Inclusion of some papers on education on webpage under Lec 8.

Lec 8 (24th July) : *EM and Learning in the Context of Educational Technology*

An overview of the work on EM and learning, introducing the EFL, and some of the papers and theses, and main ideas of how EM has application to education. Handout of [slides](#) used. The following papers are essential reading for this topic - referred to by short titles here, and an indication of their difficulty: [Lifelong Learning](#) [easy], [New Conception](#) [medium], and [Constructionism](#) [harder].

Labs

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An introduction to the EM Presentation Environment (EMPE), and the line-drawing notation Donald, using the model roomdemoShao2013.

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An introduction to the Scout notation for screen layout. We include how to make your own presentation in the EMPE. Here are the [files for this Lab](#). Here is a [suggested answer](#) for the Tasks in this Lab. And here is [my \(partial\) solution](#) for the Labsheet on Scout. Some [Notes on Lab2](#) may be useful reading also.

Lab 3 /Lec 3 (19th June) : *Introducing the JS-EDEN family of notations*

Guest lecturer Antony Harfield from Naresuan University

Handouts included [Intro to JS-EDEN](#), [Getting Started](#), and [Making Models](#).

Lab 4 (27th June) : *Coursework and Sudoku*

Consultations on coursework and workshops on Sudoku Experience. Here are the files for the [Sudoku workshops](#)

Lab 5 (3rd July) : *Introduction to JS-EDEN emile version*

Using the project JUGS in JS-EDEN linked from left-hand panel in the [emile version](#)

Good resources are also the [CS405/Lab4](#) and [CS405/Lab5](#)

See also [advice](#) about converting tkeden models into JS-EDEN.

Lab 6 (10th July) : *More Resources for Coursework in JS-EDEN*

Reminder of uses of tkeden and of JavaScript within JS-EDEN, with special reference to uses of time, random, Object prototyping, rotate functions etc. More consultations on coursework. Summarised [here](#).

Lab 7 (17th July) : *Final advice on Coursework* [Final Lab - coursework deadline 22nd July]

Particular reference to decisions on stopping work on models and resources for help with the writing piece. Coursework [details](#).

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Date: Thu, 25 Jul 2013 15:22:12 +0700
From: Steve Russ <steve.russ@warwick.ac.uk>
To: Meurig Beynon <W.M.Beynon@warwick.ac.uk>
Subject: light relief ...

Meurig

here's extract from the writing piece of the star student in the EM group. He's talking about how the position of a landmark seems to change depending on your current position:

"When you move current position. a building or landmarks which depend on position will move follow them.

Be seen. not have calculate of position in every landmarks because we use dependency of observable. to do this and this is your think in your head. it not have programs or algorithms a lot. it's your real mind."

This is with the authentic punctuation etc. Good is it not? Also his model - at least as he has shown it me on his machine is rather good. But I think he still does not realise how I envisage it could well be used. There is fascinating potential in the idea too. The 'idea' is simply having a 'minimap' representing current local view of a large area. We can only ever see the minimap but we can change our position. Armed with the minimap others who know the region well can take us anywhere they like ... we can try and remember where we have been

Steve

Aob	Nirapun	Puttajaroon	Room in JSE
Bank	Supawat	Konhan	Bubbles
Chok	Numchok	Sawangpob	Othello
Shay	Sivatep	Petcharat	Pentominoes
Daow	Susarat	Chuensiri	Matching
First	Veerapong	Pitisirigul	sliding block
Kan	Kantapong	Pinyo	Nim
Kat	Kathriya	Eustaquio	Sudoku
Krid	Krid	Singgaw	24 - Math
Natsu	Taweesak	Emsawas	Minimap
Pook	Wanpiti	Tungwatcharapong	8-puzzle

Writing / 15	Model/35	C/w TOTAL	Q1 / 20	Q2 / 15
12	26	38	12	
0	0	0		
12	21	33	13	
0	0	0		
9	20	29	12	
0	0	0		
9	19	28	9	
0	0	0		
12	23	35	16	
0	0	0		
7	16	23	8	
0	0	0		
6	15	21	12	
0	0	0		
11	15	26	14	
0	0	0		
5	14	19	15	
0	0	0		
13	28	41	15	
0	0	0		
9	15	24	9	
		0		

BURAPHA UNIVERSITY

Faculty of Informatics

Mid-Term Examination July 2013

Empirical Modelling

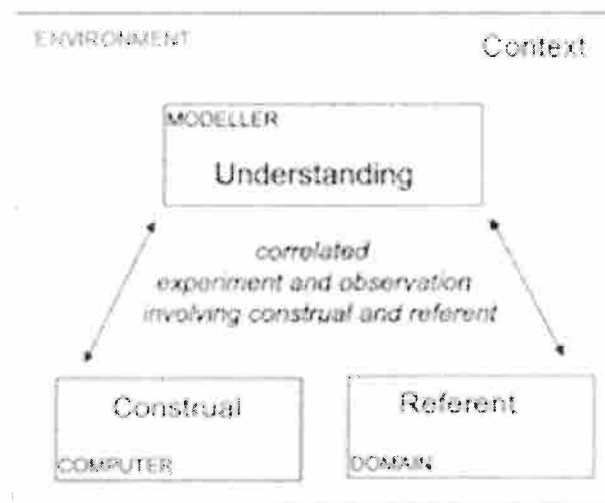
Time allowed: 2 hours

Answer question 1 and TWO other questions.

Question 1 carries 40 marks. The other questions carry 30 marks.

You are advised to read through the *whole* of a question before you start your answer to it.

1. (a)
- (i) Briefly explain the fundamental concepts of *observable*, *dependency*, *agency* in Empirical Modelling (EM). [3]
 - (ii) Give *two* examples of each of these concepts from the JUGS model. [3]
- (b) (i) Briefly explain the notion of an EM *construal*. [4]
- (ii) State *three* ways in which a construal in EM differs from a conventional program. [6]
- (c) With reference to the diagram below explain how a modeller's construal can develop in relation to the referent and to the modeller's understanding.



[5]

(Continued)

1. (Continued)

(d) Suppose a friend of yours is coming to visit you at Burapha. She rides a motorbike and you have given her directions and explained how to find a place to park her bike near the Faculty of Informatics. You should assume that the security guards are making sure everyone arriving is following the rules for riding motorbikes on the Campus. Suppose also that she finds the parking place you described is full when she arrives. You can assume she does arrive safely and she successfully finds a parking place.

You have told your friend about Empirical Modelling and she has not visited Burapha before. She decides to make an EM construal of her arrival at Burapha and of finding a parking place.

Make a list of *six* observables she might include in her construal. [6]

Write down *two* dependencies relating some of the observables you have listed. [4]

Describe (informally) *two* agencies she is likely to meet after her arrival that might change her state, or actions. [5]

[There is no need to specify a particular notation for your answer, or use a special syntax, unless you wish to. You can describe the relevant concepts informally.]

(e) Suppose your friend (in part (d)) had not found a parking place. She had got lost while looking for one, and she calls you on her mobile. Explain two ways in which her construal in part (d) would need to be revised. [4]

Total [40]

(Continued)

2. (a) Explain in your own words the key ideas of Human Computing as introduced in the EM course and explain why it is described in one of the papers associated with the lecture on this topic as ‘modelling with meaning’. Illustrate your answer with reference to any model with which you are familiar. [10]

(b) Compose a small portion of a spreadsheet with about 6 – 10 cells and 2 or 3 formulas. (Draw it on your paper, showing row and column numbers and letters.) It might refer to the budget for a party, or a holiday, or anything else you like. Invent 2 or 3 revisions or updates to the spreadsheet; state clearly the revisions to values or formulas and show their consequences. You should include at least **two** revisions to formulas.

Explain how your example illustrates the ideas of Human Computing. [10]

(c) The following is a quotation from Licklider’s paper *Man-Computer Symbiosis* (1960):

“ ... [T]o enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs. In the anticipated symbiotic partnership, men will set the goals, formulate the hypotheses, determine the criteria, and perform the evaluations. Computing machines will do the routinizable work that must be done to prepare the way for insights and decisions in technical and scientific thinking.”

Licklider is describing here some of his ideas for what a ‘human-computer partnership’ might involve. Explain which of these ideas seem to be similar to those of Human Computing in Empirical Modelling, and which of them seem harder to incorporate into the framework of EM. Explain your reasons for your decisions. [10]

3. (a) Briefly describe and **illustrate** the characteristics of the following tools that are being used for supporting the building of EM construals and models, and for introducing both tools and models:

(i) the EDEN family including tkeden, Scout and Donald; [6]

(ii) JS-EDEN in its Canvas and emile versions; [6]

(iii) the presentation environments EMPE and JSPE [4]

(b) What, in your opinion, are the most urgent needs for improving these tools? (For example, do you think they have to with making a more integrated environment which would include editors, histories, better interfaces etc? Or making them more robust (less liable to crash), or being more stable under different browsers/platforms, or giving more understandable error messages? Or some other

things?) [7]

- (c) What would you include in an online *Introduction to the EM Tools*? How would you organise it? [7]

(Continued)

4. (a) From your own experience of learning a new subject describe the role and significance of both *instruction* and *construction*. You might consider your own learning about Empirical Modelling, or any other subject that gives you good examples. Describe examples of both instruction and construction that have been especially valuable for you. Try to explain what it was about your examples that made them effective in helping you to learn new ideas. [10]

(b) When we are learning facts or ideas through tools such as search engines, or Wikipedia, our learning is largely by instruction. Briefly describe *two* examples where you have learned a new subject, or a new skill, largely by *construction* and by working with a computer. [5]

(c) Explain the difference between ‘modelling with dependency’ as in Empirical Modelling and ‘programming with dependency’. [5]

(d) What is meant by ‘constructionism’ in the context of learning? In your opinion, to what extent is the main idea of constructionism justified? [5]

(e) The papers associated with Lecture 8 in the EM course gave several reasons why an EM approach to computing might offer better support to learning than traditional programming. State *two* of those reasons and say whether you agree, or disagree with them, and why. [5]

(End)

Q3 /15 Q4 / 15 Exam/50

Final Total%

Session 1: Scene setting

Much more to knowing than classical accounts of knowledge reflect
... and much more to computing than the theory of computer programming suggests

Session 2: Varieties of knowing exemplified in practice

1. provisional - assured

2. personal/private - public : subjective - objective

3. experiential - formal : specific - general : concrete - abstract

Many nuances - "knowing where you are" infinite concept

Associations of numbers - my wife's telephone number, the number of my family home, flight number etc

Jamesian view of knowing and knowledge

Linking knowledge to ODA: the context-artefact-referent-modeller diagram - **room in EMPE**

Issues - such as recognising the correspondence between observables / active nature of this correspondence - **cabinet-digit in EMPE**

Quality of knowing suited to a very general and nuanced account of meanings: 'absolute' or relative to context

Who does the observing? what agency to they have? - can shape what dependency they perceive

LSD accounts as sketching the framework for differentiating different kinds of knowledge ...

Clayton Tunnel illustration

A. knowing and learning

B. understanding forwards / EFL

C. constructing

Case study: Perspectives on knowledge suggested by the in-progress Malaria model (**malaria.jse**)-
motivating observables, dependencies and agents

Familiarity with the syndrome that is malaria - how people apprehended malaria before they had a good construal: known through its symptoms

Abstract knowledge of the biological processes at work (<http://www.niaid.nih.gov/topics/Malaria/Pages/lifecycle.aspx>)

What was involved in establishing this knowledge?

- the microscope
- anatomical knowledge - blood, organs, constitution of the blood
- entomology - mosquito life-cycle, habits

Who knows / do we know how interventions work? What does quinine do etc? When is it effective in the cycle?

Uncertainties - will sporozoites remain dormant in liver cells?

How to correlate the abstract state with the observed state (and indeed to what extent is there a precise correspondence)

Clinician perspective - e.g. pregnant women, where drug companies will not take the risk of responsibility

Nature of the interventions: mosquito net, mosquito traps ...

Nature of the agency: LSD for the mosquito (why mosquito bites human etc); LSD for other mechanisms (how sporozoites identify the liver cells)

Nature of the medical knowledge: contingent on context - individual, physical and social - whether a drug is liable to work

Session 3

Lectures 10-11

What is CS? an EM perspective [SBR]

Program vs construal - Jugs

Construal

Lecture 2/0809 - *On construals and About construals* - key quotes from Gooding

Lecture 2/0910 - ... *as motivated by a different relationship to experience from trad programming*

Lecture 4 from <http://www2.warwick.ac.uk/fac/sci/dcs/research/em/teaching/cs405/>

... *Intelligence - artificial & real / Mensa problem with commentary / construal in commonsense context - Lift scenario*

Orientation towards explanation - James on agency, Feynman on physicists: "Ficts" Lecture 14/0809, Philosophical perspectives Lecture 20/0708

Latour - Sudoku: EM paper #100 - "the promises of constructivism"

McCarty - Erlkoenig: EM paper #50 - knowledge juke-box cf. Karl King

Gooding - Ant Navigation: EM paper #110