# Themes and Dilemmas

Ever since Descartes (c1640), we have conceptualized our world in terms of discrete **Objects** embedded within a context of **Space and Time**. Since Einstein (c1920), embedding has been in **Spacetime**, a single four-dimensional manifold.

**Mathematics** is the study of unique, discrete objects embedded in and interacting within the context of a dimensional manifold. The dual interpretation of objects as interaction (emphasized by quantum mechanics) is to see the interactions themselves as primary and the objects as patterns of interaction.

**Computation** is the study of discrete binary objects interacting within the constraints of a **timed boolean algebra**.

## The Meta-theme of Formal Systems

| Field | Object concept | Space-time concept |
|---|---|---|
| geometry | points | space |
| physics (classical) | masses | 3space and directional time |
| physics (modern) | wave/particle | entanglement, observation |
| physics (relativistic) | events | spacetime |
| mathematics | structures | axiomatic bases, proof steps |
| computation | sets | processes |
| computation (serial) | bit-streams | boolean networks |
| boundary math | distinction | void |
| **Formal Systems** | **invariance** | **variance** |
| propositional logic | truth | proof |
| quantification | property | existence |
| predicate logic | domain | recursion |
| relational theory | domain pairs | domain intersection |
| function theory | abstraction | application |
| pattern-matching | pattern | pattern variables |
| proof systems | assumptions | logic |
| category theory | math systems | morphism |
| cellular automata | cell | neighborhood |
| fractals | generator | recursion |
| finite state machines | bit-stream | state transition graph |
| program verification | specification | program |

Note that the meta-theme has been with us since ancient Greek philosophy, and is peculiar to the mathematical/scientific way of viewing the world. In particular, the object/spacetime decomposition is not appropriate -- does not work -- for biological systems (cells, viruses, organisms, plants, humans, institutions, societies, cultures, minds, religions).

## Philosophical Dilemma I: Cyber-addiction

From Communications of the ACM, 3/98, p11:

"Almost a fifth of college students spend more than 20 hours a week on the Internet...this amount of time qualifies as addition....a New York University study (that) correlates high student Internet use with doubled rates of academic dismissals. As a way of dealing with this problem, schools in Michigan, Maryland, Texas, and Washington have imposed limits on student Internet use. Dominant areas of user involvement: email, Web surfing, MUD interactive role-playing, and home page production."

ibid. p.128 (by Peter Neumann):

"...activities that can lend themselves to addictive or compulsive behavior include...even programming itself -- which seems to inspire compulsive behavior in certain individuals....computers intensify and depersonalize whatever activity is being done, enabling it to be done remotely, more expeditiously, less expensively, and perhaps without identification, accountability, or answerability.

The effects of compulsive computer-related behavior can involve many risks to individuals and to society, including diminution of social and intellectual skills, loss of motivation for more constructive activities, loss of jobs and livelihood, and so on. A reasonable sense of physical reality can be lost through immersion in virtual reality. Similarly, a sense of time reality can be lost through computer access that is totally encompassing and uninterrupted by external events."

Biological systems are incomprehensibly complex. Computational systems are incomprehensibly simple. Since the world we live in is beyond our comprehension, we construct projections (virtual worlds with detail removed) to support the illusion that we understand and are in control. The manufactured flat surfaces which surround us everywhere are an example of the removal of natural complexity to enhance our illusion of tractability. Computational environments are another example of this **abstraction neurosis**.

People fall into cyberspace because it is unnaturally simple and therefore supports the illusion of competence. Of course, cyberspace is not simple, it too is an artifact of biological activity. It is the illusion of potential simplicity which makes computational systems attractive.

Why have you chosen a profession which requires you to stare at a computer screen all day long? Was your mother correct when she asked you not to sit too closely in front of the television screen? How do you think physical reality will respond to the competition of virtual reality for the attention of humanity? Is the modern mind committed /addicted to representations of reality (reading-writing-arithmetic, books, films, computers, etc.) rather than to reality itself?

## Philosophical Dilemma II: Triviality

Quotes from Gian-Carlo Rota, **Indiscrete Thoughts**:

"The philosophy of mathematics carries out its work by focusing on the correlation between mathematical things and mathematicians." Robert Sokolowski, p.xiii

That is, between the object-concept of mathematical items (which may or may not exist in a Platonic world independent of our minds) and the process-concept of mathematical minds.

"Of all escapes from reality, mathematics is the most successful ever. It is a fantasy that becomes all the more addictive because it works back to improve the same reality we are trying to evade. All other escapse -- sex, drugs, hobbies, whatever -- are ephemeral by comparison." p.70

"Not only is every mathematical problem solved, but eventually every mathematical problem is proved trivial. The quest for ultimate triviality is characteristic of the mathematical enterprise." p.93

Computer Science deals with a trivial subset of mathematical trivality by excluding the sacred concept of Infinity and the mysterious concept of Void, and by avoiding even "intractable" (ie non-polynomial, search-based, mathematically interesting) complexity. Computer Science (at least Artificial Intelligence and Cognitive Science) pretends that the mind is like a computer, so that the issues of complexity of mind and of humanity can be conveniently ignored or forgotten.

Computer Science engages in an extreme of abstraction neurosis, let's say **abstraction psychosis**, by constructing the narrowest of worlds (binary bit-streams which interact only over timed boolean networks), and then by suggesting that this extreme reduction is somehow whole. In fact, computation addresses only **trivial trivialities**.

How can humanity become so enamored with a technology that it forgets the reality within which it is embedded? Why are we so ready and able to limit our experiences to a small screen of phosphers and a tableaux of a few dozen labelled keys? How can our minds so easily confuse a pixel array with fully visceral experience? Confuse an email exchange with fully interactive human dialog? Confuse digital information processing with bodily experience?