

Cognitive Systems and Robotics

*FP7 ICT-NCP meeting on ICT Call 6
20 October 2009*

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<http://www.cognitivesystems.eu>



Challenge 2 : Cognitive Systems, Interaction, Robotics

© Objective 2.1:

Cognitive Systems and Robotics

© creating *artificial systems* which are

© more *robust*

© more *adaptive*

© more *effective*

© more *natural, cooperative, etc*

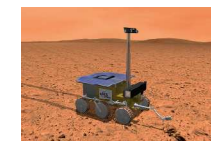
in dealing with *unconstrained, real world* situations

Where are we going with cognitive systems?

- ⊙ Where does the field start and stop?
 - ⊙ Interdisciplinary
 - ⊙ Cognition/bio-inspired/computers science/robotics streams
- ⊙ What kind of research: basic vs. applied research?
 - ⊙ New theories needed
 - ⊙ New cognitive architectures
 - ⊙ Working prototypes
- ⊙ How can the goals be reached?
 - ⊙ Bio-inspiration
 - ⊙ Machine learning
 - ⊙ Radical new forms of (intelligent) control?
 - ⊙ New math tools
 - ⊙

What about robotics?

- ⊙ **Industrial robotics** moving away from classic “heavy” automotive sector towards handling operations in lighter industries
- ⊙ **Service robotics** also represents new products and applications:
 - ⊙ 63,000 service robots for professional use installed up to end 2008
 - ⊙ approx 4.4 million domestic service robots & 2.8 million entertainment and leisure robots up to end 2009
- ⊙ **Forecast 2009 - 2012**
 - ⊙ 49,000 more service robots for professional use
 - ⊙ 11.6 million more service robots for private use



and Media

Europe
Inform



Future Vision: EUROP - European Technology Platform for Robotics

Strategic Research Agenda (SRA)

- © RTD **strategy** document developed by EUROP members in the CARE project (FP6)
- © **Industry-driven**, based on extensive analysis of market development and future opportunities
- © **Commitment** of all European stakeholders
- © Short-term (2010), mid-term (2015) and long-term (2020) vision
- © **Public release** in Brussels on July 7 2009

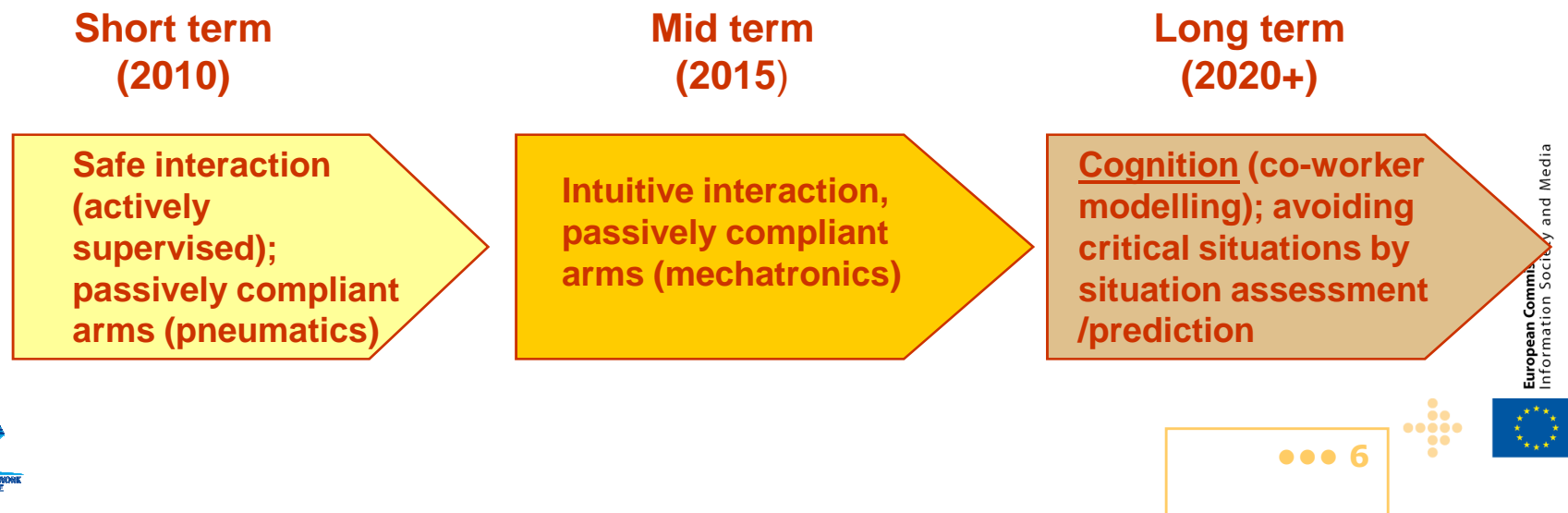
<http://www.robotics-platform.eu/>

SRA Extract of “Product Visions”

Robot Assistant in Industrial Environment

⊙ Robot Assistant in Industrial Environments

- ⊙ Direct interaction with the worker
- ⊙ Shared workspace without security fences
- ⊙ ...
- ⊙ The developments of the product vision over time are:



ICT Call 6 - Call for proposals in Cognitive Systems & Robotics

CALL OBJECTIVE: **2.1 Cognitive Systems and Robotics**
CALL: **ICT-Call 6**
PUBLICATION: **November 2009 (TBA)**
DEADLINE: **April 2010**

BUDGET: **80 M€**

- IPs / STREPs: 78 M €
(min 50% IPs , 30% STREPs)
- CA: 2 M €

ICT Call 6 - Call for proposals in Cognitive Systems & Robotics

STREPs:

- © New approaches towards **artificial cognitive systems (STREP)**
min 23.4 M € - max 39 M €

IPs:

- © New **complete robotic systems (IP)**
- © **Cross-fertilization between academic and industrial** research efforts in **robotics (IP)**
min 39 M € - max 54.6 M €

CAs:

- © Fostering an **artificial cognitive systems** research community in Europe **(CA)**
max 2 M €

ICT Call 6 - Target Outcomes

	Specific target	Project type	Call
(a)	New approaches towards understanding and solving key issues related to the engineering of artificial cognitive systems.	STREP	6
(b)	ROBOTICS: New approaches towards endowing robots with advanced <u>perception and action capabilities</u> , and towards developing pertinent benchmarks and tests.	STREP	4
(c)	New ways of designing and implementing complete robotic systems.	IP	6
(d)	COGNITIVE SYSTEMS: New, scientifically grounded <u>system architectures</u> integrating communication, control, and cognitive capabilities.	IP	4
(e)	A framework to facilitate cross-fertilisation between academic and industrial research efforts in robotics.	IP	6
(f)	COGNITION NETWORK: A ' <u>Virtual Institute</u> ' integrating diverse research areas that contribute to understanding cognitive systems and designing useful new ones.	NoE	4
(g)	ROBOTICS INFO EXCHANGES: Co-ordinated co-operation and communication within a <u>multidisciplinary robotics community</u> in Europe.	CA	4
(h)	Co-ordinated co-operation and communication within a multidisciplinary artificial cognitive systems research community in Europe.	CA	6



ICT Call 6

Research Challenges - Target “A” - STReP

A) New approaches towards understanding and solving key issues related to the engineering of artificial cognitive systems; among these issues are the following:

- ⊙ Object and scene understanding: representation / categorization / recognition / interpretation of objects, events, situations, behaviours and affordances in realistically scaled real-world environments;
- ⊙ the role and implementation of memory and learning in artificial systems;
- ⊙ adaptive and anticipatory behaviour within incompletely specified environments;
- ⊙ goal-setting and strategies for achieving goals;
- ⊙ collective behaviour arising from the interplay of (possibly large numbers of) individual subsystems;
- ⊙ modelling and design of (multimodal) interaction, communication and collaboration.

Projects are expected to demonstrate measurable progress on a suitable mix of these issues.



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Research Challenges - Target “C” - IP

C) New ways of designing and implementing complete robotic systems:

- ⊙ That operate largely autonomously in loosely structured dynamic environments and, where necessary, in close co-operation with people.
- ⊙ That may be distributed and should integrate:
 - ⊙ rich sensory-motor skills (for example, grasping, manipulation, locomotion)
 - ⊙ with high level cognitive competencies (for example, reasoning, planning and decision-making).
- ⊙ As appropriate, they should be demonstrably more robust, dependable, flexible and adaptive, and safer than it is possible today, and improve their performance through learning.



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Research Challenges - Target “E” - IP

A framework to facilitate cross-fertilisation between academic and industrial research efforts in robotics

- ⊙ through widespread experimentation with industry-strength platforms in academic research labs and
- ⊙ through the joint definition of longer term scenarios and requirements to direct robotics research towards common goals;
- ⊙ **to assure a comparative assessment of performance**
 - ⊙ through definition of suitable metrics and through
 - ⊙ benchmarking (supported by competitions or otherwise).

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Research Challenges - Target “H” - CA

Co-ordinated co-operation and communication within a multidisciplinary artificial cognitive systems research community in Europe, with concomitant outreach to potential industrial applications.

- ⊙ help create stronger cohesion among relevant communities;
- ⊙ build awareness among wider (including non-professional) audiences of the potential of the technologies at issue
- ⊙ May also touch on ethical, socio-economic issues related to the design, deployment and operation of cognitive systems

With emphasis on practical actions such as:

- ⊙ workshops, conferences, courses,
- ⊙ training (summer schools, tutorials...)
- ⊙ networking within the research community and between the projects
- ⊙ online resources
- ⊙ and much more ...



ICT Call 6 - Typical research questions

Some of the research questions proposals should think about:

- ⊙ How pro-active or autonomous can / should a robot be?
- ⊙ Can we categorise real world behaviour unambiguously through sensors?
- ⊙ How can a robot recognise and deal with critical safety problems?
- ⊙ How can we endow robots with high - level cognitive skills?
- ⊙ How can we make sense of raw data streams in environments not known to the sensors / robots?



ICT Call 6 - Some tips...

DO

- ⊙ Target the key goal of the Call & the “Target Outcomes”
- ⊙ Make clear WHAT you want to do (your concrete goal), the specific reasons WHY (your own motivation) & HOW (your methodology)
- ⊙ Make clear the added value compared with the state of the art
- ⊙ Make clear how you will measure progress of your work
- ⊙ Match the resources and management to the proposal
 - ⊙ Tip: cite references of key personnel
- ⊙ Explain the expected impact (with ref to the Workprogramme):
 - ⊙ Science and technology research and / or
 - ⊙ markets / applications / industry / engineering

DON'T

- ⊙ Add partners just for the sake of it
- ⊙ Assume IPs have always to be very big or STRePs very small
- ⊙ Just repeat the Workprogramme text



ECHORD - European Clearing House for Open Robotics Development

- ◎ Recently started Integrated Project (TU Munich, University of Naples, University of Coimbra)
 - ◎ large-scale introduction of **robotic equipment** into research institutions
 - ◎ **technology transfer** between academia and industry through the solicitation of focused, small-size scientific research **experiments**
 - ◎ three **scenarios**: human-robot co-worker, hyper-flexible cells, cognitive factory
 - ◎ Five **research foci** within scenarios: human-robot interfacing and safety, robot hands and complex manipulation, mobile manipulators and cooperation, networked robots

ECHORD - Provision of Robotic Equipment

Robotic equipment for experiments:

- ⦿ The first list of equipment with special prices was set up during the summer, it is not exclusive and will be updated periodically
- ⦿ **25 European companies** already contributed to the list, among them all big players in the European robotics industry (ABB, KUKA, Comau, Güdel, Schunk, Adept, etc.)
- ⦿ Research institutions can select equipment from list, experiment with it and develop it further → **knowledge transfer** between academia and industry

ECHORD - Calls for Experiment Proposals I

- ◎ **Three Calls** for Experiment Proposals during runtime of ECHORD, each addressing one of the three scenarios
- ◎ Goal is to fund about **50 experiments overall**; each experiment to last btw. 12-18 months with an average funding of €300.000
- ◎ **First Call** for Experiment Proposal published on 5th October, **open until 1st December:**
 - ◎ Focus on scenario 1: Human-robot co-worker
 - ◎ Indicative budget for Call: €4.5 million
 - ◎ Possibility to submit pre-proposals for a first check
 - ◎ Experiments to start in early 2010

More information and full Call text incl. guide for applicants on www.echord.info





THANK YOU!



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