



Università degli studi di Udine

EU-INDIA ECC Programme
HYDERABAD 8th- 11th Nov 2004
1st Working Conference



ICT for EU-India Cross-Cultural Dissemination
1st Working Conference
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The present EU project is carried out 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
- Elements and Astadhyayi
- Iko yan aci
- i,u, ṛ, ḷ 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 Europe and India but also Humanities and Exact Sciences

THE PROJECT

- improve connectivity and accessibility, in a logical not technological sense, between southern India and southern Europe
- Broaden research collaborations in the ICT sector

- Establish cross-cultural communities of users and developers of a digital platform generator for
- Digital museums, virtual laboratories, Technology Transfer Management Systems, Internship Management Systems for enhancing Industry-Academia relations

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, manipulate it, experience it, animate it** (notice that in these case we turn it into a dynamic, autonomous, digital agent),
- 2 issues
 - **Ontological, metaphysical**
 - **Epistemological**

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, interconnected,**

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 from 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 sensitive 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**
- **Interconnectivity 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 Artifacts

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

Simulate – 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 rhymes, 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 **irreducible** to those offered by other disciplines
 - 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**