2014 IEEE International Conference on Robotics and Automation (ICRA 2014)

May 31 - June 7, 2014 Hong Kong, China

ECHORD++ Experiments

Paolo Dario

The BioRobotics Institute
Scuola Superiore Sant'Anna
Pisa, Italy

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Bristol Robotics Laboratory

BLUE OCEAN ROBOTICS

SEVENTH FRAMEWORK PROGRAMME

2014 IEEE International Conference on Robotics and Automation (ICRA 2014)

May 31 - June 7, 2014 Hong Kong, China

Welcome to ICRA 2014

The conference theme is **"Robotics and Automation: Technologies Enabling New Economic Growth"** reflecting the growing spectrum and recent developments in robotics and automation around the world.

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Bristol Robotics Laboratory

BLUE OCEAN ROBOTICS

SEVENTH FRAMEWORK PROGRAMME

The original idea of ECHORD

ECHORD | European Clearing House for Open Robotics Development

*"ECHORD was born with the **aim** to significantly **advance technological know-how** and to **pursue progress and innovation** in joint technology and application development **in European robotics**.*

*The main instrument for achieving this goal was the setting up the **framework for European research institutions and robot manufacturers to cooperate in experiments** that have a specific ,concrete focus and that use state-of-the-art equipment provided by the manufacturers".*

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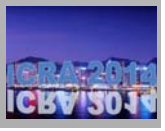
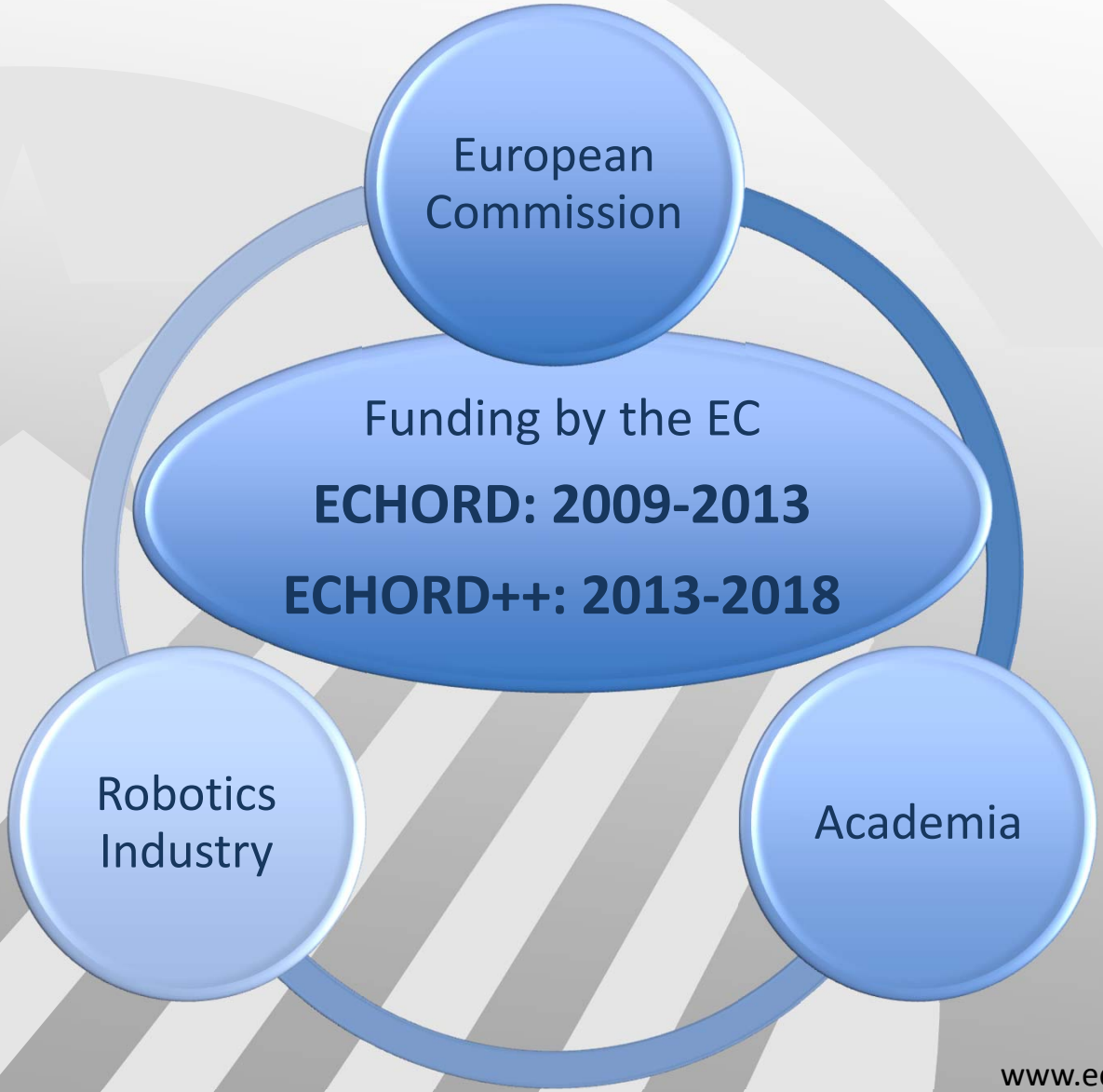


The ECHORD-Projects



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SSSA participation in ECHORD

ECHORD (2008-2013)
was installed as an incubator to **promote innovation** by facilitating the **cooperation between academia and industry**.

ASTROMOBILE- Assistive SmarT RObotic platform for indoor environments: MOBILity and intEraction
SSSA's role: **Coordinator**

HUROBIN - Human-Robot Object Interaction

SSSA's role: **Coordinator**

SprayBot
a Robotic Spray Booth for the Automatic Painting of Bodyworks

SSSA's role: Experiment's **Partner**

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di Studi Universitari e di Perfezionamento

Funding for each experiment: about **300k€**

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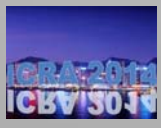

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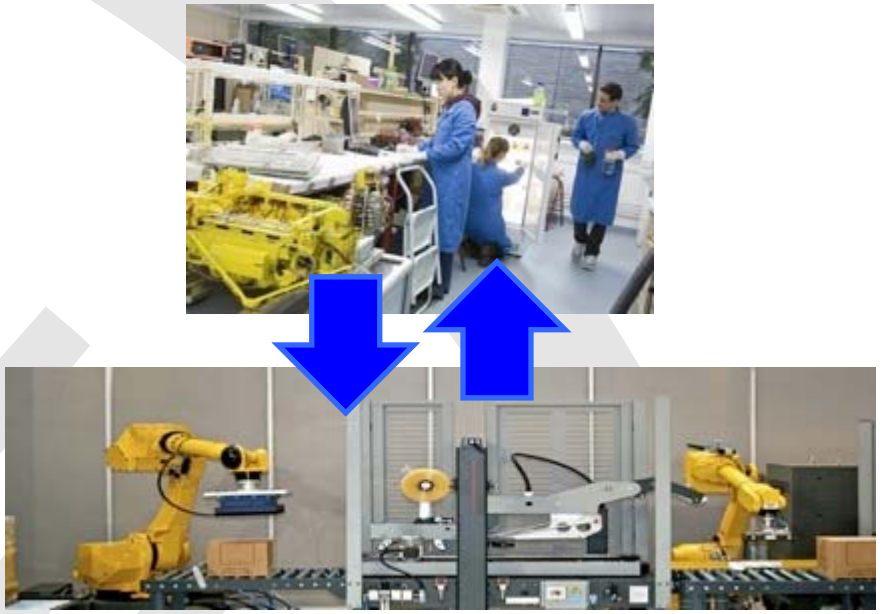
ECHORD++ (2013-2018) will further **stimulate** this **interaction** between **robot manufacturers, researchers and users**



HOW?

By **Service Robots** that will be tested in realistic environments and pushed directly into the **Market**

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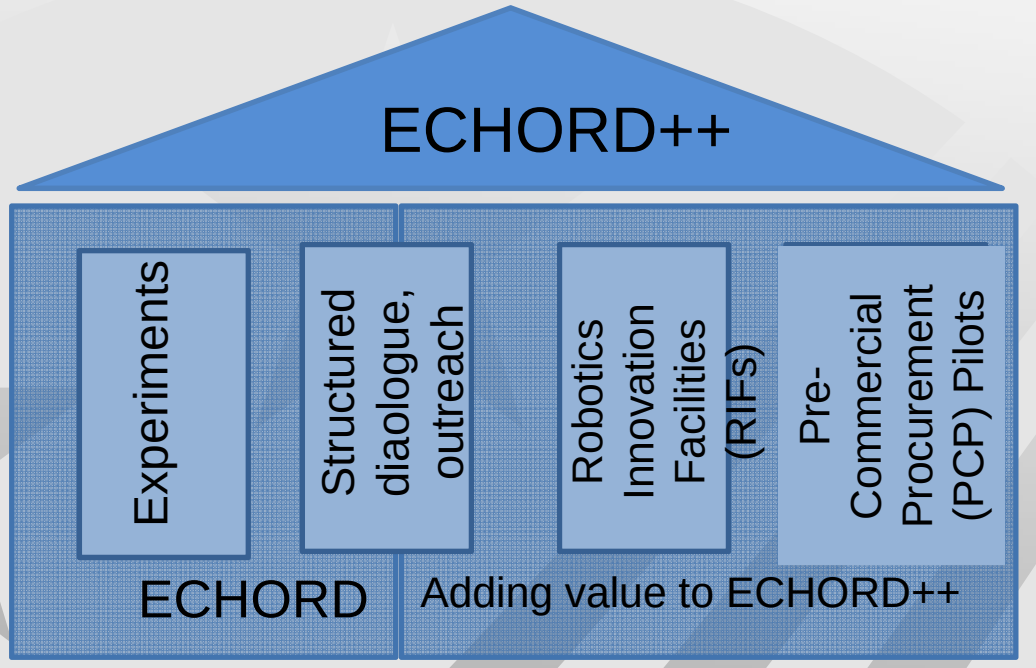
ECHORD++: new Instruments

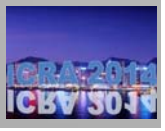


ECHORD++'s aim is to help **robotics community** to **work** together very closely on an **operational level**

Experiments

Robotics Innovation Facilities (RIF)

Pre-Commercial Procurement Pilots (PCP Pilots)



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Main Instruments

Experiments

Robotics Innovation Facilities (RIF)

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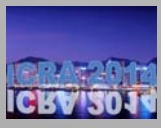

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WHAT IS AN EXPERIMENT?

A small to medium sized **scientific research and/or technology development** project with a clear focus on generation of impact

What is the size of an experiment?

- Funding ~**300k€**
- Duration up to **18 months**
- Small consortia, typically **2-3 partners**, no need for different countries

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HOW MANY CALLS WILL BE IN ECHORD++?

Two Calls

One in **Spring 2014** (ended on the 14th of April 2014), one **Mid-2015**

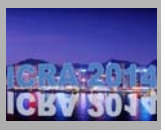
WHAT ARE THE **NEXT STEPS** OF THE FIRST EXPERIMENT CALL?

14th April 2014, 17:00 Brussels time: deadline for proposal submission

July 2014: Information about the outcome and start of the access procedure for new partners to the ECHORD++ consortium

October 2014: Formal submission of amendment documents

January 2015: start of experiments



ELIGIBILITY CRITERIA: WHO CAN APPLY FOR EXPERIMENTS

Any legal entity eligible for EU funding can apply for Experiments, **both** players from the **robotic industry** and **research institutions**.

Applications from non-EU Countries

Applicants from non-EU countries fall into **2 categories**:
1) those **automatically eligible** for funding
2) those **not automatically eligible** for funding (though they may still be funded in exceptional cases)

1) **Automatically eligible non-EU applicants.**
Applicants based in any of the countries listed here are automatically eligible for funding under the Horizon 2020 budget:
Afghanistan, Albania, Algeria, American Samoa, Angola, Argentina, Armenia, Azerbaijan Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Burkina Faso, Burundi

Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, Colombia, Comoros, Congo (Democratic Republic), Congo (Republic), Costa Rica, Côte d'Ivoire, Cuba Djibouti, Dominica, Dominican Republic
Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji

Applications from non-EU Countries

Gabon, Gambia, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana
Haiti, Honduras
Indonesia, Iran, Iraq
Jamaica, Jordan
Kazakhstan, Kenya, Kiribati, Korea (Democratic Republic), Kosovo, Kyrgyz Republic
Lao, Lebanon, Lesotho, Liberia, Libya
Macedonia FYR, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Mauritania, Mauritius, Micronesia, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar/Burma
Namibia, Nepal, Nicaragua, Niger, Nigeria
Pakistan, Palau, Palestine, Panama, Papua New Guinea, Paraguay, Peru, Philippines
Rwanda
Samoa, Sao Tome and Principe, Senegal, Serbia, Seychelles, Sierra Leone, Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Syrian Arab Republic
Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Tunisia, Turkey, Turkmenistan, Tuvalu
Uganda, Ukraine, Uruguay, Uzbekistan
Vanuatu, Venezuela, Vietnam
Yemen
Zambia, Zimbabwe.

Applications from non-EU Countries

2) **Non-EU applicants that are NOT automatically eligible**.
Applicants from other non-EU countries **may be granted funding** if:
- Funding is provided for in a **bilateral scientific/technological agreement** or similar arrangement between the EU and the country where the applicant is based.
- The **call for proposals** clearly states that applicants based in such countries are eligible for funding.
- Their participation is deemed **essential for carrying out the action** by the Commission or the relevant funding body because it provides:
  - outstanding competence/expertise
  - access to research infrastructure
  - access to particular geographical environments
  - access to data.

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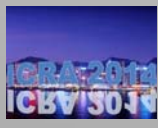
HOW ARE THE EXPERIMENTS MONITORED?

Monitoring procedure similar to the one in ECHORD

- Regular (2-monthly) blog entries on the E++ website with self-assessment of the status and discussion with a monitoring moderator (ECHORD++ staff)
- Optional mid-term review by independent experts
- Mandatory final review by independent experts



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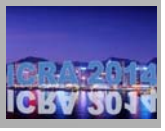
WHAT IS EXPECTED FROM AN E++'s EXPERIMENT?

- Production of **multi-media** material, i.e. Images, videos, etc.
- At least one **multimedia-report** for a public audience
- **Exploitation strategy,** already in the proposal
- **Dissemination** of project results through appropriate channels, e.g.
  - **Presence at a fair** (E++ with organise joint booths)
  - Presentation at suitable **workshops, conferences, industrial forums**, etc.
  - **Interaction with RIFs**



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WHAT ARE THE EVALUATION CRITERIA?

Scientific and/or technological excellence

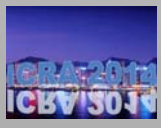
- Objective
- Advances targeted (e.g. in terms of TRL)
- Progress beyond State-Of-The-Art

Efficiency of Implementation

- Structure
- Description of partnership
- Overall Experiment resource- costs & funding ("value for money")

Expected Impact

- Expected results
- Exploitation plan
- Expected impact on the market created by the experiment when successful
- Realistic outcome (to be proven with a visit to a RIF or another kind of demonstration)



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Types of EXPERIMENTS

Joint enabling technology development

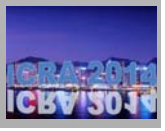
Develop new robots, components, etc. based on the bi-directional exchange of knowledge and on the industrial quality equipment provided by robot manufacturers.

Application development and implementation of use cases

Robot equipment from the robot manufacturer, together with components from third parties, combined to perform tasks in new applications.

Feasibility demonstration

Demonstrating that robots can be used in new complex industrial settings.



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SCENARIOS

1. Cognitive Tools and Workers for Cognitive Factories
2. General Purpose Robotic Co-workers
3. Cognitive Logistics Robots for Industry
4. Medical Robotics
5. Agricultural and Food Robotics

6. Urban Robotics*

*available in the 2nd Call

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SCENARIO 1

Cognitive Tools and Workers for Cognitive Factories

- Factory composed of a **multitude of cognitive robotic workers**, able to **self-adapt** to **changing working conditions**.
- **Factory as a whole fault-tolerant and robust system**.
- **Cognitive tools** and **robot workers** able to work on a **diversity of tasks** in **structured environments**, such as cognitive factories, labs, warehouses, landfill.

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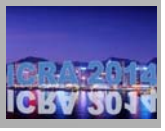
SCENARIO 1

General Purpose Robotic Co-workers

- **Humans and robots** share a **common workspace**, instruct and assist each other
- Make use of the **specific skills** of either the robot or the human.
- General purpose - **not restricted** in its application to a specific set of tasks.
- **Learning and explaining** actions and plans



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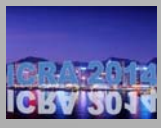
SCENARIO 3

Cognitive Logistics Robots for Industry

- **Transportation** of loads and people, material flow and …
- **"Handling"** inside the respective environment.
- Develop a **fully robotic environment**
- Provide a **service** for people
- **Simplify** the execution of specific tasks.



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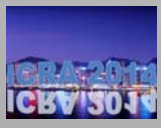
SCENARIO 4

Medical Robotics

- Successful introduction of **robust cognitive** technologies and **human-robot interfacing**
- Better **augmented vision systems**
- More **support for the surgeon**
- Increased **dexterity**



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SCENARIO 5

Agricultural and Food Robotics

- Improve **farming efficiency** and **food security** – from "farm to fork".
- Development of **agricultural robots** for **precision farming**
- Not restricted to farming – **automatization** of the entire process from the raw product to the finished one

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RESEARCH FOCI

1. Key Issues in Practical Machine Cognition
2. Advanced Perception and Action Capabilities
3. Multiple Cooperating Mobile Manipulators
4. System Architectures, Systems and Software Engineering Processes and Tools

They **subdivide** the **potential research work** contained in a scenario into **sensible work units** related to **today's state of the art.**

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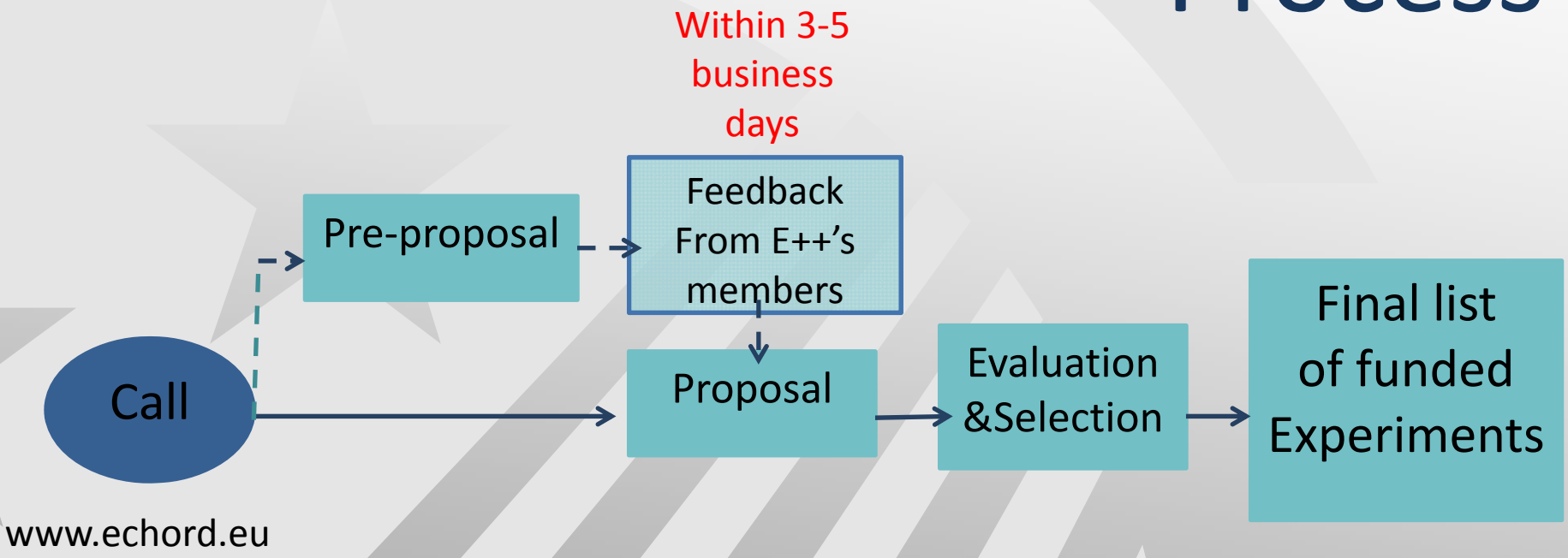
Application Process



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Summer 2015: *2° Call for Experiments*

Fall 2015: Outcome of the Call and Start of the accession procedure for new partners to the ECHORD++ consortium

Beginning of 2016: Formal submission of amendment documents

Spring 2016: start of experiments

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Main Instruments

Experiments

Robotics Innovation Facilities (RIF)

Pre-Commercial Procurement Pilots (PCP Pilots)

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Robotics Innovation Facilities (RIF)

RIFs are facilities for bringing **researchers and industry** in **direct contact** with current and new **users of robotics technology.**

RIFs will attract new user groups and help to build an **innovation technology**.

WHO ARE THE USERS?

The user groups we envisage are as follows:

- **E++ Experimenters**
- **External** Users such as:
  - ✓ *SMEs and start-ups*
  - ✓ *Students*
  - ✓ *New user groups*

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Robotics Innovation Facilities (RIF)

The purpose of the RIFs is hence:

- To be a **living lab**
- To serve as a **test-beds** for E++ experiments
- To be **central and sustainable showrooms** for the general public

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RIF France: Medical & Health Robotics

In Paris at CEA
(Commission for Atomic Energy and Alternative Energies)
Institute for Smart Digital Systems

Target Users:

- **SMEs in medical engineering** interested in robotics technology, is control and the interface with operators (doctors)
- **Researchers** with an idea related to medical technology who need a test bed
- **Students** of medicine, psychology, biology
- Health care institutions and user associations

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RIF in GB: Cognitive Workers

In Bristol at the Bristol Robotics Lab (BRL)

Bristol Robotics Laboratory's RIF will provide access to equipment and expertise to assist with:

- **Estimating and analysing market size** for new products, services or a processes
- **Design** of novel end-effectors and sensors
- **Proof of concept demonstrations** in novel robot application areas
- **Integration** of robotic systems in manufacturing, health, training, entertainment etc.
- **Human/machine interface and robot programing**

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RIF in ITALY: Indoor & Outdoor, Logistic, Agricultural, Medical Robotics

In Italy at BioRobotics Institute in Peccioli

Target users:

- **Robot manufacturing SMEs and companies** (service robots: autonomous cars, edutainment robots, assistive robots, components)
- **Robotics researchers**
- **Sociology researchers**
- **Service providers** (health care, waste management, museum management, public transportation).

Services:

- **Acceptability** and **dependability** assessment/benchmarking

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Main Instruments

Experiments

Robotics Innovation Facilities (RIF)

How to link Experiments to RIFs?

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EXPERIMENTS & RIFs

Experiments

Robotics Innovation Facilities (RIF)

A visit to one or more of E++ RIFs **increases** the **Expected Impact** of the project

The RIF is an instrument to test the **realistic outcome** of the robotic solution

Each RIF addresses **different Experiment scenarios**:

Research Scenarios	RIF
1.Cognitive Tools and Workers for Cognitive Factories	Bristol (UK), Pisa (IT), Paris (FR)
2.General Purpose Robotic Co-Workers	Bristol (UK), Pisa (IT), Paris (FR)
3.Cognitive Logistics Robots for Industry	Bristol (UK), Pisa (IT)
4.Medical Robotics	Paris (FR), Pisa (IT)
5.Agricultural and Food Robotics	Pisa (IT)

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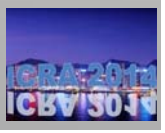
EXPERIMENTS & RIFs

Experiments

Robotics Innovation Facilities (RIF)

Why experimenters should use a RIF:

- Possibility to have **ready-to-use realistic test bed**, anytime you want → minimize deviations and errors
- **Cost saving:** take advantage of a tested technological location, do not waste time and money in developing your own → **invest money in the project and travels/accomodations to RIFs**
- **Technology transfer/knowledge sharing** → straightforward access to robotics equipment and experts to support bootstrapping and to cater for knowledge exchange for everyone and anyone who is interested in robotics – no matter how "unexposed" to robotics they have been before.
- **Specific technology-oriented programs** for spin-offs/SMEs



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1st Call for Experiments: ***PRELIMINARY RESULTS***

Experiments

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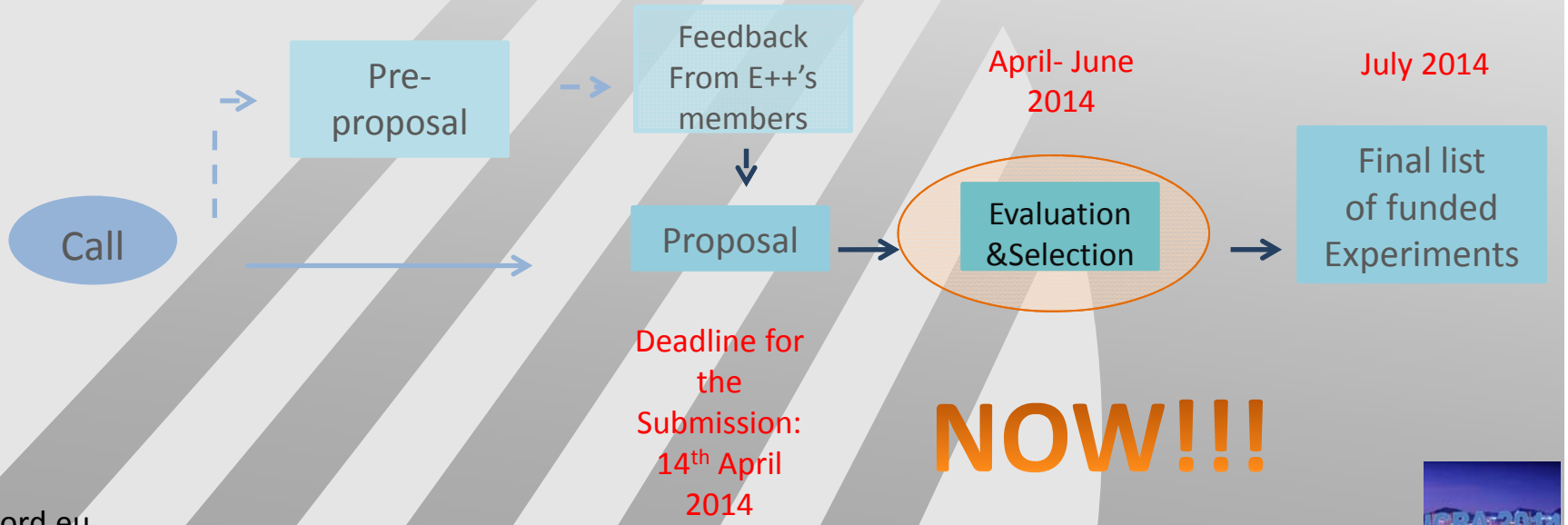
1st Call for Experiments: ***PRELIMINARY RESULTS***

Status of the 1° Call



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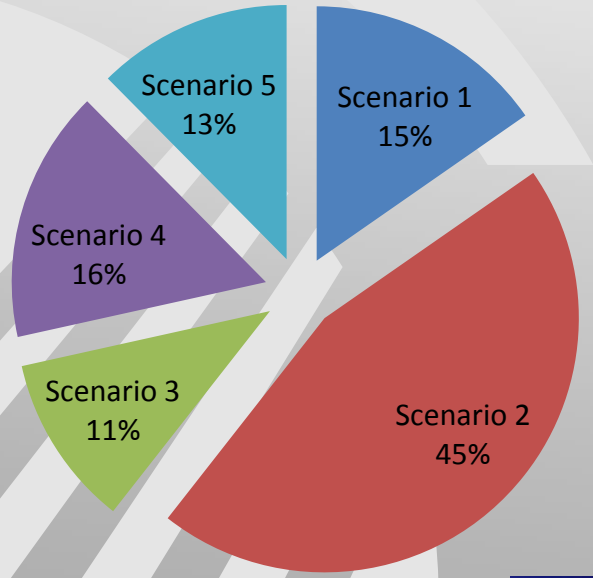
Preliminary Results of E++ First Call for Experiment

- 150 Eligible Proposals submitted, of which the percentage per Scenario is:

Distribution of the 1st Call- Proposal submitted

1. Cognitive Tools and Workers for Cognitive Factories
2. General Purpose Robotic Co-workers
3. Cognitive Logistics Robots for Industry
4. Medical Robotics
5. Agricultural and Food Robotics



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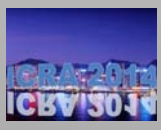
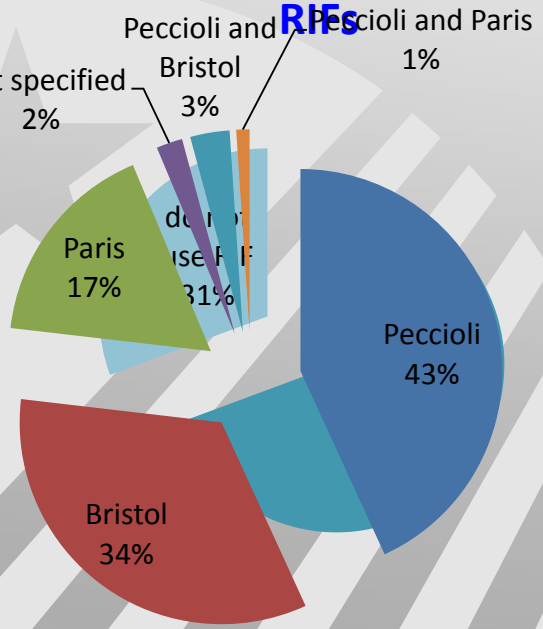


Preliminary Results of E++ First Call for Experiment Linked to RIFs

- 150 Eligible Proposals submitted, of which the interest shown to RIFs instrument is:

Distribution of E++'s RIFs in Experiments
Distribution of Proposals' Plan to use RIFs



Conclusion

- **2 Calls**: One just ended (Deadline 14th April), **next** starting from **Mid 2015**
- **300 k€** of funding for each Experiment
- **About 30** total Experiments will be funded
- Duration up to **18 months**
- **Small Consortia suggested** (1-3 partners)
- **Result** from the **first Call**: **July 2014**

The ECHORD Plus Plus Consortium acknowledges support by the European Commission under FP7 contract 601116.

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