CENTRIA

1998 Report of Activities
1999 Planned Activities
1999 Budget
1998-2000 Strategic Funding

31 st March 1999

Contents

1 CENTRIA 1998 report of activities

This reports regards the activity of CENTRIA during the year 1998. CENTRIA formally applied to FCT/MCT in 1997 and in its constitution 5 main subareas were identified: "Knowledge Representation and Reasoning, and Logic Programming" (KRLP), "Natural Language" (NL), "Soft Computing and Autonomous Vehicles" (SCAV), "Constraints" (CONS) and "Cognitive Science" (COGS). The research and other scientific activities undertaken in these areas are presented in separate sections below. Activities that involved all members of the centre are described in this introduction now.

CENTRIA was officially evaluated by an external scientific pannel nominated by FCT/MCT in July 1998. In this evaluation, the Centre was rated as "VERY GOOD" and a number of recommendations were made. Unfortunately, this information was only made available to us in the last week of 1998 and these recommendations could not possibly have been taken into account in 1998.

The Centre has appointed an Advisory Board comprised of Prof. Robert Kowalski, Imperial College, London, UK, Prof. Ryszard Michalski, George Mason U., VA, USA, Dr Fernando Pereira, AT&T, NJ, USA, and Prof. Joerg Siekmann, DFKI, Saarbrucken, Germany. Notwithstanding the uncertainty regarding the evaluation process, Prof. Ryszard Michalski, visited our Centre in May 1998 for two days, and produced a report in which the various areas of research were described, with an emphasis on Machine Learning. Dr Fernando Pereira also paid us an informal one day visit in October 1998 and had the opportunity to discuss some of the centres activities, namely in the Natural Language topic, as well as recommend the visit of senior researcher Thomas Diettrich. In this first year of activity, the Centre started building up its organization infrastructure.

This included the implementation of a first version of our WEB page that should allow a dynamic and decentralised maintenance and updating. This effort was made not only to enable our visibility outside the Centre, but also to promote the mutual knowledge of the members activities. In addition, a slide show of the CENTRIA was prepared and presented to the scientific panel that evaluated the Centre, is available at the WEB site, and included here in an appendix.

Another activity undertaken in CENTRIA was the organization of 16 Seminars, where researchers from other institutions were invited to lecture on topics of their research. The speakers range from leading international researchers to national ones. The seminars were formally organised by Luís Correia, and were initially intended to be focus on the domain of SCAV. Nevertheless their scope has been broadened, and it is intended that they will encompass the whole gamut of CENTRIA's scientific interests from now on, in a more balanced way.

In 1998, CENTRIA members put an important effort into setting up a Master's Course in Artificial Intelligence, whose first edition took place in 1997/98. A second edition is now under way (1998/99). This course, jointly organised by the Universidade Nova de Lisboa and the Universidade de Évora is intended to be a main source for recruiting young researchers in this area. The first edition had 15 students enrolled in the courses.

1.1 Subarea: Knowledge Representation and Reasoning, and Logic Programming

During the year of 1998, CENTRIA's "Knowledge Representation and Reasoning, and Logic Programming" area focused its activities on the following main topics: updates, learning, paraconsistency, action modelling, active deductive databases, logic programming implementation, applications, and started work on generalized annotated logic programs. The main stream of research has been supported by several projects, of which the main ones are: MENTAL (Mental Agents Architecture in Logic), ACROPOLE (Active Logic Programming), REAP (Reasoning with Logic Programming), the ICCTI/BMFT project entitled "Logic Programming and Model Based Diagnosis", and PADYLP (Paraconsistent Dynamic Logic Programming). In the PRAXIS funded MENTAL project the goal is to devise and study an architecture for integrating several forms of reasoning tasks into a coherent reactive/deductive mental agent. The annual report of this projects was sent to FCT/MCT on September 1998. The PRAXIS funded ACROPOLE project studies the

semantics and logic language for advanced active deductive databases. The NSF/FLAD funded REAP project is a joint collaboration between CENTRIA and the State University of New York at Stony Brook, and its major concern is the implementation of reasoning tasks resorting to the existing state-of-the-art technology in Prolog language systems. The ICCTI/BMFT funded project cross-fertilises the areas of model based diagnosis and contradiction removal and applies them to existing real-life problems. The ICCTI/INRIA funded PADYLP is a small project supporting mutual visits between the Portuguese and French teams, and aims to study the paraconsistent and dynamic aspects of extended logic programming knowledge base updating.

An important and successful phase of our research was terminated in this annual report period, namely the conclusion of two major projects, PROLOPPE and PADIPRO. The first one comprising the design and implementation of a parallel logic programming language with extensions, and attending development environment. The project report is available by request or can be found at Fundação Científica e Tecnológica of MCT. In the second completed project we made an implementation of tabling and revision techniques on top of a distributed Prolog environment, to test its efficiency and generality. This project was funded by the Digital Equipment Corporation. A small ESPRIT interchange KIT project with the Asian Institute of Technology in Bangkok was also finished. In 1998, we submitted the TARDE project proposal to the PRAXIS programme, which defines a promising line of research, for the forthcoming years, on distributed tabling systems in high-speed networks. This is a joint proposal of the CENTRIA and CITI centres, and is directed to some of the open problems identified in the PROLOPPE and PADIPRO projects. As can be gauged from the foregoing, the theoretical work was complemented with the development of several prototypical tools, to test and assess the results obtained. Three major implementations were constructed or finished during the last year: a tabled abductive meta-interpreter with constructive negation, an updating system, and a distributed tabling system with diagnosis capabilities. All these system were built by resorting to logic programming, our general research area and main implementation paradigm. These activities have been complemented with 3 sabbatical missions by Prof. Luís Moniz Pereira to the University of New York at Stony Brook, the University of California at Riverside, and to the University of Bologna, to produce joint work in, tabling with abduction, program updating and learning, respectively, resulting in a series of publications, and further ones under way. Our centre has been visited in this area, inter alia, by Fabrizio Riguzzi from the University of Bologna to continue the work on learning, by Terrance Swift from the State University of New York at Stony Brook to explore extensions of generalized annotated logic programs and abduction techniques, by Michael Schroeder from the City University of London to work on diagnosis and logic agents. We also have been visited by Pierangelo Dell'Acqua to start a consortium with a view to submit a project proposal to the Information and Society Technologies programme of the5th framework. To bridge the several centre's areas is its long term strategy, and during the last year some connections were made with respect to learning techniques, to natural language processing (intentions in dialogues), and to fuzzy logic. We hope this will result in the fortification of the divers centre's areas and in improved joint outcomes.

CENTRIA remains the coordinating node of the Knowledge Representation and Reasoning area of the Network of Excellence in Computational Logic, CompulogNet, funded by the European Commission. CENTRIA members are actively involved in post-graduate teaching, in particular with the high quality Master's course on Inteligência Artificial Aplicada (Applied Artificial Intelligence), which started in October 1997. There are several Master and PhD working on topics of each sub-area of CENTRIA.

1.2 Subarea: Soft Computing and Autonomous Agents

The main research topics, developed in the topic of Soft Computing and Autonomous Agents are data mining, machine learning, fuzzy multiple criteria decision making, evolutionary computation and autonomous vehicles. This domain was enriched by the inclusion, since October 1998, of a new element, Gabriela Guimarães.

The research in the above topics has produced a good number of publications, showing a good level of productivity and dedication to research.

In the area of autonomous agents as a result of an MSc thesis two papers on emergent collective behaviour of mobile robots were published [59],[58]. Another MSc thesis produced an application of multiagents and learning which resulted in the paper [41]. Further, the work on robust navigation of autonomous robots resulted in two seminars presented by Luis Correia.

In the area of machine learning the work related to information theory applied to clustering resulted in two publications [24], [25]. From the research in genetic algorithms two papers were published resulted [12], [13]. Four papers on self-organizing neural networks were published in 1998, [31], [33], [32], [14].

In the area of fuzzy optimization two papers were published [54][46]. The application of fuzzy theory to ergonomy produced three papers [47],[49], [48]. In the application of fuzzy multicriteria decision making to defense a paper was published [38]. Further, a communication on fuzzy linear programming was presented in the APDIO (Portuguese Association of Operations Research) and a seminar was given in the Faculty of Sciences of the University of Lisbon (by Rita Ribeiro).

Bridging the areas of optimization and constraints, a paper on fuzzy constraints problem solving was also published [55].

Besides the publications we were involved in 3 national research projects (SAFDM, ECO, ACAVA) and 2 international ones, funded by the EU (EMOLITE, ACE-PHARE). These projects cover the areas of : clustering, neural networks, fuzzy multiple criteria, fuzzy optimization and mobile robots. Two new projects were proposed, which are currently under evaluation.

As mentioned earlier, we played a major role in the organisation of regular seminars.. Our aim was to broaden our perspectives and become acquainted with different methods and approaches that are being developed in other institutions. Our post-graduate students are required to participate on the seminars and, at least once or twice a year, they will do a seminar to discuss the status of their research. We believe this is very important to promote strong research links among our group and to instigate discussion of new ideas. The seminars are open to everybody and usually many researchers from other departments and universities attend them.

Another important activity is the promotion of visits to international research centers. In 1998 we visited 5 research centers: 1. MIT (Massachussetts Institute of Technology), 6 months, USA, 2. University of Ulster, 1 week, U. K, 3. École Polytechnique Fédérale de Lausanne, 2 months, Switzerland 4. Vanderbuilt University, 1 week, USA, 5. DKFZ - German Cancer Research Center, 1 week, Germany)

1.3 Subarea: Natural Language

The results reported bellow, for 1998, were possible due the research activity in the Natural Language topic in the framework of various projects, funded by the Portuguese, Brazilian and French governments. From those projects we highlight the following: DIXIT, PGR, NALAMAS, "Medieval Portuguese Corpus, POS-tagging and bracketing", RELING, the CNRS-ICCTI project "Analysis and Synthesis of sentences in French and Portuguese", and the CAPES-ICCTI project FUNDAÇÕES. Two Brazilian Ph.D. students, funded by CNPq, have been working in Lisbon on Mental States, namely Beliefs, Desires and Intentions, required for natural interaction with human interlocutors and for agents interaction in a multiagent architecture [45, 44, 23, 21, 22]. This work deepens the work done by Lopes and Quaresma [37], in the framework of DIXIT project. Raul Wazlawick, professor of UFSC (Brazil) has stayed in Lisbon from August 1997 till February 1998, funded by CNPq for post-graduate studies. From this collaborative work on "multi-agent architectures for parsing" a paper was born [60] and there is still more material to be published. Regarding the research done, in addition to the results obtained, reported above, the Natural Language team has worked mainly on a large lexicon for Portuguese, POLARIS[34], created in an earlier version in the framework of the project FEELING. This lexicon is currently used for indexing a large Portuguese collection of opinions of the Portuguese Republic's Attorney (PGR) and for POS tagging real text corpora, namely the LUSA corpus (built in the framework of the CORPUS project, some years ago), and the PGR corpus that include those opinions. Currently we have got over 60,000,000 automatically POS-tagged corpus. The POS tagger used, based on a neural network, has also been trained with hand tagged Medieval Portuguese text (and English text also)

and achieves a precision higher than 96% for well written text and a little bit lower for languages where the lexicon it uses is rather small. That is the case for Medieval Portuguese and for English. This tagger is currently used for disambiguating the morpho-syntactic word tags, enabling that a 4 layer chart parser will syntactically analyse current Portuguese text [57]. Using this same parser (a head driven bottom-up, top-down, left to right and right to left parser) we have adapted it for declarative diagnosis of faults in the lexicon, in the input, faults that were introduced by the tagger during its processing job [36, 35]. This work, together with work on subcategoriszation mining from Pos-tagged text [40, 39] is conceived for enabling a text syntactic analyser to evolve, by detecting and proposing corrections for found faults, and by learning from errors that lead to partial parses of text. A major application for the results obtained is the information retrieval area [56] (please have a look at the URL: http://coluna.di.fct.unl.pt/ pgrd). In this area, work has started on extraction of multi-word units from large collections of texts and the first results are currently being used for accessing more naturally the documents of any collection (see the URL above). This gave rise to several papers that were submitted to conferences in 1999.

1.4 Subarea: Constraints

In the topic of Constraints, 1998 has seen the establishment of a research group within the CENTRIA under the supervision of Pedro Barahona. More specifically, three new Ph.D. students (Jorge Cruz, Paula Amaral and Francisco Azevedo) have started their Ph.D. work in this topic and a new M.Sc. student (Ludwig Krippahl) started his M.Sc. dissertation. Previous work in this area had been focussed in the topic of defeasible constraint solving where Francisco Menezes has done much of the work that will lead to his Ph.D. degree (forthcoming). In 1998, this work was extended to include boolean solvers, and a paper [15] was presented in the IBERAMIA Conference (Lisbon, October 1998). The arrival of these new students has allowed the scope of the research to be broadened.. Jorge Cruz has taken advantage of project RELING to start collaboration with the group of Frederic Benhamou in the University of Nantes in the topic of interval constraints, more in the handling of differential equations. His interest was raised by his previous work in the development of a decision support system for electromyography, that could benefit from a principled approach in the deep modelling of the peripheral nervous system by this kind of equations. Pedro Barahona and Jorge Cruz visited the University of Nantes in the beginning of 1998 and further collaboration is expected in the next few years. In 1998, Jorge Cruz presented his work on a RELING workshop (Orleans, November 1998) a paper was submitted (and accepted) to the European Conference on Artificial Intelligence in Medicine (AIMDM'99). Moreover, we visited INRIA-Grenoble in the context of project NEUROWEB where we had contacts with Dr. Jerome Gensel that is also interested in the topic of constraints. Paula Amaral has been working in the problem of relaxing linear constraints over the reals in over-constrained problems, that will extend our previous work that would only allow the removal of constraints. Instead, she has been working in the problem of updating any of the parameters of a linear constraint problem, in order to make it feasible with least "cost". Moreover the approach that she is taking has been, for the moment, purely algebraic, based on the Single Value Decomposition of the problem matrix. Her ongoing work was presented in the European Conference on Operations Research (EURO XVI, Brussels June 1998) as well as in the Portuguese Conference of Operations Research (Algarve, November 1998) work was This will possibly make it practical to extend a similar formulation of the problem made in the Soft Computing group of CENTRIA, with whom we intend to start a more focussed collaboration. This collaboration has already started in the area of fuzzy constraint solving (finite domains) where João Moura Pires was integrated in a project submitted to PRAXIS (see below). Francisco Azevedo took started with some diagnostic problems in digital circuits that Francisco Menezes has worked with and not only helped with the testing and improving of Francisco Menezes system but also has extended his work to the generation of differential test patterns. His work was presented in the Compulog Workshop on Constraints (CWI, Amsterdam September 1998) [11] and in the Conference on Constraint Programming CP'98 (Pisa, October 1998) [10]. This work has exploited an application domain to the work he is interested in for his Ph.D. thesis on global constraints. Ludwig Krippahl has finished all the subjects of the M.Sc. course on Applied Arti-

ficial Intelligence and, taking advantage of his background in Chemical Engineering, has started work on the application of constraint solving methods to data obtained with Nuclear Magnetic Resonance to determine the structure of proteins. Given the previous experience in the area of medical applications of Pedro Barahona, and given the potential of this technology in a number of applications in health care, project REMÈDIO was submitted to the PRAXIS programme, that would encompass most of the research done by this group.

1.5 Subarea: Cognitive Science

The strategy of the Cognitive Sciences (CS for short) area at CENTRIA has been impelled under two main assumptions.

Firstly, it is well known that the Cognitive Sciences have become a growing international challenge to existing academic or research centers. No matter how creatively different institutional responses to CS research have been, a strategic alliance to an established scientific area such as the Neuro Sciences or Artificial Intelligence has proved to be a rational organizational one. It has been then our first purpose to look for a formula in which CENTRIA, as a commodious host, will accommodate CS.

Secondly, despite the international acclaim of CS, in Portugal there has not been produced any systematic well-supported work so far. Some signs of emerging prospective interest in CS have already been acknowledged, though of a diluted nature. It has been then a purpose of the CS area in CENTRIA to make an analysis of what has been emerging in Portugal, so that a solid fully supported CS frame of research can be established. Due to the particular nature of CS, namely its interdisciplinary or transdisciplinary stance, it has also been a purpose of the CS area to identify thematic or conceptual clusters so that a fertile and feasible research work can be pursued. Accordingly, the activity of the CS area, in 1998, was as follows: In December 1998, the one-year project JD-15/97 'Temas e Conceitos em Ciências Cognitivas' [Concepts and Themes in Cognitive Sciences] was completed in its raw form (cf. Report presented to the Scientific Council of FCT/UNL). The project attempted to identify relevant concepts and themes in CS. It also searched for a picture of what is being done in the whole country in CS (no matter how informal or sparse it may be) so that the potential of this domain may be determined and cross fertilization may spring up.

The curricular programme of a Course in Cognitive Systems within the Licenciatura of Engenharia Informática (Computer Science Engineering graduate degree) was drawn up in 98 (it will be taught for the first time in the second semester of 99).

A one semester course in Cognitive Science continued to be held yearly within the MSc in Applied AI organized by CENTRIA. In 1998, the research work produced by the post-graduate students was of a reasonable variety of topics and of considerable scientific merit. Due to the foundational stance of the CS area, it seems worthwhile to list some of their subject-matters: music cognition, learning mechanisms and consciousness, the brain and neural self-organization, psychopathological reasoning, human vision and mental imagery. A research work on 'musical cognition and musical analysis' was subsequently submitted to, and accepted at an International Symposium on Music and Society, Vienna, March 1999. A research proposal for a Master of Arts degree in History and Philosophy of Science was prepared under the supervision of Manuel Costa Leite, a member of CENTRIA. The research is on the Philosophy of Human Cognition, and will explore the relations between Mental Models and AI-oriented Neural Networks. A PhD thesis proposal was prepared at the end of 1998 (and submitted in early 1999) on 'The Modeling and Simulation of the Evolution of Cooperative Behavior in Humans', supervised by Luís Moniz Pereira, the director of CENTRIA. The thesis aims at contributing to the elaboration of a computational theory of the mind, such that the nature of the cognitive mechanisms involved in the activities of cooperation amongst humans is progressively understood. Edited by Luís Moniz Pereira, a book series on CS has been launched by a Portuguese publisher, Relógio d'água, (the first book has come out in January 99).

1.6 Organization of Scientific Events

In 1998, the Natural Language group organised the 6th Ibero-American Conference on Artificial Intelligence (IBERAMIA'98), that took place in Lisbon, at the Fundação Calouste Gulbenkian, on October 6-9. The IBERAMIA'98 Scientific Committee was headed by Helder Coelho from FC/UL.

The Natural Language group has also organised the First Iberamia Workshop on Causal Networks, whose Scientific Committee was headed by Ramon Sangüesa and Ulises Cortés.

Pedro Barahona (as Programme Chairman) and José Alferes (as Conference Chairman) have started the preparation of EPIA'99, the 9th Portuguese Conference on Artificial Intelligence.

1.7 Divulging Activities

CENTRIA prepared a slide show on its activities for the Science and Technology week, promoted by the Ministry of Science and Technology in 1998, which was included in the Ministry's web page.

1.8 Missions

Luís Moniz Pereira - Visiting Professor on sabbatical.

Univ. Califórnia at Riverside, USA Dept. Computer Science January-March 98
Purpose: collaboration on logic program updates Contact: Prof. Teodor Przymusinski

Univ. de Bologna, Itália Dipartamento di Sistemi ed Informática May-July 98
Purpose: collaboration on learning in logic programming Contact: Prof. Evelina Lamma

Government Mission of "Nacional group for Telecommunications and Computer Science for cooperation with China" Shanghai, 25-31 July 98
Purpose: establish bilateral nacional academic and business collaboration

Rita Ribeiro

Visiting Scientist at MIT (Massachussetts Institute of Technology), Laboratory of Information and Decision Sciences (LIDS), Boston, EUA, 6 months, 1998.
Purpose: Research on fuzzy linear programming. Contact: LIDS Director: Professor Sanjoy Mitter.

Gabriel Pereira Lopes

Gabriel Pereira Lopes, visited the Laboratoire d' Informatique de Marseille, June (1 week) and November (1 week), 1998, in the framework of the cooperation project "Analysis and Synthesis of sentences in Portuguese and French". An implementation of the system ILLICO for Portuguese was done. Contacted Robert Pasero and Paul Sabatier

Gabriel Pereira Lopes, visited the Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil, in the framework of the project FUNDAÇÕES. Work was done with Michael Móra and Vera Lima

Luís Correia

University of Ulster, 25-29/June/1998 OMS (Organising the Mobility of Students) of the SOCRATES Program, in the area of Informatics. Contact: William Blackburn.

Invited Researcher at LAMI (Laboratoire de Micro-Informatique) of EPFL (École Polytechnique Fédérale de Lausanne), Switzerland, from 25/October to 19/December, 1998. Research in navigation of autonomous vehicles, during a period of sabattical leave. Contact: Dario Floreano.

Université de Genève, Faculté de Psychologie et des Sciences de l'Education, Section de Psychologie, 4/December/1998. For discussion of possible cooperation in the area of autonomous robots. Contacts: Thomas Wehrle and Susanne Kaiser.

Fernando Moura Pires

Vanderbilt Heidelberg

José Rodrigues dos Santos visited the UMR (Unité Mixte de Recherche) of the CNRS 882 (Apropriation et Socialisation de la Nature / Laboratoire d'ethnobiologie), in Paris, in November 1998.

Purpose: to establish bilateral collaboration within Cognitive Anthropology and Cognitive Sciences in general.

1.9 Visitors

Fabrizio Riguzzi, U.Bologna, 1 week, November 98. Continue collaboration on learning in logic programming.

Sten-Ake Tarnlund, U.Upsalla, whole of 1998. European TMR scholarship in computational logic.

Ryszard Michalski, U. George Mason, Washington DC, 3 days, May 98. Member of CENTRIA's advisory committee.

Fernando Pereira, ATT Labs, New Jersey, 1 day, October 98. Member of CENTRIA's advisory committee.

Terrance Swift, U. Stony Brook, NY, 1 week, March 98 and 10 days, October 98. Project REAP missions.

Pierangelo Dell'Acqua, U. Upsalla, 1 week, September 98. Project MENTAL collaboration.

Michael Schroeder, City U., London. 1 week, October 98. Project PLDP collaboration.

Michael Thielscher, U. Dresden. 1 day, November 98. SOCRATES/ERASMUS programme proposal preparation.

Professor Pamela MacCauley-Bell, University of Central Florida, USA, October 1998. Aim: To do a seminar on Fuzzy Ergonomics and discuss the PhD work of Eng. Isabel Nunes.

Raul Waslawick, Universidade de Santa Catarina, 6 month stay, August 1997 till February 1998. Post-Doctoral work on Parallel parsing.

Robert Pasero, Laboratoire d' Informatique de Marseille, July 1998 (1 week), work was done in the framework of the cooperation project "Analysis and Synthesis of sentences in Portuguese and French".

Paul Sabatier, Laboratoire d' Informatique de Marseille, September 1998 (1 week), work was done in the framework of the cooperation project "Analysis and Synthesis of sentences in Portuguese and French".

Marie Roué, Head of UMR (Unité Mixte de Recherche) of the CNRS 882 (Apropriation et Socialisation de la Nature / Laboratoire d'ethnobiologie), in Paris. January 1998. Collaboration within Cognitive Anthropology and Ethnosciences.

2 CENTRIA 1999 planned activities

For 1999 we intend to proceed with our efforts to consolidate the research activities and external visibility of centria. Following the recommendations of the scientific evaluatiors we intend to invest a significative amount of the strategic funding assigned to us in journals and books, as well as in a small very fast local network for parallel and distributed processing, required by some of the prototypes developed in the Centre, plus 2 extended post–doc contracts and a few shorter visits from foreign researchers.

A major activity concerning the Centre is a formal visit of the Advisory Board that we are planning for September or October 1999, right after the Portuguese Conference on Artificial Intelligence. This Conference will also concentrate the effort of many of the CENTRIAs members, in particular Pedro Barahona and José Júlio Alferes (Scientific and Organisation Chairperson, respectively), as well as others involved in satellite workshops on "Extraction of Knowledge from Data Bases" and on "Processing Written and Spoken Portuguese Language" (PROPOR'99).

Our WEB page will be re-engineered in order to make it more easy to maintain all the relevant information about the CENTRIA conveniently updatable.

We will continue to invest in post-graduation, namely in the Master Course in Artificial Intelligence, which had 10 students enroled in the 1998/99 edition. In particular, three more courses are foreseen, in "Declarative Programming", "Agents", and "Neural Networks", that will make it more attractive.

2.1 Subarea: Knowledge Representation and Reasoning, and Logic Programming

Continuing the work described in the 1998 area report, CENTRIA's "Knowledge Representation and Reasoning, and Logic Programming" area plans to focus its activities in 1999 on the following main topics: updates of logic programs and its use for modeling problems of reasoning about action, transaction logic, generalized annotated logic programs and its relationships with Fuzzy Logic, distributed tabling and revision systems for paraconsistent extended logic programs, learning, paraconsistency, use of logic programs to model rational agents.

Dissemination of results will continue to be an important concern in this area. In this respect, besides the usual publication of papers, it is worth mentioning:

- the publication of a book on previous results in paraconsistency and constructive negation, already accepted by Kluwer and with publication planned for 1999

- two members of CENTRIA will deliver an advanced course in the "11th European Summer School in Logic, Language and Information" based on research developed in this area.

- One member of CENTRIA will give an invited one day summer course on "Logical Agents" at the University of Santiago de Compostela, in July 99.

The collaboration with the University of California at Riverside, State University of New York at Stone Brook and University of Bologna, will continue in the basis and focusing the issues described in this area's 1998 report (program updating, tabling abduction, and learning, respectively). A number of co-authored papers with researchers from these Universities are expected in 1999.

Collaboration with CITI, another centre at our department, is planned on the implementation of distributed tabling systems in high-speed networks. This is the subject of a project proposal, TARDE, submitted to PRAXIS in 1998. The development of this line of research is also supported by the accepted programatic funding for a cluster of fast networked machines.

To bridge the centre's several areas is its long term strategy, and in 1999 we plan to continue the connections made with respect to learning techniques, to natural language processing (intentions and actions in dialogues), to fuzzy logic and constraints. We hope this will result in the fortification of the divers centre's areas and in improved joint outcomes.

Work on the application of the developments in this area to application of rational agents is also envisaged from 1999. In this respect, we plan to submit a project proposal to the european Information and Society Technologies programme of the 5th Framework on this subject, within a consortium including the Imperial College, University of Bologna, University of Cyprus, of which

we are the coordinators. An extended visit of Pierangelo Della'Acqua, to work on this project proposal is under way.

2.2 Subarea: Natural Language

As a consequence of the work programmed along the last few years, during 1999, we plan to continue and finish on-going projects, depending on their duration and start-up. We also plan to participate in the submission of a couple of European projects, in the framework of the 5th programme, as well as projects in the framework of national funding opportunities for co-operation.

In 1999 it is planned to have four Ph.D. students having their thesis finished. At least two of these thesis be discussed in 1999.

We will organise the Fourth Workshop on Processing Written and Spoken Portuguese Language (PROPOR'99) in the framework of the Portuguese Conference on Artificial Intelligence in Évora.

The visit of Professor James Allen (Rochester University) is already programmed for May 1999. We plan to invite Gregory Grefenstette (Xerox, Grenoble) in order to work with current Ph.D. students on Thesaurus construction.

During 1999 we will work on the following subject matters:

- Partial parsing of full text documents, assuming a multi-agent system architecture. Impossibility to full parse a sentence will signal possible faults in the lexicon, in the POS-tagged document or in the input text. Work on declarative diagnosis will continue in order to overcome found faults.
- Implicit Information Extraction from text (linguistic knowledge: word morphologic information, word subcategorization classes, word selection restrictions; sub-language grammars, etc.) and explicit information extraction from texts (knowledge about the world);
- Work on symbolic and statistical methods for pragmatic interpretation of texts: anaphora resolution, various kinds of text structure and summarisation;
- Dialogue handling;
- Bilingual lexicon extraction from parallel corpora and bilingual corpora on specific subject matters; Automatic Thesauri construction for the the collections of texts currently under research.
- Applications to web based information retrieval, by embedding additional knowledge about the Portuguese (and other languages) in the search engine currently used, making that information retrieval engine more friendly (for accessing the opinions of Portuguese Republic Attorney have a look at http://coluna.di.fct.unl.pt/ pgrd).
- Start a strategic partnership with Portuguese Government in order to enable web-based access to the written information produced by various Ministries and Public Services. This involves bringing together into this partnership SMEs willing to work on Information Retrieval (IR) and Cross-Language Information Retrieval (CLIR).

2.3 Subarea: Soft Computing and Autonomous Vehicles

With the addition of a new PhD in the SCAV area our new strategy is to increase the research on Neural Networks. Specifically we want to extent our research work on Neural Networks to problems that include temporal events in order to extract temporal patterns. The application of Neural Networks to perform some kind of knowledge extraction will be studied. We hope this research will provide a synergy with the other sub-areas of soft computing.

In general, the objectives for 1999 are to continue the research work being developed in this area, in the topics of:

- Navigation of mobile robots
- Formulation of optimization heuristics
- Fuzzy optimization using genetic algorithms
- Fuzzy multiple criteria decision making
- Fuzzy constrained problem modelling and solving
- Data mining
- Clustering
- Fuzzy behaviour control for autonomous vehicles
- Distributed genetic algorithms

Some of the above topics are oriented towards the support of specific applications, such as:
- Application of fuzzy theories in ergonomy
- Application of fuzzy multiple attribute decision making in military operations
- Compression and data retrieval in text databases
- Text mining applied to web pages
- Data mining in TV audiences (share prediction and preference modelling)
- Signal classification with neural networks (hydrophonic effects and electro-encephalograms)

Many contributions to this research area derive from the work being developed by post-graduate students. We expect to finish supervision of 6 MSc thesis in 1999. We will carry on with supervision of 3 Msc and 6 PhD students and we will also make efforts to increase the number our post-graduate students.

Within CENTRIA this area plans to collaborate with the natural language area and with a colleague dedicated to the study of databases, namely in the context of projects being proposed in 1999.

Other important activities this area will promote in 1999 are:

- Organization of the 2nd International Workshop on Extraction of Knowledge from Data Bases associated with EPIA '99, 9th Portuguese Conference on Artificial Intelligence in Évora/ Portugal.

- Regular seminars with international and national speakers, with the same objectives as the ones promoted in 1998.

- Visits to international research centers. We already scheduled visits to: MIT, USA, Universität Dortmund, Germany, Philipps-Universität Marburg, Germany, Bergische Universität Wuppertal, Germany, Carneggie-Mellon Univ., USA.

- Invitation of international researchers to visit this area and, if possible, to spend some time working here. We already scheduled the visit of Professor Boris Mirkin of DKFZ, Heidelberg, Germany.

- To hire a post-doc specialized in machine learning, as suggested by the evaluators of CENTRIA

We believe that fulfilling the planned objectives and activities will consolidate this research area and promote its international recognition.

2.4 Subarea: Constraints

In 1999 we expect the consolidation of the research of Constraints, namely with the continuation of the research related to the ongoing Ph.D. studies. We hope to recruit a new M.Sc. student for this area, to work on the management of resource constraints to be applicable in some application to be chosen (possible applications are in the area of school timetables, and local council resources within a geographical information system). In addition it is expected that Ludwig Krippahl will start his Ph.D. studies, with a joint supervision from the Chemistry Department.

We plan to start co-operation with a group in IST, led by Dr. XXX, that has done some work in the modelling of digital circuits as well as their diagnosis, test planning, definition of test patterns, etc. We expect to explain the application of our constraint technology into similar tasks in order to compare the approaches, and possibly to set up a deeper collaboration.

We intend to have the visit of two leading researchers in this area, Frederic Benhamou and Pascal van Hentenryck. Frederic Benhamou will visit our centre in the context of project RELING and Pascal van Hentenryck has been invited for a keynote speech in EPIA'99.

Following our visit to INRIA-Grenoble in 1998, we plan another workshop with the Grenoble group in June 1999, where we will discuss with Jerome Gensel the possibility of extending the existing collaboration within project Neuroweb, focussing on joint work on constraints, possibly with a view on other type of applications (e.g. economic models) rather than solely in medicine.

We are interested in visiting IC Parc, to study their work in Global constraints, namely their approach of integrating Operations Research techniques and tools in a CP language. We had some preliminary discussions in Pisa, during the CP'98 Conference, and we will further discuss the possibility of an exploratory visit (one week) in 1999 and/or a post-doc in 2000 (4 months). We will also take advantage of the participation of Pascal van Hentenryck in EPIA'99 to discuss the possibility of a deeper collaboration in the future.

Within CENTRIA we plan to collaborate with the Knowledge Representation and Logic Programming group, namely in the context of a project that will be proposed in 1999. It is anticipated that this project will offer opportunities to exploit the interconnection between abduction and defeasible constraints, as well as with fuzzy constraint solving.

This is also an area where the collaboration already started with the Soft Computing group in CENTRIA has already started and will be strengthened, both for finite domains and linear constraints over the rational/real numbers.

2.5 Subarea: Cognitive Science

According to the strategy established for the Cognitive Sciences (CS) area in CENTRIA's original 1997 Plan, and based on the activities of 1998, 1999 will be the year of drawing up collaborative research work, at different levels: within CENTRIA, within the FCT, within UNL, within the country, and internationally.

The plans for 1999 are as follows. Within CENTRIA. Within CENTRIA itself one can easily identify some trends of convergence into a CS-focus. Some, as MENTAL Project (of Knowledge Representation and Reasoning, and Logic Programming area) are more obvious than others (ACAVA, of Soft Computing and Autonomous Agents area, or Projects in Natural Language area), but there is a clear common ground of theoretical interests. In 1999, this goal of convergence will be stimulated.

Within FCT/UNL. Different departments within FCT/UNL have a natural interest in cognitive matters, from Mathematics (perhaps less obviously) to Education. Potential links will be carefully scrutinized. A joint paper will be submitted to the National Conference on Mathematics and Education, to be held in Lisbon, at ISEG, in April 99.

Within UNL. Still within the boundaries of the UNL, a collaboration among Departments or Centers from different Faculties, particularly with the Faculty of Humanities and Social Sciences, where an Institute for the Philosophy of Language exists, will be promoted. Synergies are expected to emerge from this approach.

Within the country. Nationwide, research activities will be drawn up. The nationwide visibility of the Cognitive Studies and emphatically of the CENTRIA-led Cognitive Sciences will be an objective. A book, based on the Report of Project JD-15/97, will come out in 1999 and will concur to that objective. It should be remembered that CENTRIA itself comprehends a significant number of members external to FCT/UNL, namely from the University of Évora.

International links. The internationalization of the activities of the CS-area will be coherently pursued. An invited paper on 'The Logical Impingement of AI', by Luís Moniz Pereira, is going to be published in an Austrian philosophical magazine (Grazer Philosophische Studien). The CS area will continue supporting and simultaneously benefiting from the academic intervention of the members of the area in the Course in Cognitive Systems within the Licenciatura em Engenharia Informática and within the MSc in Applied Artificial Intelligence in 1999. The paper on 'Musical Cognition and Musical Analysis' will be delivered at the Symposium in Vienna and will be published. Some of the research work done within the MSc in Applied AI will come part of the book based on the Report of Project JD-15/97 above mentioned.

3 Base Funding for 1999

All values in K PTE.

Central Funding (Managed by the Board)	3600
Seminars	300
Overheads for the host institution	1500
Advisory Committee	1000
Services (eg. web pages, maintenance, ...)	800
Assigned individual management by PhD' s	8700 (580/PhD avg.)
Travel	4200
Equipment	4500
TOTAL	12300 (Amount awarded by FCT/MCT)

Breakdown:

Scholarships and technical stuff	800 Services
Current	5500 Travels and advisory committee
Consumables	1500 Computer Science Department
Capital	4500 Equipment
TOTAL	12300 (Amount awarded by FCT/MCT)

4 Strategic Funding for 1998–2000

For the next two years:

Library	4.000
1 Post-doc in Machine Learning	4.000 (12 months at 300 KPTE + travel + extras)
1 Post-doc in SCAV and Nat. Language[1]	4.000 (12 months at 300 KPTE + travel + extras)
4 visitors, (2 months/each)	3.000
Cluster of computers and network	5.000
Total	20.000 (Amount awarded by FCT/MCT)

Discriminated per year as follows:

1999

Library	2.500
1 Post-doc in Machine Learning	1.000 (3 months at 300 KPTE + travel + extras)
1 Post-doc in SCAV and Nat. Lang.	1.000 (3 months at 300 KPTE + travel + extras)
Visitors	1.000
Cluster of computers and network	5.000
TOTAL	10.500

2000

Library	1.500
1 Post-doc in Machine Learning	3.000 (9 months at 300 KPTE + travel + extras)
1 Post-doc in SCAV and Nat. Lang.	3.000 (9 months at 300 KPTE + travel + extras)
Visitors	2.000
TOTAL	9.500

[1]The policy is to find a post–doc that will effectively help to bridge the two areas.

5 List of ongoing projects in 1998

Name	PROLOPPE - Programação em Lógica Paralela (Parallel Logic Programming)
Status	Finished in May/98
Funding Institution	PRAXIS
Principal researcher	Luis Moniz Pereira
Participants	CENTRIA/UNL, LIACC/U.Porto, Servisoft II/Porto, U.Hannover/DE
Description	Design and implementation of a parallel logic programming language and development environment comprising explicit negation, belief revision, constraints, types, distribution, communication, and applications to model-based diagnosis.
Results	The project completed most satisfactorily. Publications: Books, edited books, journal special issues: 8; Papers in internacional journals: 8; Papers in international conferences: 67; PhD theses: 7; MSc theses: 12; Book chapters and edited proceedings: 5.

Name	MENTAL - An architecture for mental agents
Status	Ongoing (started in April 97)
Funding Institution	PRAXIS
Principal researcher	Luis Moniz Pereira
Participants	CENTRIA/UNL, U.Evora
Description	A logic programming architecture for rational multiple agents comprising combinations of various modes of reasoning, updating, planning, learning, and applications.
Results	34 publications. 2 MSc thesis completed. First year report available from PRAXIS.

Name	LPMBD - Logic Programming and Model Based Diagnosis
Status	Ongoing (January/97)
Funding Institution	ICCTI-Portugal and BMFT-DE
Principal researcher	Luis Moniz Pereira
Participants	CENTRIA/UNL and Univ. Hannover
Description	Use of logic programming for model based diagnosis, and its application to digital circuits, electric power lines, and cellular phones.
Results	1 PhD thesis. 1 book. 6 conference papers.

Name	PADYLP - Paraconsistent Dynamic Logic Programming
Status	Ongoing (started January 98)
Funding Institution	ICCTI-Portugal and INRIA-France
Principal researcher	Luis Moniz Pereira
Participants	CENTRIA/UNL and INRIA-Rennes
Description	Recent developments in updates of logic programs make it possible to deal in a clear and precise manner with changes in the state of the world. The project studies these developments on the basis of the related theories developed for (paraconsistent) Logic and to examine how those theories might be implemented via logic programming.
Results	No publications yet, just mutual visits.

Name	RELING - Reseau Programation Logique, Contraintes, Langue Naturelle
Status	Ongoing (started January 95)
Funding Institution	ICCTI-Portugal and Ministry of Science-France
Principal researcher	Luís Moniz Pereira (Pt) e Pierre Deransart (Fr).
Participants	CENTRIA/UNLA, Univ. Minho, INRIA-Rocquencourt, Univ.Orléans, Univ. Nantes, Univ. Toulouse
Description	Research collaboration centered around joint PhD students in the areas of the project (Logic Programming, Constraints, Natural Language, Reasoning with Uncertainty).
Results	A cascade of chart parsers was built on top of the DYALOG system that uses tabulation [57]. Three papers have been accepted for publication in 1999 and a few more have been submitted. A Ph.D. Thesis will be issued till the end of 1999. Four papers in the area of Fuzzy Constraint solving and a Ph.D. thesis to be finished in 1998. A prospective Ph.D in Interval Constraint Solving with 1 paper already accepted for publications and another ready to be submitted. Initial collaboration in the area of Visual Programming.

Name	LPKRR - Logic Programming and Knowledge Representation and Reasoning
Status	Finished (Ended: December 1998)
Funding Institution	KIT - ESPRIT - European Commission
Principal researcher	Luis Moniz Pereira
Participants	CENTRIA/UNL, Asian Institute of Technology, Bangkok, Thailand
Description	Interchange KIT (Keep In Touch) programme, for cooperation in the project topic.
Results	Mutual visits. 1 draft paper to be submitted.

Name	CompulogNet - Network of Excellence in Computational Logic
Status	Ongoing (Started: July 96, renewed)
Funding Institution	ESPRIT - European Commission
Principal researcher	Luis Moniz Pereira
Participants	100 european nodes
Description	Collaboration and promotion on its subject matter in Europe.
Results	Reports, conferences, working groups, road maps, web page, advanced schools.

Name	REAP - Reasoning in Logic Programming
Status	Ongoing (Started: October 96)
Funding Institution	FLAD-Portugal and NSF-USA
Principal researcher	Luis Moniz Pereira
Participants	CENTRIA/UNL and Univ. Stony Brook, NY
Description	Use of Logic Programming theory and implementational technology for reasoning tasks
Results	1 conference paper. 1 journal paper draft. 1 MSc thesis.

Name	ACROPOLE - ACções e RaciocíniO em ProgramaçãO em Lógica Estendida
Status	Ongoing
Funding Institution	PRAXIS
Principal researcher	Jose Alferes
Participants	Carlos Damasio, Luis Moniz Pereira, Iara Mora, Vitor Nogueira
Description	The main goal of the project ACROPOLE is the definition of a logic programming language sensitive to stimuli (or triggers), and with action performing abilities too, not just over a program itself but on its environment as well. Also to be defined are its declarative and procedural semantics, and a prototype implementation. The language will be developed as an extension to an existing logic programming language with explicit negation.
Results	A logic programming language with action performing abilities.

Name	SAFDM - Simulated Annealing and Fuzzy Decision Making
Status	Completed
Funding Institution	PRAXIS
Principal researcher	Rita A. Ribeiro
Participants	Fernando Moura Pires, Jose C. Cunha, Department of Informatics, New University of Lisbon
Description	Development of specialized optimization algorithms based in genetic algorithms and simulated annealing to solve fuzzy mathematical programming problems.
Results	16 papers

Name	ECO
Status	On-going
Funding Institution	PRAXIS XXI (National Institute of Research)
Principal researcher	Pavel Brazdil
Participants	Fernando Moura Pires(CENTRIA), Faculty of Economy of University of Porto, Department of Informatics and Department of Mathematics from the New University of Lisbon, National Institute of Statistics of the North region
Description	& Application of search and clustering techniques to the automatic extraction of concepts from large databases.
Results	3 papers and 2 reports

Name	- Assymetries of the Czeck Stock Exchange Market
Status	Completed
Funding Institution	European Union (Programme PHARE-ACE)
Principal researcher	Rita Ribeiro
Participants	New University of Lisbon (Portugal); Czeck Academy of Sciences (Czech Republic); University of Amsterdam (Holland); Slovack Academy of Sciences (Slovak republic)
Description	Information assymetries on capital markets emerging in transition countries: The case of the Czech capital market
Results	2 papers and a software prototype.

Name	EMOLITE - Evaluation Model for the Optimal Location of Intermodal Terminals in Europe
Status	Completed
Funding Institution	European Union (EU)
Principal researcher	Ana Moreira
Participants	Rita Ribeiro (CENTRIA/New University of Lisbon ,Portugal); University of Antwerp-Ruca (Belgium); University of Piraeus (Greece).
Description	Evaluation Model for the Optimal Location of Intermodal Terminals in Europe.
Results	2 papers and a software prototype

Name	PIPATpor
Status	Completed
Funding Institution	Marktest (Portugal)
Principal researcher	Fernando Moura Pires
Participants	Departamento de Informática da FCT/UNL (CENTRIA)
Description	TV audiences forecasting
Results	

Name	OAR
Status	Proposed
Funding Institution	PRAXIS XXI
Principal researcher	Salvador Pinto Abreu
Participants	Ligia Ferreira, 2 scholarship students
Description	Development of a system for distributed re-writing of AND.OR trees, based on previous experience in AKL and EAM architectures. Java Implementation. Application to the development of Information Systems for Institutions incorporating a deductive functionality.
Results	Not applicable

Name	PGR - Selective Access to the information contained in the Opinions of the Portuguese Republic
Status	Ongoing (Started in January 1998; Duration: 3 years)
Funding Institution	Agência de Inovação
Principal researcher	Gabriel Pereira Lopes
Participants	Heurística, CENTRIA and Procuradoria Geral da República.
Description	Access to the opinions of the Portuguese Republic Attorney (PGR) via web, by incorporating knowledge about Portuguese Language (namely a large lexicon, and multi-word units automatically extracted from the PGR corpus) in the search engine used.
Results	# publications) [56, 34] and a demo at: http://coluna.di.fct.unl.pt/ pgrd

Name	DIXIT - Multilingual Intentional Dialogue Systems
Status	Finished
Funding Institution	JNICT/PRAXIS - Project: 2/2.1/TIT/1670/95
Principal researcher	Gabriel Pereira Lopes
Participants	DI/FCT/UNL and Universidade de Évora
Description	Mental State based dialogue control; pragmatic interpretation; identification of the intentions of the interlocutors; behaviour programming taking into account own and others mental states The last ones are assumed); acting (speech and other acts); partial parsing; implicit information (linguistic knowledge) extraction from corpora.
Results	13 publications [45, 44, 23, 21, 22, 37, 26, 60, 36, 35, 40, 39, 34]

Name	Medieval Portuguese Corpora, automatic POS-tagging and partial parsing of this corpora
Status	Ongoing (Started in September 1996; Duration: 3 years)
Funding Institution	JNICT/PRAXIS
Principal researcher	Francisca Xavier (FCSH/UNL) and Gabriel Pereira Lopes (FCT/UNL).
Participants	FCSH/UNL e DI/FCT/UNL
Description	Reuse of tools built for Contemporaneous Portuguese in texts from the XIIIth e XIVth centuries
Results	Nothing was published. Reports about the results obtained were produced.

Name	FUNDAÇÕES - Multi Agent Systems and Natural Language Processing: Foundations and Aplications
Status	Ongoing (Started in January 1998; Duration: 2 years; anual renewal)
Funding Institution	Scientific and Technical Institute for the International Co-operation (ICCTI, PT) and CAPES (BR)
Principal researcher	Gabriel Pereira Lopes (CENTRIA/DI/FCT/UNL) e Vera Lima (PUCRS)
Participants	CENTRIA and Faculdade de Ciências da Universidade de Lisboa; Departamento de Matemática da Universidade de Évora; Instituto de Informática da Pontificia Universidade Católica do Rio Grande do Sul de Porto Alegre, Brazil (PUCRS).
Description	This project was aimed at supporting the co-operation of the proponent teams for the application of Multi-Agents Architectures to Natural Language Processing Systems. This project builds on top of the projects: NALAMAS (BR) and DIXIT, PGR, CORPUS e JUSTIÇA (PT). Additional co-operation will exist on training master's and Ph.D. students.
Results	A number of publications [45, 44] and three Ph.D thesis that will be finished till the end of 1999.

Name	Analysis and Synthesis of sentences in Portuguese and French
Status	Ongoing (Started in January 1998; Duration: 2 years; renewed for 1999)
Funding Institution	Scientific and Technical Institute for the International Co-operation (ICCTI, PT) and CNRS (FR) - (ICCTI/CNRS Contract 423/France)
Principal researcher	Gabriel Pereira Lopes (CENTRIA/DI/FCT/UNL) Robert Pasero (LIM/CNRS)
Participants	researchers from CENTRIA and Laboratoire d' Informatique de Marseille (LIM).
Description	This project aims at: designing and developing a kernel grammar description for Portuguese (lexicon, syntax, compositional semantics); integrating this kernel into the system ILLICO; designing and developing an application of the kind DataBase searcheable in Portuguesse and French; taking into account context and discourse levels.
Results	The ILLICO kernal was adapted to Portuguese. Currently it works with declarative sentences as well as with some interrogative sentences (yes-no and wh) and with relative clauses.

Name	NALAMAS - Natural Language Multi-Agent Systems
Status	Terminated (Started in August 1996; lasted 2 years)
Funding Institution	CNPq, (PROTEM-III-CNPq Programme, Contract 680081/95-0
Principal researcher	Vera Strube de Lima
Participants	Various researchers from Universidade Federal do Rio Grande do Sul, Porto Alegre, Universidade Federal de Santa Catarina in Florianópolis, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (PUCRS) (Project leader), Universidade de São Paulo
Description	This project has as its main goal the feasibility study of multi-agent systems use for processing natural language texts.
Results	Various publications [45, 44, 23, 21, 22, 37, 60, 36, 35, 40, 39, 34]

Name	JUSTIÇA - Automatic acquisition of facts that occurred and are described by the decisions of the Supreme Court and Natural Language Interrogation about those facts
Status	Ongoing (Started in December 1995; Duration: 3 years)
Funding Institution	FCT (ex-JNICT)
Principal researcher	Irene Pimenta Rodrigues
Participants	
Description	Automatic acquisition of facts that occurred and are described by the decisions of the Supreme Court and Natural Language Interrogation about those facts
Results	

Name	TARDE - Tabulation And Revision in a Distributed Prolog Environment
Status	Proposed.
Funding Institution	PRAXIS.XXI
Principal researcher	Carlos Viegas Damásio
Participants	CENTRIA/UNL and CITI/UNL
Description	The combination of tabling systems, revision systems and distributed programming is mandatory and promising. It is expected in this very focused project to cross-fertilise the know-how in the implementation of PROLOG distributed systems with the know-how in tabling systems and revision techniques. This will result in building an advanced and efficient portable distributed logic programming (revision) system, incorporating the most recent semantical and operational techniques currently available.
Results	Not applicable.

Name	Satelite Image Interpretation - JD20/DI/97
Status	Finished
Funding Institution	Direcçao da FCT/UNL
Principal researcher	Joaquim N. Aparício
Participants	Joaquim N. Aparício and João P. Santos
Description	Due to the large amount of satelite images, it is accepted that (semi)-automatic systems are needed which may help in the process of classification. Here we make a test of an Object Oriented and Deuctive approach to the problem of image classification.
Results	A prototype and 3 papers

Name	Object Oriented Spatial Databases
Status	Proposed
Funding Institution	PRAXIS XXI
Principal researcher	Joaquim N. Aparício
Participants	Joaquim N. Aparicio and Joao Paulo Santos, (CENTRIA) + researchers from CITI and CNIG (Ana Moreira, Armanda Rodrigues, Joao Seco, Miguel Boavida, Cédric Grueau)
Description	This project will contribute to establish a sound theoretical basis to define a semantics for object-oriented databases, to identify adequate spatial ontologies, specifying them using an object-oriented approach, to create an object-oriented development method to model spatial ontologies, and propose mechanisms that must exist in a database to support the object-oriented programming paradigm.
Results	Not applicable

Name	NEUROWEB
Status	Ongoing
Funding Institution	ICCTI and INRIA (France)
Principal researcher	Pedro Barahona (in FCT/UNL)
Participants	CENTRIA (Jorge Cruz) , INRIA (Grenoble) and Centro de Estudos Egas Moniz
Description	Integration of knowledge based systems in an Internet Platform
Results	Definition of the context in which our system (DARE) is to be used.

Name	REMÉDIO: Constraints in Medicine and Health Care
Status	Proposed
Funding Institution	FCT, Programme PRAXIS
Principal researcher	Pedro Barahona
Participants	Jorge Cruz, Paula Amaral, Francisco Azevedo, João Moura Pires, Ludwig Krippahl
Description	To develop innovative constraint technology to be applied on the health sector, namely: a) complex finite domain problems, such as scheduling and assignment, for the management of health care resources; b) Extensions to fuzzy formulations as well as to problems over real variables; c) Non-linear constraints to handle biomedical models and develop decision support systems; d) study the structure of proteins and other important molecules in pharmaceutical applications.
Results	Not Applicable

Name	PRESTIGE - Guidelines in Healthcare
Status	Ongoing
Funding Institution	European Union (Healthcare Telematics)
Principal researcher	Pedro Barahona (in FCT/UNL)
Participants	Francisco Azevedo (UNINOA/CENTRIA), 30 European partners
Description	To develop technology to support the use of guidelines in medicine. These must be translated into computerised protocols for which there is a need of a specification languages and tools to run them and integrate their use with an electronic patient record. One such tool is a protocol manager that based on the specification of the protocol and the data on the patient recorde schedules medical acts (in the form of recommendations to the health care user)
Results	A prototype of the protocol manager

Name	ACAVA - Arquitecturas de Comportamentos Adaptativos para Veículos Autónomos
Status	On going, from Oct/98 to Sep/99.
Funding Institution	FCT/UNL
Principal researcher	Luís Correia
Participants	Luís Correia, Pedro Mariano, António Abreu
Description	Study and development of behaviour based control architectures for mobile robots. The architecture models to research should have adaptive capabilities. Results are to be implemented in a real demonstration prototype.
Results	Prototype of a controller with parameters genetically adapted, in development. Paper "Navigation using Behaviours for Space Representation", by Luís Correia, submitted to 5th European Conference on Artificial Life (ECAL99).

Name	Robust Navigation for Indoors Autonomous Vehicles
Status	Proposed
Funding Institution	PRAXIS XXI/98
Principal researcher	Luís Correia
Participants	Researchers from CENTRIA, FEUP and IST/UTL
Description	The main goal of this project is to tackle the development of Autonomous Vehicles control for unstructured inhabited indoor environments, in order to obtain robust behaviour with navigation capability.
Results	not applicable

Name	JD-15/97 Temas e Conceitos em Ciências Cognitivas [Concepts and Themes in Cognitive Sciences]
Status	Completed in December 1998
Funding Institution	FCT/UNL
Principal Researcher	Manuel Costa Leite
Participants	CENTRIA
Description	In such areas as CS, the way the subject of research is selected, or the methodology is chosen, is not a trivial matter. The goal of this "preliminary" research project is then to diagnose and analyse, in national as well as in international terms, the concepts and themes of Cognitive Science, which could be put together in a meaningful and rewarding network, in a fruitful way. National and local human research resources are therefore also subject to scrutiny.
Results	A brief internal report for the Scientific Council of FCT/UNL. A technical report, already completed; to be edited and published as a book in 1999 (cf. Plans for 1999).

Name	Formações à/pela investigação em Antropologia cognitiva e Etnociências: criação de um pólo português nestes domínios. [Research in Cognitive Anthropology and Ethnosciences : establishment of a Portuguese node.]
Status	1st phase completed; 2nd phase, in progress.
Funding Institution	ICCTI-French Embassy.
Principal Researcher	Portugal: José Rodrigues dos Santos. France: Marie Roué.
Participants	CENTRIA, University of Évora. ISCTE, Lisbon. UMR CNRS 882, MNHN, Paris.
Description	Establishment of an European research network on Cognitive Anthropology.
Results	Conferences have been held. But there are no Proceedings. José Rodrigues dos Santos was appointed to develop a Portuguese node (in collaboration with the University of Évora and within CENTRIA).

Name	Semântica e Memórias Externas. [Semantics and External Memories]
Status	Completed in July 1998.
Funding Institution	
Principal Researcher	Portugal: José Rodrigues dos Santos.
Participants	CENTRIA. SEMOT&C Group (?Group on Semantics, Montpellier, Toulouse and Compiègne?). 1 Assistance Publique and Hopitaux de Paris. Conservatoire National des Arts et Métiers (CNAM), Paris.European Institute of Cognitive Sciences and Engineering (EURISCO), Toulouse, France University of Évora, Portugal. Institut Européen d?Écologie, Metz, France. Laboratoire de Psychologie Cognitive, Univ, Paul Valéry, Montpellier, France. Laboratoire d?Informatique et de Robotique et Modélisation de Montpellier, (LIRMM), (CNRS-Univ. Montpellier III). Montpellier Cognition (Univ. Montpellier I and III), Montpellier. COSTECH/PHITECO, Université Technologique de Compiègne.
Description	The Project will be conducted by a work group including sociologists, philosophers, anthropologists, linguists, psychologists, informatics, and engineers. Its goal is to orient the various? Centers Research towards a problem area : Categorization and Management of large Knowledge Corpora which constitute external Memories. The Group has deliberately focused its efforts on Industrial World Application, e.g. the management of procedures in Aeronautics. Through the analysis and comprehension of the problems related to this type of Corpora, the Group will attempt to extract hard core ?real world? problems. These problems are studied in a cooperative way by the various partners, helped by appropriate techniques and tools at hand.
Results	Main areas of intervention have been identified. Final Report has been presented in July 98, as planned. Results were publicly presented in Paris, in 1998.

6 List of M.Sc. and Ph.D. students and topics in 1998

6.1 M.Sc. Students (15)

Name	Ludwig Krippahl
Degree	M.Sc.
Topic	Determination of the Structure of Proteins with Constraint Solving Techniques.
Supervisor	Pedro Barahona /Frederic Benhamou (Un. Nantes)
Start date	October 1998
Finish date	September 1999 (Expected)

Name	José Carlos Tavares Carreira
Degree	M.Sc.
Supervisor	Luís Moniz Pereira
Topic	A semantics for production systems
Start date	September 1996
Finish date	April 1998

Name	José Ferreira de Castro
Degree	M.Sc.
Supervisor	Luís Moniz Pereira
Topic	An expert system for diagnosis of the national electrical power distribution network
Start date	October 98
Finish date	September 99

Name	Sílvia Pinheiro
Degree	M.Sc.
Supervisor	Luís Moniz Pereira
Topic	Management of FCT/UNL research centers and social impact of their projects
Start date	December 1998
Finish date	November 1999

Name	Paulo César Monteiro
Degree	M.Sc.
Supervisor	Luís Correia
Topic	Dynamic Traffic Control in telecommunication networks
Start date	October 1997
Finish date	October 1998

Name	Pedro Lopes Mariano
Degree	M.Sc.
Supervisor	Luís Correia
Topic	Optimization of trajectories in an autonomous vehicle, using genetic algorithms
Start date	October 1998
Finish date	October 1999

Name	Pedro Quintas
Degree	M.Sc.
Supervisor	Luís Correia
Topic	Integrated system for Compression, Indexing, Search and Retrieval of Text from Data Bases
Start date	October 1996
Finish date	March 1999

Name	Mário S. Marques
Degree	M.Sc.
Supervisor	Rita Ribeiro
Topic	Fuzzy decision support system for the management of equipment repairs under battle conditions.
Start date	1998
Finish date	mid 1999

Name	Carmen Pires Morgado
Degree	M.Sc.
Supervisor	Fernando Moura Pires
Topic	Robot Controler basedon a Classifier System
Start date	
Finish date	May 1999 (Expected)

Name	Luis de Almeida
Degree	M.Sc.
Supervisor	Fernando Moura Pires
Topic	Temporal Neural Network
Start date	
Finish date	May 199 (Expected)

Name	Rogerio Cristo
Degree	M.Sc.
Supervisor	Fernando Moura Pires
Topic	Documents Classification
Start date	
Finish date	December 2000 (Expected)

Name	Nuno Bandeira
Degree	M.Sc.
Supervisor	Fernando Moura Pires/Agostinho Rosas (IST)/ Teresa Paiva (Hospital de Santa Maria)
Topic	Clustering based on Ingormation Theory
Start date	September 1998
Finish date	October 1999 (Expected)

Name	Fernando Manuel de Carvalho Almeida e Costa
Degree	M.A.
Supervisor	Manuel Costa Leite
Topic	Philosophy of Cognition
Start date	October 1998
Finish date	October 1999 (expected)

Name	João Paulo Portelinha Santos
Degree	M.Sc.
Supervisor	Joaquim Nunes Aparício
Topic	Satelite Image Classification
Start date	
Finish date	February 1999

Name	Vitor Manuel Beires Pinto Nogueira.
Degree	M.Sc.
Supervisor	Carlos Damásio
Topic	Negation in Transaction Logic.
Start date	October 1998.
Finish date	October 1999 (expected)

6.2 Ph.D. Students (22)

Name	Sérgio Andrade de Freitas
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes
Topic	Ellipsis and pronoun and definite anaphora resolution
Start date	October 1993
Finish date	1999 (expected)

Name	Jorge Ramos Rocio
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes / Pierre Boullier (Université de Orléans, France)
Topic	Infra-structure for partial parsing natural language input and for diagnosing possible faults (in the lexicon, pre-processing phases, and in the input)
Start date	April 1995
Finish date	1999 (expected)

Name	Nuno Miguel Cavalheiro
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes
Topic	Automatic extraction of subcategorization frames from text corpora.
Start date	April 1995
Finish date	July 1999 (expected)

Name	Michael da Costa Móra,
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes / Rosa Viccari (UF Rio Grande do Sul)
Topic	Belief, Desire and Intention Models and Systems: reducing the gap between specification and implementation
Start date	March 1996
Finish date	July 1999 (expected)

Name	João Balsa da Silva
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes
Topic	Multi-Agent Architecture for declarative fault finding in parsing tasks
Start date	October 1996
Finish date	2000 (expected)

Name	Gael Dias
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes / Sylvie Guilloré (Université de Orléans)
Topic	Extraction of translation equivalents from parallel corpora (French and Portuguese)
Start date	October 1997
Finish date	2001

Name	António Ribeiro
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes
Topic	Extraction of translation equivalents from parallel corpora (English and Portuguese)
Start date	October 1996
Finish date	2000

Name	Berilhes Borges Garcia
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes
Topic	changeability along the time axis of behavior pressupositions (truthfulness, co-operativity, activity, credulousness), credulidade) of an autonomous agent
Start date	October 1996
Finish date	2000 (expected)

Name	Joaquim Ferreira da Slva
Degree	Ph.D.
Supervisor	Gabriel Pereira Lopes
Topic	Extraction of Multi-word units from text corpora and decision about pp-attachement
Start date	March 1998
Finish date	2001

Name	Jorge Cruz
Degree	Ph.D.
Topic	Interval Constraints to handle Differential Equations with Applications to Medicine.
Supervisor	Pedro Barahona /Frederic Benhamou (Un. Nantes)
Start date	October 1997
Finish date	October 2000 (Expected)

Name	Paula Amaral
Degree	Ph.D.
Topic	Adaptation of Overconstrained Linear Constraint Problems
Supervisor	Pedro Barahona
Start date	October 1998
Finish date	October 2001 (Expected)

Name	Francisco Azevedo
Degree	Ph.D.
Topic	Exploitation of Global Constraints in Finite Domain Constraints
Supervisor	Pedro Barahona
Start date	January 1998
Finish date	December 2001 (Expected)

Name	Iara Mora
Degree	Ph.D.
Supervisor	José Alferes
Topic	Argumentation and cooperation in multi-agent logic programming systems, with application to distributed diagnosis
Start date	October 1997
Finish date	October 2000 (Expected)

Name	João Leite
Degree	Ph.D.
Supervisor	Luís Moniz Pereira
Topic	Architecture for rational agents
Start date	October 1996
Finish date	March 2001

Name	António Paulo Duarte Gomes de Abreu
Degree	Ph.D.
Supervisor	Luís Correia
Topic	Development of control architectures for autonomous robots navigation
Start date	September 1998
Finish date	September 2002

Name	João Moura-Pires
Degree	Ph.D.
Supervisor	Rita Ribeiro / Henri Prade (Un. Toulouse)
Topic	Constraint satisfaction problems in a fuzzy environment
Start date	1994
Finish date	1999

Name	Isabel Lopes Nunes
Degree	Ph.D.
Supervisor	Rita Ribeiro
Topic	Fuzzy Ergonomics: an Expert sytem with fuzzy logic
Start date	1996
Finish date	2000

Name	Susana Nascimento
Degree	Ph.D.
Supervisor	Fernando Moura Pires/ Boris Mirkin
Topic	Fuzzy Clustering
Start date	May 1995
Finish date	December 2000 (Expected)

Name	Victor Lobo
Degree	Ph.D.
Supervisor	Fernando Moura Pires
Topic	Classification of Hydrophnoic effects
Start date	May 1996
Finish date	December 2002 (Expected)

Name	Rafaela Azinhal
Degree	Ph.D.
Supervisor	Fernando Moura Pires
Topic	Distributed Genetic Algorithms
Start date	July 1996
Finish date	December 2001 (Expected)

Name	Teresa Cristina Goncalves
Degree	Ph.D.
Supervisor	Fernando Moura Pires
Topic	Clustering based on Ingormation Theory
Start date	April 1997
Finish date	December 2001 (Expected)

Name	Margarida Cardoso
Degree	Ph.D.
Supervisor	Isabel Themido (IST) / Fernando Moura Pires
Topic	Clustering based on Ingormation Theory
Start date	
Finish date	December 1999 (Expected)

7 Slides Overview of CENTRIA

8 CENTRIA Publications in 1998

[1] *Special volume on Logics for Artificial Intelligence.* Journal of Automated Reasoning, 1998.

[2] J. J. Alferes, L. M. Pereira, and T. Przymusinski. Classical negation in nonmonotonic reasoning and logic programming. *Journal of Automated Reasoning*, 1998.

[3] J.J. Alferes, J.A. Leite, L.M. Pereira, H. Przymusinska, and T. Przymusinski. Dynamic logic programming. In *International Conference on Knowledge Representation and Reasoning - KR98.*

[4] J.J. Alferes, J.A. Leite, L.M. Pereira, H. Przymusinska, and T. Przymusinski. Dynamic logic programming. In *Joint International Conference on Declarative Programming.*

[5] J.J. Alferes, J.A. Leite, L.M. Pereira, H. Przymusinska, and T. Przymusinski. Updates of logic programs by means of logic programs. In *7th International Symposium on Inteligent Information Systems - IIS'98.*

[6] J.J. Alferes and L.M. Pereira. Tabling abduction. In *1st International Workshop on Tabulation in Parsing and Deduction - TAPD'98.*

[7] J. N. Aparício and J. P. Santos. Non-monotonic reasoning about and within spatial images. Technical report, University of Koblenz, 1988.

[8] J. N. Aparício and J. P. Santos. Conceptual clustering. MAVIRIC: Machine Vision in Remotely Sensed Image Comprehension, 1998.

[9] J. N. Aparício and J. P. Santos. Interpreting satellite images with prolog. 11th International Conference on Applications of Prolog, 1998.

[10] F. Azevedo and P. Barahona. Dgeneration of test patterns for differential diagnosis of digital circuits. In *Principles and Practice of Constraint Programming - CP98.*

[11] F. Azevedo and P. Barahona. Generation of test patterns for differential diagnosis of digital circuits. In *Procs. of ERCIM/COMPULOG Workshop on Constraints.*

[12] Rafaela Azinhal and Fernando Moura Pires. Comparing sequential and distributed genetic algorithms: Performance measures and results. In *ANNIE98- Artificial Neural Networks in Engineering*, Smart Engineering Systems Laboratory, Department of Engineering Management, November 1998. University of Missouri - Rolla, USA, ASME Press.

[13] Rafaela Azinhal and Fernando Moura Pires. Some comparisons between a simple genetic algorithm (ga) and a synchronous non-blocking distributed ga. Abstract accepted to the Conference Optimization98, Coimbra, July 20-22, 1998, 20-22 Julho 1998.

[14] Nuno Filipe Cabrita Bandeira, Vitor Sousa Lobo, and Fernando Moura Pires. Training a self-organizing map distributed on a pvm network. In *Proceedings of the International Joint Conference on Neural Networks 1998*, page 5. IEEE, IEEE, 1998.

[15] P. Barahona. Defeasible constraint solving over the booleans. In *Progress in Artificial Intelligence - Iberamia 98.*

[16] Carlos Viegas Damásio. Resumo da dissertação "paraconsistent extended logic programming with constraints". In Helder Coelho, editor, *I Concurso Ibero-Americano de Teses e Dissertações em Inteligência Artificial do VI Congresso Ibero-Americano de Inteligência Artificial (IBERAMIA'98)*, pages 481–492. Edições Colibri, 1998. Segundo classificado.

[17] Carlos Viegas Damásio and Luís Moniz Pereira. A general tabulation procedure for extended constraint logic programs. In *First Workshop on Tabulation, Parsing and Deduction*, 1998.

[18] Carlos Viegas Damásio and Luís Moniz Pereira. A survey of paraconsistent semantics for logic programas. In D. Gabbay and P. Smets, editors, *Handbook of Defeasible Reasoning and Uncertainty Management Systems*, volume 2, Reasoning with Actual and Potential Contradictions. Coordenado por P. Besnard e A. Hunter, pages 241–320. Kluwer Academic Publishers, 1998.

[19] J. Dix, L. M. Pereira, and T. Przymusinski, editors. *Logic Programming and Knowledge Representation*. Lecture Notes in Artificial Intelligence. Springer-Verlag, 1998. Selected papers from LPKR97 ws at ILPS'97.

[20] J. Dix, L. M. Pereira, and T. Przymusinski, editors. *Logic Programming and Knowledge Representation*. Springer-Verlag, 1998.

[21] B. B. Garcia and J. G. P. Lopes. Introducing plausibility measures in the process of belief revision through extended logic programs. In Henri Prade, editor, *ECAI98. 13th European Conference on Artificial Intelligence*, Chichester, 1998. John Wiley & Sons, Ltd.

[22] B. B. Garcia, J. G. P. Lopes, and P. Quaresma. Modelling credulity and skepticism through plausibility measures. In F. Moreira, editor, *Advances In Artificial Intelligence: 14th Brazilian Symposium on Artificial Intelligence - SBIA'98, Porto Alegre, Brazil, November 1998, Proceedings*, number 1515 in Lecture Notes in Artificial Intelligence, pages 171—180, Berlin, Germany, 1998. Springer Verlag.

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[24] Teresa Cristina Gonçalves and Fernando Moura Pires. An attribute redundancy measure for clustering. In *to appear in Twelfth Canadian Conference on Artificial Intelligence*, 1998.

[25] Teresa Cristina Goncalves and Fernando Moura Pires. Using the arq function to classify unseen objects. In *4th International Conference on Information Systems Analysis and Synthesis*, August 1998. to appear.

[26] I.P.Rodrigues and J.G.P. Lopes. Ai5 - an interval algebra for the temporal relations conveyed by a text. In Martin Vide, editor, *Mathematical and Computational Analysis of Natural Language*, number 45 in Studies in Functional and Structural Linguistics, pages 223—237. John Benjamins Publishing Company, Amsterdam, Holland, 1998. Selected Paper from the second international conference on Mathematical Linguistics (ICML'96), Tarragona, 2–4 May 1996.

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[33] Vitor Sousa Lobo, Roman Swiniarski, and Fernando Moura Pires. Pruning a classifier based on a self-organizing map using boolean function formalization. In *IJCNN - WCCI 98*, page 6. IEEE, IEEE, May 1998.

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[43] I. Móra, J.J. Alferes, and M. Shcroeder. Argumentation and cooperation for distributed extended logic programs. In *NonMonotonic Reasoning Workshop*.

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