

A Perspective on Concurrent Systems

Sources for Part II on Concurrent Systems

- Main source is lectures from the (old) MSc module entitled *EM for Concurrent Systems*
- Access this material from 'Teaching' tab on the EM webpage and the link EMfCS
- The ODA framework is best understood, and motivated, by its use in the context of concurrency

CS405 Empirical Modelling

2

Varieties of Concurrent System

- Formal approaches (concurrent *processes*) and informal experience (everyday concurrency)
- Compare computer science and natural science
- Compare the contrast of *program* and *model*
- Challenge of modern computing applications
- Why such a gulf between behaviour as experienced and behaviour as abstracted?

CS405 Empirical Modelling

3

Commonsense Concurrency

- What counts as 'concurrent' depends on who is observing, and how they observe
- What is concurrent depends on what the observer can distinguish and conjoin
- What is concurrent also depends on observer's viewpoint and faculties
- Role of the 'external observer' who perceives (creates?) a concurrent system

CS405 Empirical Modelling

4

The VCCS model

- *subjectivity with respect to what exists together...*
 - time scales of action - updating of the dynamics, actions of the driver
 - what is actually "simultaneous"
 - what can be viewed at the same time
- *discrimination in identifying observables and agents ...*
 - how to link the speed of motion and the speedometer
- *discretion over viewpoint and mode of observation ...*
 - driver, external observer, car mechanic perspectives
 - static context of aesthetic design vs simulating motion

CS405 Empirical Modelling

5

Agency in Commonsense Concurrency

- Without agents there would be nothing to be 'concurrent'. (Must state-change be 'caused'?)
- *Exercise*: read examples in lecture and describe a scenario of your own. Identify the agents.
- Could you 'formalise' your example? What would be lost, or gained, by doing so?
- Are your agents 'objective', or do they depend on the 'external observer' (as in lecture)? How?

CS405 Empirical Modelling

6

Examples illustrating agency issues

- *waterfall and birds singing*
 - what connections between agency construed?
- *string quartet being played*
 - autonomy and integrity – causes of synchrony
- *participants at a meeting*
 - agency at the individual and corporate level
- *interacting with a word-processor*
 - intentional and accidental aspects of agency

CS405 Empirical Modelling

7

EM Analysis of Commonsense Concurrency

- The external observer (modeller) develops insight through building an artefact and interaction with the artefact.
- Observables constitute 'state' and must have identity through change as perceived by agent
- Three views of agency help to locate focus of EM
- Interaction revealing our, and other, agency
- Fundamental role of 'do-and-see' in identification of dependencies

CS405 Empirical Modelling

8

Three views of agency

View 1: every observable is an agent, as is the external observer

View 2: agents are objects responsible for particular state changes

View 3: virtual agency in the closed-world

... *illustrative of viewpoints shaped by previous experience and knowledge and current context*

CS405 Empirical Modelling

9