



European Network for the Advancement of Artificial Cognitive Systems

Outline of a Proposal for a Coordination Action

European Commission Framework Programme 6
IST-2004-2.4.8 Cognitive Systems

Introduction

This short document is a bare-bones skeleton of a proposal for the creation of a network devoted to the advancement of synthetic cognitive systems in Europe. It is being prepared in response to the European Commission's call for proposals for a Coordination Action (CA) and will be submitted for the call deadline of the 22nd March 2005.

The principal goal of this network is to support the research community that is already involved in FP6 projects in cognitive systems and to help other individuals from research institutes and companies become involved in this initiative. This will be achieved by facilitating interaction between projects and collaboration between individuals on a variety of fronts, ranging from workshops and conferences, bi-lateral exchanges of staff and students, development & dissemination of training material, research planning, and the creation of an extensive dynamic web-based repository of resources to facilitate research, education, and outreach to the greater community. The ultimate goal is to leverage added-value from existing work through interaction and to use this to encourage further contributions from new participants. A key objective of the network is to foster interaction between all the many different scientific sectors involved in this multi-disciplinary area and to help create truly inter-disciplinary perspectives.

The network will be organized in two complementary ways:

1. the different areas of cognitive systems
2. the activities of the network

The different areas will be grouped so that the large number of issues that are relevant to cognitive systems are covered completely but in a way that allows their inter-relationships to be clear. The first of these areas will be concerned with the underlying paradigms of cognition, the second with the scientific development of

cognitive systems, and the third with highly-topical issues. The second area will also be concerned with validation scenarios and future applications of cognitive systems.

The activities will cover the four key issues of:

1. Outreach
2. Scientific Outlook
3. Education
4. Resources for the Community

Inter-project collaboration and the involvement of new blood from all relevant sectors of both academia and industry will be addressed under the outreach heading.

In addition, there will be two administrative activities, one concerned with Activity Coordination and the other with Management of the Consortium, including financial administration and reporting. We will say more about these activities in the following.

Areas of Cognitive Systems

We propose to organize the many different facets of cognitive systems under three broad headings:

1. Underlying paradigms
2. Scientific development
3. Topical issues

The underlying paradigms area will be concerned mainly with the alternative viewpoints on the nature of cognition and the implications for building artificial cognitive systems. It is in a sense dealing with the philosophy of cognitive systems, in an empirical manner, and will address, for example, cognitivism, connectionism, self-organization, dynamical systems theory, enactive systems & autopoiesis, and artificial life. Cognition at both a microscopic (individual) and macroscopic (social) scales will be included here.

The area of scientific development will be devoted to the practical problems of constructing cognitive systems. Following the lead of the ECVision research roadmap, it will address this issue along three orthogonal axes:

1. Scientific foundations
2. Functional capabilities
3. Practical competences

The scientific foundation will address the theoretical models, the algorithmic considerations, and the technological requirements for, e.g., visual, haptic, and aural sensing, representation, memory, learning, recognition, deliberation & reasoning, planning, language & communication, action, as well as the architectural issues concerned with the unified integration of these component foundations.

The constituent functional capabilities of cognitive systems address the ability to perform certain functions, from a systems perspective. In a sense, the capabilities represent a first level of integration of the scientific foundations. Typical capabilities will include, e.g., detection & localization of entities in the cognitive system's world, tracking, recognition, classification and categorization, deliberation, prediction, concept formation and visualization, inter-agent communication and expression, planning, and perceptuo-motor coordination.

The third dimension is concerned with the instantiation of application-specific cognitive systems, the creation of environments in which they can develop and learn, the assessment of their performance, and the investigation of future applications of the technology.

Finally, the topical issues represent those concerns which transcend all the foregoing matters and which will shape the nature of the discipline in a significant manner. Examples include the nature of and need for embodiment and forcible action, the balance between phylogenic configuration and ontogenic development, and the architectural problems of system integration.

Activities of the Network

As noted already, the activities of the network will cover the four key issues of:

1. Outreach
2. Scientific Outlook
3. Education
4. On-line Resources

In addition, there will be two support activities, one concerned with Activity Coordination and the other with Management of the Consortium, including financial administration and reporting.¹

The Outreach activity embraces both inter-project collaboration and the involvement of new blood from both academia and industry. It will include initiatives for bi-lateral exchanges, particularly focusing on individuals, institutes, and companies that are not yet directly involved with funded projects, and providing where necessary the resources for new pilot initiatives (e.g. providing access to platforms for experimental work in embodied cognition).

The Scientific Outlook activity embraces research planning and technology watch actions. A large amount of effort will be devoted to refining and developing the characterization of cognition that forms the basis of the network at its inception and thereby creating an ambitious but inclusive research agenda.

The Education activity is intended to help alleviate the significant difficulties posed by the multi-disciplinary nature of the area. The goal is to provide an effective mechanism to bridge gaps between sub-disciplines and help researchers in one area come up to speed in other areas. It will be targeted both at research practitioners and graduate students. The activities will include the organization of summer schools (or, perhaps, the coordination of the efforts of the Integrated Projects in organizing summer schools) and the creation of teaching material.

The On-line Resources activity focuses on providing a dynamic web-based repository of material that will assist the cognitive systems community, in research, in education, and in assisting in making the relevance and importance of cognitive systems visible to the greater community. Its organization will reflect the operation of the euCognition network, and will be structured by both Activity and Area. The goal is to make this the community's 'common room' where they share information and interact with one another. It should also act as catalyst for deployment of cognitive systems technologies by making available show-case results and example validation experiments. The on-line resources will be accessed through www.euCognition.org.

¹ Note that the Commission guidelines define three types of activities for Coordination Actions: *Training*, *Management of the Consortium*, and *Other Specific Activities*. For the purposes of reporting, the euCognition *Education* activity will correspond to *Training*, while the *Outreach*, *Scientific Outlook*, *On-line Resources*, and *Activity Coordination* activities will be grouped under *Other Specific Activities*.

Areas and Activities

A significant feature of this network is that all activities will apply to each area (and each sub-area). Thus, for example, one could have tutorial material on each of the scientific foundations, or on the paradigms. Similarly, there might be an Outreach initiative dedicated to the validation scenarios, or a Scientific Outlook initiative on integration and architectures. Thus, the work of the network will be distributed in a matrix-like manner, as follows.

			Areas of Cognitive Systems				
			Underlying Paradigms	Scientific Development			Topical Issues
				Scientific Foundations	Functional Capabilities	Practical Competences	
Activities of the Network	Outreach	Inter-Project Collaboration					
		External Involvement					
		Pilot Initiatives					
	Scientific Outlook	Research Planning					
		Technology Watch					
	Education	Course Material					
		Summer Schools					
	On-line Resources						
	Activity Coordination						
	Management	Financial & Reporting					

Whilst all cells in this matrix are important, emphasis will be applied dynamically, as needs evolve.

Each row and column will be sub-divided further as appropriate.

The euCognition.org website will reflect this structure directly so that someone can gain access to the resources either by area or by activity (or both, with suitable relations qualifying the access).

Organizational Structures

Unlike the ECVision network, it is not intended to assign responsibility of each area or activity to specific fixed individuals. Instead, it is intended to rotate responsibility for each area or activity on a six-monthly cycle. Thus, one person or one group would take charge of coordinating and working on a given topic for a six-month period. By allowing responsibility to move like this, it is expected that we will get a higher level of participation by members since the extent of their undertaking is limited in time and in any case is relevant to their interests.

Naturally, some fixed executive structures will be required. We propose three bodies in total:

1. An Executive Committee;
2. A Watchdog Panel;
3. A Project Coordinators Round-Table Forum.

The Executive Committee will comprise a small number of key individuals who will have collective responsibility for making decisions on the allocation of funds to the various initiatives proposed by members. All decisions are subject to the final approval of the European Commission project officer. The Executive Committee will be chaired by the Network Coordinator.

It is proposed that the Executive Committee be comprised as follows:

Fred Cummins
Erik Hollnagel
Matthias Scheutz
Bill Sharpe
David Vernon
Markus Vincze
Christoph von der Malsburg
Tom Ziemke

The Project Coordinators Round-Table Forum will comprise the principal coordinator of each FP6 Cognitive Systems project. It will provide one mechanism for the network to engender greater collaboration amongst the cognitive systems projects.

The Watchdog Panel will comprise a few individuals who are not directly involved in the activities of euCognition, ideally from outside the European Union. One of their tasks will be to resolve any fundamental disagreements that arise, either in the Executive Committee or in the Coordinators' Round-Table Forum. However, their main task will be to provide periodic input to the Executive Committee on the perceived success in achieving the network's objectives.

Contractual Issues

The FP6 contract requires a minimum of three signatories from three member states. To minimize the administrative overhead, it is proposed that the Coordination Action comprise a consortium of four institutes as follows.

Italian Institute of Technology
University College Dublin
Technical University of Vienna
University of Skövde

Membership

The provisions for membership in an FP6 Coordination Action are somewhat unclear at the moment. Certainly, the concept of a membership agreement no longer exists. It would probably be too cumbersome for each affiliated institute to conclude a full contract since, as a result, they would have to then fulfill all the requirements for audit certificates, cost statements, etc. This administrative overhead is disproportionate to the amount of funding an individual receives.

It is proposed therefore that any non-labour cost incurred by a 'member' should be reimbursed directly by the prime contractor (in exactly the same way as is currently done in ECVision).

For actions which have a labour component, it is proposed that the network would issue a call for tender for the specific service on its website and that any resulting tenders would then be assessed by the Executive Committee, with final approval by

the Commission Project Officer, and then a sub-contract would be issued to the successful candidate. This call-tender-subcontract procedure is the most 'light-weight' FP6-consistent one that could be identified at time of writing. The only alternative available under FP6 contractual arrangements is for any member engaging in actions that have a labour component to become a fully-fledged contractor, with all the attendant administrative and financial overhead.

There then remains the issue of membership. It is proposed that all institutes that are members of a consortium of FP6 Cognitive Systems projects would automatically become members of euCognition, and membership would be granted upon submission of a completed application form. In addition, current members of ECVision would also be eligible for automatic membership, upon submission of a completed application form. Membership is open to all others who are active in the domain of cognitive systems. In this case, membership will be granted following a satisfactory review of the application form by the Executive Committee.

Operating Procedures

All members will be eligible to claim travel costs associated with official euCognition events, as advertised on the euCognition website, subject to guidelines similar to those already established for ECVision. Members will be free also to apply for limited funding for relevant actions. Upon approval by the Executive Committee, these members can claim non-labour costs directly from the main contractor. If the action involved an element of labour cost, it will be subject to a call as outline above and, in the event of a successful tender, a sub-contract will be issued.

Assessment of Impact

All expenditure of public funds must be open to audit and scrutiny to ensure that the European Union is getting a good return on its investment. In the past, this has been achieved by requiring each project to produce a number (usually quite a large number) of deliverables which are then assessed against pre-defined targets. Whilst this approach has the advantage of simplicity and transparency, it also tends to inhibit the evolution of a project and the adjustment of its work to new circumstances. It is proposed to adopt a different mechanism of audit and review for this coordination action. We propose that the success of the network be judged on the outcome of its

work in each area and in each activity (and, in particular, in each area-activity pairing).

Two things are needed to make this work effectively.

First, every action (be it a meeting, student exchange, tutorial, course) must have a concrete output that has some persistent form, be it a document, video clip, commentary, or some other type of communicable message. This output will be archived in the euCognition website and will be accessible through an effective (relational) access mechanism. Ideally, the person who is responsible for each action will upload this output directly to the website and it will be integrated automatically into the repository (flagging its presence to all members). Reimbursement of costs of actions will be conditional upon submission of this output.

The second requirement is a set of metrics that indicate the success of the Coordination Action. Whilst the Commission can decide on the metrics they require, each metric will have to be facilitated by the collection of statistics on the network actions. To provide for this, the extent to which each activity-area pairing is being populated by the membership, and the frequency with which the resources are being accessed and by whom, will be tracked automatically by the website and these statistics will be available to both the Commission and the Watchdog Panel on an on-going basis.

Caveat

It is not expected that everyone will agree completely on the way in which the discipline of cognitive systems has been characterized in this outline or on the issues that should receive priority attention. If they did, the work of the network wouldn't be very challenging. This outline proposal represents a point of departure for the discipline, not a point of arrival. The discipline itself will evolve and change over the next few years and the network will adapt accordingly, both in terms of content and organization.