Focus of conventional Computer Science

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

program
development

specification
of requirement
object-oriented design
abstract data types

abstract machines:

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

correctness

Algorithm

efficiency

high-level language
and compilation

testing

maintenance

semantics and development
are machine-oriented

interaction shaped by
pre-conceived interpretation

formal and theory-driven
mathematics and logic

context is public,
committed and rigid

behaviour is primary
state-as-abstracted is derived

product as circumscribed system

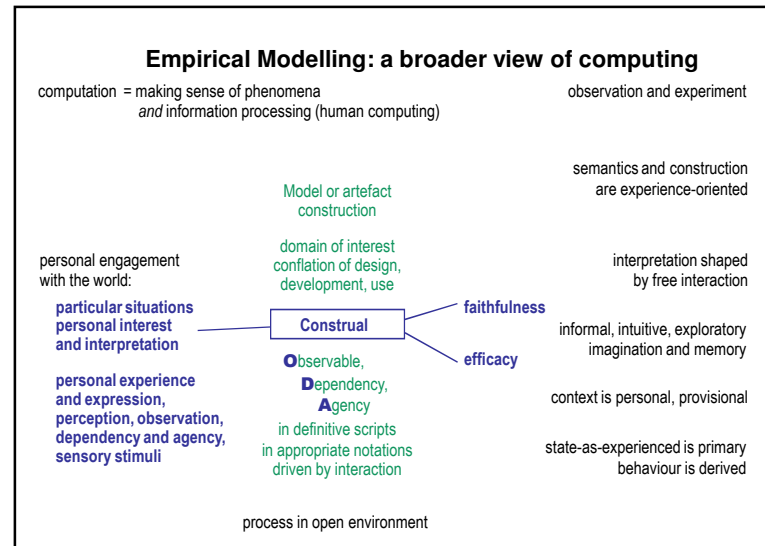## Towards a broader kind of computing …

...that characterization is too austere. It only hints at the full richness of the discipline. It does not call attention to the connections between computing knowledge and the concerns of people to whom this knowledge contributes, notably the universal concerns for reliability, dependability, robustness, integrity, security, and modifiability of computer systems. It hides the social and historical context of the field and the values of the people ...

Denning (*ibid*)

Computer Science : the discipline

The body of knowledge of computing is frequently described as the systematic study of algorithmic processes that describe and transform information: their theory, analysis, design, efficiency, implementation, and application. The fundamental question underlying all of computing is, *What can be (efficiently) automated?*

Peter Denning, *Encyclopedia of Computer Science, 1999*

Empirical Modelling: a broader view of computing

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

observation and experiment

Model or artefact
construction

personal engagement
with the world:

domain of interest
conflation of design,
development, use

**particular situations
personal interest
and interpretation**

Construal

faithfulness

Observable,
Dependency,
Agency

efficacy

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

in definitive scripts
in appropriate notations
driven by interaction

semantics and construction
are experience-oriented

interpretation shaped
by free interaction

informal, intuitive, exploratory
imagination and memory

context is personal, provisional

state-as-experienced is primary
behaviour is derived

process in open environment

Computing as modelling

"In our view, computing is fundamentally a *modeling activity.* Any modeler must establish a correspondence between one domain and another. For the computational modeler, one domain is typically a phenomenon in the world or in our imagination while the other is typically a computing *machine, whether abstract or physical.* The computing machine or artifact is typically manipulated through some *language ...."*

ITICSE Working Group 2009

Foundations of Computing

Computation is not a (determinate, autonomous) subject matter.

....

...there will be no theory of computation at all.

....

For sheer ambition, physics does not hold a candle to computer or cognitive—or rather, as we should now call it, in order to recognise that we are dealing with something on the scale of natural science—*epistemic or intentional* science. ......

Hawking (1988) is wrong. It is we, not the natural scientists, who must develop a theory of everything.

Brian Cantwell-Smith

I have found it convenient to distinguish six *construals of computation ... :* formal symbol manipulation, effective computability, execution of an algorithm, digital state machines, information processing, physical symbol systems.

....

....

... I am prepared to argue for a much more radical conclusion: that, when subjected to the empirical demands of practice and the conceptual demands of cognitive science, *all six construals fail—for deep, overlapping,* but distinct, reasons.