

# ***Cognitive Systems and Robotics***

*FP7 ICT-NCP meeting on ICT Call 6  
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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*

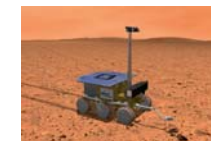
in dealing with *unconstrained, real world* situations

# *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  
Infor



# *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 cf "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:

**Short term  
(2010)**

**Safe interaction  
(actively supervised);  
passively compliant  
arms (pneumatics)**

**Mid term  
(2015)**

**Intuitive interaction,  
passively compliant  
arms (mechatronics)**

**Long term  
(2020+)**

**Cognition (co-worker  
modelling); avoiding  
critical situations by  
situation assessment  
/prediction**

European Commission  
Information Society and Media



# *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)	<b>New approaches towards understanding and solving key issues related to the engineering of artificial cognitive systems.</b>	<b>STREP</b>	<b>6</b>
(b)	ROBOTICS: New approaches towards endowing <u>robots</u> with advanced <u>perception and action capabilities</u> , and towards developing pertinent benchmarks and tests.	STREP	4
(c)	<b>New ways of designing and implementing complete robotic systems.</b>	<b>IP</b>	<b>6</b>
(d)	COGNITIVE SYSTEMS: New, scientifically grounded <u>system architectures</u> integrating communication, control, and cognitive capabilities.	IP	4
(e)	<b>A framework to facilitate cross-fertilisation between academic and industrial research efforts in robotics.</b>	<b>IP</b>	<b>6</b>
(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)	<b>Co-ordinated co-operation and communication within a multidisciplinary artificial cognitive systems research community in Europe.</b>	<b>CA</b>	<b>6</b>



# 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.



## FP7 - ICT Call 6

### 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.

## *FP7 - ICT Call 6*

### *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).

## *FP7 - ICT Call 6*

# *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 5<sup>th</sup> October, **open until 1<sup>st</sup> 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](http://www.echord.info)**





**THANK YOU!**

