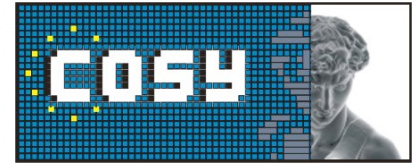# Cognitive Systems for Cognitive Assistants
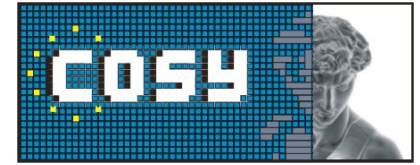
Henrik I Christensen

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Outline

- Objectives
- The consortium
- Approach to research
- Workpackages
- Scenario based research
- Summary

Objectives / The Issues

- Study of methods for (computational) cognitive systems

- The "science of the mind"

- An integrated approach to study of systems in terms of

  - Perception, perception-action, world models, learning and human-agent interaction, planning, reasoning, architecture,...

- Demonstrated in context of systems/scenarios

  - Explorer, PlayMate & Philosopher

Consortium
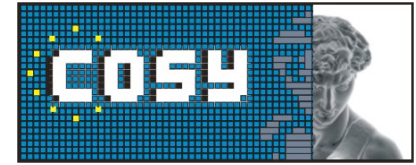
|	
KTH	Christensen
Birmingham	Wyatt/Sloman
CNRS	O'Regan
TU Darmstadt	Schiele
DFKI	Uszkoreit/Kruijff
ALU/Freiburg	Nebel/Burgard
Ljubljana	Leonardis

Challenges to be addressed

- Perception-Action Integration

- Self Understanding

- Flexible Planning and Recovery

- Flexible Interfaces

- Knowledge Generation

- Dealing with Novelty

- Introspection of Knowledge and Actions
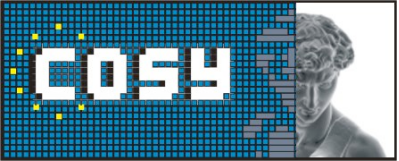
Context

- Challenges will be addressed in the context of embodied systems for everyday interaction with people in everyday settings
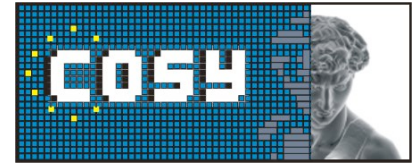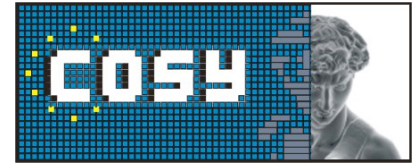
Objectives refined

- Two Types of Objectives
  - Theory and Implementation/Empirical
- Theory Objectives
  - Architecture, Perception & Action, Communication, Deliberation, Reflective, Affective/Motivational
- Implementation Objectives
  - Integration into Systems, Nature vs. Nurture

Scenario Based Research

- Three types of systems
  - Explorer – acquisition and reasoning about space and self-image
  - PlayMate – Manipulation and active changes to the world and its implications on system/ replication of structures
  - Philosopher – Reflection and introspection on actions and representations
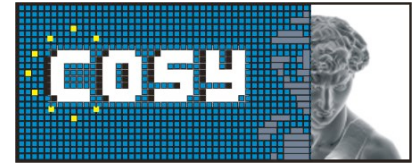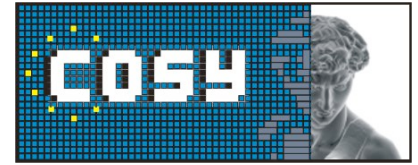
Architectures

- The integration of reactive, deliberative and reflexive processes across control, reasoning and communication

- Few real attempts across "camps"

- A need for consideration of the highly asynchronous nature of the process and the need to integrate across disciplines

- Integration of self-observation/introspection

Information Society
Technologies
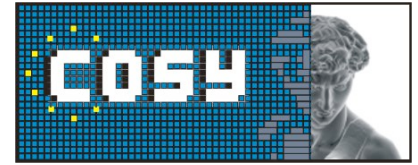
Representations

- Types and roles of representation
- The relation between language and representations
- Integration across space, action, self while also integrating uncertainty and allowing deliberation/communication
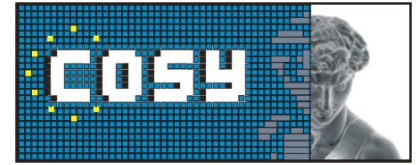
Learning

- Learning is multi-facetted
  - life-long, open-ended, incremental
- The roles of learning at different stages
  - Tutor driven vs exploratory learning
- Maintaining consistency across (and within) representations
- How can learning be distributed across the system?

Perception-Action Modelling
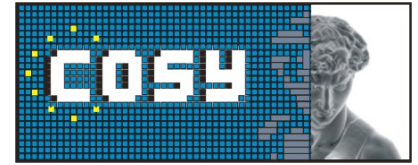
- Self-insertion and sensory perception
- Control -> Deliberation/reflection
- Design of "control-laws" for behaviour generation in the context of cognition
- Ex: how does one recognise affordances

Planning and Action Monitoring

- Robot will exist in dynamic environment
- Re-planning will be required
- What is the planning paradigm to do this across tasks and "failures"
- Close coupling between planning/ replanning and architecture

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Collaborative Planning and Acting
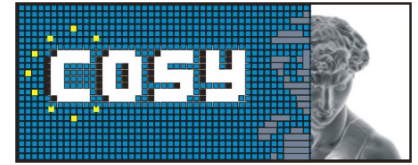
- Communication is a key to any cognitive system

- Communication >> language

- Integration of body, speech, and motion/context

- Co-operation poses interesting new challenges to interaction
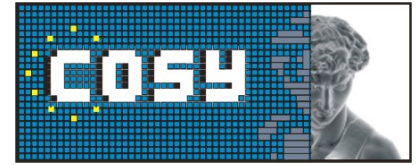
Language, Meaning and Social Interaction
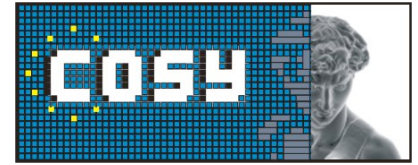
- A la the symbol grounding problem
- The balance between innate and acquired
  - The nature vs nurture issue
- Bootstrapping of ontologies?
- The social context for learning and how it mediates/slows the process.

Accompanying activities
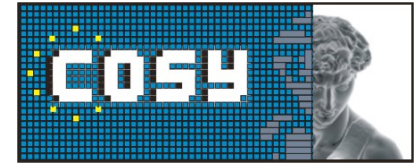
- Tutorials/Workshops on cognitive system
  - Or aspects of cognitive systems
  - First summer 2005: Representation/Learning
- Annual summer school on topics of relevance to CoSy
  - Our primary criteria will be excellence
  - First Version Spring 2005 – "CoSy Light"
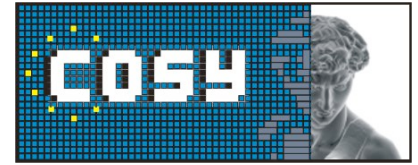- Other dissemination: "such as this event"

Milestones

- Months 18, 36 & 48
- "Using intermodality and affordances for the acquisition of concepts, categories and language"
- "Introspection of models & representations; planning for autonomy – goal seeking"
- "Social interaction and Long-term adaptation"

Summary
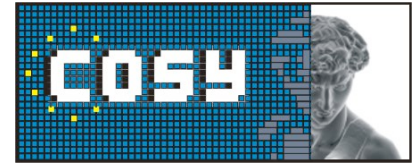
- Long-term research effort on the fundamentals of cognitive systems

- Integrated into scenario based research

- The objective is science rather than engineering systems

- We are committed to open source for our development

Open Issues

- Considering the inclusion of a new group from developmental psychology. Preferably from a "strong" psychology department. Call to be advertised early Spring 2005.