

Institute for Logic, Language and Computation

Self Evaluation 2000-2005

Part A: documentation regarding the level of the institute
Part B: documentation regarding the level of the research programmes

Common acronyms used throughout the self evaluation report

ACT:	Algorithms and Complexity Theory
CIL:	Constructive and Intensional Logic
CSIP:	Cognitive Systems and Information processing
CWI:	Centrum voor Wiskunde en Informatica (Centre for Mathematics and Computer Science)
FGW:	Faculteit der Geesteswetenschappen (Faculty of Humanities)
FNWI:	Faculteit der Natuurwetenschappen, Wiskunde en Informatica (Faculty of Science)
FTE:	Full Time Equivalent
ILLC:	Institute for Logic, Language and Computation
KNAW:	Koninklijke Nederlandse Akademie van Wetenschappen (Royal Netherlands Academy of Arts and Sciences)
LIT:	Language and Inference Technology
MoL:	Master of Logic
NWO:	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Netherlands organization for scientific research)
OZSL:	Onderzoeksschool Logica (Dutch Graduate School in Logic)
TI:	Theory of Interpretation
UvA:	Universiteit van Amsterdam

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Part A

Documentation regarding the level of
the institute

The Institute for Logic, Language and Computation

The Institute for Logic, Language and Computation (ILLC) is an interdisciplinary research institute, in which researchers from the Faculty of Science and the Faculty of Humanities co-operate. Its scientific mission is to study formal properties of information, viz., the logical structure and algorithmic properties of processes of encoding, transmitting and comprehending information. These goals are pursued in close interaction with neighbouring disciplines in which the same or similar concepts play a central role. As a result of its interdisciplinary orientation and its scientific mission ILLC has a broad scientific profile: its research spans across a number of disciplines ranging from philosophical analysis to computational complexity theory, and from psycholinguistics to game theory.

Within the Universiteit van Amsterdam ILLC takes part in the *Cognitive Science Center Amsterdam (CSCA)*, a consortium of selected groups of biologists, psychologists, linguists, logicians, mathematicians and social scientists from the faculties of Science (FNWI), Social and Behavioural Sciences (FMG), and Humanities (FGW) that have joined forces to promote and pursue the study of human cognition.

The PhD training of ILLC takes place at a national level in collaboration with the *Dutch Graduate School in Logic (OZSL)*. The OZSL organizes a yearly school week, and a varying number of master classes throughout the year.

Internationally, ILLC is very active in the *European Foundation for Logic, Language and Information (FoLLI)*. Each year FoLLI organizes the European Summer School on Logic, Language and Information (ESSLLI). FoLLI has its own journal, the *Journal of Logic, Language and Information*.

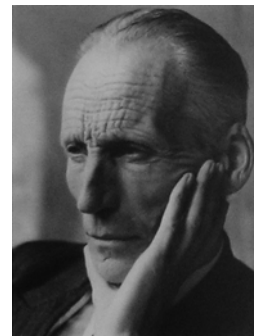
Precursors of ILLC



A. Heyting
1898-1980



E.W. Beth
1908-1964



L.E.J. Brouwer
1881-1966

1. Mission statement

Information has become a central theme for scientific studies across many disciplines. Encoding, transmission, and comprehension of information are the central topics of research at ILLC. What we envisage is an information science that is concerned with information flow in natural and formal languages, as well as in other means of communication, including music and graphics. The research aim is to develop logical systems that can handle this rich variety of information, making use of insights across

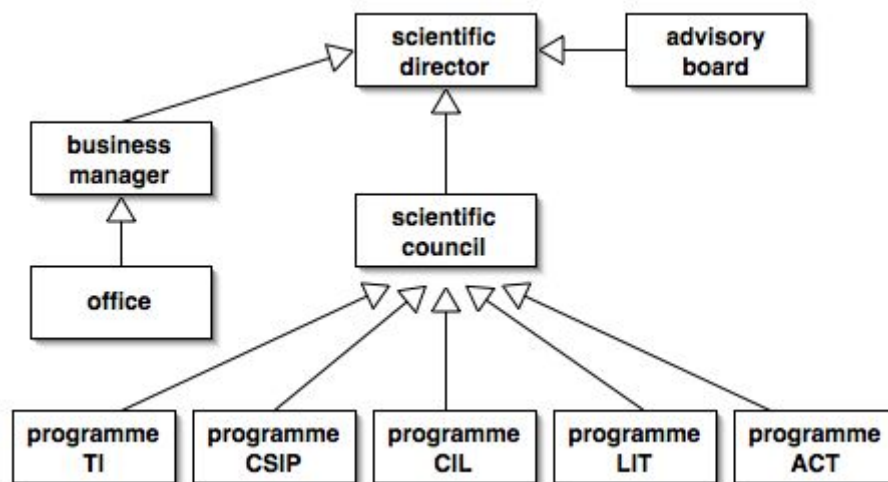
such disciplines as linguistics, computer science, cognitive science, artificial intelligence and philosophy. Whenever relevant, additional methods, ranging from statistics to argumentation theory, are actively pursued as well. In addition to its specific research goals, ILLC aims to overcome traditional borderlines between faculties and disciplines and serves as a rallying point for information scientists across computer science, linguistics, philosophy, and the social sciences.

The resulting view of information science transcends the boundaries of the university. ILLC is also committed to dissemination of its results into the broader world of general education, vocational training and industrial research. Moreover, ILLC strives to build strong alliances with institutes that share this view.

2. Leadership

Administrative Structure

The administrative structure of ILLC can be pictured as follows:



The *scientific director* is responsible for the scientific programme of the institute, its finances and the overall performance. (S)he is assisted by a *business manager* who is also chef de bureau. The director can delegate any competence to the manager, but remains responsible. The director appoints a *deputy director* who replaces the director in case of absence. The director also appoints one or more *programme leaders* to each research programme. The programme leaders report to the director on the scientific developments in their programme. They are responsible for the communication between the director and the staff working in their programme. The programme leaders and the deputy director advise the director on all scientific and administrative matters. The director, business manager and programme leaders are supported by the office for administrative and organizational tasks. There are two advisory bodies which advise the director and the institute when consulted and on their own initiative. The *Scientific Council*, which consists of all programme leaders, advises the director on all matters concerning the institute. The director of the institute receives external advice from the *Board of Scientific Advisors*. The board is appointed by the dean of the Faculty of

Science. The board reports to the dean.

During the review period 2000-2005, the following people played a role in the administrative organization.

Scientific Director:

- M. Stokhof (until March 2004)
- F. Veltman (from March 2004)

Deputy Scientific Director:

- D. de Jongh (until November 2004)
- L. Torenvliet (from November 2004)

Business Manager:

- P. Blok (until April 2002)
- I. van Loon (from April 2002)

Programme Leaders:

- *Theory of Interpretation (TI)*
J. Groenendijk, M. Stokhof
- *Cognitive Systems and Information Processing (CSIP)*
M. van Lambalgen, R. Scha
- *Constructive and Intensional Logic (CIL)*
J. van Benthem (until September 2003), D. de Jongh (until November 2004)
- *Language and Inference Technology (LIT)*(until April 2004)
M. de Rijke, M. Masuch
- *Algorithms and Complexity Theory (ACT)*
P. van Emde Boas, L. Torenvliet

Scientific Council: programme leaders

Advisory Board:

- S. Feferman, Stanford University
- W. Hodges, University of London
- H. Kamp, Universität Stuttgart
- G. Plotkin, University of Edinburgh
- J. Siekmann, DFKI, Saarbrücken.

The right and duties of the institute and its director are laid down in the *University Regulations*, in the *Regulations of the Faculty of Science*, and *The Regulations Concerning the Management of Research Institutes*.

Administrative procedures

ILLC's research programme 2001-2005, under review here, was devised after an intensive discussion with the Advisory Board during a two day visit in September 2000, which was the last time the Advisory Board as a whole visited ILLC. The Advisory Board is consulted mainly by mail. The last time this happened was when the profile of the successor of Dick de Jongh had to be established.

Internally, within the institute, the most important meetings are the meetings of the Scientific Council, which take place about six times a year. The research programmes also have their own meetings which are sometimes attended by the director of ILLC, in particular when long term strategic matters are at stake. The last time this happened was when the new research programme 2006-2010 was drawn up.

Externally, the situation is more complicated. ILLC was established in 1991 as an institute between faculties in accordance with the *University Regulations*, Chapter 5. Presently, the participating faculties are the Faculty of Science, which also houses the office, and the Faculty of Humanities. ILLC 's scientific director is appointed by the dean of the Faculty of Science. The institute's research program is approved by the deans of the participating faculties.

Due to this special administrative status, the day-to-day running of the institute itself is more complex, and more time-consuming than that of other research institutes, since consultations with two different faculty administrations and several separate departments have to be conducted. What complicates the matter further is that the administrative structure of the faculties involved differs considerably. In the Faculty of Science the research institutes are the primary units in the organization, both with regard to budgetary matters and to personnel matters. The Faculty of Humanities, however, is essentially teaching oriented. Thus, the departments, the primary organizational units which 'house' the personnel are very important as are the teaching institutes. The research institutes have no primary role in budgetary or personnel decisions, but function as responsible stakeholders for quality and strategy of research.

The administrative position is, of course, a reflection of a particular view of the profession. A natural consequence of the nature of ILLC's scientific mission is that the institute crosses not just administrative boundaries but also disciplinary ones. This may well go further than 'mere' multidisciplinary or interdisciplinary projects. The development of information science also constitutes the possibility of a new paradigm of scientific research which transcends the traditional division between natural sciences, humanities, social sciences. To the extent that ILLC is party to these developments, it fosters a scientific practice which is not only relatively independent from this traditional division of disciplines, but also aims to make a contribution to the furthering of awareness within these disciplines themselves of these new developments. For these reasons ILLC wants to, and needs to, maintain a strong presence in all its participating departments and faculties. This goes further than just the research: also through teaching and involvement in other activities and processes ILLC aims to contribute to a better mutual understanding between the disciplines.

Communication

For internal and external communication and publicity, we use the following media:

- *ILLC News*, a weekly electronic newsletter (for internal use only)
- *ILLC Current Affairs*, a monthly overview of 'matters of concern' by the manager and director (for internal use only)
- The web pages of ILLC: <http://www.illc.uva.nl/>
- *ILLC Magazine*: a magazine for alumni and other relations that appears once a year
- *ILLC Annual Report*

3. Strategy and policy

Developments in the period 2000 - 2005

As was indicated above, the study of information and information processing is becoming increasingly important. A new ‘information science’, which draws on research in logic, cognitive and neuroscience, computer science, linguistics, and philosophy, is emerging. Logic, along the broad spectrum in which it is practiced at ILLC, is the theoretical core of this new field.

ILLC’s ambition is to maintain its leading position in this area. To realize this ambition new developments have to be identified and actively stimulated. In the period 2000–2005 we identified three such developments: (a) computational applications; (b) integrated theories; (c) relations with cognitive science.

Computational applications: ILLC is traditionally very strong in research with a strong theoretical flavour. However, it has become ever more important to illustrate the fruitfulness of one’s theoretical ideas for practical applications. Thus, in the past six years an interest in implementation and experimental design of applications has emerged, as witnessed by the programme *Language and Inference Technology*, and some of the research in the programmes *Algorithms and Complexity Theory* and *Cognitive Systems and Information Processing*.

The Board of the Universiteit van Amsterdam supported the development of this research line with a subsidy from the Central Research Budget of 0,28 million Euro, which made it possible to attract a new assistant professor (Khalil Sima’an).

Integrated theories: As information and information processing is studied on a larger scale, and in real environments, the need for an integrated approach, is becoming more and more obvious. ILLC is one of the few research institutes which has expertise across a number of relevant areas. The developments that have taken place in the field of *Game Theory and Communication* and in *Learning Theory*, are typical examples of developments which cross traditional boundaries.

This research line was also stimulated by a grant from the Central Research Budget of the Universiteit van Amsterdam: ILLC got two additional PhD positions to work on ‘integrating’ projects.

Game Theory and Communication has become an important area of research using the concept of procedural activities with interdependency in mathematical logic (model theory and proof theory), foundations of mathematics (set theory), computer science (automata theory, computational complexity theory), computational linguistics (formal semantics and pragmatics) and philosophy (theory of rationality). The bustling activities in this field lead to an enormous success: we managed to get a grant for a Marie Curie Research Training Site *GLoRiClass* (Games in Logic: Reaching Out To Classical Game Theory) funding eight PhD students. The aim of the Research Training Site *GLoRiClass* is to educate young researchers who are knowledgeable in all parts of *Logic and Games*, but also in adjoining areas in the game-theoretic tradition, allowing them to reach out, and function successfully at the interface.

Relations with cognitive, neurosciences: Today disciplines such as neurophysiology and cognitive psychology are increasingly concerned with (mainly human) information processing and make great progress in unravelling the underlying psycho-physical mechanisms. These results are of immediate relevance to logic in the broad sense it is

conceived of here. Reversely, insights from logic may turn out to be important for cognitive and neurosciences, as they may contribute to a broader understanding of their findings and may help to integrate them with results from, for example, linguistics. In the review period efforts have been undertaken to establish links with research in cognitive psychology and neurobiology. This was done mainly the in the project *Cognitive Systems and Information Processing*, and resulted in substantive collaborations with cognitive psychologists at the Institute for Communicating and Collaborative Systems in Edinburgh, and neuroscientists at the F.C. Donders Centre for Cognitive Neuro-imaging in Nijmegen.

More information about the developments sketched above can be found in Part B.

Research Programme 2006-2010

The developments in the field, as well as the developments within ILLC's Research Programme itself, have opened up new connections between a number of the existing programmes. In order to foster such interactions and strengthen the existing ones, ILLC's research has been focused in a smaller number of programmes.

The following are the three new core programmes:

- Logic and Language
- Language and Computation
- Logic and Computation

Two specific themes which span all programmes are considered *spearheads*:

- Logic and Game Theory
- Cognitive Modelling

In the picture below it is visualized how, on January 1, 2006, the old programme structure changed into the new one. It also shows by which faculty the researchers are employed.

Language and Computation					
Blutner	Blutner	Bod	Franke	Honing	Honingh
Kamps	Ladinig	Prescher	Scha	Sima'an	Smith
Spiro	Tsarfaty	Zeevat	Zuidema		

Logic and Language					
Counihan	Fitz	Hindsill	Hinzen	Jager	Kwast
Lambalgen	Lambalgen	Nauze	Schulz	Veltman	
Aloni	Balogh	Bax	Dekker	Groenendijk	Janssen
Rietveld	Roelofsen	Rooij	Stokhof	Wilde	

Logic and Computation					
Apt	Buhrman	Cilibrasi	Emde Boas	Lee	Rooij
Sevenster	Spalek	Torenvliet	Unger	Vitanyi	Wehner
Bentham	Bezhanishvili	Bold	Endriss	Hendriks	Jongh
Kupke	Liu	Löwe	Niekus	Pacuit	Roy
Seginer	Semmes	Uckelman, J.	Uckelman, S.	Uridia	Venema

	<i>Cognitive Systems and information Processing</i>	<i>abc: Faculty of Humanities</i>
	<i>Theory of Interpretation</i>	<i>abc: Faculty of Science</i>
	<i>Algorithms and Complexity Theory</i>	
	<i>Constructive and Intensional Logic</i>	

Programme 1. Logic and Language (LoLa)

Programme leaders: Jeroen Groenendijk, Paul Dekker (deputy)

The project *Logic and Language* is a broad research plan in philosophy, crossing the borders of empirical linguistics and cognitive science. Human reasoning and interpretation of natural language are the major themes. Logical and philosophical analysis are the basic scientific methods. Empirical ratification of analytical work is our main ambition and touchstone for success. Our research strategy is non-monolithic, allowing for different approaches, but demanding philosophical reflection and internal and external debate.

In our investigations on interpretation we follow several intertwined research lines, using different instruments from a logical toolbox, of which intensional logic, epistemic logic, non-monotonic logic, dynamic logic, game theory, and decision theory are prominent parts. Binding force is the conviction that interpretation should be studied as a dynamic cognitive process that is embedded in both in social practices and the external environment. This view differs markedly from the more traditional one, according to which a theory of interpretation assigns ‘static’ semantic contents to linguistic structures independently of their use. Hence, the integration of semantics and pragmatics is a dominant longer term research aim.

This view on how logic and language connect, has obvious historical roots, e.g., the writings of Aristotle, Leibniz, Frege, Wittgenstein, and Montague. Systematic and historical study of the works of these intellectual forebears forms a substantial part of the project, also to stimulate critical reflection on current systematic research. Philosophical and historical studies on the works of our intellectual forebears form a substantial part of the project, which stimulates reflection and inspires debate on our current positions.

The various systematic investigations concentrate on empirical phenomena that are intrinsically related to the way in which information is structured in the context of conversations. Prominent examples are the interplay between mood and modality, questions and imperatives, implicatures and presuppositions.

In our investigations on reasoning we want to show that logical languages can be fruitfully used as high-level specifications of cognitive functions, and that contrary to current opinions in cognitive science mathematical logic can be used in explaining human reasoning behaviour. To achieve these aims logical and computational models are paired with methods from empirical psychology and neuro-science in an innovative way. In addition to the research on reasoning, other issues in the domain between cognitive science and philosophy, such as know-how and everyday expertise, are investigated.

Our basic outlook on interpretation as a cognitive process embedded in social practices, makes a strong bond between interpretation and reason(ing). Ultimately, we want to explain the procedures of the production and interpretation of speech as a natural evolution of rational human behaviour.

Programme 2: Language and Computation (LaCo)

Programme leaders: Remko Scha, Khalil Sima’an (deputy)

This project is concerned with computational models of human information processing, especially natural language processing and music perception. The methods employed in this project build on formal theories of linguistic syntax and logical semantics, but

extend these with a variety of more performance-oriented techniques, such as probabilistic grammars and computational models of human Gestalt perception. The project aims to develop computational methods which are cognitively plausible as well as practically useful.

An important focus is the further development of corpus-based processing methods for natural language, building on the ‘Data-Oriented Parsing’ model which we developed over the last fifteen years. Blind tests on annotated corpora have shown that existing implementations of this model are very successful in computing simple syntactic surface structures. Current research involves improving the probability estimations of the model, enriching its linguistic coverage, and putting semantic representations into the picture. This enables us to move toward models of first language acquisition and language change. We also pursue practical applications, such as Statistical Machine Translation.

Another important application area is concerned with Information Retrieval and Question Answering. In this area, we employ the state-of-the-art retrieval techniques, and focus on improving the practical usefulness of these systems through innovations in user-interfaces and cognitive ergonomics.

In cooperation with the project *Logic and Language*, we develop models of linguistic processes at the level of pragmatics and discourse. Here we employ the framework of *Optimality Theory* to articulate fairly complex models as hierarchies of competing constraints.

Our research on music cognition focuses on an aspect of music which is fundamental but ill-understood: the perception of the temporal aspects of music, such as rhythm, tempo and timing. We develop computational models which implement mathematically articulated theories, and which are validated through psychological experiments with human listeners. The models we develop here can be applied in algorithms for automatic transcription, automatic accompaniment and music generation.

Language research and music research deal with significantly different domains; they cannot be expected to use exactly the same concepts, tools, and techniques. But language and music do have important features in common: they are both sign systems evolved in human society, which rely on the human ability to perceive complex hierarchical structures in linear sequences. We believe it is useful, therefore, to explore these two domains jointly. Some convergence can be observed already. To begin with, formal theories of musical Gestalt perception were an important source of inspiration for the initial development of the Data-Oriented Parsing model around 1990. Now the influence starts to go in the other direction: Bayesian statistics (one of the core techniques in probabilistic language processing) turns out to very useful in music cognition as well. Also, recent research yields increasing evidence for a ‘memory-based’ component in music perception; our research on Data-Oriented Parsing will be a useful reference-point when we start to try to model this phenomenon.

Programme 3: Logic and Computation (LoCo)

Programme leaders: Jouko Väänänen, Leen Torenvliet (deputy)

A long-standing characteristic of research in the area of *Logic and Computation* is the use of logical techniques to better understand a wide range of processes and behaviours involving computation. The unique combination of expertise in modal logic, model theory and complexity theory at ILLC is combined here to yield qualitatively new applications to computation.

Research at ILLC has long emphasized update and transfer of information in language use and computation. Originally, this dynamic perspective was focused on update and learning by individuals. But the essential feature of many information-based activities is interaction between several agents, and accordingly, games have become a major paradigm for integration.

The sub programme *Games and Interaction* is about developing interfaces between logic, computer science, and game theory, with a view toward creating an integrated multi-agent process theory based on modal and dynamic logics with mathematical depth and a wide range of applications. As for the latter, in addition to language and computation, our second aim is developing new interfaces with congenial areas in the socio-economic sciences (decision theory, social choice theory, welfare economics), along topics such as negotiation, fair division, and general multi-agent resource allocation.

The next three sub programmes provide mathematical foundations for these ambitions, while also adding key concerns of their own.

This is particularly so for the sub programme *Algebra and Co-Algebra*. A heightened sensitivity to the computational costs of information processing has turned modal logic into the most widely spread branch of logic. Modal logic lies at the fault line of algebra and co-algebra, and some basic connections are emerging today. Our main focus here is on: (1) representation of partially ordered algebras, modal canonicity and correspondence; (2) universal co-algebra as a general mathematical framework for the study of behaviour; (3) modal fix point logics, the natural formalisms for reasoning about ongoing behaviour.

While modal logic is largely concerned with expressive power, the other side of the coin is computational complexity of natural information-related tasks. For the sub programme *Computation and Complexity* the contribution of our CWI-members is crucial. Quantum Computing and Kolmogorov Complexity are still the key words here. In addition, the identification of structural properties that characterize complexity classes remains an ongoing theme. Also, in close cooperation with work on finite model theory in the sub programme *Sets and Models* methods are developed for descriptive complexity analysis of data base queries, logic programs, and related topics in computer science. Wider applications range from graph theory to semantics of natural language.

All the preceding themes presuppose an up-to-date understanding of the foundations of model theory and set theory, and hence they involve strong links to the foundations of mathematics. The sub programme *Sets and Models* studies a number of mathematical themes, with games as a running thread. Topics include determinacy axioms, infinitary combinatorics, transfinite and multi-player games, generalized quantifiers, and abstract logics. One recent high-light are Turing machines for infinite computation, and their consequences for recursion theory and automata theory. While firmly grounded in mathematical logic, this sub programme already has applications to natural language, descriptive complexity theory, and modal logic – and it is actively seeking new ones at ILLC, all the way to philosophy and cognition.

4. Researchers and other personnel

Employees of the Universiteit van Amsterdam divide their time between research, teaching, and administration. How much time one can spend on research depends on one's position and on the Faculty by which one is employed. The table below shows the

different standards for the time available for research for different ranks in the two faculties. Given a rank and a faculty, the number says how much FTE is available for research to someone who works full time in the rank mentioned at the faculty concerned.

	FNWI	FGW
Full professor	0,5	0,4
Associate professor	0,5	0,4
Assistant professor	0,5	0,4
Other academic staff	0,9	1
PhD candidates		
-4 years	0,75	1
-3 years	1	1
-without employment	1	1

In individual cases deviations from the standard are possible. Both the Faculty of Science and the Faculty of Humanities are gradually changing towards a more flexible system.

The above hopefully makes it easier to appreciate the numbers in Table 1a, which indicate full time equivalents (FTE) devoted to *research*. Teaching and administration are left out.

Table 1a. Research staff at institutional level

	2000	2001	2002	2003	2004	2005
Tenured staff	7,4	7,6	7,2	6,9	5,6	5,3
Non-tenured staff	6,4	8,2	12,6	12,7	8,8	7,2
PhD candidates						
with employment	12,2	11,9	15,5	19,8	17,9	17,8
without employment	0,9	4,9	5,6	6,6	9,1	10,4
Total research staff	26,9	32,6	40,9	46,0	41,4	40,8
Supporting staff	3,0	3,0	3,0	3,0	2,6	2,4

Remarks

- (1) In 2005 the supporting staff consisted of 0.8 fte manager, 0.6 fte coordinator Master of Logic program, 1.0 fte secretarial assistance. The other years are comparable.
- (2) The sudden drop in 2004 is due to the fact that in April of that year the majority of the LIT group was transferred to the Informatics Institute.
- (3) 'without employment' means 'not employed by ILLC'. Some of the PhD students without employment are in fact employed by CWI, others work at ILLC on a grant from their home country.

Noteworthy is the ratio *Staff : PhD-students* at ILLC, which is about 1 : 2. This is quite exceptional. In the other research institutes both in the Faculty of Humanities and in the Faculty of Science this varies between 2 : 1 and 1 : 1.

Table 1b. Research staff at programme level

	2000	2001	2002	2003	2004	2005
<i>Theory of Interpretation</i>						
Tenured staff	0,9	0,9	1,0	1,0	1,0	0,7
Non-tenured staff	2,4	3,2	5,5	4,7	4,0	2,7
PhD candidates with employment	2,0	2,5	2,1	2,4	4,8	5,0
Total research staff	5,3	6,6	8,6	8,0	9,8	8,4
<i>Cognitive Systems and Information Processing</i>						
Tenured staff	1,7	1,6	1,7	1,7	2,2	2,4
Non-tenured staff	2,1	2,1	3,0	1,5	2,9	4,3
PhD candidates with employment	2,3	1,6	4,0	7,0	7,4	8,2
PhD candidates without employment	-	-	-	0,2	1,0	1,0
Total research staff	6,1	5,2	8,7	10,4	13,4	15,9
<i>Constructive and intensional Logic</i>						
Tenured staff	1,7	2,0	1,5	1,5	1,0	1,0
Non-tenured staff	0,9	0,5	0,1	0,4	0,5	0,0
PhD candidates with employment	2,7	2,5	2,2	3,0	3,0	3,2
PhD candidates without employment	0,1	0,9	1,1	0,4	1,8	3,8
Total research staff	5,4	5,9	4,9	5,2	6,3	8,0
<i>Language and Inference technology</i>						
Tenured staff	2,0	1,9	1,9	1,7	0,3	-
Non-tenured staff	0,9	2,3	3,9	6,0	1,4	-
PhD candidates with employment	4,0	5,0	6,0	5,1	1,0	-
PhD candidates without employment	0,6	3,0	3,0	3,0	1,3	-
Total research staff	7,5	12,1	14,8	15,8	3,9	-
<i>Algorithms and Complexity Theory</i>						
Tenured staff	1,1	1,2	1,1	1,1	1,2	1,2
Non-tenured staff	0,1	0,1	0,1	0,1	-	0,3
PhD candidates with employment	1,2	0,4	1,2	2,3	1,8	1,5
PhD candidates without employment	0,2	1,0	1,5	3,1	5,1	5,7
Total research staff	2,6	2,7	3,9	6,5	8,1	8,6

For each of the projects, an explanation of the numbers above is given in the corresponding section in Part B. Here we only compare the tables. Noteworthy is the disproportion in staffing between the projects. This has been an additional reason for reconsidering the organizational set up of the research.

Human Resources Management

ILLC's mandate in personnel matters in the Faculty of Science differs greatly from its mandate in the Faculty of Humanities. In the Faculty of Humanities the departments are responsible for human resource management. The research institutes have an advisory role. For example, it was not until recently that the research institutes got an official role in the selection procedure of new employees. Now it is standard that the research institute is consulted when a new recruitment profile is made, and that a representative of the research institute is a member of the selection committee.

In the Faculty of Science, on the other hand, it is the research institute that decides to fill or not to fill a vacant position, that draws profiles, sets up selection committees, prepares proposals for tenure or promotion, and so on. In the case of tenured positions the final decisions are taken by Dean of the Faculty, for non-tenured positions this is delegated to the director of ILLC.

Also the regulations for supervising the personal development of *members of staff* are different in the two faculties. The performance of staff members employed by the Faculty of Humanities is assessed annually by the head of the department for which they are working. The director of ILLC has an advisory role here. The staff members employed by the Faculty of Science have an annual performance interview with their programme leaders. In this case, the programme leaders report to the director of ILLC and advise him about the terms of employment for the staff members concerned.

When senior staff members retire, they can apply to retain a workplace within the Institute. Fortunately, most of them do. If their research plan is approved, they are given the status of *guest researcher*.

Most *PhD students* in ILLC are employed on a project externally funded by NWO or the European Union. Some PhD candidates from abroad bring their own funding, usually in the form of an individual grant from their government. Within the Faculty of Science, the director of ILLC can allocate positions for PhD-students to research programmes. The budget does not allow to do this on a regular basis. Within the Faculty of Humanities, the Faculty awards a number of PhD positions each year to the research institute. This number used to be at least one, but since January 2005 the number depends on past performance of the research institute in PhD completion. The number of PhD's completed over the previous three years is averaged and 40% of that number is awarded. Unfortunately this means that in 2006 ILLC gets no new PhD student funded by the Faculty of Humanities. The expectation is that henceforth ILLC will get 0.66 PhD student every year, which means two PhD students in three years.

It is the policy of ILLC to treat these different categories of PhD students equally. The regulations are such that it is not easier to get in for students that bring their own money than for students who apply for a paid PhD position. All PhD students have only limited time to find a promotor and to develop a training and supervision plan (also called OBP, Opleidings- en Begeleidingsplan). This plan is renewed once every year in the progress interviews that take place between the student and supervisors. Apart from this, the progress of the PhD-projects is reviewed once a year by the *Promotion Progress Committee* which is appointed by the scientific director of ILLC. This committee, which consists of junior staff members, evaluates not only the progress of the student but also the quality of the supervision, and suggests solutions if there are any problems between the supervisor(s) and student.

5. Resources, funding and facilities

Given the different financial structure in the faculties that participate in ILLC, it is impossible to provide exact numbers. Still, the amounts provided below, based on average costs, are a trustworthy approximation of reality.

Table 2a. Funding and expenditure at institutional level

Funding	2000		2001		2002		2003		2004		2005	
	k€	%	k€	%	k€	%	k€	%	k€	%	k€	%
Direct funding	799	67%	742	55%	766	44%	957	50%	924	58%	865	57%
Research funds	366	31%	578	43%	934	54%	920	48%	669	42%	623	41%
Contracts	32	3%	37	3%	42	2%	45	2%	9	1%	17	1%
Total	1.198	100%	1.357	100%	1.742	100%	1.922	100%	1.602	100%	1.505	100%

Remark: the table above is constructed by multiplying the research FTE with the average personnel costs of research staff. The following average personnel costs applied in the years 2000-2005:

	2000	2001	2002	2003	2004	2005
<i>Professor</i>	98	102	106	116	116	118
<i>Associated professor</i>	76	77	82	82	84	86
<i>Assistant professor</i>	60	62	65	66	68	69
<i>Other academic staff</i>	49	52	53	55	56	58
<i>PhD candidates</i>	25	26	28	28	32	34

Expenditure (in k€)	2000	2001	2002	2003	2004	2005
Average personnel costs						
academic staff (research FTE)	1.198	1.357	1.742	1.922	1.602	1.505
supporting staff (FTE)	111	115	121	124	110	105
Costs of Computers ¹	29	31	37	42	34	32
Travel grants ²	54	57	70	80	65	59
Training of PhD students ³	11	11	14	18	15	15
General ILLC expenses ⁴	30	30	30	30	30	30
Total	1.433	1.601	2.014	2.216	1.856	1.746

¹ Costs of computers: 750 EURO per FTE per year

² Travel grants: 1,500 EURO per FTE per year

³ Training expenses include: visit to ESSLLI, Dutch language course, other non-scientific courses.

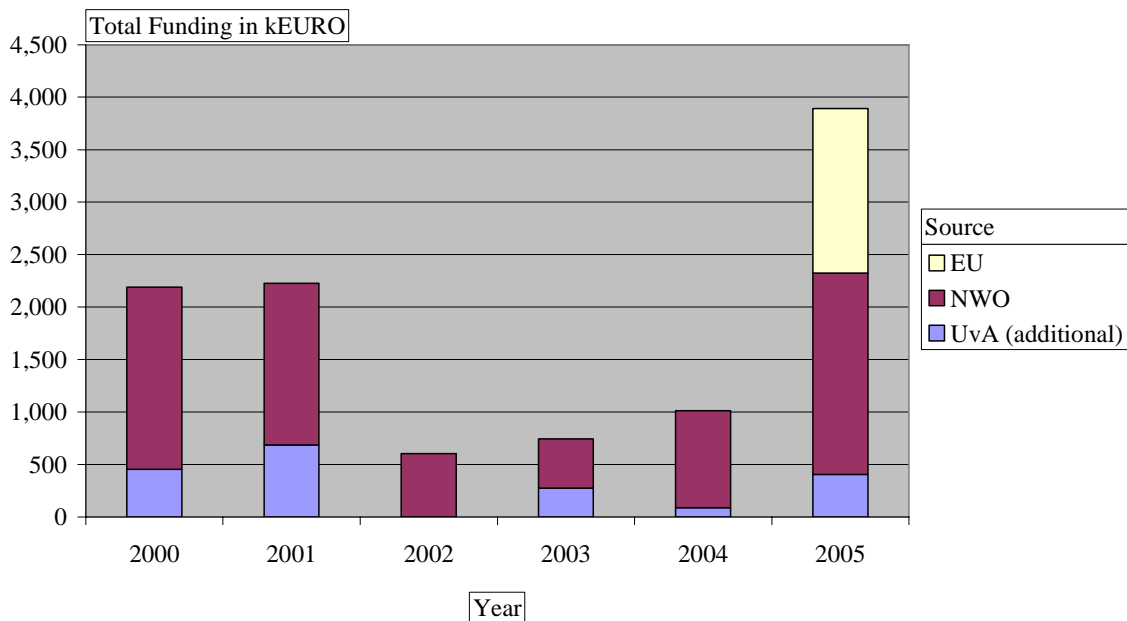
⁴ General ILLC expenses include: workshops, publicity, website, office expenses

The 'Funding' table only deals with the funding of the salary costs of the academic staff. The 'Expenditure' table adds the salary costs for the supporting staff and other expenses.

Table 2b. Funding research programme level

	2000	2001	2002	2003	2004	2005
Theory of Interpretation	21,0%	23,0%	25,0%	22,00%	29,6%	26,0%
Cognitive Syst and Inf Processing	24,6%	20,7%	24,2%	23%	37,2%	49,3%
Constructive and Intensional Logic	20,9%	18,9%	12,0%	13,50%	13,8%	11,8%
Language and Inference Technology	22,6%	28,0%	29,9%	31,80%	8,5%	-
Algorithms and Complexity Theory	10,9%	9,3%	8,5%	9,70%	11,0%	12,9%

In the chart below one can see the total funding in kEURO's recorded in the year the subsidy was awarded. The year 2005 was an absolute peak year where a total amount of almost 4 million EURO was granted. For an overview of all awards, see the Bn.8 Sections.



6. Processes in research, internal and external collaboration

Master of Logic programme

As an interdisciplinary institute ILLC participates in many teaching programmes. The present list includes:

- Artificial Intelligence, BSc+MSc*
- Beta-gamma, BSc*
- Cognitive Science, MSc*
- Computer Science, BSc+MSc*
- Linguistics, MA*
- Logic, MSc*
- Mathematics, BSc +MSc*

Medical Informatics, BA
Media and Culture, BA
Musicology, BA + MA
Philosophy, BA+MA
Rhetoric, Argumentation & Philosophy, MA

The contribution of ILLC to these teaching programmes varies from one introductory logic course of 6 ects in the Beta-Gamma bachelor, to a full flown specialization track of about 90 ects in the MSc Artificial Intelligence.

The focus of ILLC's teaching activities lies in the *Master of Logic*, a two year international research master that started in 1995 and had its first graduates in 1997. Between then and now it developed into the foremost interdisciplinary logic programme in the world, combining philosophy, mathematics, computer science and linguistics in the unique fashion that underlies the research in ILLC.

The MSc in Logic is a research-oriented programme for highly motivated and excellent students, based on (i) *interdisciplinarity*, (ii) *internationality*, and (iii) *individuality*. The MSc in Logic is

(i) *interdisciplinary* as the teaching follows the mission statement of ILLC. We strongly believe that logic is an important research area between mathematics, computer science, philosophy and linguistics, with important applications in the social sciences. Its coherence is generated by the formal methodology and the general technique of formalization.

(ii) *international* as its student body is constituted by students from all continents. We strongly believe that a wide variety of nationalities is as much of a factor in the success of the MSc Logic as is the wide variety of academic backgrounds. The majority of our students is from abroad, and moved to Amsterdam in order to study logic; this results in a high motivation to work hard while in Amsterdam. As a group of foreigners new in a novel environment, our students form a social network that goes far beyond attendance of classes.

(iii) *individual* as its main educational goal is the formation of a research personality on the basis of the strengths and interests of the student. There are very few obligatory courses, all other courses are discussed in detail with the dedicated academic mentors: every student is assigned a mentor who discusses all choices of courses with him or her, advises the student in academic questions up to the choice of a Master's thesis supervisor.

The MSc in Logic is experiencing an enormous amount of growth in the past few years. In December 2005, we had 49 active students in our programme from 18 different countries (40% Dutch). By the end of 2005 the total number of graduates amounted to 66. The number of graduates that took up a PhD position was 51. Of these 17 got a PhD position at ILLC. Presently 12 of our 37 PhD students come from the MSc of Logic.

The map below shows the origins of the MoL students from 1995 to the present population.



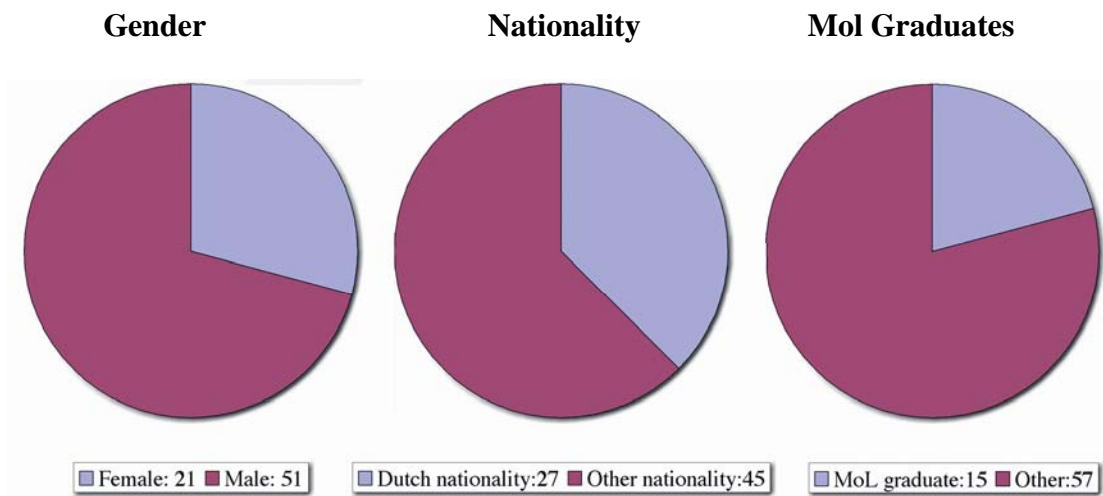
PhD programme

Research at ILLC starts at the level of the Master of Logic, with the master students writing their MSc thesis. A large percentage of our MSc thesis projects lead to actual publications. Twenty seven out of the sixty six MSc theses produced so far resulted in a paper accepted by an international journal or in a contribution to an international conference.

At the MSc level it is not a requirement to produce research results that are accepted by peer reviewed conferences or journals, but at the PhD level it is. As the publication lists in part B show, most of our PhD students have no difficulty meeting this requirement.

In the review period 2000-2005 a total number of 29 PhD students finished their studies successfully. Only two PhD students left ILLC without a doctor degree. Very few PhD students finished their work within the official time frame of four years, but the average of 56 months between starting date and exam date is pretty good in the Dutch context.

The charts below give some insight in the composition of our PhD population. It concerns the total number of 72 PhD students that are studying or have been studying at ILLC during the period 2000-2005.



Both the MSc students and the PhD students participate in the master classes organized during the School Week by the *Dutch Graduate School in Logic (OZSL)* and in the Summer School organized by the *European Foundation for Logic, Language and Information (FoLLI)*. At these occasions, the PhD students also have an opportunity to present and discuss their work.

ILLC was the founding institute of both the OZSL and FoLLI, and has acted as coordinating site for both. Presently, the *Universiteit Utrecht* is the chair of the OZSL, and INRIA in Nancy (France) is the coordinates FoLLI.

Colloquia

Regular meetings at which MSc students, PhD students, ILLC-staff, and visitors meet and exchange ideas and results, are the back-bone of the ILLC-community. In the review period 2000-2005 the following series of colloquia formed the core of ILLC's activities in this area.

- *Logic Tea*. The Logic Tea is a series of talks organized by our PhD students and addressing all the MSc and PhD students at ILLC. The series covers a large variety of topics reflecting the interdisciplinary character of the institute. Speakers include students from ILLC as well as from other research institutions.
- *LEGO-meetings*. At these biweekly meetings all ILLC members working in the *Theory of Interpretation* programme or the 'theoretical' part of the *Cognitive Systems and Information Processing* programme regularly present their work in progress.
- *Computational Linguistics Seminar*. This biweekly seminar is the platform for presenting the computational work done in the CSIP programme.
- *Seminar on Computational Social Choice*, a series of occasional talks meant for everybody in ILLC interested in this topic. Both speakers from ACT and speakers from CIL have presented their work here.

The above colloquia are restricted to ILLC members. The following address a larger audience.

- The *DIP Colloquium*, a biweekly colloquium organized by the ILLC members working at the philosophy department. The program of the colloquium reflects the research interests of the TI and CSIP teams: cognition and reasoning, formal semantics and pragmatics, and philosophy of language. All Dutch researchers working in these fields appear here to present their latest work.
- The *Colloquium on Mathematical Logic*, organized by the members of CIL team together with mathematical logicians of *Universiteit Utrecht*. This colloquium meets biweekly, alternately in Amsterdam and in Utrecht. It intends to bring together researchers working in Mathematical Logic and Logic related areas of Theoretical Computer Science.
- The national *Dutch workshop series on Logic and Games*, GLLC (Games in Logic, Language and Computation) is also coordinated by members of the CIL team. During the review period 11 workshops have been organized at various places in the Netherlands.

ILLC also organizes conferences and workshops at an international level. See Part B for a list of examples. Here we only mention the bi-annual *Amsterdam Colloquium*, which started back in 1976, and is the most important regular conference on formal semantics world wide.

External contacts

Within the Universiteit van Amsterdam, the following institutes are ILLC's immediate partners.

- Most prominent and vital at present are the ties with the *Institute for Informatics*, in particular with the group of Maarten de Rijke since he left ILLC to take up a full professorship there. There are a number of joint PhD-projects.
- At present, research in mathematics in the *Korteweg de Vries Institute* focuses less on areas which traditionally have strong links with logic (such as algebra, set theory). However, the bond between logic and mathematics remains of vital importance. The recent appointment of Jouko Väänänen to the chair of Logic and Foundations of Mathematics will strengthen this link.
- For ILLC's research in semantics, pragmatics and computational linguistics, a close cooperation with the *Amsterdam Center for Language and Communication (ACLC)* in the Faculty of Humanities is of great importance. There are currently some collaborative PhD projects being supervised across both institutes and there is collaboration on applications for externally funded projects. The Friday afternoon lecture series (ACLC and DIP) are organized such that there is minimal overlap in timing. An annual seminar is organized on a topic of joint interest; in 2005 this seminar was on linguistic modality. The directors of the two institutes have regular meetings to exchange ideas.
- In the introduction it was already mentioned that ILLC has taken a leading part in the *Cognitive Science Center Amsterdam (CSCA)*, a consortium of selected groups of biologists, psychologists, linguists, logicians, mathematicians and social scientists from the faculties of Science (FNWI), Social and Behavioural Sciences (FMG), and Humanities (FGW) which have joined forces to promote and pursue the study of human cognition.

At a *national* level, ties with the Dutch logic community are maintained mainly via the OZSL. The relation with the *Centrum for Wiskunde en Informatica* (CWI), the national research institute for mathematics and computer science, deserves special mention. Three prominent scholars of CWI, Apt, Buhrman, and Vitányi hold part-time positions at ILLC.

As already mentioned in Section 3 it is very important for ILLC to have links with research groups in cognitive psychology and neurobiology. At a national level our efforts here resulted in substantial collaborations with cognitive psychologists at the Max Planck Institute in Nijmegen and neuroscientists at the F.C. Donders Centre for Cognitive Neuro-imaging, also in Nijmegen.

In the near future it will become even more important to have good contacts with institutes with an expertise complementary to ILLC's expertise. Given the national research policy, most money will be invested in large programmes, carried out by a consortium of research institutes, companies and civil-society organizations, and spanning a broad spectrum of research activities, from highly theoretical investigations and empirical research through to precompetitive development of prototypes. ILLC is preparing itself for this by joining a research alliance, IC4, between the computer science institutes of the Universiteit Utrecht, the Free University, the Universiteit van Amsterdam, and the national Research Center for Mathematics and Computer Science (CWI). This alliance will develop a common research strategy and aims at becoming one of the leading clusters in IT research in Europe.

Internationally, there is a long tradition of intensive contacts with the following institutes:

- Centre for the Study of Language and Information (CSLI), Stanford University
- Institut für Maschinelle Sprachverarbeitung (IMS), Universität Stuttgart
- Division of Informatics, University of Edinburgh

This is reflected in the composition of the Advisory Board.

In 2005 an Memorandum of Understanding was signed by the director of ILLC and the director of the Institute for Logic and Cognition (ILC) of the Sun Yat-Sen University in Guangzhou (China). The agreement provides in an exchange programme for teachers and students.

Publications

The official publications of the institute encompass

- a series of technical notes,
- a prepublication series,
- a series of Master of Logic theses,
- a dissertation series.

At the end of 2005, the ILLC dissertation series, which has been set up in 1993, contained 90 titles. There were 66 titles in the Master of Logic series, the first appearing in 1997. There are about 5 titles each year in the Technical Notes series, and between 30 and 40 in the Prepublication series.

7. Academic reputation

The quality of research at ILLC is very high. Some senior staff members are considered world leaders in their disciplines, while many junior staff members have the talent to become one.

This is the first time that the research programme of the entire institute is evaluated, and its *interdisciplinary* character can be judged. However, the various disciplines (computer science, mathematics, philosophy) represented in ILLC have been evaluated separately several times in the past and each time the results were ‘very good’ (for computer science), ‘very good/excellent’ (for mathematics) and ‘excellent’ (for philosophy).

In Part B a detailed overview is given of the prizes and grants awarded to the ILLC staff. Here we will just sketch the situation (reference date December 31st 2005). Restricting ourselves to the ‘individual’¹ grants awarded by NWO, we find that one of our members (van Benthem) received the Spinoza-prize, three (van Lambalgen, Venema, Buhrman) were awarded a VICI grant (or its predecessor the Pionier award), three got a VIDI award (Dekker, van Rooij, Bod) and one (Aloni) a VENI award.

Two of our emeriti (Bartsch, Troelstra) and two of our full professors (van Benthem, Stokhof) are a member of Royal Netherlands Academy of Arts and Sciences (KNAW).

Other quality indicators: A prize was awarded to three MSc theses (Wehner, de Graaf, Leskes) written in the last six years. Three papers (ten Cate, Endriss, Scha) got ‘best paper’ awards, and six dissertations (Aiello, Aloni, de Bruin, Gerbrandy, Sima’an, de Wolf) were selected as the best in their field on national or international level. Again, for details see Part B, where also the many editorial positions, memberships in scientific boards and other proofs of academic reputation are listed.

8. Internal evaluation

ILLC is a small research institute. Officially, there are only six chairs. Given this, it would seem that dividing things up in four research programmes, each with two programme leaders, is not very efficient. Indeed, the general feeling has been that this structure created too much administrative overhead. This has been one of the reasons – in addition to the scientific reasons specified in Part B – why a new structure was introduced in January 2006 in which the number of programmes has been reduced to

¹ NWO established a subsidy scheme for stimulating researchers in different stages of their scientific career, the *Innovational Research Incentives Scheme* (in Dutch: Vernieuwingsimpuls). It is subdivided in VENI, VIDI, VICI. Veni grants are meant for researchers who have recently taken their PhD, to allow them to continue to develop their ideas (a maximum of 208,000 euro). Vidi grants are for researchers who want to develop their own innovative line of research and appoint one or more researchers (a maximum of 600,000 euro). Vici grants are open for application for senior researchers to build their own research group (a maximum of 1,250,000 euro).

The NWO/Spinoza prize, which some regard as the ‘Dutch Nobel Prize’, is awarded to Dutch scientists who are at the very top of the research profession. The laureates are internationally renowned and are an inspiration to young scientists. Every laureate is given 1.5 million euro

three, each with only one programme leader. So, now the meetings of the Scientific Council are attended by five rather than ten people (director, manager, three programme leaders). And now, with only one programme leader for each programme it is much clearer who is responsible for the performance interviews, the input for the annual report, the programme budget, internal communication etcetera.

The internal administrative bureaucracy has been reduced considerably. Externally, it will be more difficult, if not impossible to make things more efficient. As explained above the day-to-day running of the institute is rather cumbersome since consultations with two different faculty administrations have to be conducted. This is not only time consuming, but it also creates problems of its own because within the university the faculties are financially independent and to a certain extent 'competitors'.

Here is an example of the kind of problem this financial structure gives rise to. One of the things that should be easy to arrange in an interdisciplinary institute is that a PhD student on the payroll of the one faculty is supervised by a professor employed by the other. However, in fact this is not easy at all, because the costs (estimated on 300 man-hours in case the professor is employed by The Faculty of Humanities) are for the one faculty, whereas the benefits (presently about 30000 Euros) are for the other. Hence, a mechanism has to be created so that the one faculty gets paid for this 'service' to the other faculty.

In spite of these bureaucratic obstacles, there have been several fruitful PhD projects in which the student and the supervisor come from different faculties. Examples: Van Benthem supervised several PhD projects in the Faculty of Humanities, and Scha who did so in the Faculty of Science.

Much more serious are the problems arising in connection with teaching services. A significant number of ILLC-members employed by the Faculty of Humanities have teaching duties in the BSc or MSc Artificial Intelligence or the MSc of Logic. Since these teaching programmes are coordinated by the Teaching Institute of Information Sciences, the revenues of these activities are for the Faculty of Science, whereas the costs are for the Faculty of Humanities. Again, the Faculty of Science is supposed to compensate the Faculty of Humanities for this service, but so far no satisfactory arrangements have been made.

Without transparent arrangements, the teaching achievements of some of its employees remain invisible in the Faculty of Humanities. And then, if the teachers concerned underachieve in the teaching programmes coordinated by the Faculty of Humanities itself, why would the Faculty of Humanities keep employing them? This has been the mechanism that has led to the plan to abolish the Chair of Computational Linguistics when the present chair holder retires – a real threat to one of ILLC's core groups. (See also Part B).

There is consensus concerning the need for more transparency in various administrative procedures across faculties. Maybe the new 'financial allocation model' adopted by the university makes it possible to actually realize such a transparent situation. The teaching activities by members of the Faculty of Humanities are essential for the AI programmes and the Logic programmes. They ensure their interdisciplinary character.

One aspect of ILLC's special position is the housing of the institute. At present ILLC is housed on two different locations. This situation does not present an optimal environment for the kind of interactive research that ILLC fosters. In particular PhD students need regular and informal interactions with each other and with other members of the staff besides their supervisors. Housing of the entire institute on one location is to

be preferred from this point of view. On the other hand, as was already indicated above, ILLC is aware of the fact that it has its roots in different parts of the university community, and wants to maintain a strong presence there. Simply re-locating various parts of ILLC in one location, as the new housing plan of the Faculty of Science² suggests, goes against that. A creative solution is needed which will allow ILLC to realize both ambitions, viz., constituting an optimal research environment and crossing boundaries between disciplines and administrative units.

9. External validation

For an institute as ILLC, where the focus is on fundamental and highly theoretical research, external validation is mostly *indirect*. For us it is important to see that more empirically oriented scientists use our ideas in their empirical studies and computational models. Fortunately, this happens more and more.

This is not to say that members of ILLC do not pay any attention to empirical research or to the development of practical applications. Examples can be found in the in Part B, in particular the Sections 2 (CSIP), 4 (LIT) and 5 (ACT). There one can also find a description of the outreach activities undertaken by various members of ILLC who want to make the general public aware of the value of purely theoretical research.

10. Overview of the results

Adding up the results of the five research programmes we get the following result.

Table 3. Aggregated results of the institute

	2000	2001	2002	2003	2004	2005
1. Academic publications						
a. refereed journals	27	42	37	44	32	44
b. other journals	0	3	0	0	0	1
c. book chapters/papers in proceedings	72	80	92	104	100	80
Total	99	125	129	148	132	125
2. Monographs	1	3	3	1	3	2
3. Ph.D. theses	5	10	6	3	4	4
4. Professional publications and products	14	8	16	8	11	23
5. Edited Volumes	4	7	6	6	6	5

As in all tables the decrease in 2004 is due to the transition of the majority of the LIT-group to the Informatics Institute.

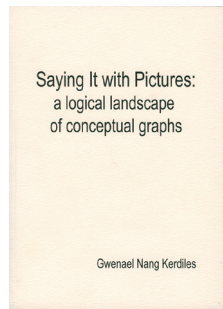
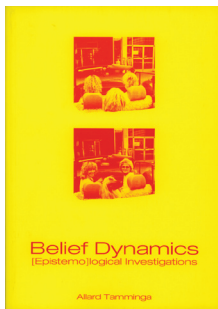
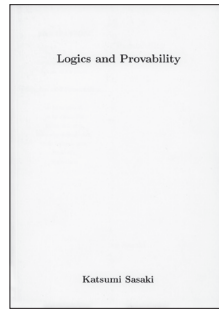
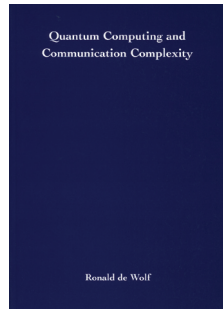
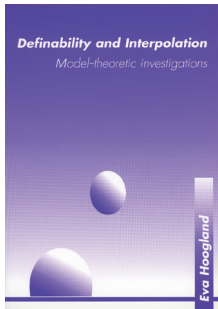
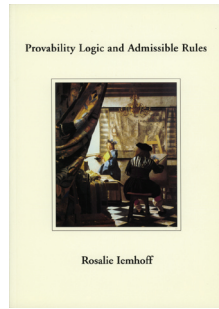
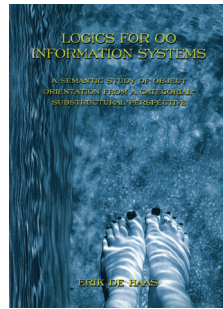
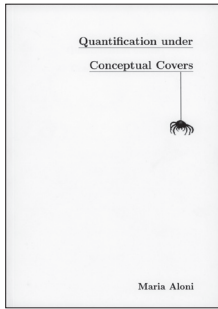
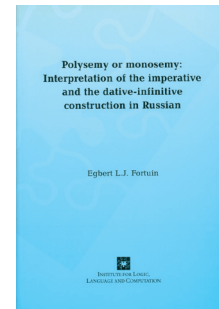
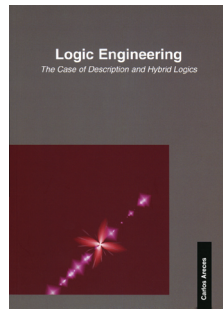
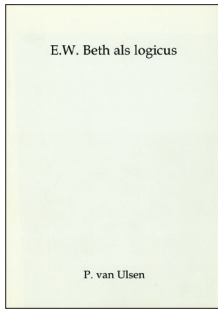
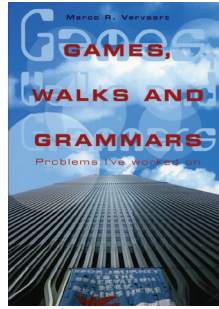
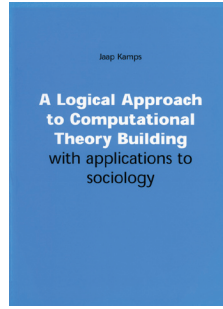
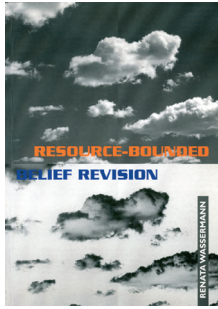
Comparing table 3 with table 1a we see that the productivity is high: For example, In 2005, 125 academic papers were produced by 12,5 research FTE staff plus 28,2 research FTE PhD students.

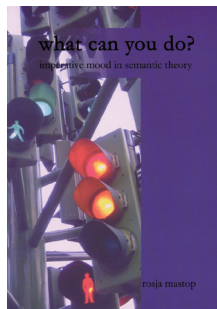
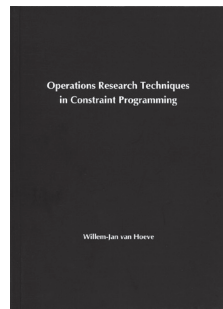
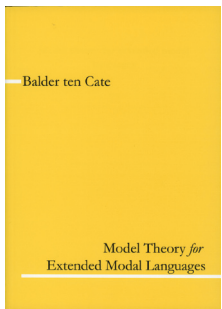
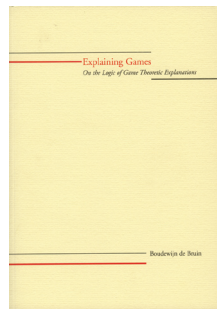
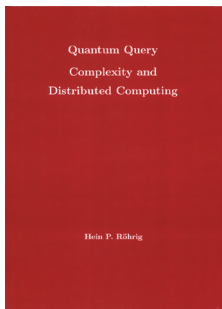
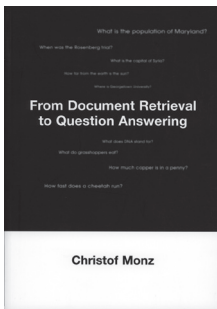
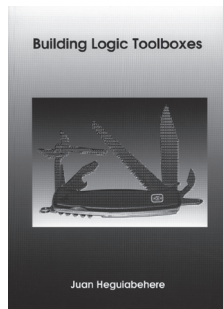
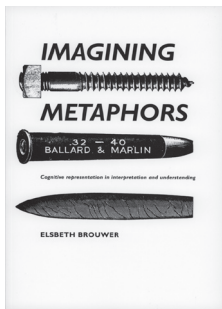
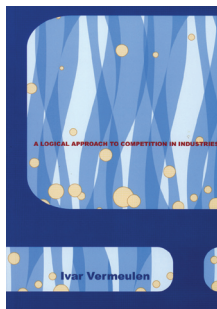
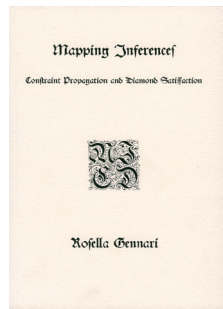
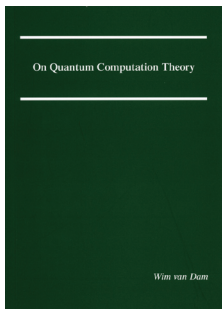
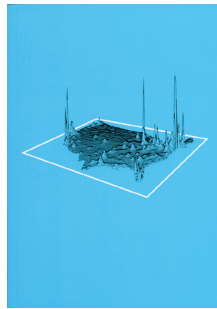
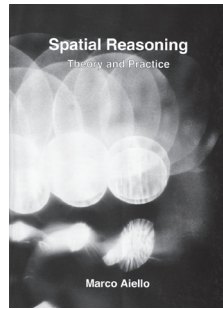
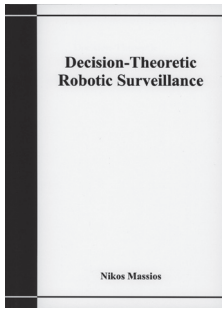
² The Faculty of Science will be concentrated in a new building the Science Park in Watergraafsmeer, far from the centre of Amsterdam where the Faculty of Humanities has its buildings. If no measures are taken, this will create logistic problems for teachers with teaching duties in both faculties.

11. Analysis, perspectives and expectations for the institute

Most of what could be said here, was already said in the above, and will be detailed in Part B. Summarizing, we arrive at the following SWOT analysis, in which the positive points clearly outweigh the negative ones.

Strengths	<ol style="list-style-type: none"> 1. Quality of research output. See Section A7 and Subsections Bn.4 for $1 \leq n \leq 5$. 2. Interdisciplinarity. See in particular B2. 3. External funding. See A5, and Bn.8 for $1 \leq n \leq 4$. 4. Master of Logic. See A6.
Weaknesses	<ol style="list-style-type: none"> 1. Housing situation. See A8. 2. Administrative structure. See A2 and A8.
Opportunities	<ol style="list-style-type: none"> 1. 'Cognition' is a spearhead in the research programme of both the Faculty of Science and The Faculty of Humanities. ILLC's research strategy fits in with this. See in particular A3. 2. Europe. More possibilities for interdisciplinary research created by the European Science Foundation and within the 7th Research Framework Programme.
Threats	<ol style="list-style-type: none"> 1. Abolishment chair of computational linguistics. See A8 and B2.10. 2. Several members senior staff too much involved in administration. See in particular B1.7. 3. Purely theoretical research difficult to 'sell' in a time where public demands and market demands are getting more important. See A6.
Analysis	<ol style="list-style-type: none"> 1. Transparent administrative regulations between faculties required. See A8. 2. More links required with institutes whose expertise is complementary to ILLC's expertise. See A6.
Adjusted goals	<ol style="list-style-type: none"> 1. In 2010, 55% of ILLC's budget should be supplied by external funding.
Adjusted strategy	<ol style="list-style-type: none"> 1. Join large research alliances! See A6.





Part B

Documentation regarding the level of
the research programmes

Chapter B1. Theory of Interpretation

Research area

The project *Theory of Interpretation* (TI) investigates logical and philosophical foundations of theories of interpretation. Its main goal is the development of formal and conceptual tools for adequate interpretation of natural language, testing these against both empirical data as well as methodological and philosophical constraints.

In the period 2000-2005, the main themes in this programme were:

- *Interpretation in conversation*
- *Cognitive aspects*
- *Philosophical backgrounds*

Research on *interpretation in conversation* focused on interpretation as an element in the process of linguistic information exchange. It built on earlier research on the dynamics of interpretation at sentence level, applying the results of that research to phenomena that play a key role in the structuring of discourse. Relevant empirical phenomena that were studied here include question-answering, the structure of information in conversational exchange, and the use of mood and intonation. Increasingly the research in this theme makes use of decision theory, game theory and epistemic logic in the analysis of the procedures used by rational communicative agents in both production and interpretation. Innovative is the general perspective on these issues, which takes into account formal (syntactic, typological, and prosodic) and pragmatic (conversational) aspects, paying due attention to the cognitive and social nature of these agents.

Central in the second theme, *cognitive aspects*, is the framework of ‘dynamic conceptual semantics’ (DCS), a formal model of the way in which concepts arise from (relatively) unstructured data. This model is closely connected with the data-oriented approach towards information processing that is used in the project Logic and Cognitive Systems. Research in DCS was directed towards the role of memory (general and specific historical memory) in the understanding of situations and linguistic utterances. Another topic in this theme is concerned with the clarification of the roles of experience and appreciation in skilful coping as source of (linguistic) normativity.

Research on *philosophical foundations* involves coming to grips with the presuppositions and limitations of the kind of theories developed in the first two themes. Historical and philosophical analyses of various key notions used there also bring out connections with different paradigms. Topics addressed within this theme include origins, development and employment of the notion of an ideal language; backgrounds and status of the principle of compositionality; the status of formal semantics as a scientific discipline; Wittgenstein’s notion of ‘perspicuous representation’ in relation to installation art; and the nature and consequences of a Wittgensteinian analysis of subjectivity.

Project Leaders

Jeroen Groenendijk
Martin Stokhof

Starting date and end date of the programme

Starting date: January 1st 1996, with a renewal on January 1st 2001. On January 1st 2006 this programme has been merged with part of the *Cognitive Systems and Information Processing* programme into the new *Logic and Language* programme. (For more information on this see below and Section A11).

Affiliations outside the institute

The members of this programme participate in the activities of the Dutch Graduate School in Logic (OZSL) and the European Foundation for Logic, Language and Information (FoLLI). The PhD students attend the OZSL schooldays, and participate in the European Summer school in Logic, Language Logic and Information.

Ties with the Dutch linguistic community are maintained via the DIP colloquium, which is a biweekly colloquium organized by the ILLC members working at the philosophy department. The programme of the colloquium reflects the research interests of the group: cognition and reasoning, formal semantics and pragmatics, and philosophy of language. All Dutch researchers working in these fields appear regularly here to present their latest work.

Internationally, this programme manifests itself by organising the bi-annual Amsterdam Colloquium, which started back in 1976. This is the most important regular conference on formal semantics world wide.

At an individual level, in the Netherlands there has been cooperation with researchers in Utrecht, Nijmegen and Tilburg. Internationally, cooperation involved researchers in Berlin, Bogota, Frankfurt, Stuttgart, Oxford, Osnabrück, Helsinki, Nancy, and Stanford.

1. Leadership

The programme leaders manage the group as first among equals: all programmatic decisions are taken in consultation with the entire team.

All but one of the staff members in the TI-programme are employed by the Faculty of Humanities. Their performance is assessed annually by the head of the philosophy department. The programme leaders have an advisory role here.

The programme leaders also advise the director of ILLC about the terms of employment of the one staff member (Janssen) in the TI-programme who is employed by the Faculty of Science. To that end an annual performance interview is held.

2. Strategy and policy

The staff members working in the programme *Theory of Interpretation* all have a background in philosophy, and most of them have teaching duties in the Bachelor and Master of Philosophy. This embedding in philosophy is what sets this programme apart from the research programmes in semantics that one finds in most linguistics departments.

More than once it have been philosophical considerations that gave new directions to this programme. For example, when it is said that the overall aim of this programme is to develop a theory of interpretation which does justice to the inherent situatedness and social nature of meaning and which can deal with both linguistic and non-linguistic sources of information, this is for a large part inspired by what philosophers have taught us about meaning.

The development of *dynamic semantics* with its focus on context dependence, and more recently the attention given to *game theory* as a paradigm for dealing with interaction and exchange can be seen in this light — as possible ways to realise the overall aim. This also explains why interactive linguistic processes, such as question-answering, topic-focus distribution and information packaging, have become the main empirical topics studied in the review period.

3. Processes in research, internal and external collaboration

Since Renate Bartsch's retirement the research team carrying out the TI-programme can roughly be subdivided in four smaller groups: one group around Martin Stokhof, one around Jeroen Groenendijk, one around Paul Dekker's NWO project *Formal Language Games*, and one around Robert van Rooij's NWO project *The Economics of Language*. The members of each of these groups, in particular the PhD students, meet on a day to day basis.

The entire team meets biweekly at the LEGO-meeting³. Here all ILLC members working at the Philosophy Department regularly present their 'work in progress'. Sometimes these meetings are used for try outs of talks to be given elsewhere, sometimes they serve to discuss administrative matters, but most of the time they are filled with presentations by staff members or PhD students and discussions of new research results.

PhD students are supervised by at least one full professor plus a second supervisor (not necessarily a full professor) with whom the PhD student is supposed to have contact on a regular basis. The progress of the PhD projects is reviewed at least once a year by the Promotion Progress Committee which is appointed by the scientific director of ILLC. (See Part A for more information).

Within ILLC there is much contact with the members in the CSIP-team, in particular the philosophers among them, who also come to the LEGO meetings and present their work there. But there is also co-operation with the other programmes. For example, in the InIGMA project belonging to the ACT programme described in Section B5, Sevenster investigated the signalling games for non-literal use of language, developed by van Rooij in the *Theory of Interpretation* programme. Another example: Both Dekker and van Rooij are core staff members of the Marie Curie Research Training Site GLoRiClass (see Section B3).

Within the Universiteit van Amsterdam collaboration exists with the linguists in the Amsterdam Center for Language and Communication and the philosophers in the Amsterdam School of Cultural Analysis. In both cases it concerns joint supervision of PhD projects. For collaboration outside Amsterdam, see above.

³ 'LEGO' is short for 'leerstoelgroepoverleg' which means so much as 'chair group consultation'

4. Academic reputation

ILLC is an established name in formal semantics. Groenendijk and Stokhof are world leaders in the field. Their work on dynamic semantics in the 90's determined the research agenda for this decade. Some of their papers are classics and have been reprinted many times in anthologies. Their article 'Dynamic Predicate Logic', which was selected by the *Philosopher's Annual* as one of the ten best papers in philosophy published world wide in 1991, is the most cited paper ever published in *Linguistics & Philosophy*.

The international profile of the younger generation is very high, too. Both Paul Dekker and Robert van Rooij have been KNAW fellow, both have been awarded a VIDI-grant by NWO, which has enabled each of them to develop their own innovative line of research.

Previous peer reviews

The last time this programme was evaluated was in 2000, when the Association of Universities in the Netherlands (VSNU) assessed the quality of university research in philosophy in the Netherlands over the period 1994-1998. The evaluation concerned the work of all the ILLC members employed by the Department of Philosophy, which is more than just the people working in *Theory of Interpretation* project but also includes the philosophy part of the *Cognitive Systems and Information Processing* programme.

This is what the final report said:

Assessment :

Quality: 5

Productivity: 5

Relevance: 5

Viability: 4

This is an excellent programme in terms of both quality and quantity. The Committee noted for example that the programme has made a real breakthrough in the field of Formal Semantics by creating a dynamic predicate calculus. The only concerns the Committee has are those pertaining to long term funding, additional external funding, and the filling of staff vacancies.

The grade '5' means 'excellent', and '4' means 'good'. The quality of the research is called excellent when 'The research group belongs to the international elite within its field of research. It works at the frontiers of international progress in its field and contributes effectively to that progress by means of substantial publications in highly rated scientific journals.'

Prizes and Awards

- 2000: Jelle Gerbrandy received the *Beth Dissertation Prize* from the Foundation of Logic, Language and Information for his thesis *Bisimulations on Planet Kripke*. Supervisors: Jeroen Groenendijk and Johan van Benthem
- 2002: The FoLLI *Beth Dissertation Prize* was awarded to Maria Aloni for her thesis *Quantification under Conceptual Covers*. She was supervised by Jeroen Groenendijk and Paul Dekker

- 2002: Balder ten Cate received the *Kluwer Academic Best Student Session Paper Award* at the ESSLLI summer school in Trento for the paper *The Partition Semantics of Questions, Syntactically*. His co-author was C. Shan.

Professional distinctions, memberships of scientific boards, etc. (Reference date: December 31st 2005)

- Renate Bartsch (emeritus) is a member of the *Royal Netherlands Academy of Arts and Sciences*.
- Martin Stokhof is chairman of the board of the *Division of Humanities of the Netherlands Organisation for Scientific Research*, and member of the *Standing Committee for the Humanities of the European Science Foundation*.

Editorial positions (Reference date: December 31st 2005)

- Paul Dekker is associate editor of *Linguistics and Philosophy* and member of the editorial board of *the Journal of Semantics*.
- Jeroen Groenendijk is member of the editorial board of *Natural Language Semantics*.
- Robert van Rooij is member of the editorial board of the *Journal of Semantics*.
- Martin Stokhof is associate editor of *Linguistics and Philosophy*, and member of the editorial board of *Natural Language Semantics, Logic and Computation, Current research on the semantics pragmatics interface*.

5. Internal evaluation

Binding force in this programme is the belief that interpretation is much more than a ‘static’ evaluation of the semantic contents of a linguistic structure. It also involves dynamic updates of information, interaction between participants, cognitive processes in the individual and evolutionary processes in the language community .

Most of the work carried out in this programme during the review period fits in with this belief, and the response they have got has strengthened the confidence of the TI-researchers in what they are doing. This work must be continued.

Not all the work carried out in this programme fits in with this belief. One cannot expect so in a programme containing a critical reflection on its own foundations. Actually, in that case one should expect some work that is totally out of line, work that questions – directly or indirectly – the enterprise one is undertaking. This kind of work should be continued as well.

6. External validation

For a highly theoretical research programme such as TI, external validation is mostly *indirect*. For us it is important to see that more empirically oriented linguists and computational linguists use our ideas in their empirical studies and computational models. Are our ideas applied, our techniques useful, and do we have interesting questions for these fields? Fortunately, all this is the case.

However, there are a few examples where the dissemination of results outside the scientific community has been more *direct*. Martin Stokhof regularly lectures on various aspects of Wittgenstein’s philosophy to general audiences and has given special

courses on his work to philosophy teachers in primary and secondary education. Tine Wilde, who is working on a PhD project on Wittgenstein's philosophy and installation art, has set up various projects, --- on the internet, in art galleries in Amsterdam, and 'in situ' in the Department of Philosophy --- which were open to the general public. Like all projects at ILLC, her projects are interdisciplinary, but in this case it is not interdisciplinary between two scholarly disciplines, but between one scholarly discipline and a form of artistic expression. (See <http://www.tinewilde.com/> for more information)

7. Researchers and other personnel

Table 4. Research staff of Theory of Interpretation

Appointment	Position	Name	2000	2001	2002	2003	2004	2005
tenured	assistant professor	Janssen, T.M.V.	0.25	0.25	0.32	0.30	0.30	0.30
	assistant professor Total		0.25	0.25	0.32	0.30	0.30	0.30
	professor	Bartsch, R.I.	0.28	0.28	0.28	0.28	0.25	
		Groenendijk, J.A.G.	0.20	0.20	0.20	0.20	0.20	0.20
		Stokhof, M.J.B.	0.20	0.20	0.20	0.20	0.20	0.20
professor Total		0.68	0.68	0.68	0.68	0.65	0.40	
tenured Total			0.93	0.93	1.00	0.98	0.95	0.70
non-tenured	assistant professor	Hendriks, H.L.W.	0.11	0.11	0.11	0.05		
	assistant professor Total		0.11	0.11	0.11	0.05		
	other academic staff	Aloni, M.		0.01	0.79	0.80	0.80	0.80
		Butler, A.J.		0.07	1.00	1.00	0.41	
		Dekker, P.J.E.	1.00	1.00	1.00	1.00	1.00	1.00
		Maat, J.		0.47	0.80	0.80	0.80	0.10
		Rooij, R.A.M. van	0.50	0.76	1.00	1.00	1.00	0.78
		Stein, H.P.	0.80	0.80	0.80			
	other academic staff Total		2.30	3.11	5.39	4.60	4.01	2.68
	PhD candidate	Albert, C.M.	0.34					
		Aloni, M.	0.58					
		Balogh, K.				0.33	1.00	1.00
		Bax, C.					0.33	1.00
Brouwer, E.C.		0.80	0.80	0.07				
Cate, B.D. ten		0.25	1.00	1.00	1.00	0.92		
Rietveld, D.W.					0.08	1.00	1.00	
Roelofsen, F.							0.33	
Safarova, M.			0.67	1.00	1.00	1.00	0.67	
Wilde, M.					0.58	1.00		
PhD candidate Total		1.97	2.47	2.07	2.41	4.83	5.00	
non-tenured Total			4.38	5.69	7.57	7.06	8.84	7.68
Total research staff			5.31	6.62	8.57	8.04	9.79	8.38

Remarks

- 1) In 2004 Renate Bartsch retired.
- 2) In the review period both Jeroen Groenendijk and Martin Stokhof were overloaded with administrative duties. That's why their research time is brought down to 0,2 fe.
- 3) 'other academic staff' consists entirely of 'postdocs'. Both Paul Dekker and Robert van Rooij will get a permanent position as assistant professor after their grant period.
- 4) Chris Albert left ILLC before he finished his PhD.

8. Resources, funding and facilities

External grants

- 2000: NWO Humanities, Vernieuwingsimpuls: *Formal Language Games*, Dfl. 1.500.000 granted to Paul Dekker (Dfl. 1.000.000 by NWO and Dfl. 500.000 matching by UvA). This is sufficient to employ 1 senior researcher for a period of four years, 1 post doc for a period of two years and a half, and one PHD student for four years.
- 2000: fellowship (Dfl. 120.000 per year) of the Royal Netherlands Academy of Arts and Sciences (KNAW) for Robert van Rooij, which enabled him to carry out the project *Games, Relevance, and Meaning* in the period 2001-2003.
- 2000: NWO Humanities, open competition: postdoc position for four years for Jaap Maat (Dfl. 332.556) to carry out his project *Leibniz's rational grammar*
- 2004: NWO Humanities, Vernieuwingsimpuls: VIDI grant for Robert van Rooij for *The Economics of Language. Language Use and the Evolution of Linguistic Convention*. The amount €600.000 (€400.000 by NWO and €200.000 matched by UvA) covers the salaries of 1 senior researcher for 4 years and two PhD students for three years each.
- 2004: NWO Humanities, Vernieuwingsimpuls: VENI grant for Maria Aloni for *Semantic Structure and Dynamics in Natural Language Interpretation* (€ 135.000 by NWO and €65.000 matched by UvA).
- 2004: Robert van Rooij received the 2004 *Hendrik Casimir - Karl Ziegler Research Stipendium* (€45.000) awarded by the KNAW. This enables him to spend some time at the Institut für Kommunikations-forschung und Phonetik (IPK) in Bonn to enhance the already existing cooperation between ILLC and the interfacultary research group 'Wissensformate: Information, Representation, Kognition'.

The next table gives an overview of the funding sources for the TI-programme. The first row indicates the amount of fte directly funded by the university, the second row indicates the funding by NWO. See the analysis under 10 for future plans.

Table 5. Funding of Theory of Interpretation

Funding	2000		2001		2002		2003		2004		2005	
Direct	3.01	56.7%	2.84	42.9%	2.18	25.4%	2.44	30.3%	4.78	48.8%	5.03	60.0%
Research	2.30	43.3%	3.78	57.1%	6.39	74.6%	5.60	69.7%	5.01	51.2%	3.35	40.0%
Total	5.31	100.0%	6.62	100.0%	8.57	100.0%	8.04	100.0%	9.79	100.0%	8.38	100.0%

9. Overview of the results

Key publications:

1. Dekker, P., 2002, 'Pronouns in a Pragmatic Semantics', *Journal of Pragmatics*, 34:815-827.
2. Rooij, R. van, 2004. 'Signalling games select Horn strategies', *Linguistics and Philosophy*, 27: 493-527.
3. Aloni, M., 2005, 'Individual Concepts in Modal Predicate Logic'. *Journal of Philosophical Logic*, 34:1-64.

4. Rooij, R. van, 2003, 'Questioning to Resolve Decision Problems', *Linguistics and Philosophy*, 26, 727- 763.
5. Stokhof, M., 2002, *World and Life as One. Ethics and Ontology in Wittgenstein's Early Thought*. Stanford University Press, Stanford.

Table 6. Programme results

	2000	2001	2002	2003	2004	2005
1. Academic publications						
a. refereed journals	3	4	4	6	8	6
b. other journals	0	1	0	0	0	0
c. book chapters/papers in proceedings	11	23	23	16	16	15
Total	14	28	27	22	24	21
2. Monographs	0	1	2	0	1	1
3. Ph.D. theses	0	2	0	1	2	1
4. Professional publications and products	2	0	2	0	1	13
5. Edited Volumes	0	3	3	2	1	2

Table 7. Full outcome list

See Appendix B1.

10. Analysis, perspectives and expectations for the research programme

This is a *strong* programme; it is at the forefront of theoretical linguistics and the quality of the output is among the best the field has to offer.

If a *weakness* has to be noted, it would be that during the review period the time of the programme leaders has so much been taken up by administrative matters that they hardly had time for research. Jeroen Groenendijk was Director of Education of the Teaching Institute for Philosophy at the time the Bachelor/Master system had to be introduced. Martin Stokhof was Research Director of ILLC until 2004, and next became chairman of the *Division of Humanities of the Netherlands Organisation for Scientific Research*, which is a very prestigious but time consuming position.

As indicated above, the programme will be merged with part of the CSIP programme into the new *Logic & Language* programme. We are confident that this new programme will be able to attract funds from the special cognition programme that NWO is setting up, and to capitalize on new *opportunities* for interdisciplinary research created by the European Science Foundation and within the 7th Research Framework Programme. A proposal in the EUROCORES scheme has already been sent off.

There is some danger that the theoretical research done in this programme gets out of touch with what is happening at the empirical forefront -- there always is such danger for theoretical research. Extending this programme with part of the more empirically oriented CSIP programme, will help to diminish this danger. But it is even more important to intensify contacts with the linguists working at the Amsterdam Center for Language and Communications. Joint supervision is not enough. The next step should be setting up joint research projects to be funded by NWO.

Chapter B2. Cognitive Systems and Information Processing

Research area

The *Cognitive Systems and Information Processing* (CSIP) programme collects a number of researchers who believe that logic may benefit from interaction with empirical science, and vice versa. They engage in empirically oriented investigations on language, logical reasoning, graphics and music, developing mathematical and computational models for the data obtained. The empirical methods include use of large corpora, psychological experiments and brain imaging.

In the period 2000-2005, the main themes in this programme have been

- *Logic and cognition*
- *Cognitive approaches to semantics.*
- *Discourse modelling and optimality theory*
- *Gestalt perception and data-oriented parsing*
- *Music cognition*

The sub programme *Logic and cognition* was devoted to empirical investigations into reasoning in healthy and in cognitively impaired subjects. The reasoning power of these subjects has been investigated in relation to mental functions such as long term memory, working memory and planning. The relevance of the results for cognitive architecture has been evaluated, and mathematical models were devised to explain the observed results.

Starting point of *Cognitive approaches to semantics* has been the conviction that semantic explanations must be informed by cognitive considerations. In particular, the semantics of tense and aspect was studied from the point of view of human event-coding and time-perception. Another question of interest here was how different moods (declarative imperative, interrogative) and different modalities (epistemic, deontic) can be distinguished in an overall dynamic framework in which meaning of an utterance is equated with the change it brings about in the hearer's cognitive state.

Modelling semantic phenomena that involve discourse and context has always been an important strand in ILLC. Most of the work in *Discourse modelling and optimality theory* was based on the tenets of the so-called 'radical pragmatics' school. Since linguistic meanings severely underdetermine the content expressed by an utterance, there must be a pragmatic mechanism of completion; the conjecture is that this mechanism is an optimization procedure, the properties of which may be articulated in the general framework of bi-directional Optimality Theory.

The sub-programme *Gestalt perception and Data-oriented parsing* is concerned with the design of algorithms that interpret and/or generate messages expressed in various natural languages. It construes the notion of 'language' broadly, to also include graphics and music. The methods employed in this project build on formal theories of linguistic syntax and logical semantics, but extend these with statistical and complexity-theoretic techniques which are inspired by theories of human Gestalt perception. The project aims to develop computational methods which are cognitively plausible as well as practically useful. Central in this sub-programme is the development of a performance model of natural-language processing, called Data-Oriented Parsing (DOP). It also encompasses some more applied work on information retrieval based on statistical language modelling.

Not all properties of music are directly subsumed by general considerations of structural Gestalt perception. Some of these are treated as research themes in their own right. For example, an important ongoing topic in *Music cognition*, is the perception and categorization of temporal properties of music, such as rhythm, timing and tempo. Another topic investigated is the mathematical basis of tuning systems.

Programme leaders

Michiel van Lambalgen
Remko Scha

Starting date and end date of the programme

This programme started on January 1st, 2001.

On January 1st 2006 the programme was split. In the new set up the computationally oriented part of this programme became an independent programme *Language and Computation*. The other part merged with the programme *Theory of Interpretation* into the new *Logic and Language* programme.

Affiliations outside the institute

The members of this programme participate in the activities of the Dutch Graduate School in Logic (OZSL) and the European Foundation for Logic, Language and Information (FoLLI). The PhD students attend the OZSL schooldays, and participate in the European Summer school in Logic, Language Logic and Information.

In the sub programme *Logic and Cognition* there has been a close co-operation with the Human Communications Research Center in Edinburgh, the F.C. Donders Centre for Cognitive Neuroimaging in Nijmegen, and the Seminar für Sprachwissenschaft in Tübingen.

As for *Cognitive Approaches to Semantics*, there has been contacts with researchers at and the Seminar für Sprachwissenschaft in Tübingen, the Department of Linguistics at Stanford, the Department of Linguistics at North Western.

The research on *Data-Oriented Parsing* is coordinated with the work on memory-based language processing at the University of Tilburg, the work on statistical language processing at the Technion in Haifa, the work on statistical language processing at the University of Leeds, and work on data-oriented Lexical-Functional Grammar at Xerox Parc (Palo Alto).

The Institut für Deutsche Sprache und Linguistik at the Humboldt Universität, the Zentrum für Allgemeine Sprachwissenschaft (ZAS) at the Berlin; and the Institut für Linguistik in Potsdam are the most important international collaborators for the people working in *Discourse modelling and optimality theory*. At the national level this group takes part in the activities of the NWO Cognition project *Conflicts in Interpretation* which is coordinated by the department of Linguistics of the Radboud University Nijmegen.

1. Leadership

The programme leaders manage the group as first among equals: all programmatic decisions are taken in consultation with the entire team.

At an individual level, the regulations for staff members employed by the Faculty of Science differ from the regulations for the staff members employed by the Faculty of Humanities. The performance of the latter is assessed annually by the head

of the department for which they are working, which for some is the Department of Philosophy, and for others the Department of Language and Literature. The programme leaders have an advisory role here. The staff members employed by the Faculty of Science get an annual performance interview by one of the programme leaders. In this case, the programme leaders report to the director of ILLC and advise him about the terms of employment for the staff members concerned.

2. Strategy and policy

The research in this programme is well embedded in the MSc AI, the MSc Cognitive Science and the MSc Logic. Actually, part of the original motivation to put the research teams of the chair of Computational Linguistics and of the Chair of Logic and Cognition together in one research programme was because both play an important role in the AI and Cogsci curricula. Another, more important reason was that for both teams 'cognition' is at the centre of interest. Both teams model cognitive processes, one in mathematical models and the other in computational models.

The researchers in this programme pursue empirical relevance. Hence, much effort has been put in strengthening the empirical component of the work. Here, a major step forward was made when the project *Reasoning and the brain*, a joint venture of ILLC, F.C. Donders Centre Nijmegen and the Psychiatry Department of the University Medical Centre Nijmegen was funded by the Cognition programme of NWO. One goal of this project is to investigate mental processing of temporal expressions by means of EEGs, in order to test some predictions of the model proposed in the book *The Proper Treatment of Events* by Michiel van Lambalgen and Fritz Hamm, (Blackwell, 2004). Another goal of this NWO project is to investigate reasoning processes in autistic patients, which will hopefully result in improved diagnostic tests.

This kind of empirical investigations will become ever more important. Therefore it is very important for ILLC to build bridges to research groups in psycholinguistics and cognitive neuroscience. That is why at the Universiteit of Amsterdam ILLC has taken the lead in bringing researchers from different fields together to get new interdisciplinary activities off the ground. Since 2002 ILLC participates in the Centre for Cognitive Science Amsterdam (CSCA), a collaborative effort of biologists, psychologists, linguists, logicians and philosophers. In the field of psycholinguistics, a special interest group has been created on *First Language Acquisition, Developmental Language Disorders and Executive Functions*. The group consists of researchers from various universities and hospitals and is coordinated by the Amsterdam Center of Language and Communication (ACLIC).

3. Processes in research, internal and external collaboration

The research team carrying out the CSIP-programme can be subdivided in five smaller teams carrying out the sub programmes. The senior members of each of these sub programmes are:

- *Logic and cognition*: van Lambalgen
- *Cognitive approaches to semantics*: van Lambalgen, Veltman
- *Discourse modelling and optimality theory*: Blutner, Zeevat
- *Gestalt perception and Data-oriented parsing*: Scha, Sima'an, Bod, Kamps

- *Music cognition: Honing*

The members of each of these groups, in particular the PhD students, meet on a day to day basis.

As in all programmes PhD students are supervised by at least one full professor plus a second supervisor (not necessarily a full professor) with whom the PhD student is supposed to have contact on a regular basis. The progress of the PhD projects is reviewed at least once a year by the Promotion Progress Committee which is appointed by the scientific director of ILLC. (See Part A for more information).

New research results are discussed either in the biweekly LEGO-meetings⁴ at which all ILLC members working at the Philosophy Department regularly present their ‘work in progress’ or in the biweekly *Computational Linguistics Seminar*, which is the right platform for presenting the computational work done in this programme.

This shows that there has been much contact between the people working in the sub programmes *Logic and cognition* and *Cognitive approaches to semantics* on the one hand and the people working in the *Theory of Interpretation* programme. In fact the contacts have been so intensive that these sub programmes have been merged with *Theory of interpretation* into the new *Logic and Language* programme.

Within the Universiteit van Amsterdam collaboration exists with

- the *Institute for Informatics*, in particular with the group of Maarten de Rijke since he left ILLC to take up a full professorship there,
- the psycholinguists and typologists at the *Amsterdam Center for Language and Communication*, and the *Department of Psychology*
- the people interested in music cognition at the *Department of Musicology* and
- with the people interested in information retrieval at the *Department of Media Studies*.

For collaboration outside Amsterdam, see above.

4. Academic reputation

Michiel van Lambalgen held a NWO Pionier grant from 1994 until 1999 for a project entitled *Reasoning with Uncertainty*. He is widely considered a key player in the field of Logic and Cognition where he advocates combining formal and empirical investigations. Frank Veltman is best known for his work on update semantics. His paper ‘Defaults in update semantics’ was selected by *The Philosopher’s Annual* as one of the ten best papers in philosophy published in 1996. It is the second most cited paper ever published in the *Journal of Philosophical Logic*. Remko Scha initiated the work on Data-Oriented Parsing, and inspired Khalil Sima’an and Rens Bod to further develop this approach. Their work is well received by the international community, witness the recent appointment of Rens Bod as full professor in St Andrews.

Henkjan Honing was one of the directors of the NWO Pionier project ‘Music, Mind, Machine’ at the Radboud University in Nijmegen which ran from 1997 until 2003, and made him and his co-director Peter Desain (Nijmegen) the main representatives in the Netherlands of the new field of music cognition.

⁴ ‘LEGO’ is short for ‘leerstoelgroepoverleg’ which means so much as ‘chair group consultation’

Previous peer reviews

A small part of this programme was evaluated in 2000, when the Association of Universities in the Netherlands (VSNU) assessed the quality of university research in philosophy in the Netherlands over the period 1994-1998. See Section B1.4 for further information.

Prizes and Awards

- 2000: Khalil Sima'an received the Beth Dissertation Prize from the Foundation of Logic, Language and Information for his thesis *Learning Efficient Disambiguation*. He was supervised by Remko Scha and Jan Landsbergen (Utrecht)
- 2000: Khalil Sima'an received the BNAIC Best Paper Award for his paper *Efficient Parsing of Domain Language* (BNAIC stands for Belgian-Netherlands Artificial Intelligence Conference).
- 2003: Arthur Elsenaar and Remko Scha's article 'Electric Body Manipulation as Performance Art: A Historical Perspective', published in *Leonardo Music Journal* 12, has been named the winner of the 2003 Leonardo Award for Excellence.

Editorial positions (Reference date: December 31st 2005)

- Reinhard Blutner, member of the editorial board of *Linguistics and Philosophy*.
- Henkjan Honing, advisory editor of the *Journal of New Music Research*.
- Khalil Sima'an, editor of *DIXIT*, a Dutch journal of applied language and speech technology addressed to industry.
- Frank Veltman, member of the editorial board of *Argumentation*, and the *Journal of Applied NonClassical Logics*.
- Henk Zeevat, member of the editorial board of the *Journal of Semantics*.

Memberships of scientific boards, etc. (Reference date: December 31st 2005)

- Michiel van Lambalgen is member of the *National Research Initiative Brain and Cognition*. He chairs the committee 'Communication'.
- Frank Veltman is chair of the *VIDI-committee* of NWO Humanities.

5. Internal evaluation

Overall, the quality of the output of this programme is very good if not excellent. Moreover, in all sub programmes the research is highly innovative. In particular the work in *Logic and Cognition* has broken new ground for interdisciplinary research; it has set new standards for comparing and confronting (normative) logical theories with (descriptive) psychological theories of reasoning.

All sub programmes should be continued. However, the question is whether all of them should remain part of one and the same umbrella programme. There has been little contact between *Logic and cognition* and *Cognitive approaches to semantics* on the one hand and the rest of the programme on the other. ILLC's research programme gets more coherent if these two sub programmes merge with *Theory of interpretation*. That is were the real contacts have been. (See also Section B1.10)

On the other hand, it looks like a good idea to keep the other sub programmes together in one big computationally oriented programme. Even if at first sight music,

graphics, and language seem altogether different media, it has turned out to be very fruitful to look at these through the same pair of glasses. Moreover, the computational tools developed for one of these domains often prove to be useful in the other domains as well. This is definitely so for the tools developed in the sub programme Data-oriented parsing.

6. External validation

As an offspring of the Pionier project *Reasoning with uncertainty* Michiel van Lambalgen jointly with two psychiatrists of the St. Lucas Hospital (Amsterdam) developed an expert system for the diagnosis of alcoholism. The system is built upon the Bayesian network shell HUGIN, and has variables for physiological measurements as well as physical and psychological disorders.

Van Lambalgen also appeared as an expert witness for the defence before the court of appeal in the notorious case against the nurse Lucia de B. who was accused of killing a number of patients in two hospitals where she had worked. His testimony concerned the statistical argumentation on the basis of which Lucia de B. was sentenced to life imprisonment in the first trial.

Some of the software developed in *Gestalt perception and Data-oriented parsing* is available for download on the web as enabling technology for industry under GNU licence. Examples are the DOPDIS parsing environment (<http://staff.science.uva.nl/~simaan/dopdis/>), and *MorphTagger*, a part-of-speech tagger and word segmenter, based on HMM technology, originally developed for Hebrew but also suitable for other Semitic languages such as Arabic. (<http://www.cs.technion.ac.il/%7Ebarhaim/MorphTagger/>)

The societal impact of the work on information retrieval is immediate. An example is the work in the *MuSeUM project* funded by in the CATCH (Continuous Access To Cultural Heritage) programme of NWO, in which the Gemeentemuseum in The Hague is a partner.

The work on *Music Cognition* enjoys a high visibility in the Dutch popular press. In the year 2005 Henkjan Honing was interviewed by the two most important national newspapers (NRC, Volkskrant), and by a popular science journal (Natuurwetenschap & Techniek). He also presented his work in a science programme (Hoe?Zo!) on Dutch National radio). For the years 2004 and 2003 something similar holds.

7. Researchers and other personnel

Table 4. Research staff of Cognitive Systems and Information Processing
See next page

Appointment	Position	Name	2000	2001	2002	2003	2004	2005	
tenured	assistant professor	Blutner, K.R.					0.21	0.25	
		Hinzen, W.						0.17	
		Honing, H.J.			0.08	0.08	0.08	0.04	
		Kamps, J.						0.17	
		Kwast, K.L.	0.28	0.28	0.28	0.28	0.20	0.00	
		Sima'an, K.					0.38	0.50	
	assistant professor Total			0.28	0.28	0.36	0.36	0.87	1.13
	associate professor	Lambalgen, M. van	0.40	0.10	0.10	0.10	0.10	0.10	
		Veltman, F.J.M.M.	0.20	0.10	0.10	0.10	0.10	0.10	
		Zeevat, H.W.	0.40	0.40	0.40	0.40	0.40	0.40	
associate professor Total			1.00	0.60	0.60	0.60	0.60	0.60	
professor	Lambalgen, M. van	0.00	0.20	0.20	0.20	0.20	0.20		
	Scha, R.J.H.	0.40	0.40	0.40	0.40	0.40	0.40		
	Veltman, F.J.M.M.		0.10	0.10	0.10	0.10	0.10		
professor Total			0.40	0.70	0.70	0.70	0.70	0.70	
tenured Total			1.68	1.58	1.66	1.66	2.17	2.43	
non-tenured	assistant professor	Blutner, K.R.			0.38	0.45	0.24	0.20	
		Hinzen, W.				0.17	0.40	0.23	
		Kamps, J.					0.30	0.23	
	assistant professor Total				0.38	0.62	0.94	0.66	
	other academic staff	Bod, R.	1.00	0.95	0.83	0.87	0.87	0.87	
		Honing, H.J.						0.80	
		Prescher, D.H.J.K.					0.68	0.90	
		Sima'an, K.	0.50	1.00	1.00				
		Smith, L.M.						0.15	
		Voorbraak, F.P.J.M.	0.60						
		Zaanen, M.M. van Zuidema, W.H.		0.15	0.75			0.38	0.90
	other academic staff Total		2.10	2.10	2.58	0.87	1.93	3.62	
	PhD candidate	Bonnema, R.L.	0.58						
		Counihan, M.E.			0.08	1.00	1.00	0.88	
		Fitz, H.			0.08	1.00	1.00	1.00	
		Franke, M.						0.42	
Hindsill, D.L.				1.00	1.00	1.00	1.00		
Honingh, A.K.				0.69	0.75	0.60	0.60		
Jager, S.T. de							0.38		
Ladinig, O.							0.25		
Massios, N.A.		0.38	0.56						
Mastop, R.J.			1.00	1.00	1.00	1.00	0.12		
Nagtegaal, A.J.I.M.		0.40							
Nauze, F.D.					0.50	1.00	1.00		
Schulz, K.				0.50	1.00	1.00	1.00		
Spiro, N.			0.69	0.75	0.75	0.75			
Tamminga, A.M.	0.58								
Tsarfati, R.						0.75			
Vervoort, M.R.	0.40								
			4.44	3.66	7.00	8.49	10.22	12.43	
non-tenured Total			4.44	3.66	7.00	8.49	10.22	12.43	
Total research staff			6.12	5.24	8.66	10.15	12.39	14.86	

Remarks

- 1) Since March 2001 Frank Veltman and Michiel van Lambalgen share the Chair of Logic and Cognitive Science, previously held by Hans Rott. Both are full professor for 0.5 fte. In addition Veltman is associate professor for 0.5 fte, and van Lambalgen is associate professor for 0,3 fte.
- 2) In the review period Frank Veltman was overloaded with administrative duties. That is why his research time is brought down to 0,2 fte.

- 3) Karen Kwast's research time was brought down to 0 fte in 2004 when she became the director of Teaching Institute for Philosophy in 2004.
- 4) 'other academic staff' can be read as 'postdoc'. Rens Bod has been guaranteed a permanent position as assistant professor after his grant period

8. Resources, funding and facilities

External grants

- 2000, NWO Science Vernieuwingsimpuls: to Rens Bod *'Towards a Unifying Model of Linguistic, Musical and Visual Processing'*, in total Dfl 1.500.000 (€680.673) for the proposer (5 years), one senior researcher (1 year) and two PhD students for 4 years each.
- 2002, NWO Humanities Open competition: *Logic meets psychology*, €380.000 granted to Michiel van Lambalgen and Frank Veltman for three PhD students, each for 4 years.
- 2002, Khalil Sima'an was awarded a KNAW-fellowship to continue his work on integrating Data-Oriented Parsing with similarity-based techniques.
- 2004, NWO Science Open Competition: *Unsupervised Stochastic Grammar Induction from Unlabeled Data*. This project, awarded to Rens Bod, deals with modelling language acquisition and language evolution with the DOP model, and will last three years. The subsidy (€171.407) is meant for a postdoc.
- 2004, NWO Mozaïek awards Reut Tsarfaty with a grant (€180.000) for a 4 year PhD position within ILLC. The Mozaïek programme is designed to attract more ethnic minority graduates into academic research. Reut's proposal, jointly with Khalil Sima'an (mentor), concerns probabilistic models for morphological and syntactic processing of Modern Hebrew Texts. The Ph.D. project is conducted under the supervision of Remko Scha and Khalil Sima'an and in cooperation with Yoad Winter (Technion, Haifa, Israel).
- 2004, NWO Cognition, grant to a project entitled *Reasoning and the brain, a joint venture of ILLC, F.C. Donders Centre Nijmegen and the Psychiatry Department of the University Medical Centre Nijmegen*. One goal of the project is to investigate mental processing of temporal expressions (including tense and aspect) by means of EEGs. Another goal is to investigate reasoning processes in autistic patients, which will result in improved diagnostic tests.
- 2005, NWO Humanities: grant for Henkjan Honing for a project called *Music as a social, psychological, and acoustical phenomenon* (0.8 postdoc for three years).
- 2005, EU FP6-IST: EmCAP (*Emergent Cognition through Active Perception*) is an EU research project in the field of Music Cognition awarded to a consortium in which Henkjan Honing represents ILLC. It covers the salary and other costs of 1 postdoctoral researcher and 0.5 PhD-student up to €323.000. The project started in October 2005 and will finish by September 2008.
- 2005, NWO Humanities Open Competition: Wolfram Hinzen was awarded funding for his project *Origins of truth and the sentence*. The subsidy amounts to €375.568 for the appointment of a PhD student for three years and a postdoc.
- 2005, MuSeUM (*Multiple-collection Searching Using Metadata*) is a project awarded within the CATCH programme of NWO. Jaap Kamps will receive funding of almost €544.604 to appoint a postdoctoral researcher (3 years), a PhD student (4 years) and a scientific programmer (3 years)

The next table gives an overview of the funding sources for the CSIP-programme. The first row indicates the amount of fte directly funded by the university, the second row indicates the funding by NWO, and the third row the funding by the EU.

Table 5. Funding of Cognitive Systems and Information Processing

Funding	2000		2001		2002		2003		2004		2005	
Direct	4.04	61.0%	3.14	55.6%	3.12	36.0%	4.78	46.2%	6.11	45.6%	5.21	32.8%
Research	2.08	31.4%	2.10	37.2%	5.54	64.0%	5.37	51.9%	6.28	46.9%	9.25	58.3%
Contract	-	-	-	-	-	-	-	-	-	-	0.40	2.5%
Other	0.50	7.6%	0.41	7.3%	-	-	0.20	1.9%	1.00	7.5%	1.00	6.3%
Total	6.62	100.0%	5.65	100.0%	8.66	100.0%	10.35	100.0%	13.39	100.0%	15.86	100.0%

9. Overview of the results

Key publications:

1. Bod, R., Remko Scha, and Khalil Sima'an (eds.), 2003, *Data-Oriented Parsing*, CSLI Publications, Stanford.
2. Stenning K., and M. van Lambalgen, 2004, 'A little logic goes a long way', *Cognitive Science* 28:481-529.
3. Blutner, K.R., H. de Hoop, H., & P.C.J. Hendriks, 2005, *Optimal Communication*. Stanford: CSLI.
4. Lambalgen, M. van, and F. Hamm, 2004, *The proper treatment of events*, Blackwell, Oxford.
5. Desain, P., and H. Honing, 2003, 'The formation of rhythmic categories and metric priming', *Perception*, 32(3), 341-365

Table 6. Programme results

	2000	2001	2002	2003	2004	2005
1. Academic publications						
a. refereed journals	6	5	11	9	9	11
b. other journals	0	0	0	0	0	0
c. book chapters/papers in proceedings	18	11	16	22	34	36
Total	24	16	27	31	43	47
2. Monographs	0	1	0	0	1	1
3. Ph.D. theses	3	2	1	0	0	1
4. Professional publications and products	1	0	5	3	7	2
5. Edited Volumes	0	2	2	3	0	1

Table 7. Full outcome list

See Appendix B2.

10. Analysis, perspectives and expectations for the research programme

As already stated in B2.5, *strong* points of this programme are the quality of the research output and the truly interdisciplinary character of some of its sub programmes. The *weak* point is its coherence. Measures have been taken to remedy this defect. Part of the CSIP programme merges with TI into the new *Logic and Language* programme. The remaining part is now a new programme *Language & Computation* which is concerned with building computational models of human information processing.

In Section A8 it was already indicated that the Faculty of Humanities decided that the Chair of Computational Linguistics will be abolished when the present chair holder retires. This is a real *threat* to this programme, and in fact to the research programme of ILLC as a whole. The increasing interest, both nationally and at university level, in interdisciplinary research and in cognitive science has created ideal opportunities for a research programme in which the computational modelling of information processing is the central theme. We hope to convince the Faculty of Humanities that one cannot optimally take up these opportunities without a chair in this field.

Chapter B3. Constructive and Intensional Logic

Research area

The programme *Constructive and Intensional Logic* (CIL) continues a long-standing Amsterdam tradition in mathematical logic, going back to the chairs of Brouwer in the foundations of mathematics and that of Beth in general logic.

The programme deals with foundational questions about the principles of mathematical and ordinary reasoning and attempts to capture the mechanisms of reasoning in mathematical models.

Traditionally, the main mathematical models covered were intuitionistic and modal logic, and this historical perspective is honoured in the terms ‘Constructive’ and ‘Intensional’ in the programme title. Current research extends beyond this traditional scope to include game-theoretic and set-theoretic approaches and combine them with the constructive and intensional techniques.

More specifically, in the review period 2000-2005 this programme dealt with the topics

- *Logic of communication and learning*
- *Logic and games*
- *Mathematical theory of modal logic*
- *Foundations of mathematics*

There are many links between these four themes that one to see our research as aspects of one important foundational question.

The Leitmotiv of this research programme is the question ‘What is an adequate mathematical model of processes of private and interactive reasoning?’ Questions of this type are the catalyst for logics of communication (most notably, dynamic-epistemic logic), they figure prominently in the theory of games (for instance in formalizations of rationality assumptions for games), they show up in the foundations of mathematics in a specialized form (namely as the question ‘What is an adequate metamathematical model of mathematical reasoning?’). As modal logics are used as a technique in all of these areas, the Leitmotiv question motivates all of the research concerning the mathematical theory of modal logic as well.

Programme leaders

Johan van Benthem (until September 1st 2003)

Dick de Jongh (until November 1st 2004)

Starting date of the programme

The programme started in January 2001 as a continuation of the programme ‘Mathematical logic’ which was part of ILLC’s research programme since 1996. We have included the results for the year 2000 of the latter programme here.

In January 2006 the programme has been merged with the programme *Algorithms and Complexity Theory* into the new *Logic and Computation* programme. For a description of this new programme, see Section A3)

Affiliations outside the institute

The members of this research team together with mathematical logicians of Utrecht university organize the *Colloquium on Mathematical Logic*. The CML meets biweekly, alternately in Amsterdam and in Utrecht. The Colloquium intends to bring together researchers working in Mathematical Logic and Logic related areas of Theoretical Computer Science.

The national *Dutch workshop series on Logic and Games*, GLLC (Games in Logic, Language and Computation) is also coordinated by members of this research group. During the review period 11 workshops have been organized at various places in the Netherlands.

For our PhD programme at a national level cooperation with other institutes is organized in the *Dutch Graduate School in Logic* (OZSL).

As will be clear from the list of publications, there exist many research relations with researchers at institutes all over the world. In addition the CIL-group is very active serving the international community by organizing a variety of meetings, ranging from small workshops to big conferences.

To give an impression, we mention the activities in this area for the year 2005.

- In September the group around van Benthem organized a workshop entitled *Interfacing Probabilistic and Epistemic Update* which aimed at exploring shared topics between the communities in dynamic epistemic logic and in Bayesian update.
- In June Olivier Roy (PhD student) initiated a mini-series of workshops between Paris and Amsterdam, called PALMYR ('Paris-Amsterdam Logic Meeting of Young Researchers'). The idea of these workshops was to bring together young researchers in logic, language and theories of rationality from Paris and Amsterdam. The series will be continued and a third meeting is planned for June 2006.
- In November the 7th Augustus de Morgan Workshop took place in London. Organized by Johan van Benthem, Dov Gabbay and Benedikt Löwe, it brought together the researchers in the intersection of epistemic logic, mathematical logic and game theory and incited debate and collaboration.
- ILLC is a central node in the research network PhiMSAMP (Philosophy of Mathematics: Sociological Aspects and Mathematical Practice) that is combining work from philosophy, sociology, psychology and education. The network now includes members in Belgium, Germany, Austria and Canada and had a first workshop in May 2005 (held in Bonn). The network was successful in establishing a prestigious workshop at the conference GAP.6 in Berlin for September 2006.
- Another development bridging the different research projects in ILLC is the collaboration CiE ('Computability in Europe'). CiE is a European network of about 70 universities with groups working on various theoretical aspects of computability. Among others, the notions of infinitary computation (connected to descriptive set theory and definability theory) are being covered in CiE. ILLC was successful in attracting the conference CiE 2005 to Amsterdam. CiE 2005 was the first of a series of annual conferences organized by the network, and it was a tremendous success: there were 200 participants and CiE 2005 ended up

being the biggest logic conference of the year.

1. Leadership

In 2003 Johan van Benthem was appointed a University Professor, which freed him from administrative duties. In 2004 Dick de Jongh retired. Although both continued contributing to this research programme, officially the programme has been without a programme leader since then.

Things will change in September 2006, when Jouko Väänänen will join ILLC and become the programme leader of the new *Logic and Computation* programme. Until then the scientific director of ILLC will be acting as programme leader. This means that the annual performance interviews with the staff members are held by him.

2. Strategy and policy

It is amazing how successful this programme has been despite the fact that there have been so many personnel changes in the review period. Anne Troelstra retired in 2000 and it took until March 2001 before Dick de Jongh was officially appointed as his successor. The position left by Dick de Jongh was filled by Yde Venema, who had been working as a post doc on van Benthem's Spinoza project. Kees Doets retired in the beginning of 2002 and it took more than a year until Benedikt Löwe came to Amsterdam to ILLC to fill his position. Then Dick de Jongh retired in 2004 and no worthy successor for him could be found until the very end of 2005.

Under these circumstances, the most important strategic questions dealt with during the review period concerned the profile of the people to be recruited. In the case of the successor of Dick de Jongh this became an important issue when it turned out that it was impossible to find a qualified candidate to continue the tradition in constructivism and proof theory established by Troelstra and de Jongh. It was decided to extend the search area: the candidate had to be an internationally renowned expert in *some* field of mathematical logic (not necessarily proof theory) and somebody who had used this expertise in carrying out innovative research in the foundations of mathematics or computer science (not necessarily of a constructivist nature).

The fact that there were so many personnel changes did not mean that the work plan could not be carried out. The only sub programme that did not produce the output that one would otherwise have expected was *Foundations of Mathematics*.

Johan van Benthem's appointment as University Professor did not stop him giving his best to this research programme. In collaboration with colleagues from the Netherlands and abroad, he and his students contributed much to the sub programme *Logic of communication and learning*. In the last few years, the development of dynamic-epistemic logic has become the focus of attention.

In the review period the research area of *Logic and Games* developed from an important subfield of the work in this programme into a theme that pervades all research programmes in ILLC. This includes the work of Peter van Emde Boas, Krzysztof Apt, and Ulle Endriss (ACT), Robert van Rooij and Paul Dekker (TI), and Jelle Zuidema (CSIP). The interaction between logic and game theory in both directions is a blooming area of research.

Last year ILLC's activities in this area got an enormous impulse because, mainly through the effort of Benedikt Löwe, ILLC got funding for a Marie Curie Research Training Site funding eight PhD students over a project period of four years from the European Commission. This site is coordinated by Krzysztof Apt, Johan van Benthem, Paul Dekker, and Benedikt Löwe and will start its work in February 2006.

The goal in the sub programme *mathematical theory of modal logic* is to obtain a deeper understanding of the properties of modal formalisms. This sub programme received highest honours in December 2005 when Yde Venema received a VICI grant of the NWO for his project *Algebra and Coalgebra: the mathematical environment of modal logic*. In the future supported by three PhD students and two postdocs, Venema will continue to do high-level research in this area.

The senior staff members working in the CIL programme play an important role in the MSc Logic. Benedikt Löwe is the director of this highly successful teaching programme. (For more on the MSc Logic, see Part A)

3. Processes in research, internal and external collaboration

Within ILLC there is a lot of interaction between the CIL-team and the ACT-team. Actually the contacts between these programmes have been so varied and intense that there is no sense in keeping them apart. That is one of the reasons why in the new set up they are merged into the new programme *Logic and Computation*. (For a description of this programme, see Section A3).

As the publication list indicates, the contacts with people from outside have been very intense, too. Examples here are the collaboration of Benedikt Löwe with Joel Hamkins (CUNY), who spent three months as a guest at ILLC, or the collaboration of Yde Venema with Ian Hodkinson (London) and Rob Goltblatt (Wellington). In both cases the collaborative efforts led to groundbreaking results.

For Johan van Benthem contacts with people from abroad are only natural given that he holds a chair at Stanford University, where he spends the spring quarter every year.

As in all programmes, the PhD students are supervised by at least one full professor plus a second supervisor (not necessarily a full professor) with whom the PhD student is supposed to have contact on a regular basis. The progress of the PhD projects is reviewed at least once a year by the Promotion Progress Committee which is appointed by the scientific director of ILLC. (See Part A for more information).

4. Academic reputation

Johan van Benthem is a world-renowned logician. He received one of the 1996 NWO Spinoza awards, for overall scientific excellence and national and international impact. He is a doctor honoris causa of the Université de Liège. Van Benthem is a member of the Royal Netherlands Academy of Arts and Sciences (KNAW), the Academia Europaea, and the Institut International de Philosophie. Van Benthem is a University Professor at the Universiteit van Amsterdam, and a full professor at Stanford University, where he is active in the Center for the Study of Language and Information.

Yde Venema is a leading expert in modal logic. He held a research fellowship of the Royal Netherlands Academy of Arts and Sciences (KNAW) from 1995-2000. In 2005 NWO awarded a prestigious VICI grant to him for his project *Algebra and Coalgebra: the mathematical environment of modal logic*.

Previous peer reviews

The last time this programme was evaluated was in 2003, when the Association of Universities in the Netherlands (VSNU) assessed the quality of university research in Computer Science in the Netherlands over the period 1996-2001. This is a quotation from the final report:

Research programme: very good

Quality: very good

Productivity: good

Relevance: good

Vitality and feasibility: good

The *Constructive and Intensional Logic* group has a long-standing excellent reputation in the field of pure and applied logic, with applications in a wide range of fields, including natural language. They deal with mathematical logic and the foundations of mathematics, in particular constructivism and proof theory. The second theme is a broad study of modal and dynamic logic. Both themes meet in research on provability logics of arithmetic and modal logics of information and information flow. There have been some fine recent achievements, including recent work in fragments of first order logic. The group has a wide network of international contacts. Only part of its activity has a direct connection to computer science. The group has a wide perspective on logic and its application and this is reflected in the attitude towards Ph.D. students, encouraging them towards strong independence. The group seems in a transitional phase but has a good strategy to manage the transition

Prizes and Awards

- 2001: The Universiteit van Amsterdam honoured Johan van Benthem with an appointment as a University Professor to ‘further interdisciplinary research in the field of information science and cognitive science’.
- 2003: Marco Aiello won the prize for the best dissertation in the field of AI from the Italian Association for Artificial Intelligence for his thesis *Spatial reasoning: theory and practice*. His supervisors were Johan van Benthem and Arnold Smeulders.
- 2005: The Praemium Erasmianum Foundation yearly awards a maximum of five prizes of EURO 3000 in recognition of an extraordinary dissertation in the humanities (in the Netherlands). Boudewijn de Bruin received this prize in 2005 for his ILLC thesis *Explaining Games On the Logic of Game Theoretic Explanations*, supervised by Martin Stokhof and Johan van Benthem.

Editorial positions (Reference date: December 31st 2005)

- Johan van Benthem, managing editor of *Studies in Logic and Foundations of Practical Reasoning*, *Who’s Who in Logic*, *Synthese*, and *Transactions on Computational Logic*. Nominating Editor of *The Philosopher’s Annual*, Member editorial board of *Journal of Philosophical Logic*, *Studia Logica*,

- Studies in Linguistics and Philosophy, Logic Journal of the Interest Group in Pure and Applied Logics, Cognitive Science Quarterly, Logic and Computation, Language and Computation,*
- Benedikt Löwe is editor of the *Journal of Logic, Language and Information*.
 - Yde Venema is editor of the open-access electronic journal *Logical Methods in Computer Science*, and of the Springer Verlag book series on *Logic, Language and Information*.

Professional distinctions, memberships of scientific boards, etc. (Reference date: December 31st 2005)

- Johan van Benthem, *Vienna Circle Archive*, Chairman; *Beth Foundation*, Treasurer; *TARK*, Board of Directors; *International Federation for Computational Logic*, Vice-President; *Academia Europaea*, Member; *KNAW, Royal Dutch Academy of Arts and Sciences*, Member; *Institut International de Philosophie (Paris)*, Member; *Hollandse Maatschappij van Wetenschappen*, Member; *Universiteit van Amsterdam*, University Professor, *University of Liège*, honorary doctor, *University of Guangzhou*, visiting university professor.
- Anne Troelstra (emeritus) is a member of the *Royal Netherlands Academy of Arts and Sciences*.

5. Internal evaluation

The quality and quantity of the work in *Logic of communication and learning, Logic and games*, and *Mathematical theory of modal logic* is outstanding. That there are hardly any results in *Foundations of mathematics* is because there was nobody available to work on this subtask. With the new professor of Mathematical Logic and Foundations of Mathematics starting in September 2006 this will change.

The borders between this programme and the programme *Algorithms and Complexity theory* have faded away. Therefore it is a good idea to merge these programmes.

6. External validation

Ideally, the results of interdisciplinary research are relevant for all disciplines involved. Even if this is not the same as external validation it should be part of the evaluation of the programme to check that this is indeed the case. That's why it is good for mathematical logicians to publish their results every now and then in real mathematical (rather than logical) journals, or to publish in economic journals if one thinks the results are relevant for economists, or in linguistic journals if that's opportune, etc.

The publication list below shows that the researchers in this programme try to live up to this ideal. Van Benthem published a paper in *Bulletin of Economic Research* (2001), Venema in the *Transactions of the American Mathematical Society* (2005)

It is important that the general public sees the value of purely theoretical research. That is why it is good to invest time in outreach. Johan van Benthem does so. Examples: With the physicist Robbert Dijkgraaf he gave an 'open' course at the Universiteit van Amsterdam entitled 'Hoe wiskunde werkt' (How mathematics works). In NEMO, a technology museum, he gave a talk for children entitled 'Wat is Logisch?' (What is logical?). In Paradiso, a theatre in Amsterdam, he gave a talk for a general

public ‘Informatiestroom voor oplettende mensen’ (Stream of Information for attentive people). In collaboration with the K.L. Poll Foundation he organized a Public Day which included talks as well as installation art. This day was organized in conjunction with an authors meeting for the *Handbook of the Philosophy of Information* (edited by J. van Benthem & P. Adriaans).

7. Researchers and other personnel

Table 4. Research staff of Constructive and Intensional Logic

Appointment	Position	Name	2000	2001	2002	2003	2004	2005	
tenured	assistant professor	Doets, H.C.	0.50	0.50	0.04				
		Löwe, B.						0.50	
		Venema, Y.		0.50	0.50	0.50	0.50	0.50	
	assistant professor Total			0.50	1.00	0.54	0.50	0.50	1.00
	associate professor	Jongh, D.H.J. de	0.50						
	associate professor Total			0.50					
	professor	Benthem, J.F.A.K. van Jongh, D.H.J. de Troelstra, A.S.		0.50	0.50	0.50	0.50		
				0.50	0.50	0.50	0.50		
			0.17						
professor Total			0.67	1.00	1.00	1.00	0.50		
tenured Total			1.67	2.00	1.54	1.50	1.00	1.00	
non-tenured	assistant professor	Löwe, B.				0.38	0.50		
	assistant professor Total					0.38	0.50		
	associate professor	Eijck, D.J.N. van	0.10	0.10	0.08				
	associate professor Total			0.10	0.10	0.08			
	other academic staff	Baltag, A. Martinez Baldares, M. Pacuit, E.J. Venema, Y. Zambella, D.			0.23				
							0.00	0.00	
				0.50					0.00
				0.30	0.20				
	other academic staff Total			0.80	0.43		0.00	0.00	
	PhD candidate	Aiello, M. Bezhanishvili, N. Bruin, B.P. de Hoogland, E. Iemhoff, R. Kupke, C.A. Liu, F. Pauly, M. Seginer, Y. Uridia, L.		0.38	0.75				
					0.75	0.75	0.75	0.75	
			0.25	0.75	0.75	0.75	0.75		
			0.75	0.25					
			0.60	0.20					
					0.69	0.75	0.75	0.75	
								0.75	
			0.75	0.56					
						0.75	0.75	0.75	
PhD candidate Total			2.73	2.51	2.19	3.00	3.00	3.19	
non-tenured Total			3.63	3.04	2.27	3.38	3.50	3.19	
Total research staff			5.30	5.04	3.81	4.88	4.50	4.19	

Remarks

- 1) Retirements: Anne Troelstra (2000), Kees Doets (2002), Dick de Jongh (2004)
- 2) Johan van Benthem was appointed University Professor in 2003.

8. Resources, funding and facilities

External grants

- 2000, NWO Sciences, Open Competition: *De kennis en rationaliteitsaannamen van speltheoretische oplossingsconcepten* was granted to Johan van Benthem. It supplied funding for one PhD student (Dfl. 276.011).
- 2000, NWO Sciences, Open Competition: Yde Venema, together with Bart Jacobs (Nijmegen) and Jan Rutten (Free University Amsterdam), got funding (Dfl. 239.792) for the project *Coalgebraic Modal Logic, Theory and Applications*.
- 2001, NWO, Teachers in Research: 0.2 position for the years 2001-2005 for Joop Niekus to carry out the project *Choice sequences in the work of Brouwer*.
- 2003, Combined NWO & DFG grant (€14.000) for a joint project entitled *Determinacy and Combinatorics* of Peter Koepke (Bonn) and Benedikt Löwe
- 2004, Brian Semmes received a DAAD German Academic Exchange Service grant for an extended visit (May to August 2004) at the RhFWU Bonn, for a research project entitled *Rationality in Infinite Games* supervised by Benedikt Löwe and Peter Koepke (Bonn).
- 2005, NWO Sciences, Vernieuwingsimpuls: The VICI research proposal of Yde Venema has been selected by NWO Exacte Wetenschappen. He is awarded the sum of 1.43 million EURO (incl. matching by UvA) for his project *Algebra and Coalgebra the mathematical environment of modal logic*, consisting of 3 PhD students (4 years) and 2 postdocs (2 years).
- 2005, EU, Marie Curie programme: GLoRiClass (*Games in Logic: Reaching Out To Classical Game Theory*) is a project with Benedikt Löwe as main applicant that was awarded 1.25 million EURO. This covers the costs of 8 PhD students, each for 3 years.

The next table gives an overview of the funding sources for the CIL-programme. The first row indicates the amount of fte directly funded by the university, the second row indicates the funding by NWO.

Table 5. Funding of Constructive and Intensional Logic

Funding	2000		2001		2002		2003		2004		2005	
Direct	4.45	78.1%	3.46	47.7%	2.29	42.5%	3.38	56.0%	3.00	36.3%	3.44	29.8%
Research	0.85	14.9%	1.58	21.8%	1.52	28.2%	1.50	24.8%	1.50	18.2%	0.75	6.5%
Other	0.40	7.0%	2.22	30.6%	1.58	29.3%	1.16	19.2%	3.76	45.5%	7.35	63.7%
Total	5.70	100.0%	7.26	100.0%	5.39	100.0%	6.04	100.0%	8.26	100.0%	11.54	100.0%

9. Overview of the results

Key publications:

1. Benthem, J. van, 2001, 'Games in Dynamic-Epistemic Logic' *Bulletin of Economic Research*, 219-248.
2. Löwe, B., 2004, 'The Simulation Technique and its Consequences for Infinitary Combinatorics under the Axiom of Blackwell Determinacy', *Pacific Journal of Mathematics* 214: 335-358.

3. Goldblatt, R., I. Hodkinson and Y. Venema, 2004. 'Erdős graphs resolve Fine's canonicity problem', *Bulletin of Symbolic Logic*, 10: 186-208.
4. Aiello, M., J. van Benthem, and G. Bezhanishvili, 2003, 'Reasoning About Space: The Modal Way', *Logic and Computation* 13: 889-920.
5. Blackburn, P., M. de Rijke and Y. Venema, *Modal Logic*, Cambridge University Press, Cambridge, 2001.

Table 6. Overview Programme results

	2000	2001	2002	2003	2004	2005
1. Academic publications						
a. refereed journals	3	12	7	14	9	14
b. other journals	0	0	0	0	0	0
c. book chapters/papers in proceedings	9	16	10	8	10	13
Total	12	28	17	22	19	27
2. Monographs	1	1	0	0	1	0
3. Ph.D. theses	1	4	1	0	1	0
4. Professional publications and products	4	4	7	3	2	6
5. Edited Volumes	1	1	3	1	3	2

Table 7. Full outcome list

See Appendix B3.

10. Analysis, perspectives and expectations for the research programme

Summing up: *Strong* points of this research programme are its interdisciplinary nature, the high quality of the research output, and its international visibility. There are *no weak points*, or it would be the fact that there has been no real management in the last few years which had as a consequence that it was not always clear who was responsible for what. The arrival of the new professor (and programme leader) will change this. Extending the programme by merging it with the ACT-programme will create new possibilities for co-operation. It will be a challenge for the new programme leader to make the new programme even better than the union of the two old ones.

Chapter B4. Language and Inference Technology

Research area

Research within the *Language and Inference Technology* (LIT) group was aimed at developing and studying the computational, linguistic, statistical and logical underpinnings of effective ways of providing intelligent information access. Addressing the latter task requires synergy between AI-research, IR-techniques, and natural language processing.

In the four years of its existence, the LIT team identified four sub areas into which it organized its research activities:

- *Computing with content*
- *Computational inference*
- *Declarative programming*
- *Computational theory building.*

The *computing with content* theme was aimed at turning text into information and, eventually, knowledge. To this end, advances in applied natural language processing are brought to bear on areas such as information extraction and information retrieval. Research within this theme explored combinations of statistical natural language processing tools and symbolic information for text understanding. There were further activities in the areas of semi-structured databases, shallow parsing and digital libraries.

Within the general setting of intelligent information access research within the *computational inference theme* was aimed at providing support for knowledge-intensive tasks such as identifying conflicts, relevance, novelty, or answer hood to a given question, as well as significant changes in dynamic data. Both statistical and deductive underpinnings of such reasoning services were investigated.

Traditionally, logic programming has been used for computing in knowledge-intensive domains such as the ones outlined here. More recently, constraints have proved to be a very natural way of formalizing and computing in knowledge-intensive domains. Within the *declarative programming theme* both foundations and applications of constraint programming were studied. The foundational work concentrated on the design and implementation of an adequate programming environment for constraint programming and the application part concentrated on the use of constraint programming for various optimization problems drawing on integer programming techniques.

The fourth theme, *computational theory building*, built on Michael Masuch's PIONIER grant and its continuation (1990–1994, 1995–1999). It aimed at bringing advances in the earlier themes to bear on a specific domain: theory building in the social sciences. Social science discourse is exclusively formulated in ordinary language (except, of course, for the mathematical theories in economics). As a result, the main theories are put forward in essay-style articles, and much of the discussion can be brought back to differences in their interpretation. To resolve these problems, there has been a concerted effort to linguistically analyze and formalize theories from the social sciences. A key ingredient of this theme is the development of a computational methodology of formal theory building, in tandem with appropriate computational linguistic and inferential support.

Programme leaders during the review period

Dr. M. Masuch

Dr. M. de Rijke

Starting date and end date of the programme

The programme started in January 1, 2000. It ended on April 1st 2004, when Maarten de Rijke, and with him a large part of the LIT- group, left ILLC and moved to the Informatics Institute where Maarten took up a full professorship in Information Processing and Internet. His PhD-students and post docs moved with him, among them Maarten Marx who also was a very active ILLC-member for quite some time.

Affiliations outside the institute

The LIT project participated in the Dutch graduate school for Logic (OZSL) and in the Dutch Research School for Information and Knowledge Systems (SIKS).

Members of the LIT group have been highly active in the international scientific community, as is witnessed by, for instance, a large number of external academic collaborations. These involve Nottingham, Buenos Aires, Utrecht, Nancy, Paris, Udine, Enschede, Saarbrücken, UC Berkeley, Technion Haifa, Stanford University, IMS Stuttgart, University of Manchester, Liverpool University, and Imperial and King's College, London.

Members of the group were involved with a large number of international initiatives, organizations and events, including the Association for Computational Linguistics (ACL); Association for Logic Programming; Association for Computing Machinery (ACM), Advances in Modal Logic (AiML); the Association of Logic Programming (ALP); Computer Aided Deduction (CADE); ERCIM; the European Conference in Artificial Intelligence (ECAI); Hybrid Logic (HyLo), CologNET, Belgian Netherlands Artificial Intelligence Conference (BNAIC); Inference in Computational Semantics (ICoS), Methods for Modalities (M4M).

Finally, members of the LIT programme were the driving organizational heart of the European Association for Logic, Language and Information (FoLLI), under whose auspices the annual European Summer Schools in Logic, Language and Information (ESSLLI) are organized, which attract between 400 and 600 researchers each year.

1. Leadership

During the review period around 80% of the members of the LIT-group were employed on short term contracts (between 1 and 4 years); less than 10% was senior staff (assistant professor or up); and only about 25% was funded directly by the Universiteit van Amsterdam. This of course had consequences for the management style. In this programme, the programme leaders really *direct* the work, much more so than in the other programmes, in which the leaders coordinate the programme as *primus inter pares*.

2. Strategy and policy

What set this programme apart from the other programmes in ILLC is the methodological stance taken, particularly in the sub areas *Computing with content* and *Computational Inference*. Here, the leading methodology is to identify real world scenarios that give rise to interesting research questions. These questions are answered from a broad spectrum of perspectives, ranging from theoretical to experimental. But that is not all. The members of the LIT-team are convinced that it is crucial for the development of the general area of information processing that the research be *evaluation-driven*. Therefore LIT participated in the CLEF evaluation campaigns for cross-language retrieval systems, in the TREC text retrieval competition, and in Initiative for the Evaluation of XML Retrieval (INEX), where it scored best in 2003.

3. Processes in research, internal and external collaboration

Given that the LIT-programme was discontinued in April 2004, there is little sense in describing and evaluating 'current processes and the research culture within the group'.

4. Academic reputation

The *Language and Inference Technology* programme had a former and a current NWO PIONIER-grant holder amongst its members. Masuch held a NWO PIONIER-grant from 1990 till 1994, with a continuation from 1995 till 1999. De Rijke holds a PIONIER grant entitled *Computing with Meaning* since September 2001.

Previous peer reviews

The last time this programme was evaluated was in 2003, when the Association of Universities in the Netherlands (VSNU) assessed the quality of university research in Computer Science in the Netherlands over the period 1996-2001. This is a quotation from the final report:

Research programme: good
Quality: very good
Productivity: excellent
Relevance: very good
Vitality and feasibility: good

The *Language and Inference Technology* group researches intelligent information retrieval which uses inference and language technologies: representational and algorithmic aspects of computational linguistics and computational logic, with a strong emphasis on mechanizing and evaluating language processing and inference methods. They explore new applications for automated reasoning and language technology and comparing and refining existing methodologies.

There seems to be a major change between the review period working on broader topics and the current period, with a narrower focus. The group

seeks an interesting balance between theory, experiment, and application. It has become a very coherent team. The group has strong external funding but lacks sufficient permanent staff. A full professor is required.

Although this group is located within ILLC, there would be value in integrating this group geographically and organizationally with other groups in the Informatics Institute, particularly in the MMIS-laboratory (Multimedia and Intelligent Systems).

Professional distinctions, memberships of scientific boards, etc. (Reference date: December 31st 2003)

- Krzysztof Apt, see Section B5.4
- Michael Masuch, Area editor of *Computational and Mathematical Organization Theory* and associate editor of *Journal of Artificial Societies and Social Simulation*.
- Maarten de Rijke, chair of the *AiML Steering Committee*, chair of the *ESSLLI Standing Committee*, chief executive officer *European Association for Logic, Language and Information*, member of the *evaluation committee for the NWO-VIDI scheme*, member of the *ICoS Steering Committee*, member of the *IFCoLOG Executive Board*.

Editorial positions (Reference date: December 31st 2003)

- Krzysztof Apt, see Section B5.4
- Michael Masuch, Area editor of *Computational and Mathematical Organization Theory* and associate editor of *Journal of Artificial Societies and Social Simulation*.
- Maarten de Rijke, Editor of *ACM Transactions on Computational Logic* and *Journal of Language and Computation*; review editor of *Journal of Logic, Language and Information*.

5. Internal evaluation

When in 2003 the evaluation report cited above came out, the board of ILLC shared the conclusions of the 2003 evaluation committee about the LIT programme.

Therefore we have welcomed the appointment of Maarten de Rijke as full professor in Information Retrieval at the Informatics Institute, and stimulated the transition of a large part of the LIT team to the Informatics Institute in order to continue the programme there.

6. External validation

One of the greatest challenges facing researchers in computer science and artificial intelligence today is intelligent information access: finding information (documents, answers, ...) that truly satisfies a user's information need. Because of the dramatically growing availability of online documents, the societal relevance of the general theme driving research within the *Language and Inference Technology* programme is obvious.

The potential technological impact of the work of the LIT team ranges from disciplines with an obvious societal impact, such as medicine, to more traditional

humanities disciplines such as digital, and to state of the art high-tech companies in document handling and information access.

The implementation efforts of the LIT group resulted in a number of applications that are publicly available. See <http://ilps.science.uva.nl/Resources/index.html> for further information and the current supply.

7. Researchers and other personnel

Table 4. Research staff of Language and Inference Technology

Appointment	Position	Name	2000	2001	2002	2003	2004
tenured	assistant professor	Rijke, M. de	0.50	0.50			
	assistant professor Total		0.50	0.50			
	associate professor	Masuch, J.M.F.	0.40	0.30	0.30	0.30	0.08
		Rijke, M. de			0.50	0.50	0.13
	associate professor Total		0.40	0.30	0.80	0.80	0.21
	other academic staff	Ó Nualláin, B.S.	0.90	0.90	0.90	0.68	
	other academic staff Total		0.90	0.90	0.90	0.68	
	professor	Apt, K.R.	0.10	0.10	0.10	0.10	0.03
Mokken, R.J.		0.10	0.10	0.10	0.10	0.03	
professor Total		0.20	0.20	0.20	0.20	0.06	
tenured Total			2.00	1.90	1.90	1.68	0.26
non-tenured	assistant professor	Kamps, J.				0.17	0.10
		Sima'an, K.				0.50	0.13
	assistant professor Total					0.67	0.23
	other academic staff	Ahn, D.D.					0.08
		Areces, C.E.		0.90	0.90		
		Franceschet, M.			0.18	0.72	0.18
		Kamps, J.	0.45	0.90	0.90	0.45	
		Marx, M.J.	0.45	0.45	0.90	0.90	0.23
		Müller, K.E.				0.90	0.23
		Prescher, D.H.J.K.				0.90	0.23
		Schlobach, K.S.			0.75	0.90	0.23
	Vermeulen, I.E.			0.29	0.60		
	other academic staff Total		0.90	2.25	3.92	5.37	1.18
	PhD candidate	Areces, C.E.	0.50				
		Caracciolo, C.		0.63	0.75	0.75	0.19
Gennari, R.		0.75	0.75	0.68			
Heguiabehere, J.M.		0.75	0.75	0.75	0.69		
Infante Lopez, G.G.			0.44	0.75	0.75	0.19	
Jijkoun, V.				0.69	0.75	0.19	
Mishne, G.A.					0.06	0.19	
Monz, C.		0.75	0.75	0.75	0.60		
Musillo, G.A.			0.13	0.75			
Ragetli, H.J.N.		0.50					
Sigurbjörnsson, B.				0.13	0.75	0.19	
Stol, M.C.			0.75	0.75	0.75		
Vermeulen, I.E.	0.75	0.75					
PhD candidate Total		4.00	4.95	6.00	5.10	0.95	
non-tenured Total			4.90	7.20	9.92	11.14	2.36
Total research staff			6.90	9.10	11.82	12.82	2.62

Remarks

In April 2004 most members of the LIT-team moved with Maarten de Rijke to the Informatics Institute. The exceptions were: (a) Krzysztof Apt, who joined the ACT team, and (b) Jaap Kamps, Detlev Prescher, and Khalil Sima'an, whose work was reallocated in the CSIP programme.

8. Resources, funding and facilities

External Grants

- 2000, NWO Exact: *ALMA-0 and New Foundations for Declarative Programming*, Krzysztof Apt
- 2000, NWO: Krzysztof Apt and Maarten de Rijke: *Simulation and Testing for Feature Interaction (STeFI)*; Dfl 598.000 for 1 postdoc (2 years), 1 PhD student (4 years), and one programmer (4 years).
- 2000, NWO Sciences: Michael Masuch; a grant (Dfl. 237.988) one postdoc for research on *Organizational Embedding of IT*
- 2000, NWO 'vervangingsubsidie' of Dfl 25.000: *Computing with Modal Logics*
- 2001, NWO, Pionier award to Maarten de Rijke, for his project *Computing with Meaning*. The project has started in September 2001 and will run for five years. It employs two postdocs (each for five years), three PhD students and two scientific programmers. The total funding is: Dfl 1.809.000 from NWO and Dfl 910.000 matching from the UvA.
- 2001, fellowship of the Royal Netherlands Academy of Arts and Sciences (KNAW) for Khalil Sima'an, which enabled him to carry out the project *Beyond Tree-Banks: Ambiguity Resolution by Distributional Similarity-based Performance Models*.
- 2002, NWO Sciences, *Complex Knowledge Base Classification*, a subsidy of € 239.430 for one postdoc and 0.5 scientific programmer, each for 3 years
- 2002, NWO Sciences, open competition: Maarten de Rijke, grant (€167.530) for one postdoc who works on the project *Model Checking Algorithms and Tools for Hybrid Logics*.
- 2003, NWO Sciences, open competition:: M. de Rijke, *Inference for Temporal Question Answering*. €254.000 for one postdoc for three years
- 2003: NWO Sciences, open competition: K. Sima'an, *Learning Stochastic Tree Grammars from tree-banks (LeStoGram)*, €166.765 for one postdoc for three years.

The next table gives an overview of the funding sources for the LIT-programme. The first row indicates the amount of fte directly funded by the university, the second row indicates the funding by NWO, and the third row the funding by the EU.

Table 5. Funding of Language and Inference Technology

Funding	2000		2001		2002		2003		2004	
Direct	2.90	38.8%	2.80	23.1%	2.61	17.6%	3.69	21.9%	0.66	15.8%
Research	3.40	45.5%	5.57	46.0%	8.36	56.4%	8.28	49.2%	1.75	42.3%
Contract	0.60	8.0%	0.73	6.0%	0.85	5.7%	0.85	5.1%	0.22	5.2%
Other	0.58	7.8%	3.00	24.8%	3.00	20.2%	4.00	23.8%	1.52	36.7%
Total	7.48	100.0%	12.10	100.0%	14.82	100.0%	16.82	100.0%	4.14	100.0%

9. Overview of the results

Key publications:

1. Apt, K.R. and E. Monfroy, 2001, 'Constraint programming viewed as rule based programming', *Theory and Practice of Logic Programming (TPLP)*, 1(6): 713-750
2. Monz, C., and M. de Rijke, 2001, 'Tequesta: The University of Amsterdam's textual question answering system' In *Proceedings of Tenth Text Retrieval Conference (TREC 10)*, pages 513-52
3. Kamps, J., 2002, 'The ubiquity of background knowledge.' In: R. Festa (ed.), *Logic of Scientific Cognition: Essays in Debate with Theo Kuipers*, Poznan Studies in the Philosophy of the Sciences and the Humanities. Rodopi, Amsterdam
4. Sima'an, K. and L. Buratto, 2003, 'Backoff Parameter Estimation for the DOP Model' In N. Lavrac, D. Gamberger, H. Blockeel and L. Todorovski (eds.), *Proceedings of the European Conference on Machine Learning (ECML'03)*, Lecture Notes in Artificial Intelligence (LNAI 2837), 373-384, Springer
5. Apt, K.R., 2003, *Principles of Constraint Programming*. Cambridge: Cambridge University Press.

Table 6. Overview programme results

	2000	2001	2002	2003	2004	2005
1. Academic publications						
a. refereed journals	4	10	11	7	3	0
b. other journals	0	2	0	0	0	0
c. book chapters/papers in proceedings	21	28	35	49	42	0
Total	25	40	46	56	45	0
2. Monographs	0	0	0	1	0	0
3. Ph.D. theses	1	0	2	2	0	1
4. Professional publications and products	5	3	0	0	1	0
5. Edited Volumes	3	3	1	1	0	0

Table 7. Full outcome list

See Appendix B4.

10. Analysis, perspectives and expectations for the research programme

See the remarks under 5 (Internal Evaluation).

Chapter B5. Algorithms and Complexity Theory

Research area

A leading conception structuring the research at the Universiteit van Amsterdam is the view that informatics is a unifying paradigm between humanities, the natural sciences and the social sciences. From this perspective the potential domains and application areas of research in *algorithms and complexity theory* are numerous. In the review period 2000-2005 research in this programme (ACT) focused on two domains:

- The study of algorithms and complexity in the context of alternative paradigms of computation, in particular *Quantum computing*.
- *Complexity and the real world*. The study of algorithms and complexity in the context of the manipulation of real world systems, e.g. machine learning, and object orientation.

Quantum computing is a new field of research that has attracted an increasing number of computer scientists and physicists over the last fifteen years. Evidence has arisen that the proposed coherent quantum computers are for some tasks intrinsically much faster than classical computing devices. In addition to this potential for technological development, these models are also of theoretical interest as they may lead to the solution of open problems in complexity theory, and to increased understanding of quantum phenomena in nature.

Under the heading *Complexity in the real world* various themes dealing with the application of complexity theory are combined. Research in *complexity theory* itself has focused on reductions and completeness notions. An ongoing theme here is the identification of structural properties that characterize complexity classes. This theme has been studied at the Universiteit van Amsterdam since the 80's. In the field of *learning* our results range from very theoretical work on the relations between Kolmogorov Complexity, the Minimum Description Length Principle and Bayesian Inference to practical work on building an autopilot on a single handed sailing ship trained by the experience of previous voyages.

In addition to the above, some smaller projects were carried out.

In *distributed computations and network models* problems like mutual search and naming conventions in networks have been investigated. The work on *programming methodology* focused on the efforts of rendering declarative programming more efficient and usable. This led to research on integrating logic programming with imperative programming and on various aspects of constraint programming.

The recent field of *computational game models* aims at bridging the conceptual gap between the anthropomorphic conceptions invoked in agent theory in AI and object technology on the one side and traditional computational models on the other side. Modelling imperfect information of agents turns out to be the major bottleneck.

Programme leaders

Peter van Emde Boas

Leen Torenvliet

Starting date and end date of the programme

The programme started in January 2001 as a continuation of the programme *Computation and complexity* which was part of ILLC's research programme since 1996. We have included the results for the year 2000 of the latter programme here.

In January 2006 the programme has been merged with the programme *Constructive and Intensional Logic* into the new *Logic and Computation* programme. For a description of this new programme, see Section A11.

Affiliations outside the institute

The composition of the ACT-group is somewhat special as three of its members, Apt, Buhrman, and Vitányi, have their main job at the *Center for Mathematics and Computer Science* (CWI). This is an independent national research institute financed directly by The Netherlands Organisation for Scientific Research (NWO). They have a part-time appointment (one day a week) as full professors at the UvA, which gives them the right to act as a promotor for PhD students. At the UvA they teach one course a year and supervise MSc students and PhD students.

Strictly speaking, the research carried out by our CWI-professors is not subject to this review. Nevertheless we have taken the liberty to include it here because the cooperation with CWI is at the core of this programme and the work done by our CWI-professors is of vital importance to it.

At a national level cooperation with other institutes is mostly organized in the Dutch Graduate School in Logic (OZSL). An exception is the UMEEPI (Understanding and Modelling of End-to-End Performance of the Internet) project, in which Delft University of Technology, RIPE NCC, KPN Research and ILLC collaborate.

As will become clear from the list of publications, there exist many research relations with researchers at institutes all over the world. Some of these were formalized in *EU Quantum Information Processing and Communications Network of Excellence* (QUIPROCONE) which included 35 sites and ran from 2000 to 2003 with Vitányi as site manager.

1. Leadership

In this programme the work of the programme leaders is mainly restricted to purely administrative matters. Strategic decisions and long term plans are made in consultation with the entire team. This is only natural given that three of the professors working in this programme are high level experts responsible for their own projects in the Center of Mathematics and Computer Science, and importing that work into their part-time job at ILLC.

All staff members have an annual performance interview with one of the programme leaders or with the director of ILLC. In the first case, the programme leaders report to the director of ILLC and advise him about the terms of employment of the staff members concerned.

2. Strategy and policy

The research in this programme is well embedded in the BSc Computer Science, the

MSc AI, and the MSc Logic. The quality of the teaching is high, witness the many prizes collected by students who wrote their master thesis under the supervision of a member of this research team.

The research group seeks cooperation with members of other groups within ILLC and outside ILLC. Within ILLC the overall themes ‘cognitive modelling’ and ‘game theory’ give ample opportunity to do so. For example, in the InIGMA project Sevenster investigated the signalling games for non-literal use of language, developed by van Rooij in the *Theory of Interpretation* programme. Another example: Ulle Endriss started a seminar on *Computational Social Choice*, a series of occasional talks meant for everybody in ILLC interested in this topic. Both speakers from ACT and speakers from CIL have presented their work there.

It is especially important to find partners outside ILLC that can help to turn the highly theoretical ‘inventions’ made in this group into practical applications. Here an example is given by the UMEEPI project in which Leen Torenvliet together with researchers of the Technical University of Delft developed methods for reconstructing parts of the internet graph from incomplete data and implemented algorithms for computing link delays from end-to-end delay measurements.

3. Processes in research, internal and external collaboration

As the list of publications shows, the work in this programme characteristically splits up in small projects carried out by two or three members of the group plus in many cases one or two colleague from abroad. There is for instance the cooperation of Torenvliet and Buhrman on structural properties of complexity classes, resulting in a steady stream of papers. There is the work of Vitányi and his student Cilibrasi on the use of mutual normalized compression distance (a Kolmogorov Complexity based notion) for classification of concrete objects of an arbitrary nature, ranging from music pieces to genome fragments of infectious viruses. And in the InIGMA project Merlijn Sevenster and the NWO sponsored summer guest Tero Tulenheimo (Helsinki) have investigated the various options for designing an IF version of modal logic.

Daily supervision of the PhD students is being done by at least one full professor plus a second supervisor, not necessarily a full professor, with whom the PhD student is supposed to have contact on a regular basis. The progress of the PhD projects is reviewed at least once a year by the Promotion Progress Committee which is appointed by the scientific director of ILLC. (See Part A for more information). A problem here is the fact that sometimes the PhD student is employed by ILLC while his/her supervisor spends most of his time at CWI. In such cases the student usually gets a work place at CWI, where he/she is supposed to work one or two days a week.

4. Academic reputation

Previous peer reviews

The last time this programme was evaluated was in 2003, when the Association of Universities in the Netherlands (VSNU) assessed the quality of university research in Computer Science in the Netherlands for the period 1996-2001.

This is a quotation from the final report:

Research programme: good
Quality: very good
Productivity: excellent
Relevance: good
Vitality and feasibility: satisfactory

The general themes of the *Algorithms and Complexity Theory* project are algorithmic methods and complexity analysis. Specific subjects are quantum information processing, computational learning (in cognition and artificial intelligence), network algorithms, computational complexity theory, descriptive complexity theory and its applications, and computational game models. The goal of this group is to focus on algorithms and complexity including quantum computation. They act as a facilitating group that has many interactions with other groups in the department. It contains a number of strong researchers and has a lot to contribute. Inspired by the vision of Informatics as a unifying paradigm, their activities range from theoretical work on complexity to practical applications including in a variety of domains such as language learning and biological processing. The group is small with many part-time researchers. A new leader could guarantee its vitality in the future. The group could benefit from a stronger integration, on one location, with the main body of computer science in the Informatics Institute.

Prizes and Awards

- 2001: CIVI Study Award of Dfl. 25.000,- granted to Mart de Graaf for his MSc thesis *Quantum Computing and the Yao Principle*, supervised by Harry Buhrman, Ronald de Wolf and Leen Torenvliet.
- 2003: Paul Vitányi was appointed CWI fellow, which enables him to concentrate full-time on his research.
- 2003: Ronald de Wolf got the ERCIM's 2003 Cor Baayen Award for his dissertation *Quantum Computing and Communication Complexity* which was written under the supervision of Harry Buhrman and Paul Vitányi.
- 2004: Stephanie Wehner investigated a quantum computing based method for information transmission granting absolute anonymity to all participants. For this and other work she collected the 2004 Bakkenist price of 10.000 Euro for the best Computer Science master student.
- 2005: Boaz Leskes defended his joint master study in computational science and logic with a thesis on an agreement based boosting strategy for computational learning. For this thesis he obtained the first prize in the thesis competition of the Universiteit van Amsterdam.
- Ulle Endriss got the best paper award at the Journées Francophones sur les Systèmes Multi-Agents (JSMA-2005) for the paper *Sur le Caractère Égalitaire de l'Allocation de Ressources Distribuée*, that he wrote together with S. Estevie, Y. Chevaleyre and N. Maudet.

Editorial positions (Reference date: December 31st 2005)

- Krzysztof Apt is member of the editorial board of *Logical Methods in Computer Science* (electronic journal), *Theory and Practice of Logic Programming*, and *Journal of Logic and Computation*, and editor of *ACM Transactions on Computational Logic*.

- Harry Buhrman is editor of *Theory of Computing Systems*, and *Computational Complexity*.
- Peter van Emde Boas is editor of *RAIRO* and *Information and Computation*.
- Paul Vitányi is editor of *Distributed Computing, Information Processing Letters, Mathematical Systems Theory/Mathematical Computing Theory, Parallel Processing Letters, International Journal of Foundations of Computer Science, Journal of Computer and System Sciences (guest editor), Journal of New Generation Computer Systems*, and *Frontiers in Computing Systems Research*. He is also a Member of the Scientific Board of the *Encyclopedia of Mathematics*.

Professional distinctions, memberships of scientific boards, etc. (Reference date: December 31st 2005)

- Krzysztof Apt is member of the executive committee of the *Association for Constraint Programming*, member of the advisory board of the *Computing Research Repository*, and member of the *Board of the International Federation for Computational Logic*.
- Paul Vitányi is a member of the *Gödel Prize Committee*, and the *International Federation for Information Processing* in which he serves as co-chair of the working group on computational learning.

5. Internal evaluation

As said above, the work by the CWI-members is extremely important for this programme even if officially only a small part of it is produced in the (part-) time they work ILLC. Strictly speaking, only that part is subject to this evaluation.

Still, both the work on Kolmogorov complexity, and the work on Quantum computing is excellent, highly original, and at the forefront of theoretical computer science.

If the work of the CWI-members of this programme is put aside, what is left to evaluate is the following:

1. the work on complexity theory by Leen Torenvliet, some of which he did in collaboration with CWI-professor Harry Buhrman.
2. The work on grammar induction in the group around Pieter Adriaans, who worked at ILLC until 2004. (This was part of the sub programme *Complexity and the real world*)
3. the work in the group around Peter van Emde Boas. This includes the work on object orientation including the Inigma project that finishes in 2006 when Merlijn Sevenster defends his PhD thesis.

The work under (1) is first rate. It is a pity that the work under (2) was discontinued when Pieter Adriaans left ILLC, but ‘learning language’ remains an important topic in the new programme *Language and Computation*. As for (3), the quality of the work delivered is very good, but the quantity is below the standard of ILLC.

6. External validation

The dissemination of research results outside the scientific community appears from the items listed below (selection):

- The newly developed technique of quantum fingerprinting (Harry Buhrman) got international press coverage in *Physics Update Now* (Number 560 #2, October 9, 2001).
- About Vitányi & Cilibrasi's *Automatic meaning discovery using Google*, an article was written in *New Scientist*, 29 January 2005, p.21 by Duncan Graham Rowe.
- Several articles about music classification appeared in the popular press: 'Software to unzip identity of unknown composers', *New Scientist*, 12 April 2003, by Hazel Muir. 'Software sorts tunes', *Technology Research News*, April 23/30, 2003, by Kimberly Patch. 'Classer musiques, langues, images, textes et genomes', *Pour La Science*, 317 (March 2004), 98--103, by Jean-Paul Delahaye.
- The method and software implementation developed by Cilibrasi was used to classify the sequenced SARS virus in relation to potential similar viruses. A similar tree appeared later in the *New England Journal of Medicine*.
- The software used for the items mentioned above can be downloaded from the CompLearn homepage at <http://www.complearn.org/>. This is open source software.

7. Researchers and other personnel

Table 4. Research staff of Algorithms and Complexity Theory

Appointment	Position	Name	2000	2001	2002	2003	2004	2005
tenured	assistant professor	Torenvliet, L.	0.50	0.25				
	assistant professor Total		0.50	0.25				
	associate professor	Torenvliet, L.		0.25	0.50	0.50	0.50	0.50
	associate professor Total			0.25	0.50	0.50	0.50	0.50
	professor	Apt, K.R.					0.07	0.10
		Buhrman, H.M.	0.01	0.10	0.10	0.10	0.10	0.10
		Emde Boas, P. van	0.50	0.50	0.40	0.40	0.40	0.40
		Vitanyi, P.M.B.	0.10	0.10	0.10	0.10	0.10	0.10
professor Total		0.61	0.70	0.60	0.60	0.67	0.70	
tenured Total			1.11	1.20	1.10	1.10	1.17	1.20
non-tenured	assistant professor	Endriss, U.						0.25
	assistant professor Total							0.25
	PhD candidate	Dam, W.K. van	0.44					
		Druiven, S.			0.25	0.75	0.31	
		Lee, T.J.			0.69	0.75	0.75	0.75
		Sevenster, M.			0.25	0.75	0.75	0.75
		Wolf, R.M. de	0.75	0.44				
	PhD candidate Total		1.19	0.44	1.19	2.25	1.81	1.50
professor	Adriaans, P.W.	0.10	0.10	0.10	0.10			
professor Total		0.10	0.10	0.10	0.10			
non-tenured Total			1.29	0.54	1.29	2.35	1.81	1.75
Total research staff			2.40	1.74	2.39	3.45	2.98	2.95

Remarks:

- 1) Apt, Buhrman and Vitányi work part-time (0,2 fte) at ILLC, and have their main job (0, 8 fte) at the *Center for Mathematics and Computer Science (CWI)*, an independent national research institute.
- 2) Van Emde Boas: as a chairman of four exam committees he does not have much time for research left.
- 3) Adriaans worked part-time (0,2 fte) at ILLC as a professor by special appointment until 2004.
- 4) Krzysztof Apt has been on leave from September 2002 – September 2005. During that period he was visiting professor at the Department of Computer Science of the National University in Singapore. When most of the LIT-group moved to the *Informatics Institute* in April 2004, Apt's work was reallocated to the ACT-programme. Since he is back, most of his work has been in game theory. This work is not explicitly mentioned in the ACT programme description above, but we have included his publications in the ACT publication list. As of January 2006, his work is part of the new *Logic and Computation* programme.
- 5) Ulle Endriss joined ILLC in July 2005, filling the vacancy left by Maarten de Rijke. He works at the interface of computational logic, mathematical economics, and artificial intelligence. His work is not explicitly mentioned in the ACT programme description above, but we have included his publications in the ACT publication list. As of January 2006, his work is part of the new *Logic and Computation* programme.
- 6) Sjoerd Druiven left ILLC before finishing his PhD.

8. Resources, funding and facilities

External grants

- 2002: NWO open competition: Peter van Emde Boas and Johan van Benthem: two PhD students, for 4 years each, on a project on *Imperfect information games, models and analysis* (InIGMA). The total funding is €286.986.

For the Center for Mathematics and Computer Science (CWI) our members acquired the following grants:

- 2000: NWO open competition: *Average case analysis of algorithms*, granted to Paul Vitányi.
- 2000: EU, IST programme: *Quantum algorithms and information processing*, with Harry Buhrman as coordinator.
- 2001: NWO open competition: *Universal Learning*, granted to Paul Vitányi.
- 2003: VICI grant in NWO's Vernieuwingsimpuls for Harry Buhrman to continue his work on *Quantum Information Processing*.
- 2003: EU, IST programme: *Resources for Quantum Computing* (RESQ), with CWI (contact Harry Buhrman) as partner.

The next table gives an overview of the funding sources for the LIT-programme. The first row indicates the amount of fte directly funded by the University, the second row indicates the funding by NWO, and the third row the funding by the EU.

Table 5. Funding of Algorithms and Complexity Theory

Funding	2000		2001		2002		2003		2004		2005	
Direct	2.30	89.5%	1.64	59.9%	1.79	46.0%	1.85	28.3%	1.92	23.8%	2.20	24.8%
Research	-	-	-	-	0.50	12.9%	1.50	23.0%	1.06	13.2%	0.75	8.5%
Contract	0.10	3.9%	0.10	3.6%	0.10	2.6%	0.10	1.5%	-	-	-	-
Other	0.17	6.6%	1.00	36.5%	1.50	38.6%	3.08	47.2%	5.08	63.0%	5.92	66.7%
Total	2.57	100.0%	2.74	100.0%	3.89	100.0%	6.53	100.0%	8.06	100.0%	8.87	100.0%

9. Overview of the results

Key publications:

1. Hemaspaandra, L. and L. Torenvliet, 2003, *Theory of Semi-Feasible Algorithms*, EATCS Monographs in Theoretical Computer Science, Springer-Verlag, Berlin, 158 pages
2. Buhrman, H. and L. Torenvliet, 2004. 'Separating Complexity Classes Using Structural Properties', *Proceedings 19th IEEE Annual Conference on Computational Complexity*, 130-138.
3. Cilibrasi, R. and P.M.B. Vitányi, 2005, 'Clustering by compression', *IEEE Transactions on Information Theory* 51(4), 1523- 1545.
4. Endriss, U., and N. Maudet, 2005, 'On the Communication Complexity of Multilateral Trading: Extended Report', *Journal of Autonomous Agents and Multiagent Systems*, 11(1), 91-107.
5. Apt, K.R., 2004, 'Uniform Proofs of Order Independence for Various Strategy Elimination Procedures', *Contributions to Theoretical Economics*, 4(1), 1-48.

Table 6. Overview of results

	2000	2001	2002	2003	2004	2005
1. Academic publications						
a. refereed journals	11	11	6	9	5	13
b. other journals	0	0	0	0	0	1
c. book chapters/papers in proceedings	17	7	10	10	15	17
Total	28	18	16	19	20	31
2. Monographs	0	0	1	0	0	0
3. Ph.D. theses	0	2	2	0	2	2
4. Professional publications and products	3	1	3	2	0	3
5. Edited Volumes	0	0	1	0	3	2

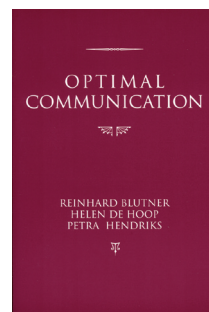
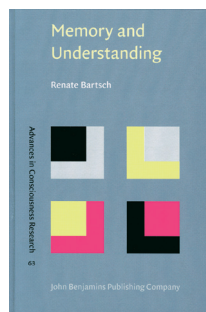
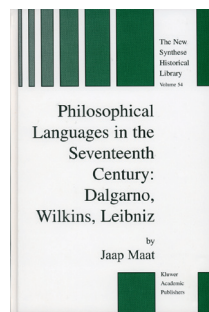
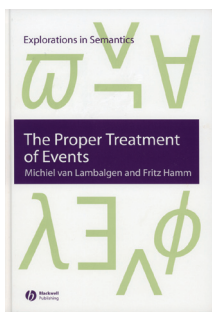
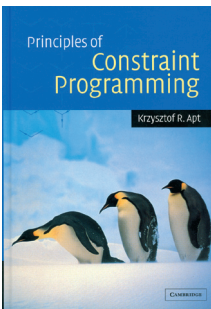
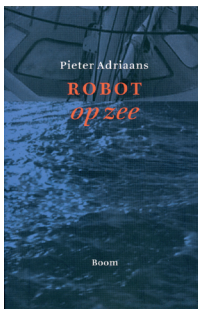
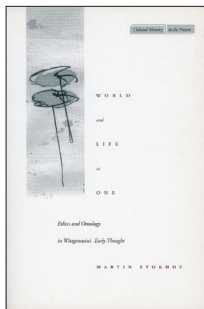
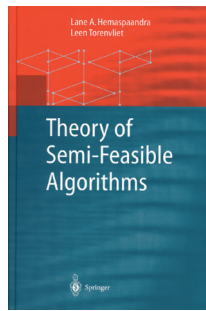
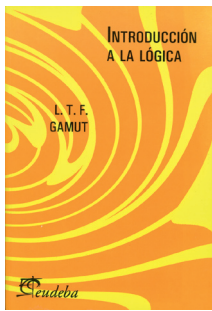
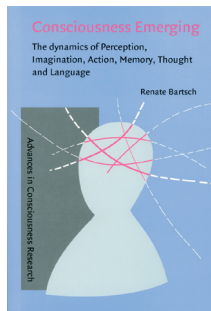
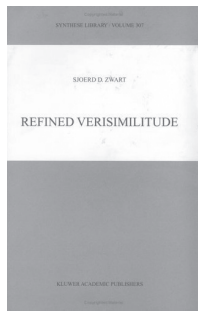
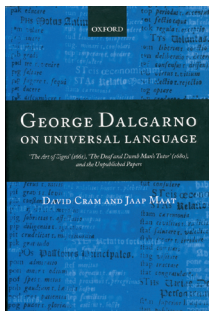
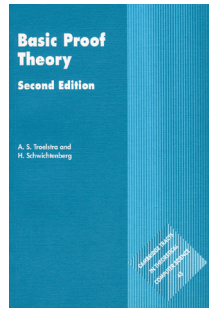
Table 7. Full outcome list

See Appendix B5

10. Analysis, perspectives and expectations for the research programme

Most of what could be said here has already been said above under ‘internal evaluation’. It remains to draw some conclusions.

- The ties with CWI are extremely valuable for ILLC. This programme benefits greatly from the input of the CWI-members. The excellent quality of their is most inspiring to our students.
- The work done by ILLC staff in this programme is of very high quality, too, and should be continued.
- As the previous evaluation committee already said (see above): ‘The group is small with many part-time researchers.’ In fact, given the number of fte’s allocated to this programme, the group is just too small to deserve independent existence. That is one reason why this programme is merged with the CIL-programme into the new *Logic and Computation* programme. The other reason being that in the last five years the borders between ACT and CIL have gradually faded away.
- Unlike in the case of the LIT-programme we disagree with the previous evaluation committee that the research done in the ACT-programme would fit in better in the *Informatics Institute*. The natural place for theoretical computer science is at ILLC. The *Informatics Institute* is much more focused on applications. Moreover, since the abolishment of the MSc Computer Science (which was transformed into a MSc Grid Computing), the main teaching opportunities for the researchers in this programme are in the MSc Logic.



Appendix: Full outcome lists

Appendix B1. Full outcome list of Theory of Interpretation

2000

Academic publications

In refereed journals

- Dekker, P.J.E., & Rooij, R.A.M. van (2000). Bidirectional Optimality Theory: An application of Game Theory. *Journal of Semantics*, 17(3), 217-242.
- Hendriks, H.L.W. (2000). Compositionality and Model-Theoretic Interpretation. *Journal of Logic, Language and Information*, 9(4), 419-438.
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Book chapters/papers in proceedings

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Appendix B5. Full outcome list of Algorithms and Complexity Theory

2000

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