Human Computing

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The Plato quote ….

Why, on what lines will you look, Socrates, for a thing of whose

nature you know nothing at all? Pray, what sort of thing,

amongst those you know not, will you treat us to as the object of

your search? Or even supposing, at the best, that you hit upon it,

how will you know it is the thing you did not know?

Plato *Meno*

What's the Problem?

Current conceptions of computing or computation such as:

Execution of an algorithm;

Formal symbol manipulation;

Information processing; etc

do not offer any adequate account (or theory) of the computing activities that we use, participate in, or rely upon every day.

The gulf between 'theory' and practice is enormous and embarrassing to a 'science', as our students know very well.

See Brian Cantwell-Smith *The Foundations of Computing* (2002)

More Critics ….

Winograd & Flores, *Understanding Computers and Cognition* (1986)   [Ch.2 '…computers … have been shaped by a rationalistic tradition that needs to be re-examined and challenged…']

Peter Naur, *Knowing, and the Mystique of Logic and Rules* (1992)

Peter Wegner, *Interactive Computation: the New Paradigm* (2006)

Willard McCarty, *Humanities Computing* (2005)

What's Human Computing?

Thomas Hobbes (around 1660) claimed that reasoning was a form of calculation.

The idea of human computing is to broaden the conception of computing to include understanding and sense-making. It thus requires the close and essential integration of human processing with machine processing.

It is the same idea as Empirical Modelling.

Human Computing

We are familiar with computing as specified in formal and abstracted ways, when logic, language and mathematics are used for description and exploited in reasoning and modelling.

Human computing is complementary and makes immediate, raw, experience fundamental.

Not the *alternation* of human and computer interaction, but the *continuous engagement* and negotiation of the human with the computer.

Experience 'as of now'

The artefacts we build on the computer are themselves a source of immediate experience which can be compared – through interaction – with experience of their referent.

This drives their incremental development and gives grounds for confidence in their reliability.

The computer as a medium with which to think and explore allows for personal expression of a kind that is prior to programming.

Modelling before Programming

Central focus of interest is on a *construal*: a personal, provisional, model which is the basis for the developing computer artefact.
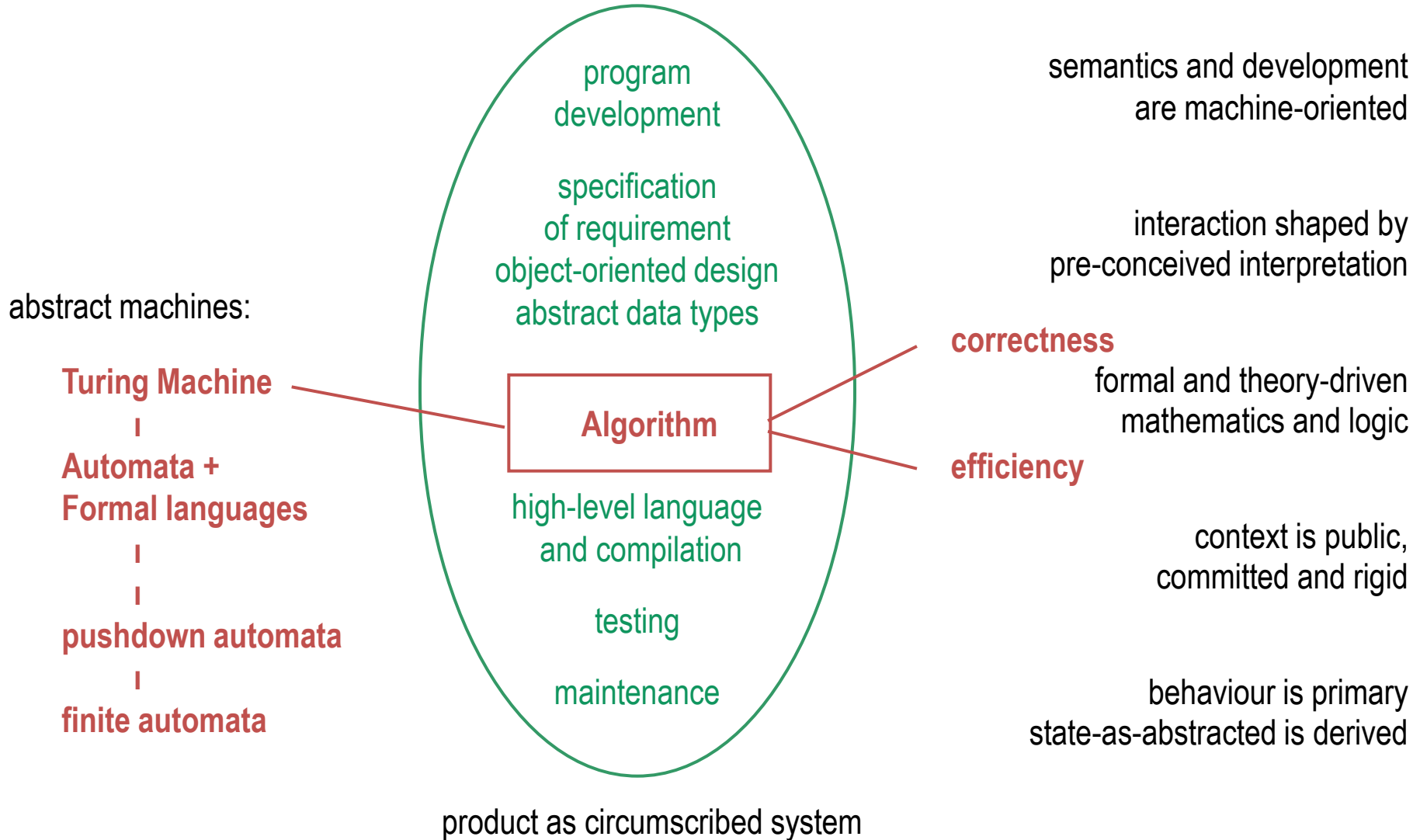
(cf David Gooding)

Three main concepts which guide our analysis, development and tools are:

observables, dependency, agency

Initial modelling is prior to 'programming'

Focus of conventional Computer Science

computation = execution of algorithm (cf. mechanism + automation)

program
development

specification
of requirement
object-oriented design
abstract data types

Algorithm

high-level language
and compilation

testing

maintenance

semantics and development
are machine-oriented

interaction shaped by
pre-conceived interpretation

correctness

formal and theory-driven
mathematics and logic

efficiency

context is public,
committed and rigid

behaviour is primary
state-as-abstracted is derived

abstract machines:

Turing Machine
|
**Automata +
Formal languages**
|
|
pushdown automata
|
finite automata

product as circumscribed system

Empirical Modelling: a broader view of computing

computation = making sense of phenomena
and information processing (human computing)

observation and experiment

semantics and construction
are experience-oriented

Model or artefact
construction

personal engagement
with the world:

domain of interest
conflation of design,
development, use

interpretation shaped
by free interaction

particular situations
personal interest
and interpretation

Construal

faithfulness

informal, intuitive, exploratory
imagination and memory

efficacy

Observable,
Dependency,
Agency
in definitive scripts
in appropriate notations
driven by interaction

context is personal, provisional

personal experience
and expression,
perception, observation,
dependency and agency,
sensory stimuli

state-as-experienced is primary
behaviour is derived

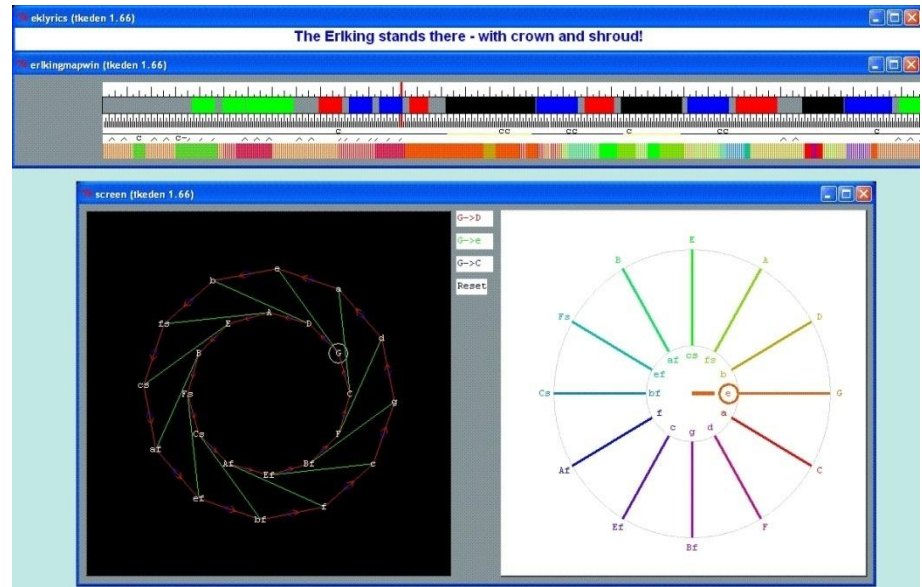process in open environment

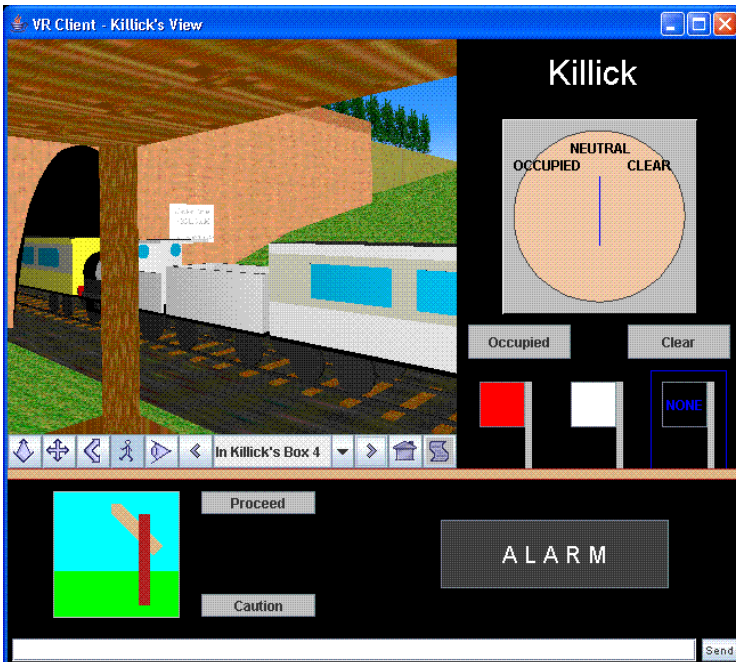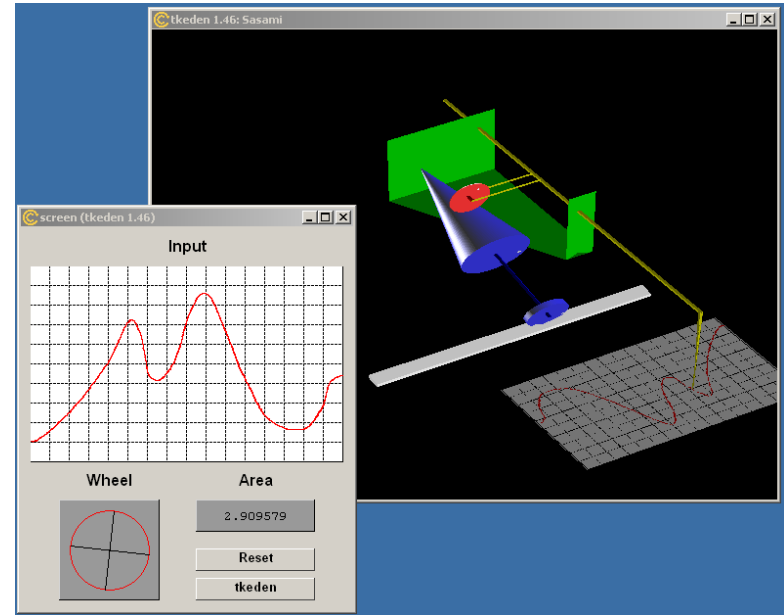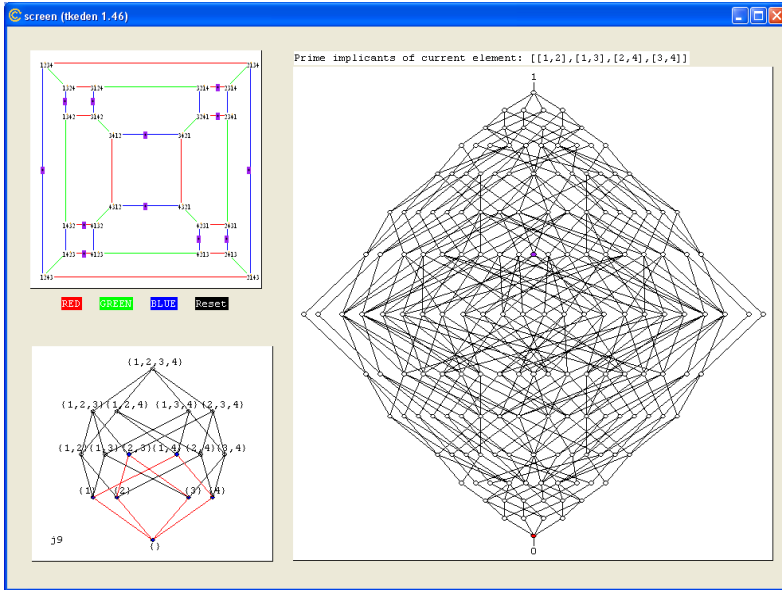A simple example ....

The JUGS program

Simple BASIC program with a 'clear functionality'

Challenge to model our (provisional) understanding of what 'users' might experience and learn from such an environment

Immediate benefit of being ported to many platforms and languages. (cf Cartwright and BBC)

Wider generic benefit of exploiting other interpretations – both plausible and implausible.

Sense-making in mathematics, in the physical world, social interactions and music ...

Model, Program, Knowledge

Human computing (or EM) contrasts with conventional computing with regard both to computation and to knowledge.

Compare:
  'knowing a city' and 'knowing how to use the underground',
 with
'familiarity with EM model' and 'familiarity with program'
 [in regard to ontological and computational differences]

and also with
'real' personal knowledge grounded in experience and 'complete propositional knowledge' (as sought in GOFAI)

Human Computing and Philosophy

Much insight and inspiration has come from many works by William James, especially his *Essays in Radical Empiricism.*

Some concepts due to Heidegger such as 'breakdown' and 'thrownness' seem natural and suggestive for our approach.

Many themes from phenomenology (deriving from Husserl, Brentano, and others) as developed by Paul Dourish, Don Ihde, for example, in relation to HCI and technology are important.

The 'process philosophy' of Bergson and Whitehead (for example) is also relevant to our work. Our approach has strong connections with activity theory (Vygotsky) , constructionism (Piaget, Papert ,etc) and constructivism (Latour).

Further reading

Meurig Beynon , 'Radical Empiricism, Empirical Modelling and the nature of knowing'

Meurig Beynon, Steve Russ, Willard McCarty, 'Human Computing – Modelling with Meaning'

Meurig Beynon, Steve Russ, 'Experimenting with Computing'

Can all be downloaded from:
www.dcs.warwick.ac.uk/modelling

www.dcs.warwick.ac.uk/modelling

Human Computing not new

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

Licklider again

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