

Human Computing ...

... a perspective on Empirical Modelling

Review of CS405

Construal and the ODA framework
Tools of EDEN and JS-EDEN

Construction, constructivism, coursework
Software Development and Learning

Concurrency + more advanced ODA

Motivations for EM

- Technical motives, e.g.
 - Integration of programming paradigms
 - Bridging gap between theory and practice
- Human motives, e.g.
 - Need for sense-making and interpretation
 - Need to accommodate ignorance and breakdown

Human Computing

- ♦ Observation, experiment and modelling owe as much to human qualities as to mechanism
- ♦ Construal, construction, concurrency and correspondence are profoundly associated with human qualities and faculties
- ♦ Wish human experience to be enhanced by computing not diminished

A Vision

The hope is that, in not too many years human brains and computing machines will be coupled together very tightly and that the resulting partnership will think as no human brain has ever thought

JCR Licklider *Man-Computer Symbiosis* 1960

Early Vision...

People 'track' during every conscious moment ... alignment processes, in which the alignment error serves as datum for its own annihilation, are forever being carried out in the familiar operations of living ... The needs and nature of the interpretive and computing equipment cannot finally be separated from those of tracking controls.
George Philbrick, 1945 [cf C. Care PhD thesis]

More Vision

The main aims are 1) to let computers facilitate formulative thinking ... and 2) to enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs.

JCR Licklider *Man-Computer Symbiosis*. 1960

Humans as Computers

- ◆ Hobbes: 'When a man *reasoneth*, he does nothing else but conceive a sum total, from *addition* of parcels;....For reason, in this sense, is nothing but *reckoning*, that is adding and subtracting....(Leviathan, 1651)
- ◆ Computationalism: the brain/mind is a computer; cognition is computation, etc
- ◆ (Cf. M. Scheutz, *Computationalism*, 2002)

Humans Computing

- ◆ Negotiating movement among busy crowds
- ◆ Conducting conversations
- ◆ Planning complicated events
- ◆ Learning, designing, creating
- ◆ Building and nurturing relationships
- ◆ Proposals for research, business, or politics

Human Computing

- ◆ Not something humans alone can do, nor is it computing for human affairs, nor 'soft' computing, nor HCI, nor human-centred computing
- ◆ Computing that only proceeds with the essential and continuous engagement of human cognitive processes - 'symbiosis' of the human and electronic
- ◆ Most computing has not been of this kind, some of it already is, and much of it will be in the future

9

User As Semantic, Computational Agent

- ◆ Continuous, connected interaction (contrast with *alternation*): integration
- ◆ User interaction as a constituent of computation
- ◆ Interaction informed by meanings, expectation, knowledge and context
- ◆ Interaction may give rise to new knowledge

4

New Ways of Thinking about Computing

- ◆ Understanding (versus goal) -oriented perspective
- ◆ A modelling machine as well as a programmable machine; modelling within ODA framework
- ◆ Computer as reliable, interpretable, state-changing machine: requires complement of the human
- ◆ Computation not only 'evaluation of a function' but presentation of *something* in the world (semantics)
- ◆ Each feature above calls for humans as essential partners in the computation

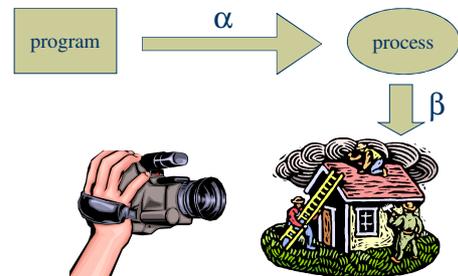
2

New Ways of Using Computers

- ♦ Human 'user' as essential participant (with machine) in computation: games, social, Web2.0
- ♦ Warehouse management (Chen, PhD) has employees involved in 'participative business process re-engineering'
- ♦ Restaurant management (Rasmequan, PhD) manager makes booking decisions while interacting with model of restaurant bookings
- ♦ Not really 'new' cf. spreadsheets; many EM models can be thought of this way: Clayton Tunnel, Sudoku, Heapsort, Jugs, VCCS etc.

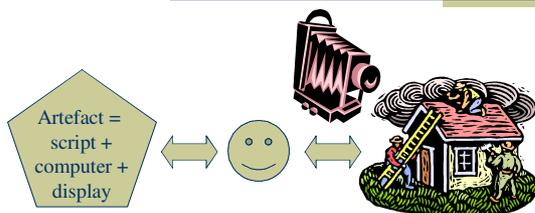
3

Semantic Relations (I)



5

Semantic Relations (II)



6

Machine Computing

- ♦ Machine metaphor and engineering paradigm
- ♦ Focus of conventional computing has been on program and process – on maps α and β
- ♦ Essence of computing seen in the algorithmic or the automatic – so beginning with the specification of a process (behaviour)
- ♦ **Whole** computation automated, versus **some** computation is automated

7

What is Computing?

- ♦ Can also use computers to explore and identify new patterns of interaction, construals, & interpretations
- ♦ Such activity is *prior* to programming
- ♦ Motivates model development on basis of the meanings derived from comparison of experiences of the artefact and world
- ♦ Modeller mediates the correlation of artefact and referent: experiment, and the user, establishes meanings and reliable patterns of interaction

8

Research Programme

- ♦ Human computing and Empirical Modelling
- ♦ Human computing and other disciplines
- ♦ Modelling and software system development
- ♦ Object-orientation and methodology
- ♦ Evolution of requirements and software

10

Empirical Modelling

EM as a framework for the movement between the unreliable and the reliable:

- | | | |
|---------------|---|--------------|
| • state | | behaviour |
| • experience | → | abstraction |
| • modelling | ← | programming |
| • experiment | | construction |
| • environment | | system |

11

Bibliography

Papers on webpage, books including ...

Philip Agre, *Computation and Human Experience*, CUP, 1997

David Mindell, *Between Human and Machine*, John Hopkins University Press, 2002

Willard McCarty, *Humanities Computing*, Palgrave, 2005

Bo Dahlbom, Lars Mathiassen, *Computers in Context*, Blackwell, 1995

11