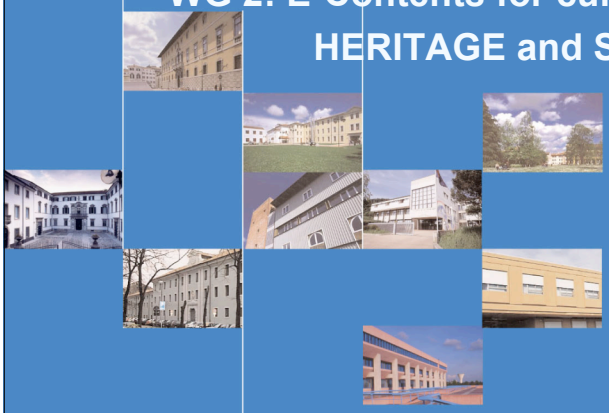
EU-INDIA ECC Programme HYDERABAD 8th- 9th Nov 2004

Università degli studi di Udine ICT for EU-India Cross-Cultural Dissemination

WG 2: E-Contents for cultural dissemination: HERITAGE and SCIENCE



E-Content: some visions, some problems

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The present EU project falls under the umbrella of the joint-laboratory called the

International Virtual Institute for Applicable Mathematics and Information Sciences

B.M.Birla Science Centre Hyderabad – Università di Udine

•Since 2000 a number of joint-research and higher-education initiatives have been carried through the Institute:

- PhD Programme in Informatics
- Master in IT
- Post Graduate Summer Schools in Informatics
- Workshops on Academia-Industry interactions, in collaboration with the AssIndustria Udine and the Italian Embassy
- Joint research in innovative information systems
- EU-INDIA collaboration projects
- Joint Conferences FP6 2004

OUR VISION

Informatics and Applicable Mathematics as a

***Lingua Franca* for cross-disciplinary and cross - cultural dialogues**

OUR VISION

- The task of representing and processing data, information, and knowledge can be viewed as a common denominator to all disciplines , both ancient and modern
- Similarly for the task of posing and solving problems
- Different disciplines can place somewhat different emphasis: e.g. Linguistics, Physics

OUR VISION

- Informatics is such a general science of problem solving and knowledge data processing and has made us aware of these common patterns trasversal throughout all disciplines
- Europe – INDIA share the common privilege of being cultural and artistic superpowers
- Informatics can be the medium for enhancing and cross-fertilizing their mutual collaboration

A PARADIGM EXAMPLE

- Euclid and Pānini
- Iko yan aci
- i,u,r,l, are to be orderly replaced by y,v,r,l, respectively, in continuous speech, when a heterogenous vowel follows
- A=>B(C) Pānini's context dependent rule as a concise sutra

- A bridge between Humanities and Exact Sciences

THE GENERAL PROBLEM

- How should we digitize a given entity, thus turning it into data, so that we can memorize it, preserve it, access it, retrieve it, manipiulate it, experience it, animate it (notice that in these case we turn it into a dynamic, autonomous, digital agent),
- 2 issues
  - Ontological, metaphysical
  - Epistemonological

ONTOLOGICAL ISSUE

- What entities exist?
- What is their extension?

- What processes exist?
- What is their dynamics?

VIRTUAL MUSEUMS AND LABORATORIES

ICT provides excellent opportunities for enhancing museums, archives, guides, catalogues, laboratories

- interactive,
- "hands-on",
- they should provide Problem Solving scenarios
- can/should be customizable, personalizable, internationalized, interconected,

WHICH BENEFITS

- interconnectivity allows for completely new transversals, thus providing the emergence of new perceptions
  - e.g. how the Italian countryside was at the time of the Renaissance form the way various painters portriaited it
- In a 3D virtual scenario we could view, touch, even … break artifacts
- The digital scenario should provide extra experiences
- Great potentials for animation
- New learning experiences and dynamics

EPISTEMOLOGICAL ISSUE

- Are there properties which are sentisitive to coding?
- What is/is not coding invariant? Euclid vs Pānini
  - Geometrical reasoning, reflexivity, "how do we construe space, i.e. access and manipulate it?"
  - Symbol processing
    - linguistic-logical approach
    - algorithmic-procedural

EPISTEMOLOGICAL ISSUE

- Assuming simplistically that anything can be digitised and reduced to a Turing Machine is akin to the Laplacian view of Physics, i.e. that deterministic, feasibly predictable universe
- We have alternative models of computation
- Discrete vs analogical computation

DIGITIZATION, VIRTUALIZATION

- Provides
  - Standardization, common denominator,
  - Interactive, even remotely
  - Customizable, yet open to standards, flexible
  - allows for exchange and possibly automation
- Linguistically, methodologically, conceptually normative
- SERVICES ARE ENHANCED

DIGITIZATION, VIRTUALIZATION

- Criticalities
  - Rapid obsolescence, a need for open standards, avoid short term solutions
  - Data often not homogeneous, also because there are plenty of different artefacts

OUR PROBLEM

- How can we put on the web our
  - The challenges
  - The Programme
  - The deliverables:
  - The impact

INFORMATION COMPUTATION

- **Information:**
  - **How do you measure its quantity?**
  - **How do you measure its value?**
  - **How do you measure its depth?**

- **Computation:**
  - ***Divide et impera* compositionality vs multiscale phenomena**

THE CHALLENGES

- **Human factors have to be accounted both in developing tools and in fostering a community of users**

THE PROGRAMME

- the network
- the action plan
- the logical framework

THE DELIVERABLES

- Material Assets, albeit digital
  - Intelligent Platforms
  - Intelligent Portals
  - Proceedings
- Intangible
  - Community of developers
  - Community of endusers

THE IMPACT

- Synchronize institutions to EU projects for E-contents in digital artifacts
- Interconnetivity among institutions
- Foster and share strategies in promoting digitisation

E-contents activity at the University of Udine

- Various exhibitions
  - Informatics: past, present and future "Numeri e Macchine"
  - Physics: "Giochi, Esperienze, Idee"
- Research Centre for Digital Documentation for Heritage and Cultural Artifacs

INFORMATION

- Question: How do we measure information?
- Answer: using Bits

This is not the whole story:

- How do we measure its value?
- Chaitins-Kolmogorov Algorithmic Information Theory – Ne'eman's comment (Shannon's probabilistic notion)
- Its depth? Bennett's Logical Depth
- Absolute or relative notions, useful

Still this is not the whole story:
WE NEED TO PROCESS IT

COMPUTATIONAL PHYSICS

- The distinction between
  - prosthesis, a telescope
  - neosthesis, the computer

Simluate – compute – study virtual reality

But I feel that Computer Science, like Mathematics, besides being a tool is also language, methodology

COMPUTATIONAL PERSPECTIVE

- What we are left with in chess, bridge, etc. when there is no chessboard, no deck anymore.
- The computation residuum in ritual, dance, railway manoeuvres, nursery rhimes, juggling
- how should you go about in getting rid of the largest number of coins in buying your coffee cup?
- Pānini vs Euclid

COMPUTATIONAL PERSPECTIVE

- Computation is the cartesian art of (methodology for) problem solving with software tools.
  - problems, tasks, expectations

    vs
- solutions, procedures, methods, programs, fulfillments
- What is a Black Hole computing? Itself. Everything is a computer -
- 't Hooft's perspective

SOFTWARE PROBLEM SOLVING

- We decompose problems into subproblems until we can solve them with *ad hoc* methods, then we recompose intermediate solutions until we find the global solution to the given task.

- Ex. The "20 questions" problem.

COMPUTATIONAL PERSPECTIVE

- It offers a new conceptual framework for interpreting the world autonomous and irreducibile to those offered by other disciplinines
  - the algorithmic, procedural approach
  - the linguistic, semantical approach

    isolating and relating abstraction levels and compositionality

  Modelling paradigms are generally monolithic
- Quantum Computing

COMPUTATIONAL PARADIGMS

- *divide et impera*
- What's the use of the position notation?
- Exponential vs logarithmic growth

- How do we interpret sentences, data structures, how do we reason about them

CAVEATS

- The linguistic turn vs the geometric turn
- Computation has capitalized on coding (the essence of digital technology) but there are coding sensitive notions, adequacy
- A strength and a weakness: software and hardware are too far apart
- Turing Machines entail Laplacian determinism
- Predictability vs decidability
- Concurrency and universal time

ISSUES

- Is Computer Science a Natural (Experimental) Science
- top down (big science) or bottom up scientific paradigms
- Need for NEW paradigms
- Sheer complexity of systems in global (distributed + concurrent) computing
- Legacy software, fine tuning: autonomic computing

ISSUES

- Information processing in physics, biology, cognition, philology
- Imitation game: initial conditions
- Compositionality vs Multiscale
- Computational and information content in morphological changes in breaking of symmetries
- Has Maxwell's Paradox been completely solved?
- Concurrency and global time

ISSUES

- Physicists are utilizing more and more concepts related to information processing (computation)
- they should not passively absorb the current Von Neumann's approach, which stems from Eighteen Century Physics,
- But boldly address computation as a fundamental physical process with the Twentieth's Century mentality

INFORMATION SCIENCES AT UDINE UNIVERSITY

- COMPUTATIONAL PHYSICS
- INFORMATICS
- WEB AND MULTIMEDIA TECHNOLOGIES
- INFORMATION TECHNOLOGIES
- PEDAGOGY AND DYDACTICS OF INFORMATICS THROUGH PROBLEM SOLVING