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INSTITUTE FOR LOGIC, LANGUAGE AND COMPUTATION

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Contents

Chapter 1 GENERAL INFORMATION

Scientific Mission

Many broad flows of information drive the modern technological world. It is a challenge for contemporary science to provide a deeper understanding of this phenomenon and where possible, enhance existing practices in dealing with it. Indeed, in the course of this century, information has become a crucial theme for scientific studies across many disciplines. Encoding, transmission and comprehension of information are the central topics of research at the Institute for Logic, Language and Computation (ILLC) of the Universiteit van Amsterdam. The broader context in which ILLC sees itself is that of an upcoming information science or 'informatics', which is concerned with information flow in natural and formal languages, as well as many other means of communication, including music and images of various kinds. Research at ILLC aims at developing logical systems that can handle this rich variety of information, making use of insights across such disciplines as linguistics, computer science, cognitive science and artificial intelligence. Additional methods are actively pursued as well, whenever relevant, ranging from statistics to argumentation theory. In addition to its specific research goals, ILLC aims at overcoming traditional borderlines between faculties and disciplines and serves as a rallying point for information scientists across computer science, linguistics, philosophy, and the social sciences. Moreover, the institute propagates exact logical standards of semantic clarity, algorithmic perspicuity and increasingly also efficient computability. 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.

Research Projects

ILLC's research program is divided into projects oriented toward a particular subject matter. This division also reflects the way research is actually carried out. Projects cut across the various groups which make up ILLC. The 2001 project reports can be found in chapter 6.

1. Theory of Interpretation
2. Cognitive Systems and Information Processing
3. Constructive and Intensional Logic
4. Language and Inference Technology
5. Algorithmics and Complexity Theory

Participants in ILLC in 2001

Participating Departments:
Faculty of Science: Department of Computer Science
Faculty of Humanities: Department of Philosophy
Faculty of Humanities: Department of Linguistics
Faculty of Social Sciences: Department of Sociology

Scientific Advisory Board:
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(Stuttgart), Gordon Plotkin (Edinburgh), Jörg Siekmann (Saarbrücken)

Scientific Director:
Martin Stokhof

Deputy Scientific Director:
Dick de Jongh

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Graduate Program in Logic:
Dick de Jongh (director), Ingrid van Loon (program manager)

Chapter 2 SCIENTIFIC STAFF, STUDENTS, GUESTS

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Christof Monz, Gabriele Musillo, Marc Pauly, Yoav Seginer, Maarten Stol,
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Ivar Vermeulen

Graduate Program in Logic

Students 2000-2001
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Andreas Giannakoulopoulos (Greece), Mehmet Giritli (Turkey/Cyprus),
Nicole Hausen (USA), Darrin Hindsill (USA), Troy Lee (USA), Fabrice Nauze
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Fadillah Tala (Indonesia), Marcello Vavassori (Italy), Mathieu Vidal (France)

Exchange Students:
Mika Cohen (Sweden), Chris McCaw (Australia), Özan Kahramanogullari
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Contract Students:
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Students 2001-2002
MSc Students:
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Contract Students:
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Guests

Fabio Massacci (Italy), Enrico Franconi (UK), Wolfgang Thomas (Germany),
Stefan Schlobach), Marina de Vos (Belgium), Heinrich Wansing (Germany),
Patrick Blackburn (France), Ullrich Hustadt (UK), Giovanna Corsi (Italy),
Joe Halpern (USA), Edwin Mares (New Zealand), Michael Pelis (Poland),
Tao Mingzhong (China)

Chapter 3

Martin Stokhof
Scientific Director

VAGRANCY AND *STABILITAS LOCI*: CONSOLIDATION IN A DYNAMIC ENVIRONMENT

In older days there was a distinction between various monastic orders as to their policy with regard to the location of their members. There were orders whose members were vagrants, roaming around and providing services wherever they were needed. And there were orders that subscribed to the principle of stabilitas loci: the vow to stay, in principle forever, at the place where one entered the order. The distinction is about physical movement and physical location, but there is an analogy in the mental realm, in which science lives. Science is dynamic, investigating new phenomena, exploring new connections and new directions. But it also needs stability, a core of established results and trusted techniques that provide a measure that we can use to value new developments and that changes at a much lesser pace. And what is true of science, holds for scientific institutions in an analogous fashion.

The year 2000, in which ILLC finalized its new 5 year research program and in which quite a number of new projects received external funding, was a year of change, of exploring new directions and setting new goals. The year 2001, per contrast, was one of consolidation: of implementation of the new scheme of five core research areas, -including the re-arrangement , also physically, of various groups of researchers-, and of getting the newly funded projects underway. Of course, the contrast is a relative one, but it is characteristic for what went on at ILLC in 2001.

Research

The year 2001 started with NWO granting an prestigious Pioneer 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. Other, smaller scale projects also received funding, among which a KNAW-fellowship for Khalil Sima'an; two PhD positions for a project of Johan van Benthem and Peter van Emde Boas on game theory; a postdoc and a programmer for a project of Carlos Areces and Maarten de Rijke on complex knowledge bases; and a postdoc and a PhD position for a project of Michiel van Lambalgen en Frank Veltman on the psychology of reasoning.

Many of these newly funded projects contribute to the implementation of the goals of ILLC's long term research program. In this process of consolidation several other steps were taken in 2001.

One of the goals of the long term research program is the further development of research in computational logic, or, more broadly 'Language and Inference Technology' (LIT), as the research area is now called within ILLC. The above mentioned Pioneer grant to Maarten de Rijke strengthens ILLC's research in this field. The research group is also involved in a project proposal together with Syllogic and Unilever Research for the upcoming third round of the Dutch national ICES/KIS program. A further impetus in 2001 was the funding by the Universiteit van Amsterdam, for a five year period, of an assistant professorship. In view of its long term aspirations, ILLC decided to turn this assistant professorship into a permanent position, which is expected to be filled in 2002.

Another area that the long term research program singles out as deserving special attention is that of cognition. In 2001 the NWO -program in cognition got underway, with Johan van Benthem as the chairman of the steering committee. The initiative to found a Cognitive Science Center Amsterdam (CSCA), which was started in 2000, succeeded: with financial support from the university CSCA has started in the fall with a number of activities, such as a series of workshops and the development of an interdisciplinary masters program in cognitive science. Various members of ILLC are actively engaged in these activities. The 'Cognitive Systems' project was strengthened by the NWO grant to Van Lambalgen en Veltman mentioned above.

The third major goal set in the long term research program is the (relative) increase of second and third stream funding. With regard to NWO-funding 2001 was a reasonably successful year. Some initiatives, such as the ICES/KIS project mentioned above, were undertaken to procure more third stream funding in the future. Other possibilities that need to be explored are those provided by the EU's upcoming 6th Framework Program.

The year 2001 was also the last year of Johan van Benthem's Spinoza-program 'Logic in Action', something which deserves to be mentioned. With a festive, one-day conference in December this project, which has shaped much of ILLC's research over the past five years, and which will continue to have its effects in the years to come, came to an official close. The conference started with talks of three speakers of international renown and representative for the

broad scope of the Spinoza-program and its leader: Peter Gardenfors, Joseph Halpern, and Hans Kamp. It also featured presentations of the three projects that Van Benthem had set up: computational logic; logic and communication; and dissemination. All three have contributed to ILLC's research profile and will continue to do so. The computational logic project, headed by Maarten de Rijke, has grown into one of ILLC's new core research areas , among others through De Rijke's Pioneer-project. The logic in communication project, headed by Paul Dekker and Yde Venema , has given a decisive impetus to the broad interest in game theory among ILLC's researchers and has led to Dekker's Vernieuwings Impuls project 'Formal Language Games'. And the dissemination project, led by Jan van Eijck, is beginning to bear fruit in the form of a series of books for Dutch VWO (Highschool), to be published by Amsterdam University Press.

Of course, ILLC's other research areas and the researchers involved therein have made significant contributions to what can only be regarded as a successful year. As was predicted, the number of publications grew significantly compared to 2000. A number of international scientific events were organized, among which the thirteenth installment of the Amsterdam Colloquium, the longest running international conference in semantics. Judged by the number of invited lectures, visiting professorships, editorships of international journals and book series, and other scientific functions, the various members of ILLC continue to play a significant role in their respective scientific communities. And the future looks bright as well: nine of ILLC's PhD students completed and successfully defended their theses in 2001.

Teaching

The major ongoing development in the field of teaching is the implementation of the bachelor-master (BAMA) structure of Dutch higher education. Unfortunately, the various faculties that participate in ILLC are introducing the new structure at different paces. The Faculty of Humanities will start in the academic year 2002-2003, whereas the Faculty of Science and the Faculty of Social and Behavioral Sciences will do so only in 2003-2004. Consequently, discussions about the revision of the various curricula in which ILLC participates, are taking place in different time frames as well, which means that the necessary coordination across faculty borders of ILLC's various teaching activities is severely hampered. Nevertheless, in combination with the organizational changes that are being made in the Onderwijsinstituut Informatiewetenschappen, the revision of the various curricula that the

implementation of the BAMA structure necessitates provide new opportunities that may lead to substantial innovations of ILLC's teaching efforts.

As for ILLC's Master of Logic program, the decision has been made to subsume this program under the new 2-year MA program in Logic. This has several consequences, both financially and organizationally. It is expected that by making the Master of Logic program part of a regular, accredited MA program, its future is secured: the teaching and supervision that it requires can be accounted for in the same way as other teaching and supervision. Financially there may be an initial setback, since EU-students no longer will pay the higher tuition fees. However, since credits earned in the Master of Logic program are now counted as ordinary credits and the Faculty of Science moves towards a system in which credits produced are a factor in determining an institute's budget, this may be balanced by a modest increase of ILLC's income.

As far as PhD training is concerned, 2001 was a regular year. Quite a number of ILLC's PhD students visited the ESSLLI Summer School in Helsinki, to take courses and give presentations at various student sessions and in workshops. In the fall the annual Autumn School Week of the OZSL (the Dutch Graduate School in Logic) was held, which was also attended by a large number of ILLC's PhD students.

In 2001 no decision was made regarding the status of the OZSL as a graduate school that is to be recognized by the KNAW (the Dutch Royal Academy of Sciences). However, the KNAW has complicated the issue by formulating in its 'Rijzende Sterren' declaration strong conditions for graduate schools that want to get KNAW recognition, such as (partial) transference of budgetary and other responsibilities by the participants. The Universiteit van Amsterdam has made it clear that it will not allow research groups or institutes to participate on these terms. This is in line with the position taken by ILLC, viz., that the OZSL should function primarily as a network in which various groups cooperate in the organization of PhD training.

Administration

Whereas some developments take place at such speeds as to make one's head spin, changes in administrative structure are notorious for taking much time and much effort. At the end of 2000 the deans of the three faculties participating in ILLC met with ILLC's management and agreed to try to make ILLC's administrative position, including its funding structure, as uniform and

transparent as possible. Although a concerted effort was made to realize this in 2001, the situation is still far from satisfactory. In 2001 little progress was made, although the Faculty of Humanities started a process that should lead to long term budgetary and other arrangements.

Financially, ILLC's situation remains precarious. The fact that this holds for practically all institutes within the Universiteit van Amsterdam provides some consolation, but no relief. Budget cuts, such as the additional budget cut in 2001 in the Faculty of Science in combination and the annual cuts by the university administration, are beginning to take their toll. In the Faculty of Humanities longer term budgetary perspectives are hazy at best, but frightening when the fog lifts. This means that with the rising costs of permanent staff the budget for temporary staff, in particular for PhD positions, is shrinking.

Finances are not the only worry when it comes to administration. Another concern is the disproportionate amount of time that members of ILLC, in particular senior staff, spend on administrative duties and in administrative functions. In some cases, when such work is combined with a normal teaching load, this leads to unacceptably small amounts of time for research. This situation is one that needs attention, both internally and externally. Within the institute it needs to be investigated whether a better division of labor is possible or whether some tasks can be given up. But external measures are needed as well: the faculties and the university should provide better compensation, e.g., by providing additional financial means for diminishing the teaching load of staff that have time-consuming administrative duties.

Conclusion

Above an opposition was made between vagrancy and stabilitas loci. Although this may be an absolute, qualitative distinction when it comes to monastic orders, in science it is a relative, quantitative difference at best. Sometimes we move about in a search for new goals, new challenges, at other moments we sit down and focus on the dedicated efforts that are needed to realize them. But the opposition is never absolute, and neither should it be, lest we either get caught in an immutable view on what our scientific enterprise is, or simply follow the fashion of the day.

On the administrative and budgetary plane, however, something is to be said for a little more stabilitas than seems available at present. A perspective on budgetary development for four or five years, for example, would make better planning of resources possible. Something similar holds for administrative structures and procedures. Of course, here too, changes are unavoidable and also needed: any long term perspective should include a challenge, a possibility to improve. So stability in the weaker sense of predictability seems what we need most.

There is, however, one locus where ILLC will vow to exhibit stabilitas in the extreme: the one location, wherever it may be, where all of ILLC will be housed.

Chapter 4   FUNDAMENTAL RESEARCH

Theory of Interpretation

Project Leaders
Jeroen Groenendijk and Martin Stokhof

Characterization
The project investigates the logical and philosophical foundations of a formal theory of interpretation. Its main goal is the development of tools for adequate interpretation of natural language, testing these against both empirical data as well as methodological and philosophical constraints.

Main Themes
The three main themes in the project are: interpretation in conversation, concept formation, philosophical backgrounds. Research on interpretation in conversation focuses on interpretation as a dynamic process in actual conversation. It builds on earlier research on the dynamics of interpretation at sentence level, applying the results of that research to phenomena which play a key role in the structuring of discourse, in particular of conversations. To this end the scope of existing formalisms need to be extended to cover multi-speaker exchanges. Relevant empirical phenomena that are studied here include question-answering and anaphoric uptake across speech participants. Increasingly the research in this theme makes use of decision and game theory in the analysis of the procedures which are used by rational communicative agents in both production and interpretation. This research had strong links with research in the Spinoza project Logic in Communication, that ended in 2001, and with ongoing work on dynamic logic in the project Constructive and Intensional Logic. Computational feasibility of the resulting theories is a topic of investigation in the project Language and Inference Technology.
The work on concept formation is devoted to the development of a formal model of the way in which concepts arise from (relatively) unstructured data. This research is closely connected with the data-oriented approach towards information processing which is being developed in the project Logic and Cognitive Systems. One important topic here is the role of consciousness vis-à-vis the possibility of language in general and semantics in particular. This issue is investigated against the background of both connectionist, neural network based models of learning as well as more traditional approaches in terms of rules and representations. Another central topic within this theme is the study of metaphor, which raises important questions concerning the origins and the transfer of meaning, its dependence on context and background, and its relation to general cognitive processes of analogy and imagery.

Research on philosophical backgrounds 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 the historical origins and subsequent development and employment of the notion of an ideal language; the historical backgrounds of modern intensional semantics, in particular that of the central principle of compositionality; the relevance of Wittgenstein's rule-following considerations for linguistics, in particular the role of normativity in interpretation and its connection with epistemology; and the use of formal models in semantics and pragmatics.

Researchers
Maria Aloni, Renate Bartsch, Alastair Butler, Paul Dekker, Jeroen Groenendijk, Herman Hendriks, Theo Janssen, Jaap Maat, Robert van Rooy, Harry Stein, Martin Stokhof.

PhD Students
Elsbeth Brouwer, Balder ten Cate, Marie Nilsenova

External Cooperation
In the Netherlands there is cooperation with researchers in Utrecht and Tilburg. Further cooperation involves researchers in Berlin, Frankfurt, Oxford, Stuttgart, Helsinki and Nancy.

2001
Research within the first theme, interpretation in conversation, saw several interesting developments. With the start of the NWO and the KNAW projects 'Formal Language Games' and 'Games, Relevance and Meaning' new topics emerged concerning the interplay between pragmatics and syntax. Tools from dynamic semantics, game theory, and decision theory have been used to provide an explanation of traditional semantic puzzles having to do with negation, questions, and conditional sentences and with the analysis of keys notions such as relevance of both assertions and questions. The work on the role of optimization techniques in interpretation, and their formulation in game-theoretical terms, was continued. Exchanges can be characterized as a game of finding an optimal balance between generation and interpretation. But also specific syntactic and prosodic phenomena lend themselves to an analysis using the dynamics of optimization in organizing discourse. Optimization has furthermore been used to characterize possible shifts in the conceptualization

of discourse, thereby coming to grips with some classical puzzles in the semantics of attitude reports and wh-questions.

Work in the second theme, concept formation, has resulted in a book about consciousness, which elaborates on the dynamic interaction between perception, imagination, action, and language in understanding both situations and linguistic utterances. Furthermore an article about generating polysemy by metaphor and metonymy, has been completed. Both will appear in 2002. Work on metaphorical interpretation has concentrated on the role of imagery, in particular in poetical metaphor. Building on Kant's analysis of the role of imagination a model for the creation and production of metaphor has been developed that stresses its 'free' nature, i.e., that, unlike existing semantic and pragmatic analyses, does not regard metaphor as driven by semantic or pragmatic 'unwellformedness', but as an option that language users have, both in production and in reception.

In the third theme, philosophical backgrounds, work on philosophical languages has continued. New research has started on Leibniz's rational grammar and its relevance for modern philosophy of language.
The investigation of the role of the principle of compositionality in Frege's work was concluded and the results were published. The investigation of Hintikka's IF-system, the best-known logic for informational independence, was continued. It was shown that the system lacks several standard properties and moreover does not do justice to certain intuitions concerning independence of information. An alternative system was developed.
The project on the role of testimony and trust that was started in 2000 was discontinued, due to the departure of the postdoc researcher carrying out the project.
Also within the third theme an small-scale investigation was carried out into the philosophical backgrounds of theories of dynamic interpretation and dynamic semantics. A first paper, focusing on the relation between semantics and interpretation, was completed and will appear in 2002.

2002
Within the first theme, interpretation in conversation, research on the philosophical foundations and the logical formalization of game-theoretic concepts remains high on the agenda. The application of game theory in the analysis of conversation will be continued and the use of Bayesian belief nets will be investigated. The integration of dynamic semantics and theories of question-answering and topic/focus will also be pursued. Besides these

pragmatic aspects of interpretation theory, also more syntactic issues remain on the agenda. We will try and apply dynamic semantic and optimality theoretic methods in the (partial) description of discourse trees, the use of prosody, and in the explanation of syntactic constraints on binding, and, e.g., differential subject and object marking.

In the second theme, concept formation, research centers on the relationship between concept formation, memory, and understanding. A neural architecture is designed in which remembering is treated as a structure of interaction circuits connecting a central memory unit consisting of episode indices, with indicators on conceptual and routine maps, sensorial and motor maps, proprioceptic maps and emotion maps. The possible correctness of the architecture is supported by psychological and neurological observations, including memory abnormalities, which we find reported in the literature on memory and consciousness. A background for the phenomenological descriptions of this interaction will be formed by Marcel Proust's novel 'A la Recherche du Temps Perdu'.

The work on poetic metaphor research is expected to be concluded with the completion of the PhD thesis of Brouwer.

In the third theme, philosophical backgrounds, work on the ideal language movement will proceed. Leibniz's writings on rational grammar will be made accessible through annotated English translations of the Latin originals.

Work on the compositionality principle will be continued with an investigation of its role in the work of various 19th century logicians.

The alternative system of informational independence will be examined in detail, through comparison with Hintikka's original IF-system, but also through investigation of the consequences of application in mathematics and linguistics.

Work on philosophical dimensions of dynamic theories will proceed with an investigation of the role of truth in such frameworks. A PhD project on the nature of Wittgenstein's notion of 'übersichtliche Darstellung' of the grammar of concepts in natural language will start in 2002.

Cognitive Systems and Information Processing

Project Leaders
Michiel van Lambalgen and Remko Scha

Characterization
This project consists of two subprojects.
The Cognitive Systems project emphasizes both the logical study of cognitive processes and the psychological study of logical reasoning. Our guiding

principle is that logic may benefit from interaction with empirical science, and vice versa. Cognitive processes studied include the representations of space, time and modality and their correlations in natural language. Our psychological investigations concentrate upon reasoning with various kinds of conditionals. The project Information processing is concerned with the design of algorithms which interpret and/or generate messages expressed in various natural languages. It construes the notion of 'language' somewhat more broadly than most of the other projects, to include also graphics and music. The methods employed in this project build on formal theories of linguistic syntax and logical semantics, but extend these with statistical or complexity-theoretical techniques which are inspired by theories of human Gestalt perception. The project aims at computational methods which are cognitively plausible as well as practically useful.

Main Themes
Reasoning with Uncertainty (Cognitive Systems)
In this theme we have investigated theory and practice of reasoning with incomplete information, supported by an NWO PIONIER grant. The emphasis of the research in the later years of the project has been on concrete applications, in particular the design of autonomous surveillance systems and medical expert systems.

Psychology of Reasoning (Cognitive Systems)
Here, we investigate empirically human reasoning with logical operators, and we evaluate the results obtained with respect to their relevance for cognitive architecture.

Semantics of Tense and Aspect (Cognitive Systems)
The guiding theme is the application of formalisms for reasoning about time and change, as developed in Artificial Intelligence, to a fundamental area of natural language semantics. The aim is to achieve better understanding, but also to come up with valuable tools for natural language processing.

Vagueness (Cognitive Systems)
Most approaches to a clarification of vagueness in natural language have concentrated on providing truth conditions. This project explores the usefulness of a pragmatic approach.

The Counterfactual Mood (Cognitive Systems)
Sentences of the form 'It would have been the case that ...' make no sense if they are presented without a context. They typically occur in the context of a

clause of the form 'If it had been the case that...'. So far, most semantic investigations have been restricted to their occurrence in that particular context; the claim is that dynamic semantics will account for a much greater set of data.

Models of Discourse (Cognitive Systems)
Computational models of discourse and context constitute a long-standing theme within this project. The research on this topic is carried out in close cooperation with the work on discourse dynamics in the project 'Theory of Interpretation'. It complements this work in that it focuses more on linguistic issues and empirical coverage. The models developed here articulate the structural properties of discourse by means of unification grammars, and employ type theory and dynamic logic to represent semantic interpretations and their context-dependence.

Data-Oriented Parsing (Information Processing)
A central theme in this project is the development of a performance model of natural-language processing, called Data-Oriented Parsing (DOP). This model de-emphasizes the problem of delimiting the class of 'grammatical' sentences; instead, it assumes an overgenerating competence-grammar and focusses on the problem of statistical disambiguation. A data-oriented parsing system employs a large corpus of annotated utterances as a representation of its 'past language experience', and makes its disambiguation decisions on the basis of statistics about arbitrarily large and complex subtrees from this corpus. (The corpus-annotations themselves are based on logic-oriented theories of grammar and semantics.)

Linguistic Gestalt Perception (Information Processing)
We do not view language processing as a unique and independent cognitive module; rather, we expect that many of its properties are shared by other perceptual processes. It is an important part of our research agenda to fold our ideas about 'linguistic Gestalt perception' back into computational models for the perception of structure in visual and musical patterns. While existing Gestalt perception models often employ the detection of formal regularities as their sole disambiguation criterion, our models emphasize the memory-based aspect of human perceptual processes.

Diagram Interpretation (Information Processing)
This theme is more semantically oriented. It is concerned with the interpretation of 'information graphics', and addresses the design of multimedia interfaces and automatic information visualization systems.

21

In particular, we develop informal theories, mathematical models, and computational models of diagram interpretation and generation. This work is carried out in close cooperation with the project 'Computation and Complexity Theory', and is also connected with work on Multimedia in the ISIS project at the Faculty NWI, and with work on New Media at the Department of Media and Culture in the Faculty of Humanities.

Researchers
Michiel van Lambalgen, Frank Veltman, Henk Zeevat, Karen Kwast, Rens Bod, Remko Scha, Khalil Sima'an

PhD Students
Remko Bonnema, Yuri Engelhardt, Allard Tamminga, Gwen Kerdiles, Nikos Massios

Allard Tamminga completed and defended his thesis 'Belief dynamics. (Epistemo)logical investigations', in which he presents both a philosophical and a technical analysis of the process of belief revision.
For the PhD project of Gwen Kerdiles, see the project 'Constructive and intensional logic'.
For the PhD project of Nikos Massios, see below.

External Cooperation
The cognitive systems project has contacts with Human Communications Research Center, Edinburgh; Seminar für Sprachwissenschaft, Tübingen; Humboldt Universität and ZAS, Berlin; Linguistik, Potsdam

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).

Other important research contacts are Carnegie Mellon University (automatic visualization), the Max Plank Institut für Psycholinguistik (Nijmegen), and the Psychology Department of the University of Nijmegen (Gestalt perception).

2001

Reasoning with Uncertainty
Jointly with two psychiatrists of the St. Lucas Hospital (Amsterdam), van Lambalgen 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. The required conditional probabilities were mostly obtained from an extensive literature search, but had to be estimated in some cases. The system will be used in clinical practice and for screening of traffic offenders suspected of alcohol abuse.
The NWO-funded PIONIER project 'Reasoning with uncertainty' has now come to an end. Nikos Massios defended his dissertation 'Decision-theoretic robotic surveillance' in January 2002. The dissertation presents a number of algorithms for near-optimal planning in the (intractable) problem of robotic surveillance. Frans Voorbraak left ILLC in March 2001 to apply his expertise in integrating sources of incomplete information to genetics; he now works at the Bioinformatics Unit.

Psychology of Reasoning
Jointly with the psychologist Keith Stenning (HCRC, Edinburgh) 7 experiments were performed aimed at investigating the sources of difficulty in Wason's selection task that were identified in the paper Stenning and van Lambalgen (2001). The results show that the distinction between the 'hard' and 'easy' cases of the selection task corresponds precisely with the distinction between indicative and deontic semantics. Thus, the oft-repeated claim that formal logic plays no role in human reasoning is shown to be ill-founded. As an application, van Lambalgen showed in his inaugural lecture 'Betekenis en experiment, of de lemen voeten van de evolutionaire psychologie' that evolutionary psychology's claim to have shown that successful reasoning can occur only when genetically programmed 'cheating detectors' are activated, is nonsense.

Semantics of Tense and Aspect
Jointly with linguist Fritz Hamm (Sprachwissenschaft, Tübingen), van Lambalgen developed a constraint logic programming approach to the semantics of aspect in natural language. This material was presented as an invited address to the Logic Colloquium '01 in Vienna, and will be published in its proceedings. Further work includes an 'aspectual calculus', which explains the various possibilities for aspectual shift in terms of constraint logic programming and the event calculus from AI.

Vagueness

One characteristic of vague expressions like 'tall' and 'many' is that the participants in a discussion can to a certain extent decide for themselves whether or not these expressions apply. That is why one is going to miss the point if one tries to explain what these expressions mean merely by supplying truth conditions for the sentences in which they occur. Vagueness is an excellent domain for studying the ways in which speakers co-ordinate their language to promote mutual understanding, but it is in this respect under-explored. In his inaugural lecture 'Het verschil tussen 'vaag' en 'niet precies', Veltman sketched the problems one encounters when one tries to develop a theory that does full justice to the semantic and pragmatic intricacies connected with his phenomenon.

The Counterfactual Mood

The dynamic outlook on semantics offers a way to get to grips with the question in which other contexts the counterfactual mood can occur and what kind of information it supplies in such cases. The first results of a study to this effect were presented in an invited talk at the Semantics, Pragmatics and Rhetorics Colloquium in San Sebastian.

Models of Discourse

The investigation of the repercussions of optimality theory for the study of semantics and pragmatics has led to a series of presentations and publications.

Data-Oriented Language Processing

In our work on data-oriented language processing we consolidated, tested and extended the innovations reported in previous years. Successful tests were carried out on the benchmark Wallstreet Journal Corpus, validating the basic DOP approach and confirming recent theoretical refinements in the probability calculations. The work on Data-Oriented LFG was continued. The Tree-gram model, which generalizes DOP in order to create enhanced robustness, was further developed, and successfully tested on the OVIS corpus (Dutch train travel dialogues), as well as on a newly developed corpus for modern Hebrew. Khalil Sima'an was awarded a KNAW-fellowship to continue his work on integrating Data-Oriented Parsing with similarity-based techniques.
The most important development in 2001 may have been the initiation of a new line of work concerned with data-oriented musical processing. Successful pilot experiments were carried out using the Essen Folk Song database. Rens Bod was awarded an NWO 'innovation impulse' grant, which will allow us to scale up our work on music and visual processing in a major way.

2002

A grant proposal on 'Logic meets psychology: nonmonotonicity' was submitted to NWO, and accepted. This means that in 2002 two PhD students and one postdoc will join our group. Our research will focus on three topics, which build upon some the results outlined above: psychology of reasoning, semantics of aspect and nominalisation, and the counterfactual mood.

Also, dr Reinhard Blutner (formerly ZAS, Berlin) will join our group as a lecturer. His research will focus on optimality theory, together with Henk Zeevat, and logics abstracted from neural networks.

Data-Oriented Parsing will be integrated with similarity-based methods in order to induce data-oriented feature unification models from corpora of limited size.

Work towards optimal methods for subtree-extraction and probability calculation will continue. In particular, the application of the 'Minimum Description Length' concept for corpus compactification will be explored.

An important new development will be the start of some sub-projects concerning musical and visual processing, which will investigate to what extent, in these realms, memory-based rather than regularity-based criteria contribute to the disambiguation behaviour observed in humans. Depending on the outcome of these investigations, we will then proceed to develop a 'unified perception theory' which articulates how linguistic, visual and musical perception are related.

We are editing a survey of the state of the art in Data-Oriented Parsing and closely related approaches, with contributions from 22 international researchers. This book will appear with CSLI publications in the summer of 2002.

Yuri Engelhardt will defend his PhD thesis on the grammar of information graphics in the fall of 2002.

Constructive and Intensional Logic

Project Leaders
Johan van Benthem and Dick de Jongh

Characterization
This project continues the long-standing Amsterdam tradition in mathematical logic and the foundations of mathematics. Over the years, the original core theme of constructivism has widened towards general proof theory. A second long-standing theme consists of a broad study of modal and dynamic logic. Both themes meet in research on provability logics of arithmetics and modal logics of information. Thus, the two main 'trademarks' of mathematical logic at Amsterdam fit together in their efforts to create a general framework for reasoning and information flow.

Main Themes
One core theme is concerned with the foundations of constructivism and more general proof theories emanating from that tradition. Semantic foundations of constructive theories, in terms of Kripke models or categorial models, are also actively investigated. The eventual aim is a general formulation of the constructivist program as a practical general-purpose tool for the working mathematician, computer scientist, and computational linguist.

A second central theme is provability and interpretability logic of classical and intuitionistic arithmetic, with its current ramifications into recursion theory and complexity theory, as well as 'weak arithmetics'. Topics here include interpolation properties, axiomatic completeness, and modal-style formalizations of further proof-theoretic notions. This research has close ties with the projects Algorithmics and Information Processing and Computational and Applied Logic. It also serves as a test-bed for more discriminating notions of complexity that may increase our theoretical understanding of the actual workings of automated deduction on large-scale input sets.

The third theme in this project is the mathematics of modal logic. Modal languages are designed to combine reasonable expressive power with a decidable notion of validity. There are four key topics. One is the search for large decidable 'guarded fragments' of first-order logic and related languages, which generalize modal logics. Another aspect of this approach is the use of modal techniques to reduce complexity of logical systems by decomposing their standard semantics into a decidable logical core plus mathematical extras.

A second main topic is the modal study of a wide spectrum of process equivalences: semantic invariance and syntactic definability, expressive completeness of process repertoires. A third key topic is the study of systematic connections between modal languages and current research in universal algebra. And as a fourth, new mathematical angle, connections are being explored between modal logics and coalgebra.

The other aspect of the modal logic interest is the development of systems for specific tasks pertaining to the general ILLC interest in information. In this fourth theme, special emphasis is given to dynamic logics, i.e., modal logics of action inspired by the analysis of computation and information flow. Our overall goal is a modally inspired mathematical framework for information flow, pursued in analogy with classical logic. Currently, this goal is approached via a modal analysis of games as a dynamic many-agent model for communication and interaction. This involves new connections with game theory in economics andcomputer science. On the more representational side, we also pursue the study of modal structures in visual information,i.e., non-linguistic spatial structures forming a 'modal geometry'.

Finally, the project also covers research on logical learning theory, model theory, as well as various connections with algebraic logic, and histroy of modern Dutch logic.

Researchers
Alexandru Baltag, Johan van Benthem, Kees Doets, Jan van Eijck,
Lex Hendriks, Dick de Jongh, Joop Niekus, Anne Troelstra, Yde Venema,
Domenico Zambella.

PhD Students
Marco Aiello, Annette Bleeker, Boudewijn de Bruin, Eva Hoogland,
Rosalie Iemhoff, Gwen Kerdiles, Marc Pauly, Katsumi Sasaki.

External Cooperation
The group maintains close connections with logic groups at the universities of Aachen (informatics), Arizona, Bloomington, Edinburgh, Groningen, Liverpool, London (Imperial college, King's College), Moscow (Stekhlov Institute for Mathematics), München, Münster, New York (CUNY), Oxford, Prague, Rochester, Siena (Logic Graduate School), Stanford (CSLI, CS), Udine, Utrecht, and the Hungarian Academy of Sciences in Budapest (mathematics).

2001

In the first theme the research of Dick de Jongh and Lex Hendriks concentrated on intuitionistic logic and intermediate logics. There were developments in three directions. In Arevadze's master's thesis the projective formulas with finite sets of models in n-universal algebras were described. More results were obtained about extensions of the intuitionistic propositional calculus using rules which define new connectives. An article was completed concerning the applicability of intuitionistic and intermediate logics in the semantics of logic programs, concentrating on the stable semantics.

In the second theme two dissertations were completed. In Rosalie Iemhoff's thesis considerable progress was made concerning the problem of the provability logic of Heyting's Arithmetic: a conjecture was stated that covers all the various known principles. It turns out that a unifying view is obtained by considering the notion of Sigma-preservativity and its logic instead of provability logic itself. Also, the thesis gives a very simple infinite basis for the admissible rules of intuitionistic propositional calculus with regard to the propistional calculus itself as well as for HA. The proof uses the new reults of Ghilardi on projective formulas thereby connecting up with the results in the first theme. In the second thesis, by Katsumi Sasaki, proof-theoretic investigations were made on propositional logics with a provability intepretation. These concerned Visser's propositional logic, propositional lax logic (an intuitionistic modal logic) and the interpretability logic IL. For the latter a cutfree proof system was given. In this theme there is intensive collaboration with Albert Visser and Lev Beklemishev of the University of Utrecht.

In the theme of the mathematics of modal logic, in particular the connections between modal languages and universal algebra, Venema proved that not all varieties of Boolean algebras with operators are generated by their atomic members, thus showing that not all modal logics are characterized by their discrete general frames. In cooperation with Mai Gehrke and Hideo Nagahashi he proved a general Sahlqvist result for expansions of distributive lattices with operations that preserve or reverse finitary meets and joins. Alexandru Baltag continued his studies of modal logics of communication, presenting a new system for analyzing security issues at the TARK conference in Siena. He also pursued his studies on the metamathematics of coalgebra. In August of 2001, he took up a lectureship at the Computing Laboratory of Oxfod University. Eva Hoogland finished her dissertation on definability and interpolation. In this dissertation definability was related to the algebraic property of surjectiveness.

Furthermore, for a great variety of systems definability and interpolation theorems were proved and disproved. The interpolation property was shown to be much stronger than the definability property, specifically in two case studies both connecting up with other of our themes, one regarding guarded fragments of first order logic, the other concerning interpretability logics.

Within the fourth theme, van Benthem's work has continued on a systematic exposition of update systems for epistemic logic, leading to a prototype for a lecture notes volume, parts of which have been tested at Oxford, Rotterdam, Bern and Prague. In particular, one version was an invited tutorial at TARK VII in Siena. Current results include a systematic development of analogies with computer science, and a determination of the complete set of structural rules for dynamic update-to-test inference, making it fully comparable with other varieties of nonstandard reasoning, such as nonmonotonic logics. He also finished papers on (a) game algebra (general game algebra coincides with that of logical evaluation games), (b) game bisimulations (these mix various notions known from computational processes for different players), (c) imperfect information (dynamic-epistemic logic provides a systematic account of game types and their properties), and (d) games in law (juridical procedure is close to logic games). Collaborations for this games project include Rohit Parikh (CUNY, New York), Samson Abramsky (Computing Lab Oxford), and Giacomo Bonanno (Economics department, UC Davis). In the topic of logic and games, Marc Pauly finished a dissertation on Modal Logics for Coalitions, analyzing powers of interacting groups of players in a game. This is part of a larger interest in 'social software', pursued in collaboration with Rohit Parikh at CUNY New York. Contacts with the agents group at Liverpool University will be strengthened by Marc Pauly's appointment there as a lecturer. Boudewijn de Bruin started his PhD research on rationality assumptions in game theory, including a critical look at backward induction arguments and current logical formalisms describing games. In particular, he found several applications of the modal mu-calculus for defining strategic equilibria.

In the subtheme on logics for spatial reasoning, Gwen Kerdiles finished a dissertation on Conceptual Graphs, showing how this well-known visual representation formalism can be analysed and extended using a systematic analogy with modal languages. In particular, he proved that the 'guarded existential fragment' is a useful polynomial-time extension of existing conceptual graph calculi.
Marco Aiello continued the investigation of logics of space emphasizing topological and metric structures, showing again how extended modal

languages offer a natural balance between expressive power and computational complexity. It is shown how such calculi perform on some meaningful image processing tasks, such as document image analysis. (This research was performed in cooperation with the ISIS group of the Informatics institute.) More mathematical results were obtained in cooperation with Guram Bezhanishvili (New Mexico State University, Las Cruces), including a modal analysis of topological spaces and morphisms based on the equivalence notion of topo-bisimulation, and new completeness proofs for topological logics of serial sets and other special spatial structures over the real line. David Gabelaia's master's thesis investigates modal definability in topology, in particular a topological analogon of the Goldblatt-Thomason theorem is proved.

Van Eijck has continued his work, with colleagues from ILLC and from Uil-OTS (Utrecht), on a new format for Montague Grammar, IMG (Incremental Montague Grammar), and published about it in the *Journal of Logic, Language and Information* (JoLLI). Van Eijck is also involved in interactive information engineering, in a pilot project with Elsevier Science BV (in collaboration with ILLC), together with Johan van Benthem and Maarten de Rijke. With Juan Heguiabehere and Breanndan Ó Nualláin at ILLC, Van Eijck published a paper on programming and automated (tableau) reasoning with Dynamic First Order Logic in the Journal of the IGPL.

Research in computability theory by Domenico Zambella (in cooperation with Sebastiaan Terwijn of the VU) was concentrated in and around the recently discovered notion of generic computably enumerable sets.

In learning theory a PhD project was started by Yoav Seginer with as its first object studying the learning of simple categorial grammars.

2002
In the first theme, a new PhD project intuitionistic logic and Heyting algebra will be started by Nick Bezhanishvili. The first object is to build on the work started in Arevadze's master thesis to obtain a better understanding of the connection between the concepts of exactness and projectivity as well as a better understanding of the role of Ruitenburg's theorem. Hendriks and de Jongh will continue their study of intermediate logic and stable semantics. Hendriks will be concerned with his study of 'anticipation' and other new intuitionistic connectives.

Within the second theme we will study completeness problems in classical and constructive provability logic in particular regarding provability logic extended by a predicate for Sigma-1, relating this logic to interpretability logic.

In the mathematics of modal logic theme Venema plans to investigate the duality and canonicity theory of expanded lattice structures and to study expressivenes and completeness issues concerning modal fixpoint logics, both in specific contexts of languages describing information flow and in a general coalgebraic context. A new PhD project on modal languages with co-algebraic semantics will be started by Clemens Kupke.

As to the fourth theme, van Benthem plans a lecture notes volume on logics of communication after a few more trial runs in 2002. One major concern will be the border line between the general space of all possible updates described by standard update logics, and the additional information available in 'information games', or special knowledge about protocols followed by the participants in episodes of communication.
With regard to the game theory aspects, van Benthem's plan for 2002 is finishing a monograph 'Logic in Games', of which a preliminary version was produced in March 2001 and presented at courses in Stanford and Taiwan. De Bruin intends to investigate signaling games and applications to linguistic questions, as well as collective action and intentionality and coalition logic. Marco Aiello will finish his thesis on logics of space, before taking up a position at the University of Trento.

Van Eijck will extend his work on incremental semantics for NL to the analysis of dialogue. Also, he intends to work on tableau calculi for hybrid logic.

In learning theory Yoav Seginer will give a description of rigid categorial grmmars on an alphabet of two letters and the simple learnability of such languages. Concepts of complexity of learning involving telltale sets will be studied.

In history of logic a new two-year NWO-project in the program 'Leraar in onderzoek' (secondary school teacher in research) was started by Joop Niekus. He will study the concept of individual choice sequence in Brouwer's writings and its relation to the creating subject.

Language and Inference Technology

Project Leaders
Michael Masuch and Maarten de Rijke

Characterization
The Language and Inference Technology project was started in 2001 with the merger of the Applied Logic Lab (formerly CCSOM) and the Computational Logic group (part of Johan van Benthem's Spinoza project 'Logic in Action'). While initially distributed across two locations, the group moved to a single location in August 2001.

The project focuses on representational and algorithmic aspects of computational linguistics and computational logic, with a strong emphasis on mechanizing and evaluating language processing and inference methods developed at ILLC, exploring new applications for automated reasoning and language technology, and comparing and refining existing methodologies.

The group's research and teaching initiatives are accompanied by service activities with the aim of furthering the use of computational linguistic and computational logic tools in ongoing research at ILLC, both in language, logic, and information. These activities range from maintaining workbenches and test sets to developing front ends for computational systems.

Main Themes
The overall aim of the projects carried out within the Language and Inference Technology group is to put abstract theories to work with the aim of gaining insights in the algorithmic and representational aspects of language, information and communication.

Research activities within the Language and Inference Technology group fall under one or more of the following headings:

'Computing with Information'. Work under this heading covers topics such as spatial reasoning and image retrieval, semistructured data, cross-lingual retrieval, mono-lingual retrieval for European languages, question answering systems, knowledge representation, and the semantic web.

'Computing with Language'. This heading covers topics such as lexical semantics, parsing technologies, computational syntax and semantics, information extraction, and disambiguation.

Finally, work under the 'Computing with Logic' heading includes constraint satisfaction problems, expressive power of restricted description languages (including modal, description, and feature logic), proof and decision methods for modal-like logics, satisfiability testing for propositional and modal solvers; verification; automated reasoning.

Software: much of the research in the Language and Inference Technology group is aimed at understanding the computational behavior of language processing and inference techniques, especially in relation to their potential benefits for real world information processing tasks. As a consequence, there is a strong emphasis on implementatoin efforts. Larger software products developed or extended during 2001 include

- Webstraction, a tool for analyzing Internet discussion sites on a daily basis, attempting to measure general views, attitudes and opinions.
- FlexIR, a document retrieval system for Dutch, English, German, and Italian.
- The LoLaLi.net environment is a pilot aimed at exploring mutliple ways of accessing online scientific resources.
- HyLoRes, an automated theorem prover for hybrid logics based on direct resolution.
- WordNet Visualization Scripts, a set of scripts for visualizing the structure of the WordNet lexical database.
- Tequesta, a corpus-based question answering system.
- MoTEr, a testing environment for modal and modal-like logics that provides a convenient setting for the experimental analysis of modal provers, using a variety of test sets.
- Further implementation efforts went into the development of ETNA (Economische Toepassingen van Neurale Analyse) was, which is aimed at predicting economic features using neural networks.

Researchers
Kzysztof Apt, Carlos Areces, Jaap Kamps, Maarten Marx, Michael Masuch, Rob Mokken, Maarten de Rijke, Khalil Sima'an

PhD Students
Sebastian Brand, Caterina Caracciolo, Rosella Gennari, Juan Heguiabehere, Willem Jan van Hoeve, Gabriel Infante Lopez, Gabriele Musillo, Christof Monz, Maarten Stol, Ivar Vermeulen

Support Staff
Gertjan van der Hoeven, Breanndán Ó Nualláin

Grants
Research in the Language and Inference Technology group is largely funded by external sources. Continuing the stream of successful grant submissions in 2000, several project proposals were approved during 2001.

External Cooperation
Academic external collaborations involved Alechina (Nottingham), Becher (Buenos Aires), Bernardi and Moortgat (Utrecht), Blackburn (Nancy), Demri (Paris), Fisher (Manchester), Franceschet (Udine/Pescara), Gabbay (London), Hiemstra (Enschede), Montanari (Udine), de Nivelle (Saarbrücken), Ohlbach (München), de Vries (CWI), UC Berkeley (Haas School of Business), Technion Haifa, Stanford University, IMS Stuttgart, University of Manchester, Liverpool University, and Imperial and King's College, London. Industrial collaborations involved Bolesian, Elsevier Science, IRION, KPN Research, Xerox Europe.

2001
In the 'Computing with Logic' line, there has been research on new modal languages, such as hybrid logics and description logics, and its application to situation calculus and to semantic web languages. Also, characterizations of consequence relations for interpreted languages have been investigated. A link between bisimulation in modal logics and the (earlier) notion of regular equivalence in social network analysis has been established. In the area of logic and constraints there was work on rule-based constraint programming and on the interpretation of first-order logic as a programming language. Furthermore, resolution-based modal theorem proving methods were developed and implemented, and a modal test environment was set up.

Within the 'Computing with Information' theme there was development work on the infrastructure of and content for a prototype implementation of a glossary based browser for the Handbook of Logic and Language. Network analysis of data on the Internet search engine market was used to validate a formalization of the organizational theory of resource partitioning. Network analysis and multidimensional scaling techniques were also used to analyse the structure of lexical databases. The resulting structure on modifiers yields a measure for emotive or affective meaning. The resulting measure has been applied for Internet opinion polling. There was extensive work on retrieval methods for (non-English) European languages which was evaluated

as part of the CLEF evaluation campaign, and on corpus-based question answering, which was evaluated as part of TREC.

The 'Computing with Language' theme featured work on statistical models of natural language processing and their application for Question Answering technologies. Also, there were investigations into machine Learning of stochastic feature structure grammars from phrase-structure tree-banks. There is an ongoing project on developing a Hebrew Tree-Bank within a project on Corpus-Based Analysis of Hebrew. A spectrum of methods was studied for computing light-weight entailments between open domain natural language texts. And there was further research on logical and algorithmic aspects of structural reasoning in categorial grammars.

2002
In 2002 we aim to correct the current imbalance in the composition of the group by bringing in more senior members. The year 2002 will also see the arrival of new group members as a number projects will get underway.
A number of research proposals is currently under review by NWO and the European Union, and further proposals are being formulated at present.

In the addition to the existing theoretical and experimental investigations, there are plans to join further evalution efforts in both language processing and computational logic.

Finally, 2002 will see the launch of a number of projects for which funding was secured during 2001. These include Khalil Sima'an's KNAW Fellowship, and an NWO-funded project on Complex Knowledge Base Classification.

Computation and Complexity Theory

Project Leaders
Peter van Emde Boas and Leen Torenvliet

Characterization
The main themes of the project are algorithmic methods and complexity analysis. Specific subjects are quantum information processing, computational learning and cognition and AI, network algorithms, computational complexity theory, descriptive complexity and its applications and computational game models.

Main Themes
Quantum coherent computation is a new field of research that has attracted an increasing number of computer scientists and physicists over the last 10 years. In the last years evidence has arisen that the proposed coherent quantum computers may be (and for some tasks are) intrinsically much faster than classical computing devices. Aside from 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, but also lead to increased understanding of quantum phenomena in nature.

A central theme in Machine learning is the so-called 'Minimum Description Length Principle', which states that any regularity in any given set of data can be used to compress these data. The more regularity, the more compression. A specific example investigated involves learining context free grammars from positive examples.

A main theme in the study of algorithms is Kolmogorov Complexity. Research in Complexity Theory focusses on reductions and completeness notions. In distributed computations and network models problems like mutual search and naming conventions in networks are investigated.

The recent field of computational game models aims at bridging the conceptual gap between the antropomorphic 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.

Researchers
Pieter Adriaans, Harry Buhrman , Peter van Emde Boas, Leen Torenvliet,
Paul Vitanyi

PhD Students
Mart de Graaf, Ronald de Wolf

External Cooperation The cooperation with CWI is at the core of this project.
Furthermore the coordination of the 5th European framework project
Quantum Algorithms and Information processing is centered at CWI
(Buhrman). This framework involves eight European, three Canadian and one
American partners. Vitanyi is site manager in the EU Network of Excellence
QUIPROCONE which includes 35 sites. Finally, there are many long term
research relations with numerous institutes.

2001
The year 2001 was again a very fruitful year for Quantum Computing research.
In this year our group got strengthened considerably by the appointment of
H. Buhrman to full professor. Several new areas were explored and the newly
developed technique of quantum fingerprinting even got international press
coverage (Physics Update Now and Süd Deutsche Zeitung). Items also worth
mentioning separately are the cum laude PhD defense by Ronald de Wolf and
the winning of the industrial CIVI prize by Mart de Graaf for his work on the
Quantum Yao Principle.

The field of information theory has many areas of applications. In 2001 work
has been done on the application of information theory in from cognitive
psychology, in cooperation with the University of Warwick, to bio-informatics,
in cooperation with the University of Western Ontario. The latter work
resulted in a completely automatic computed mitochondrial phylogeny tree,
which is considered a break-through in genome research. Also, more
fundamental work was done in the field of algorithmic information theory in
cooperation with P. Gács and N. Vereshchagin, who visited the CWI for an
extended period this year.

Cooperation with Lucent (S. Haldar) and the Tokyo Institute of Technology
led to new results in the field of distributed computing and computational game
models.

2002

Two new PhD researchers have recently started their projects: Mart de Graaf and Troy Lee both are involved in the Quantum Computing Project.
A systematic comparison between game models and general computational models exhibits the lack of a proper computational model for games of imperfect information. A project proposal (InIGMA) on this topic submitted by J. van Benthem and P. van Emde Boas was accepted for funding by NWO. The program is expected to start in the fall of 2002.

FEELING THE MOOD

*Michiel
van Lambalgen*

A plea for the philosophy of science

Many of us got their education at a time when philosophy of science was a field showing great promise. The list 'Popper, Kuhn, Lakatos, Feyerabend' had achieved the status of a mantra, and for those with logical inclinations the analyses of theoretical terms due to Sneed and Stegmüller seemed to provide work for many years to come. In the meantime, the field somehow seems to have lost its brilliance. Grand analyses have given way to detailed studies of particular episodes or concepts, or rather, grand analyses are now supplied by postmodern quarters. It is not always easy to discern causes for the waxing and waning of fields, but in this case it would be worth the effort. It is surely not the case that science itself has become of lesser interest to the populace at large; the number of popular science books has vastly increased since the heyday of the philosophy of science. Similarly, it is now common for major newspapers to include a science supplement. I would hazard the opinion that one cause for the decline of the philosophy of science is that it was very much concerned with great upheavals of our world view (e.g. the transition from classical to quantum physics) and less so with the day to day workings of science.

The faculty of the humanities has a course in the philosophy of science which is obligatory for all students. It seems to me the faculty of sciences needs such a course as well, especially now that there is a drive toward broader curricula. The precursor of ILLC, the Institute for Foundational Research founded by Evert Willem Beth, aimed at studying the foundations of the exact sciences generally, not just mathematics; at the time it was thought that logic would play a pivotal role in such foundational analysis. In the meantime, of course, the idea that science (including mathematics) needs foundations, has receded into the background, and logic has turned out to be less useful in the analysis of scientific theories then was once hoped. In line with these developments, analysis of scientific theories has all but disappeared from ILLC's research program. In my view this is unfortunate, both from an intellectual and an educational point of view. Intellectually, because the failure of the foundational program has not made a historical and critical analysis of science superfluous. The picture painted by the popular science books and the science supplements is that of science on its inexorable march toward progress, new results building upon well-established earlier results. This picture is far from being accurate. For one thing there is a tremendous amount of hype and spin, from which even journals such as *Nature* and *Science* are not exempt. The presentation of

original research in popular science books, not to mention the supplements, generally resembles the parlour game where a single message is transmitted from person to person: what comes out at the end of the chain bears little resemblance to what went in. It takes a sharp eye for methodology, and a distrust of authority, to separate the chaff from the wheat. Given the ever-increasing role that science plays in human life, it is vitally important that the ability to do research goes hand in hand with an ability to analyse critically the fruits of that research.

Educationally a renewed attention to the philosophy of science would be helpful also because students do have an interest in the ideas and intellectual context that have shaped their chosen field. Last year I taught a course on the development of the notions of finite and infinite in mathematics. To my surprise, few students were aware that in mathematics there is a development of ideas at all; or that the same notion, say the continuum, can (and has been) formulated in equally valid but incompatible ways. When this was pointed out to them, the students' reaction was mostly along the lines of 'If only I had known this before, what I had to study would have made much more sense!'.

What would be needed, I think, is a course on philosophy of science which fuses history of ideas, methodology, critical analysis and philosophical reflection. If such a course is to achieve its purpose, it should move away from the tidy picture of science presented in textbooks, and emphasise the sheer messiness of for example empirical research, the many steps between a hunch (about an experiment or a theorem) and the published result, and the many layers of interpretation that accrue to a result; in short, it should emphasise science as process over science as result. If we thus present science as a human endeavour, we may again attract the prospective students which are now put off by its austere image.

Chapter 5 EDUCATION AND COMMUNICATION

Graduate Program in Logic

The Graduate Program in Logic is an international study program organized by ILLC. It includes a PhD program, a MSc program, a Certificate program and the possibility for exchange or contract students to spend a semester/year at ILLC. It offers courses and research in foundations of mathematical and philosophical logic and their applications in computer science, linguistics and cognitive science.

Master of Science Program
The MSc program is a full year program, consisting of course work and a Master of Science thesis. The required background is at least a Bachelor's or equivalent degree in computer science, mathematics, philosophy or linguistics. All applicants must have a strong academic record. The amount of time needed to complete the program varies and will depend on previous academic training. Earning a MSc degree will take a student a minimum of twelve months. Sometimes more time is required to complete a Master's. Because the program is interdisciplinary, there is a lot of freedom in a student's choice of courses. The student gets a highly individualized program which is developed in interaction with a personal study advisor. This advisor is always one of the ILLC faculty members.

The Certificate Program
This program is especially designed for advanced undergraduate students with at least two years of academic training in a relevant field, who would like to earn extra credits abroad. A certificate is awarded after the completion of six courses, the choice of courses is up to the student. A student usually takes two courses per trimester, so that the Certificate is earned in one academic year (ten months). Students may also take courses for a shorter period of time, such as one or two trimesters, without the intention of qualifying for a degree. This option is of special interest to exchange and contract students.

PhD Program
As in most PhD programs, the work in the ILLC PhD program is divided into two parts. Firstly, the student acquires a fairly broad but rigorous working knowledge in the field of logic and its applications. ILLC organizes this part of the PhD program in cooperation with the Dutch Graduate School in Logic (OZSL, see below). This school offers a national program of courses, colloquia,

workshops and annual PhD conferences (all in English). Secondly, the student carries out original research and writes a dissertation under the guidance of two dissertation supervisors. During the first year of the program, the emphasis is on training and from the second year onwards, the emphasis is on research.

In the 2000/2001 academic year 14 MSc students, 7 exchange students and 2 contract students were enrolled. From the MSc students, 7 received their MSc degree before December 2001, the others will graduate in 2002.

The 2001/2002 the program was attended by 15 MSc students, 4 exchange students and 3 contract students.

In 2001 ILLC had 25 PhD students. The following dissertations were succesfully defended:

Maria Aloni: *Quantification under Conceptual Covers*
Erik de Haas: *Logics for OO Information Systems: A Semantic Study of Object Orientation from a Categorial Substructural Perspective*
Rosalie Iemhoff: *Provability Logic and Admissible Rules*
Eva Hoogland: *Definability and Interpolation: Model-Theoretic Investigations*
Ronald de Wolf: *Quantum Computing and Communication Complexity*
Katsumi Sasaki: *Logics and Provability*
Allard Tamminga: *Belief Dynamics. (Epistemo)logical Investigations*
Gwen Kerdiles: *Saying It with Pictures: A Logical Landscape of Conceptual Graphs*
Marc Pauly: *Logic for Social Software*

Information about the Graduate Program in Logic can be found at
www.illc.uva.nl/gpil

PhD Training and the OzsL

The PhD training of the ILLC takes place in collaboration with the Dutch Graduate School in Logic (OZSL). The director of the school is Jan van Eijck (CWI-Amsterdam/OTS-Utrecht). ILLC's managing director is its secretary. ILLC researchers are very active in the educational program of OZSL, and ILLC also hosts the bureau of the school.

Partners in the Dutch Graduate School in Logic:
■   the Institute for Logic, Language and Computation (ILLC),
    Universiteit van Amsterdam,

- the Research Institute for Language and Speech, section Computational Linguistics and Logic, of the Faculty of Arts of Utrecht University
- the Institute for Mathematics and Computer science (IWI), incorporating the Faculty of Mathematics and Natural Sciences of the University of Groningen
- the Institute for Behavioral and Cognitive Neurosciences (BCN) incorporating the Faculty of Mathematics and Natural Sciences, Medicine, Arts and Psychology and Philosophy of the University of Groningen,
- the Centre of Language and Cognition Groningen incorporating the Faculty of Arts of the University of Groningen (participation through BCN)
- the Center for Mathematics and Computer Science (CWI), Amsterdam
- the Faculty of Computer Science of the Free University of Amsterdam
- the Faculty of Philosophy and Faculty of Arts of Tilburg University
- individual associates of the University of Leiden and the University of Nijmegen

The Educational Program

The OZSL organizes one or two schoolweeks yearly, and a varying number of masterclasses throughout the year. Also, the OZSL is heavily involved in the European Summer Schools of Logic, Language and Information (ESSLLI). In 2001, ESSLLI 13, organized by FoLLI), took place in Helsinki.

The OZSL Autumn Schoolweek of 2001 took place October 21-26 in Hotel Dennenhoeve in Nunspeet. This event offered a broad range of tutorials and discussion opportunities, up-to-date overviews of the Staff and PhD research carried out within the school (Staff Accolade and Accolade New Style), an occasion for social interaction between PhD students, and an occasion to meet staff. In detail, the following events took place:

- Student Accolade: a one-day opening event where PhD students gave short short accounts of how their research is going.
- Tutorials on Quantified Modal Logic, on Language and Optimality, on Tableau Methods in Theorem Proving, and on Information Retrieval.
- Workshops on Tableau Methods in Theorem Proving, and on Information Retrieval and Language Technology.
- A round table session for students and recent graduates. Topic of discussion: their experiences with the supervision they receive(d).
- A one-day closing event where staff members gave short accounts of their current research interests: 'Adult Accolade'.

Further details can be found in the web archive of the school, at
http://www.ozsl.uva.nl/archive.html

Communication and Contacts

Publications
The official publications of the institute encompass a series of research reports, a series of technical reports, a series of Master of Logic theses and a dissertation series. At the end of 2001, the ILLC dissertation series, which has been set up in 1993, contained 72 titles. In 2001, 22 research reports (PP series), 1 technical note (X series) and 10 Master of Logic theses (MoL series) appeared.
The coordinating editor of these series is Dick de Jongh. Marco Vervoort is the executive editor. All theses and reports can be downloaded from *http://www.illc.uva.nl/Publications/* or ordered from the ILLC Bureau.
The Applied Logic Lab has its own series of pre-publications, the ALL/CCSOM Prepublication Series. In 2001, 7 new reports appeared. A list of all reports can be found in appendix 2.

Communication and Publicity
For internal and external communication and publicity, we use the following media:
■ illc-list, a weekly electronic newslist (for internal use only);
■ The webpages of ILLC *http://www.illc.uva.nl/*
■ ILLC Magazine: a magazine for alumni, appearing twice a year;
■ The annual catalogue Graduate Program in Logic.

Colloquia
Regular meetings at which both ILLC-staff and visitors meet and exchange ideas and results, are one of the back-bones of the scientific activity of the ILLC-community. The following series of colloquia, lectures and workshops, form the core of ILLC's activities in this area. They are complemented by informal meetings on an ad-hoc basis.
■ Computing with LLI Seminar, weekly
■ The DIP Colloquium (semantics, discourse), bi-weekly
■ Logic Tea

Workshops
In 2001, ILLC organized 12 local workshops and other conferences of which an overview can be found in appendix 3.

International Embedding

FoLLI

The Language and Inference Technology group at ILLC provides coordination for the European Association of Logic, Language and Information (FoLLI). During 2001 FoLLI's activities included:

- Organization of an annual Summer School in Logic, Language and Information. The 13th Summer School was held in Helsinki (Finland), in August.
- Publication of the FoLLI Newsletter, edited by Alexander Koller (*newsletter@folli.org*)
- Development of a FoLLI membership program (Raffaella Bernardi)
- Maintenance of the FoLLI and ESSLLI websites
- Sponsoring of the Journal of Logic, Language and Information (JoLLI)
- Sponsoring of a series Studies in Logic, Language and Information (SiLLI) of lecture notes and monographs, published by CSLI
- Supporting an electronic news service in the field (Colibri)
- Sponsoring scientific events such as WoLLIC
- Supporting the ESSLLI Standing Committee
- Coordinating the E.W. Beth Best Dissertation Award

In 2001, the Executive Board of FoLLI had the following composition: Paul Gochet (President), Phillipe Blache, Patrick Blackburn (editor-in-chief of the Journal), Dov M. Gabbay, John Nerbonne, Jörg Siekmann, Maarten de Rijke (managing editor of the book series and chair Standing Committee).

Chapter 6 FACTS, FIGURES, AND THOUGHTS

Input

As was stated in chapter 3, the year 2001 was one of consolidation.
The total staff grew with 4% compared to the year 2000.
The total number of permanent staff (full, associate and assistant professors) decreased a little from 17.2 to 16.13 fte. There were some internal upward moves from assistant to associate to full professor which made the ratio FP-AssocP-AssistP change from 1-1-1 in 2000 to 1-0.7-0.5 in 2001. In 2002 we expect the number of permanent staff to reach the level of 2000 again by the hiring of an assistant professor in the field of computational logic.
The growth of 4% is mainly caused by the number of PhD students funded by NWO, which increased with 3.6 fte. The total number of NWO/KNAW funded staff (2nd 'geldstroom') grew from 12.53 in 2000 to 17.31 in 2001. This is

Figure 6.1

Human Resource Input 2001	Funding	GW/TF	GW/LC	GW/AI	FMG/ALL	NWI/LTI	Total
Full professor	1	1,50	1,00	1,00		3,60	**7,10**
	2						**0,00**
	3				0,10	0,20	**0,30**
Associate professor	1	1,00	0,20	1,00	0,40	1,50	**4,10**
	2					1,00	**1,00**
	3						**0,00**
Assistant professor	1	0,30	0,50			1,83	**2,63**
	2					1,00	**1,00**
	3						**0,00**
Postdoc	1						**0,00**
	2	2,90	0,60	1,00	1,50	1,56	**7,56**
	3						**0,00**
PhD student	1	1,80	2,58		0,92	3,68	**8,98**
	2	0,67				6,55	**7,22**
	3					0,83	**0,83**
Other	1				1,00		**1,00**
	2					0,53	**0,53**
	3						**0,00**
Total		**8,17**	**4,88**	**3,00**	**3,92**	**22,28**	**42,25**

Figure 6.1 represents total staff in full time equivalents (human resource input).

due to the highly successful KNAW/NWO project proposals in 2000 and 2001, especially the Pionier project and 2 Vernieuwingsimpuls-projects.
Staff funded by external resources like industry (3rd geldstroom) staid at the level of 2000 and is still relatively small: 1.23 fte. The ratio between 1st, 2nd and 3rd geldstroom was 1-0.73-0.05 in 2001.
Note that 7 persons, mainly PhD students, funded their own research in 2001.

Figure 6.2
Research Input 2001

	Funding	GW/TF	GW/LC	GW/AI	FMG/ALL	NWI/LTI	Total
Full professor	1	0,75	0,50	0,50		1,80	**3,55**
	2						0,00
	3				0,10	0,10	0,20
Associate professor	1	0,50	0,10	0,50	0,30	0,75	**2,15**
	2					0,50	0,50
	3						0,00
Assistant professor	1		0,05			0,95	**1,00**
	2					0,50	0,50
	3						0,00
Postdoc	1						0,00
	2	2,43	0,48	0,80	1,20	1,25	**6,15**
	3						0,00
PhD student	1	1,70	2,33		0,83	3,32	**8,17**
	2	0,60				5,98	**6,58**
	3					0,75	0,75
Other	1				0,80		0,80
	2					0,53	0,53
	3						0,00
Total		**5,98**	**3,46**	**1,80**	**3,23**	**16,41**	**30,87**

Figure 6.2 gives the research time in full time equivalents (research input)
The research input (RI) is connected to the human research input (HRI) in the following way.
Per default, regular staff spends 50% of its time on research. Some staff may have deviating arrangements, which are of course incorporated in the figures.
Postdocs spend 80%, and PhD students 90% of their time on research.

The first column lists the ranks. The second column represents the source of funding ('geldstroom'):
1 = direct funding from university
2 = funding by KNAW or NWO
3 = funding from external sources
The departments are the following:
FGW/TF= Philosophy of Language, Faculty of the Humanities
FGW/LC = Logic and Cognition, Faculty of the Humanities
FGW/AI = Computational Linguistics, Faculty of the Humanities
FMG/ALL = Applied Logic Lab, Faculty of Social and Behavioural Sciences
FNWI/LT = Logic and Theoretical Computer Science, Faculty of Science.

Figure 6.3 Human Resource Input 1998-2001	1998	1999	2000	2001
	———	———	———	———————
	47,50	50,60	40,52	42,25
	———	———	———	———————

We expect the number of PhD students to increase in 2002. In the first three months of 2002 already 7 new PhD students joint ILLC, most of them funded by NWO. Less good news is that because of budgetary cuts the ILLC will not be able to fill at least one, and perhaps two first stream funded PhD positions at the Faculty of Science. All in all we do expect the total staff to grow considerably, and the ratio 1st-2nd geldstroom to make a further shift to the latter.

Output

The number of refereed publications and books rose from 103 to 149 (!) and is back at the level of 1999. In that year however this amount was published by a total of 50.62 researchers; in 2001 by 42.25 only. These figures indicate that on average each ILLC researcher was responsible for 3.5 refereed publications or books, against 2.7 in 1999 and 2.4 in 2000. The rise is somewhat at the expense of unrefereed publications like research reports but this seems to be a logical consequence. The number of talks dropped from 210 to 176 compared to 2000 and the main reason for that is that in 2001 researchers were only asked to submit a list with *invited* and *refereed conference* lectures. In 2000 and the years before we used to ask for all lectures.

All other key figures grew (editorships and program committee membership) or remained stable (scientific functions and organization of international events).

Figure 6.4 Scientific Output 2001	
Refereed publications	142
Edited volumes	7
Technical Reports and other publications	37
Dissertations	9
Talks	176
Editorships	47
Program Committee Memberships	39
Scientific Functions	36
International Events Organized	18

Figure 6.5		*1998*	*1999*	*2000*	*2001*
Scientific Output					
1998-2001	Refereed publications and books	132	149	103	149
	Talks	218	172	210	176
	Dissertations	5	4	7	9

Grants and Awards

KNAW-fellowship
- Khalil Sima'an for his project 'Beyond Tree-Banks: Ambiguity Resolution by Distributional Similarity-based Performance Models'.

NWO
- Peter van Emde Boas and Johan van Benthem: two PhD students on a project on 'imperfect information games' (NWO Sciences)
- Frank Veltman and Michiel van Lambalgen: one PhD student and one postdoc on a project 'Logic meets psychology: non-monotonic reasoning' (NWO Humanities)
- Rosalie Iemhoff, Wim van Dam and Ronald de Wolf have all won a NWO TALENT stipendium

Miscellaneous
- CIVI Study Award of fl. 25.000 granted to Martijn de Graaf for his Msc thesis 'Quantum Computing and the Yao Principle', supervised by Harry Buhrman, Ronald de Wolf and Leen Torenvliet.
- Johan van Benthem has been selected to become a member of the Institut International de Philosophie in Paris.

FEELING THE MOOD

Dick de Jongh

I'll never lose my fascination with intuitionistic propositional logic

From the very start of my research until the present day, the intuitionistic propositional calculus (**IPC**) has been one of the subjects I have been interested in. In 1962, when Anne Troelstra and I were master students with Heyting and Beth respectively, we looked at **IPC**. We found that with two propositional letters p and q one can generate exactly 14 nonequivalent formulas with only Æ . This turned out to be known. In 1961 Alexander Diego had proved that for any finite number of propositional letters the number of nonequivalent formulas with only Æ is finite. I then tackled one propositional letter with all the connectives Ÿ,∕¬, Æ , and showed that there were infinitely many nonequivalent formulas pŸ¬p, p, ¬p, p∕p, ¬¬p, ¬¬pÆ p, ¬p∕¬p, (¬¬pÆ p)Æ p∕p, ... This result had already appeared in the *Journal of Symbolic Logic*, in 1960. It was due to Nishimura and the resulting structure became known as 'the Nishimura lattice.' When it became clear that Rieger had published the same result already in an obscure journal in 1949, the structure was renamed 'Rieger-Nishimura lattice.' In 1962/63 I wrote an Algol-LISP program for **IPC** together with Hans Kamp. One of the ideas behind this was to be able to generate such fragments. However, although the program did work properly, computers at the time were not fast enough to test the number of formulas necessary to generate nontrivial cases.

In the meantime I had obtained an interest in the role of **IPC** in Heyting Arithmetic **HA**, the intuitionistic pendant of Peano Arithmetic. In 1969 I showed that those propositional schemes of which all instances are provable in **HA**, are exactly the ones provable in **IPC**. In addition, the observation that in practice neither in **HA** nor in other intuitionistic systems more complicated formulas from the Rieger-Nishimura lattice occur than ¬¬p or ¬¬p Æ p, led me to the following theorem: If f(A) is provable in **HA** for a sentence A for any Nishimura f, then ¬¬A or ¬¬A Æ A is provable in **HA**. Also, I formulated the following concept of 'exactly provable': f(A) is exactly provable in **HA** if (f(A) is provable and) for any g, g(A) is provable in **HA** only if g(p) follows from f(p) in **IPC**. For one propositional variable only p, ¬p, ¬¬p, ¬¬p Æ p and p Æ p are exactly provable. So the infinity of the Rieger-Nishimura lattice had been squashed. The result appeared somewhat belatedly in 1982.

It was soon clear that this finiteness result would not carry over to two or more propositional variables. On the other hand, it did look like rather a daunting task to characterize the formulas of two and more variables that can be exactly provable. In the late eighties Albert Visser and I joined forces and we showed that for infinite sets of formulas differences between **HA** and **IPC** do occur. However, Visser later (1999) showed that with regard to finite sets of formulas

50

HA and **IPC** behave in the same way. In particular, the concept of 'exactly provable' is the same for **HA** and **IPC**. We formulated a conjecture as to a semantic characterization of exact provability: exactly provable formulas are the 'extendible' ones, i.e. those formulas such that, if they are valid on a set of Kripke models, then a one-node extension by a new root to a new model can be found which still validates the formula. However, we were not able to come up with a general proof of the more difficult direction of the intended equivalence. Without being aware of our project Ghilardi in 2000 introduced the concept of projective formula that is prima facie stronger than exact provability, and showed its equivalence to extendibility, thereby proving our conjecture. Both the algebraic origin of his ideas and his ultimate purpose were quite different from ours. With PhD student Nick Bezhanishvili I am now studying the projective (exactly provable, extendible) formulas again with several objectives in mind. One is to get as concrete results as my original one for one variable, for the 2-variable case: what, for example, are the exactly provable formulas that are equivalent in classical logic to p Æ q? A second objective is to get a proof of Ghilardi's theorem based on structural properties of the so-called 'n-universal model'. A third objective is to better understand the meaning of Ruitenburg's theorem, which states that for each formula A(p) in **IPC** there exists an n such that $A^n(p)$ and $A^n+2(p)$ are equivalent in **IPC**.

The second track that was started 40 years ago, computer-aided generation of fragments of intuitionistic logic, has also remained alive. For many years Lex Hendriks has worked on this subject. It is, in principle, an empirical project. By applying theorem provers to generate fragments one obtains results which can again be used to obtain better programs. For example, Diego's work on fragments with only Æ had been extended by the Dutch mathematician de Bruyn to larger fragments using the notion of exact model. This was the basis for Hendriks' dissertation in 1996.

The idea of generating a fragment is simply to start to list all its formulas. Beginning with a finite number of proposition letters one joins a connective to formulas already obtained. One checks for each new formula whether it implies or is implied by any of the previous ones and keeps a record of all implications and non-implications found. If it turns out that a new formula is equivalent to one obtained before it is not added to the list, and hence not used to obtain new formulas. If the fragment is finite it will be constructed eventually. In this manner one obtains a list of interesting theorems and non-theorems that are more informative than what one gets if one generates formulas randomly, since they are as compact as possible with regard to the information they carry. The idea to use the theorems that have been found during the process as schemes to test new formulas, is the theme of our present project. It turns out that using established logical equivalencies systematically is a far from trivial matter, and one that needs to be researched further.

APPENDIX 1: PUBLICATIONS

ILLC Project: Theory of Interpretation

Refereed Publications

- M. Aloni. Optimization games: An application. In Johan van Benthem, editor, *Proceedings of TARK 2001*, Morgan Kaufmann, Los Altos, 2001.

- B.D. ten Cate and M. Nilsenova. Interpreting uncertain or inconsistent information using belief networks. In D. O'Donoghue, editor, *Proceedings of The 12th Irish Conference on Artificial Intelligence and Cognitive Science*, pages 243-252, Maynooth, Co. Kildare, Ireland, September 2001. National University of Ireland.

- B.D. ten Cate and M. Nilsenova. Representing model conversation failures with belief networks. In G. Schreiber, B. Kröse, M. de Rijke and M. van Someren, editors, *Proceedings of BNAIC 2001*, pages 365-372, Amsterdam, 2001.

- D. Cram and J. Maat. *George Dalgarno on Universal Language*. Oxford University Press, 2001.

- P.J.E. Dekker. Dynamics and pragmatics of 'Peirce's Puzzle'. *jos*, 18:1-31, 2001.

- P.J.E. Dekker. Meanwhile, within the Frege boundary. In Robert van Rooy and Martin Stokhof, editors, *Proceedings of the Thirteenth Amsterdam Colloquium*, pages 73-78, ILLC, Amsterdam, 2001.

- P.J.E. Dekker. A pragmatic view upon indefinites. In Ruth Kempson, Klaus von Heusinger and Wilfried Meyer-Viol, editors, *Proceedings of the ESSLLI 13 Workshop on Choice Functions and Natural Language Semantics, Konstanz*, Working Papers of the Department of Linguistics in Konstanz, 2001.

- P.J.E. Dekker. 'She''s character. In Myriam Bras and Laure Vieu, editors, *Semantics and Pragmatic Issues in Discourse and Dialogue*, pages 7-28. Elsevier, Amsterdam, 2001.

- H.L.W. Hendriks. Compositionality and model-theoretic interpretation. *Journal of Logic, Language and Information*, 10(1):29-48, 2001.

■ H.L.W. Hendriks. Information packaging: From cards to boxes. In Fritz Hamm and Thomas Ede Zimmermann, editors, *Linguistische Berichte Sonderheft 10: Semantics*, pages 165-189. Helmut Buske Verlag, Hamburg, 2001.

■ T.M.V. Janssen. On the definition of independence in logic. In G. Sandu and M. Pauly, editors, *Workshop on Logic and Games. ESSLLI'01*. Department of Philosophy, University of Helsinki, 2001

■ T.M.V. Janssen. Computational aspects of if logic. In I. van der Sluis, H. Bunt and E. Thijsse, editors, *Proceedings of the fourth international workshop on computational semantics IWCS-4*, pages 173-187. Tilburg University. Computational Linguistics and IA group, 2001.

■ T.M.V. Janssen. Frege, contextuality and compositionality. *Journal of Logic, Language and Information*, 10(1):115-136, 2001.

■ R.A.M. van Rooy. Exhaustivity in dynamic semantics; referential and descriptive pronouns. *Linguistics and Philosophy*, pages 621-657, 2001.

■ R.A.M. van Rooy. Conversational implicatures. In Jan van Kuppevelt and Ronnier Smith, editors, *Proceedings of the 2nd SIGdial Workshop on Discourse and Dialogue*, 2001.

■ R.A.M. van Rooy. *Exhaustivity and Specificity: A Parallelism between Answers and Pronouns*, pages 29-56. Elsevier, 2001.

■ R.A.M. van Rooy. The pragmatics of mention-some readings of questions. In Harry Bunt et al, editors, *Proceedings of the Fourth International Workshop on Computational Semantics*, 2001.

■ R.A.M. van Rooy. Questions and answers in cooperative and non-cooperative dialogues. In Peter Kühnlein et al., editors, *Proceedings ESSLLI Workshop on Cooperation and Action*, 2001.

■ R.A.M. van Rooy. Relevance of communicative acts. In Johan van Benthem, editor, *Proceedings of TARK 2001*, Morgan Kaufmann, Los Altos, 2001.

Edited Volumes and Books

- J.F.A.K. van Benthem, P. Dekker, D.J. van Eijck, M. de Rijke and Y. Venema. *Logic in Action*. ILLC, University of Amsterdam, 2001.

- M.J.B. Stokhof and R.A.M. van Rooy, editors. *Proceedings of the Thirteenth Amsterdam Colloquium*, ILLC, Amsterdam, 2001.

Dissertations

- M. Aloni. *Quantification under Conceptual Covers*, PhD Thesis, ILLC Dissertation Series DS-2001-01, Amsterdam, 2001

Other Publications

- M. Aloni. Pragmatics for propositional attitudes. In Robert van Rooy and Martin Stokhof, editors, *Proceedings of the Thirteenth Amsterdam Colloquium*, ILLC, Amsterdam, 2001.

- R.I. Bartsch. Consciousness at the cutting edge between world and brain. ILLC-prepublications PP-2001-03, ILLC, Universiteit van Amsterdam, 2001.

- A.J. Butler. Degree relatives are ordinary relatives. In B. Jackson, R. Hastings and Z. Zvolenszky, editors, *Proceedings of SALT XI*, pages 76-94, Cornell University, CLC Publications, 2001.

- A.J. Butler. Relatives and there-insertion. In E. van der Torre, M. van Koppen and M. Zimmermann, editors, *Proceedings of Console 9*. SOLE, 2001.

- A.J. Butler. Sentences with exhaustification. In I. van der Sluis, H. Bunt and E. Thijsse, editors, *Proceedings of the Fourth International Workshop on Computational Semantics,* pages 21-34, Tilburg, 2001.

- B.D. ten Cate. The dynamics of information exchange dialogues. In *Proceedings of FG/MOL 2001*, 2001.
- B.D. ten Cate. Information exchange as reduction. In Kristina Striegnitz, editor, *Proceedings ESSLLI 2001 Student Session*, 2001.

- B.D. ten Cate and M. Nilsenová. Interpreting uncertain or inconsistent information using belief networks. In *Proceedings of the 12th Irish Conference on Artificial Intelligence and Cognitive Science AICS 2001*, Maynooth, 2001.

■   B.D. ten Cate, D.J.N. van Eijck and J.M. Heguiabehere. Expressivity of extensions of dynamic predicate logic. In Robert van Rooy and Martin Stokhof, editors, *Proceedings of the Thirteenth Amsterdam Colloquium*, pages 61-66, ILLC, Amsterdam, 2001.

■   P.J.E. Dekker. On *if* and *only*. In Rachel Hastings, Brendan Jackson and Zsofia Zvolenszky, editors, *Proceedings from SALT XI*, Ithaca, NY, 2001. CLC Publications.

■   H.L.W. Hendriks. Links without locations. Information packaging: From cards to boxes. In Fritz Hamm and Thomas Ede Zimmermann, editors, *Linguistische Berichte Sonderheft 10: Semantics*, pages 165-189. Helmnut Buske Verlag, Hamburg, 2001.

■   J. Maat. Drijfzand of rotsbodem: logische vorm in Leibniz' rationele grammatica. *Meesterwerk*, (22), 2001.

■   M.J.B. Stokhof. Het goede leven en het virtuele zelf. In H. Schwab, T. Koetsier and K. Vintges, editors, *Word Ik van Filosofie een Beter Mens?* Damon, 2001.

ILLC Project: Cognitive Systems and Information Processing

Refereed Publications

■   R. Bod. A memory-based model for music analysis. *In Proceedings ICMC'2001, Havana, Cuba*, 2001.

■   R. Bod. Memory-based models of melodic analysis: challenging the gestalt principles. *Journal of New Music Research*, 30(3), 2001.

■   R. Bod. Probabilistic grammars for music. In In G. Schreiber, B. Kröse, M. de Rijke and M. van Someren, editors, P*roceedings of BNAIC 2001*, 2001.

■   R. Bod. Sentence memory: Storage vs. computation of frequent sentences. In *Proceedings CUNY'2001 Conference*, 2001.

■   R. Bod. Using natural language processing techniques for musical parsing. In *Proceedings ACH/ALLC'2001,* New York, 2001.

■   R. Bod. What is the minimal set of fragments that achieves maximal parse accuracy? In *Proceedings ACL'2001,* Toulouse, France, 2001.

- M. van Lambalgen and K. Stenning. Semantics as a foundation for psychology: a case study of Wason's selection task. *Journal of Logic, Language and Information*, 10(3):273-317, 2001.

- M. van Lambalgen. Conditional quantification, or poor man's probability. *Journal of Logic and Computation*, 11(2):295-335, 2001.

- M. van Lambalgen. Randomness. *Entry for Routledge Encyclopedia for Philosophy of Science*; August 2001.

- N. Massios, L. Dorst and F. Voorbraak. A strategy for robot surveillance using the hierarchical structure of the environment. In *IJCAI'01 Workshop on Reasoning with Uncertainty in Robotics*, pages 43-50, Seattle, USA, August 2001.

- J. Spenader, H.W. Zeevat and S. Gustafson-Capkova. Comparative and empirical discourse studies. In P. Kühnlein, H. Rieser and H. Zeevat, editors, In *Proceedings of Bidialog, the 5th Workshop on the Semantics and Pragmatics of Dialogue*, Bielefeld, 2001.

- R.J.H. Scha. Readymades, artificial art, new media. In Annette W. Balkema and Henk Slager, editors, *Exploding Aesthetics*., volume 16 of *L & B Series of Philosophy and Art Theory*, pages 40 - 47. Rodopi, Amsterdam/Atlanta, 2001.

- K. Sima'an. Robust data oriented parsing for speech understanding. In *Proceedings Natural Language Processing Pacific Rim Symposium*, Tokyo, Japan, 2001.

- K. Sima'an. Robust data oriented parsing for speech understanding. In *Proceedings International Workshop on Parsing Technologies 2001 (IWPT'01)*, Beijing, China, 2001.
- K.Sima'an. Enhancing the robustness of data oriented parsing for speech understanding. In *Proceedings of the Natural Language Processing Pacific-Rim Symposium*, 2001.

- K. Sima'an, A. Itai, Y. Winter, A. Altman and N. Nativ. Building a Tree-Bank of Modern Hebrew Texts. In Béatrice Daille and Laurent Romary, editors, *Journal Traitement Automatique del Langues, Special Issue on Natural Language Processing and Corpus Linguistics*, 42(2), 2001.

■ A.M. Tamminga. Waarheid als limiet van onderzoek: de ontoereikendheid van Charles Sanders Peirce' waarheidsopvatting. *Algemeen Nederlands Tijdschrift voor Wijsbegeerte*, 93(2):73-92, 2001.

■ A.M. Tamminga and K. Tanaka. A natural deduction system for first degree entailment. *Notre Dame Journal of Formal Logic*, 40(2):258-272, 1999 (appeared in 2001)

■ H.W. Zeevat and R.A.M. van Rooy. Introduction to special issue on dialogue. *Journal of Semantics*, 17(1):1-7, February 2000 (appeared in 2001).

■ H.W. Zeevat. Demonstratives in discourse. *Journal of Semantics*, 16(4):279-315, 1999 (appeared in 2001).

■ H.W. Zeevat. The asymmetry of optimality theoretic syntax and semantics. *Journal of Semantics*, 17(3):243-262, 2000 (appeared in 2001).

Edited Volumes and Books
■ P. Kühnlein, H. Rieser and H. Zeevat, editors, *Proceedings of Bidialog, the 5th Workshop on the Semantics and Pragmatics of Dialogue*, Bielefeld, 2001

■ J. Veenstra, J. Zavrel, W. Daelemans and K. Sima'an, editors *Proceedings of Computational Linguistics in the Netherlands 2000 (CLIN'00)*. Rodopi publications, 2001.

Dissertations
■ G. Kerdiles. *Saying It with Pictures: a Logical Landscape of Conceptual Graphs*, PhD Thesis, ILLC Dissertation Series DS-2001-09, Amsterdam, 2001.
■ A.M. Tamminga. *Belief Dynamics: (Epistemo)logical Investigations*, PhD Thesis, ILLC Dissertation Series DS-2001-08, Amsterdam, 2001.

Other Publications
■ R. Bod. Stochastic models of melodic analysis: Challenging the Gestalt Principles. In *Proceedings 14th Meeting of the FWO Research Society on Foundations of Systematic Musicology*, Ghent, Belgium, 2001.

■   K. Sima'an. Robust data oriented parsing for speech understanding. In Harry Bunt and Georgio Satta, editors, *Proceedings of the International Workshop on Parsing Technologies (IWPT01)*. Beijing University, 2001.

ILLC Project: Constructive and Intensional Logic

Refereed Publications

■   M. Aiello, P. Busetta, A. Doná and Serafini L. Ontological overhearing. In *Int. Workshop on Agent Theories, Architectures and Languages (AT AL-2001)*, volume LNAI of *Lecture Notes in Artificial Intelligence*. Springer, 2001.

■   M. Aiello. Computing spatial similarity by games. In F. Esposito, editor, *AI*IA 2001: Advances in Artificial Intelligence*, LNAI, 2175, pages 99-110. Springer, 2001.

■   M. Aiello. Document image analysis via model checking. In A. Chella and D. Malerba, editors, *Workshop on AI techniques in Pattern Recognition (at AI*IA01)*, pages 1-7, Bari, 2001.

■   J.F.A.K van Benthem. Correspondence Theory, In *Handbook of Philosophical Logic*, pages 325-408. Second revised edition, Kluwer, Dordrecht, 2001.

■   J.F.A.K. van Benthem. Games in dynamic epistemic logic. In *Bulletin of Economic Research*, 53:4:219-248, 2001.

■   J.F.A.K. van Benthem. Logics for information update. In Johan van Benthem, editor, *Proceedings TARK VIII*, page 51-88. Morgan Kaufmann, Los Altos, 2001.

■   J.F.A.K. van Benthem. Modal logic in two gestalts. In H. Wansing, M. Zakharyashev and M. de Rijke, editors, *Advances in Modal Logic*, vol. II,, volume II, page 73-100. CSLI Publications, 2001.

■   J.F.A.K. van Benthem and H.C. Doets. Higher-Order Logic. In *Handbook of Philosophical Logic*, page 189-243. Second revised edition, Kluwer, Dordrecht, 2001.

■   D.J.N. van Eijck, J.M. Heguiabehere and B. Ó Nualláin. Tableau reasoning and programming with dynamic first order logic. *Logic Journal of the IGPL*, 9(3):411-445, May 2001.

■   D.J.N. van Eijck. Incremental dynamics. *Journal of Logic, Language and Information*, volume 10, pages 319-351, 2001.

■   D.J.N. van Eijck. Constrained hyper tableaux. In L. Fribourg, editor, *Computer Science Logic*, LNCS 2142, pages 232-246, 2001.

■   D.J.N. van Eijck. Model generation from constrained free variable tableaux. In Rajeev Goré, Alexander Leitsch and Tobias Nipkov, editors, *IJCAR 2001 - Short Papers*, pages 160-169, Siena, 2001.

■   M. Pauly. A logical framework for coalitional effectivity in dynamic procedures. *Bulletin of Economic Research*, 53(4):305-324, 2001.

■   L. Todoran, M. Aiello, C. Monz and M. Worring. Logical structure detection for heterogeneous document classes. In *Document Recognition and Retrieval VIII*, pages 99-110. SPIE, 2001.

■   S. D. Zwart. *Refined Verisimilitude*. Synthese Library. Kluwer academic Press, 2001.

Dissertations

■   E. Hoogland. *Definability and Interpolation: Model-theoretic investigations*, PhD Thesis, ILLC Dissertation Series DS-2001-05, Amsterdam, 2001

■   R. Iemhoff. *Provability Logic and Admissible Rules*, PhD Thesis, ILLC Dissertation Series DS-2001-04, Amsterdam, 2001

■   M. Pauly. *Logic for Social Software*, PhD Thesis, ILLC Dissertation Series DS-2001-10, Amsterdam, 2001

■   K. Sasaki. *Logics and Provability*, PhD Thesis, ILLC Dissertation Series DS-2001-07, Amsterdam, 2001

Edited Volumes and Books

- J.F.A.K. van Benthem, editor, *Proceedings TARK VIII*, Morgan Kaufmann, Los Altos, 2001.

- J.F.A.K. van Benthem, P. Dekker, D.J. van Eijck, M. de Rijke and Y. Venema. *Logic in Action*. ILLC, University of Amsterdam, 2001.

- D.J.N. van Eijck, J. Jaspars, J. Ketting and M. Pauly. *Denkende machines: Computers, rekenen redeneren*. Secondary School Textbook, 2001.

- P. Blackburn, M. de Rijke and Y. Venema. *Modal Logic*, volume 53 of *Cambridge Tracts in Computer Science*. Cambridge University Press, 2001.

Other Publications

- M. Aiello. Review of: Parts and Places, R. Casati and A. Varzi, MIT press. *Journal of Logic, Language and Information*, 10(2):269-272, 2001.

- A. Baltag. Logics for insecure communication. In *Proceedings of the Eighth Conference on Theoretical Aspects of Rationality and Knowledge* TARK, 2001.

- A. Baltag. A logic for suspicious players: Epistemic actions and belief-updates in games. *Bulletin of Economic Research*, 54(1):1-46, January 2002.

- J.F.A.K. van Benthem, G. Bezhanishvili and M. Aiello. *Reasoning about space: the modal way*. Technical Report PP-2001-18, ILLC, 2001.

- J.F.A.K. van Benthem. Interdisciplinariteit en monogamie. *Newsletter Instituut I2O*, February 2001.

- J.F.A.K. van Benthem. *Logic in games*. Lecture notes, March 2001.

- J.F.A.K. van Benthem. Preface of the general chair. In C. Bettini and A. Montanari, editors, *Proceedings TIME 2001*, page ix. IEEE Computer Society, Los Alamitos, 2001.

- P. Blackburn, M. de Rijke and Y. Venema. *Modal Logic*, volume 53 of *Cambridge Tracts in Computer Science*. Cambridge University Press, 2001.

■ B.D. ten Cate, D.J.N. van Eijck and J.M. Heguiabehere. Expressivity of extensions of dynamic predicate logic. In Robert van Rooy and Martin Stokhof, editors, *Proceedings of the Thirteenth Amsterdam Colloquium*, pages 61-66, ILLC, Amsterdam, 2001.

■ P.A.T. van Eck, J. Engelfriet, D. Fensel F. van Harmelen Y. Venema and M. Willems. A survey of languages for specifying dynamics: A knowledge engineering perspective. *IEEE Transactions on Knowledge and Data Engineering*, 13:462-496, 2001.

■ D.J.N. van Eijck and R. Nouwen. Quantification and reference in dynamic semantics. manuscript, 2001.

■ D.J.N. van Eijck. CHT - a theorem prover for constrained hyper tableaux. Documented program, 2001.

■ D.J.N. van Eijck. Context semantics for nl. Paper presented at CLIN'01, November 2001.

■ D.J.N. van Eijck. Reasoning with tableaux. School Week Tutorial Paper, October 2001.

■ D.J.N. van Eijck. Border crossings. In *Logic in Action*, pages 51-74. ILLC, Amsterdam, 2001.

■ G. Goguadze, C. Piazza and Y. Venema. Simulating polyadic modal logics by monadic ones. Technical Report PP-2001-2, 2001.

■ A. Hendriks and D.H.J. de Jongh. Characterization of strongly equivalent logic programs in intermediate logics'. PP series ILLC, 2001.

■ I. Hodkinson, Sz. Mikulás and Y. Venema. Axiomatizing complex algebras by games. *Algebra Universalis*, 46:455-478, 2001.

■ D.H.J. de Jongh. Intuicionismo. In Desidério Murcho Joao Branquinho, editor, *Enciclopedia de Termos Lógico-Filosóficos*, pages 413-417. Gradiva, 2001.

■ V. Stebletsova and Y. Venema. Undecidable theories of lyndon algebras. *Journal of Symbolic Logic*, 66:207-224, 2001.

■   A.S. Troelstra. Honderd jaar keuzenrijen. *Verslagen KNAW, afd. Natuurkunde*, 110:223-227, 2001.

■   Y. Venema. Temporal logic. In L. Goble, editor, *The Blackwell Guide to Philosophical Logic*, pages 259-281. Blackwell Publishers, 2001.

ILLC Project: Language and Inference Technology

Refereed Publications

■   N. Alechina, S. Demri and M. de Rijke. Path constraints from a modal logic point of view. In *Proceedings KRDB 2001*, 2001.

■   K.R. Apt. The Role of Commutativity in Constraint Propagation Algorithms. *ACM Toplas*, 22, 6, pages 1002-1036, 2000, (appeared in 2001).

■   K.R. Apt. One More Revolution to Make: Free Scientific Publishing. *Communications of ACM*, 44 (5), pages 25-28, 2001.

■   K.R. Apt and E. Monfroy. Constraint Programming viewed as Rule-based Programming. *Theory and Practice of Logic Programming*, 1 (6) pages 713-750, 2001.

■   K.R. Apt. Towards free Access to Scientific Literature. *Nieuw Archief voor Wiskunde*, 5/2 nr. 3, pages 251-255, 2001.

■   K.R. Apt and J. Smaus. Rule-based versus Procedure-based view of Logic Programming. *Joint Bulletin of the Novosibirsk Computing Center and Institute of Informatics Systems*, Series: Computer Science, 16, pages 75-97, 2001.

■   C. Areces, P. Blackburn, and M. Marx. Repairing the interpolation theorem in first-order modal logic. In G. Schreiber, B. Kröse, M. de Rijke and M. van Someren, editors, *Proceedings of BNAIC 2001*, Amsterdam, The Netherlands, October 2001.

■   C. Areces, P. Blackburn and M. Marx. Hybrid logics: Characterization, interpolation and complexity. *Journal of Symbolic Logic*, 66(3):977-1010, 2001.

■ C. Areces, R. Gennari, J.M. Heguiabehere, and M. de Rijke. Tree-based heuristics in modal theorem proving (abstract). In G. Schreiber, B. Kröse, M. de Rijke and M. van Someren, editors, *Proceedings of BNAIC 2001*, pages 31-32, 2001.

■ P. Blackburn, J. Kamps and M. Marx. Situation calculus as hybrid logic: First steps. In Pavel Brazdil and Alípio Jorge, editors, *Progress in Artificial Intelligence*, volume 2258 of *Lecture Notes in Artificial Intelligence*, pages 253-260. Springer Verlag, 2001.

■ P. Blackburn and M. Marx. Quantified hybrid logic and natural language. In Robert van Rooy and Martin Stokhof, editors, *Proceedings of the Thirteenth Amsterdam Colloquium*, ILLC, Amsterdam, 2001.

■ P. Blackburn and M. Marx. Tableaux for quantified hybrid logic. In Carlos Areces and Maarten de Rijke, editors, *Workshop Proceedings of Methods for Modalities 2*, Amsterdam, 2001.

■ C. Caracciolo and M. de Rijke. Organizing and accessing online handbooks. In *Philologien und Informationstechnologien (CLIP 2001)*, 2001.

■ D.J.N. van Eijck, J.M. Heguiabehere and B. Ó Nualláin. Tableau reasoning and programming with dynamic first order logic. *Logic Journal of the IGPL*, 9(3):411-445, 2001.

■ J.M. Heguiabehere and M. de Rijke. The random modal qbf test set. In *Proceedings IJCAR Workshop on Issues in the Design and Experimental Evaluation of Systems for Modal and Temporal Logics*, 2001.

■ J.M. Heguiabehere, G.G. Infante López and M. de Rijke. Structured Problems in Modal Satisfiability Testing. In Carlos Areces and Maarten de Rijke, editors, *Workshop Proceedings of Methods for Modalities 2*, Amsterdam, 2001.

■ M. Marx. Relation algebra with binders. *Journal of Logic and Computation*, 11(5):691-700, 2001.

■ M. Marx. Tolerance logic. *Journal of Logic, Language and Information*, 10:353-373, 2001.

■   M. Marx and Sz. Mikulás. Products, or how to create modal logics of high complexity. *Logic Journal of the IGPL*, 9(1):77-88, 2001.

■   M. Marx and J. Treur. Trust dynamics formalised in temporal logic. In L. Chen and Y. Zhuo, editors, *Proceedings of the Third International Conference on Cognitive Science, ICCS 2001*, pages 359-363. USTC Press, Beijing, 2001.

■   C. Monz and M. de Rijke. Deductions with meaning. In P*roceedings LACL-3*, LNCS 2014. Springer, 2001.

■   C. Monz and M. de Rijke. Light-weight entailment checking for computational semantics. In *Proceedings* ICoS-3, 2001.

■   C. Monz and M. de Rijke. The University of Amsterdam at CLEF2001. In *Working Notes for the Cross Language Evaluation Forum Workshop (CLEF 2001)*. ERCIM, 2001.

■   R.J. Leeferink, A.J. Mokken and W.H. Van Schuur. *The circles of our minds: a nonparametric IRT model for the circumplex*, volume Essays on item response theory, pages pp. 339-356. New York: Springer-Verlag, 2001.

■   H.-J. Ohlbach, A. Nonnengart, M. de Rijke and D.M. Gabbay. Encoding two-valued non-classical logics in classical logic. In A. Robinson and A. Voronkov, editors, *Handbook of Automated Reasoning*, pages 1403-1486. Elsevier Science Publishers, 2001.

■   B. Ó Nualláin, M. de Rijke and J. van Benthem. Ensemble-based prediction of SAT search behaviour. In *Proceedings SAT 2001*, 2001.

■   B. Ó Nualláin, M. de Rijke and J. van Benthem. Ensemble-based prediction of SAT search behaviour. In *Electronic Notes in Discrete Mathematics*, 9, 2001.

■   B. Ó Nualláin, M. de Rijke and J. van Benthem. Ensemble-based prediction of SAT search behaviour (abstract). In G. Schreiber, B. Kröse, M. de Rijke and M. van Someren, editors, *Proceedings of BNAIC 2001*, pages 423-424, 2001.

■   M. de Rijke and M. Stol. Adaptive model generation for modal logic. In G. Schreiber, B. Kröse, M. de Rijke and M. van Someren, editors, *Proceedings of BNAIC 2001*, pages 241-248, 2001.

■   M. de Rijke and H. Sturm. Global definability in basic modal logic. In H. Wansing, editor, *Essays on Non-classical Logic*, pages 111-135. World Scientific Publishers, 2001.

■   M.C. Stol and M. de Rijke. Modal logic and local search. In *Proceedings Modal Logic in AI*, 2001.

■   I.E. Vermeulen and J. Bruggeman. The logic of organizational markets: Thinking through resource partitioning theory. *Computational & Mathematical Organization Theory*, 7:87-111, 2001.

■   I.E. Vermeulen and J. Bruggeman. Organizational differentiation: The population of web search engines. In Richard Burton et al, editors, *Computational Analysis of Social and Organizational Systems*, page 85. Carnegie Mellon University, USA, 2001.

Edited Volumes and Books
■   Carlos Areces and Maarten de Rijke, editors, *Workshop Proceedings of Methods for Modalities 2*, Amsterdam, 2001.

■   J.F.A.K. van Benthem, P. Dekker, D.J. van Eijck, M. de Rijke and Y. Venema. *Logic in Action*. ILLC, University of Amsterdam, 2001.

■   P. Blackburn, M. de Rijke and Y. Venema. Modal Logic, volume 53 of *Cambridge Tracts in Computer Science*. Cambridge University Press, 2001.

■   M. Zakharyaschev, K. Segerberg, M. de Rijke and H. Wansing, editors. *Advances in Modal Logic*, Vol. 2. CSLI Publications, 2001.

■   G. Schreiber, B. Kröse, M. de Rijke and M. van Someren, editors, *Proceedings of BNAIC '01*, 2001.

Other Publications
■   K.R. Apt. The Logic Programming Paradigm and Prolog. *The Computing Research Repository* (CoRR).

- C. Areces, P. Blackburn and M. Marx. Repairing the interpolation lemma in quantified modal logic. Technical Report PP-2001-19, ILLC, University of Amsterdam, 2001.

- C. Areces and R. Bernardi. Analyzing the core of categorial grammar. In *Proceedings of ICoS-3*, Siena, Italy, June 2001.

- C. Areces, R. Bernardi and M. Moortgat. Galois connections in categorial type logic. In *Proceedings of Mathematics of Language and Formal Grammar*, Helsinki, Finland, Augustus 2001.

- C. Areces, H. de Nivelle and M. de Rijke. Resolution in modal, description and hybrid logic. *Journal of Logic and Computation*, 11(5):717-736, 2001.

- C. Areces and J.M. Heguiabehere. Hylores: Direct resolution for hybrid logics. In Carlos Areces and Maarten de Rijke, editors, *Workshop Proceedings of Methods for Modalities 2*, Amsterdam, 2001.

- S. Brand. Constraint propagation in presence of arrays. *Joint Bulletin of the Novosibirsk Computing Center and Institute of Informatics Systems*, 16:Series: Computer Science, 2001.

- P. Blackburn, J. Kamps and M. Marx. Situation calculus as hybrid logic: First steps. Technical Report PP-2001-17, Institute for Logic, Language and Computation, University of Amsterdam, 2001.

- P. Blackburn and M. Marx. Third international workshop on hybrid logic (hylo'01). *Logic Journal of the IGPL*, 9(5):735-737, 2001.

- B.D. ten Cate, D.J.N. van Eijck and J.M. Heguiabehere. Expressivity of extensions of dynamic predicate logic. In Robert van Rooy and Martin Stokhof, editors, *Proceedings of the Thirteenth Amsterdam Colloquium*, pages 61-66, ILLC, Amsterdam, 2001.

- R.G. Gennari. General schema for constraint propagation. *Joint Bulletin of of the Novosibirsk Computing Center and Institute of Informatics Systems*, 2001/2.

- R.G. Gennari. Translations for comparing soft frameworks. In T. Walsh, editor, *Proceedings of CP01*, volume 2239 of LNCS, 2239.

■   E. Heemskerk, R.J. Mokken and M. Fennema. The Dutch Corporate
     Network 1976-1996. Paper for *Conference on Corporate Governance in a
     Globalizing World: Changes in Structure and Strategy*, April 2001.

■   J. Kamps and M. Marx. Words with attitude. Technical Report PP-2001-
     16, Institute for Logic, Language and Computation, University of
     Amsterdam, 2001.

■   M. Marx. Complexity of intuitionistic predicate logic with one variable.
     Technical Report PP-2001-01, Institute for Logic, Language and
     Computation, University of Amsterdam, 2001.

■   M. Marx and Sz. Mikulás. An elementary construction for a non-
     elementary procedure. Technical Report PP-2001-10, Institute for Logic,
     Language and Computation, University of Amsterdam, 2001.

■   M. Marx and J.M.F. Masuch. Regular equivalence and dynamic logic.
     Technical report, Applied Logic Laboratory, Amsterdam, 2001.

■   R.J. Mokken. Comparative density measures in bipartite graphs.
     Technical report, NIAS Technical paper, 2001.

■   R.J. Mokken. Massive graphs and small worlds. Paper Workshop
     Network Analysis: New Perspectives, February 2001.

■   C. Monz. Document fusion for comprehensive event description.
     In M. Maybury, editor, *Proceedings of the ACL 2001 Workshop on
     Human Language Technology and Knowledge Management*, 2001.

■   C. Monz and M. de Rijke. Deductions with meaning. In M. Moortgat,
     editor, *Logical Aspects in Computational Linguistics*, LNAI 2014,
     pages 1-10. Springer, 2001.

■   C. Monz and M. de Rijke. Light-weight inference for computational
     semantics. In P. Blackburn and M. Kohlhase, editors, *Proceedings of the
     3rd Workshop on Inference in Computational Semantics (ICoS-3)*, pages
     59-72, 2001.

■   C. Monz and M. de Rijke. Tequesta: The University of Amsterdams
     Textual Question Answering System. In *Proceedings of Tenth Text
     Retrieval Conference (TREC-10)*, pages 513-522, 2001.

■   C. Monz and M. de Rijke. Tequesta: The University of Amsterdams Textual Question-Answering System. In D. Harman and E. Voorhees, editors, *Notebook Papers TREC-10*, pages 513-522, 2001.

■   C. Monz and M. de Rijke. University of Amsterdam at CLEF2001. In *Working Notes for the Cross Language Evaluation Forum Workshop (CLEF 2001)*, pages 165-169, 2001.

■   M. de Rijke, B. Ó Nualláin and J.F.A.K. van Benthem. Ensemble-based prediction of sat search behaviour. In Henry Kautz and Bart Selman, editors, *Electronic Notes in Discrete Mathematics*, volume 9. Elsevier Science Publishers, 2001.

■   M. de Rijke and C. Caracciolo. Organizing and accessing online handbooks. In *Philologien und Informationstechnologien*, 2001.

■   M. de Rijke. Review of *Handbook of Tableau Methods*, edited by M. D'Agostino, D.M. Gabbay, R. Hähnle and J. Posegga. In *Journal of Logic, Language and Information*, 10:518-523, 2001.

■   L. Todoran, M. Aiello, C. Monz and M. Worring. Logical structure detection for heterogeneous document classes. In *Proceedings of Document Recognition and Retrieval VIII*, pages 99-110. SPIE, 2001.

ILLC Project: Algorithms and Complexity Theory

Refereed Publications

■   H.M. Buhrman, R. Cleve, J. Watrous and R.M. de Wolf. Quantum fingerprinting. *Physical Review Letters*, 87(16), 2001.

■   H.M. Buhrman and R.M. de Wolf. Communication complexity lower bounds by polynomials. In *Proceedings of 16th IEEE Conference on Computational Complexity*, pages 120-130, 2001.

■   H.M. Buhrman and R.M. de Wolf. Complexity measures and decision tree complexity: A survey. *Theoretical Computer Science*, 2001.

■   L. Fortnow, H.M. Buhrman, S. Fenner and L. Torenvliet. Two oracles that force a big crunch. *Computational Complexity*, 10:93-116, 2001.

■   M. Heiligman, P.Hyer, F. Magniez, M. Santha, H.M. Buhrman, Ch. Dürr and R.M. de Wolf. Quantum algorithms for element distinctness. In *Proceedings of 16th IEEE Conference on Computational Complexity*, pages 131-137, 2001.

■   M. Li and P.M.B. Vitányi. Algorithmic complexity. In N.J. Smelser and P.B. Baltes, editors, *International Encyclopedia of the Social & Behavioral Sciences*. Pergamon, 2001.

■   N. Steward, N. Chater and P.M.B. Vitanyi. Universal generalization and universal inter-item confusability. *Behavior and Brain Sciences*, 2001.

■   J. Tromp, H.M. Buhrman and P.M.B. Vitányi. Time and space bounds for reversible simulation. *Journal of Physics A: Mathematical and General*, 34:6821-6830, 2001.

■   P.M.B. Vitányi, H.M. Buhrman, J. Tromp. Time and space bounds for reversible simulation. In *Proceedings ICALP 2001*, Lecture Notes in Computer Science. Springer Verlag, 2001.

■   P.M.B. Vitanyi, K. Amano, J. Tromp and O. Watanabe. On a generalized ruin problem. In *Proceedings RANDOM 2001*, Lecture Notes in Computer Science. Springer-Verlag, 2001.

■   P.M.B. Vitányi, P. Gács and J. Tromp. Algorithmic statistics. *IEEE Transactions on Information Theory*, 47(6):2443-2463, 2001.

■   P.M.B. Vitányi. Quantum kolmogorov complexity based on classical descriptions. *IEEE Transactions on Information Theory*, 47(6):2464-2479, 2001.

■   P.M.B. Vitányi. The quantum computing challenge. In *Informatics: 10 Years Back, 10 Years Ahead*, Lecture Notes in Computer Science. Springer Verlag, 2001.

■   M. van Zaanen and P.W. Adriaans. Alignment-based learning versus emile: A comparison. In G. Schreiber, B. Kröse, M. de Rijke and M. van Someren, editors, *Proceedings of BNAIC 2001*, pages 315-322, October 2001.

Dissertations

■   E. de Haas. *Logics For OO Information Systems: a Semantic
     Study of Object Orientation from a Categorial Substructural Perspective*,
     PhD Thesis, ILLC Dissertation Series DS-2001-03, Amsterdam, 2001

■   R.M. de Wolf. *Quantum Computing and Communication*, PhD Thesis,
     ILLC Dissertation Series DS-2001-06, Amsterdam, 2001

Other Publications

■   P.W. Adriaans. Semantic induction with emile, opportunities in
     bioinformatics. In Paul van der et al Vet, editor, *TWLT19, Information
     Extraction in Molecular Biology, Proceedings Twente Workshop on
     Language Technology 19, ESF Scientific Programme on Integrated
     Approaches for Functional Genomics, Enschede*, pages 1-6. Universiteit
     Twente, Faculteit Informatica, November 2001.

■   A. Ambainis, H.M. Buhrman, W.I. Gasarch, B. Kalayanasundaram and
     L. Torenvliet. The communication complexity of enumeration,
     elimination and selection. *Journal of Computer and System Sciences*,
     63:148-184, 2001.

■   A. Ambainis and R.M. de Wolf. Average-case quantum query complexity.
     Journal of Physics A: Mathematical and General, 34(35):6741-6754, 2001.
     Earlier conference version in STACS'2000. quant-ph/9904079.

■   H.M. Buhrman, R. Cleve, J. Watrous and R.M. de Wolf. Quantum
     fingerprinting. *Physical Review Letters*, 87(16), September 26, 2001.
     quant-ph/0102001.

■   H.M. Buhrman, Ch. Dürr, M. Heiligman, P. Høyer, F. Magniez,
     M. Santha and R.M. de Wolf. Quantum algorithms for element
     distinctness. In *Proceedings of 16th IEEE Conference on Computational
     Complexity*, pages 131-137, 2001. quant-ph/0007016.

■   H.M. Buhrman and L. Torenvliet. Randomness is hard. *SIAM Journal on
     Computing*, 30(5):1485-1501, 2001.

■   H.M. Buhrman and R.M. de Wolf. Communication complexity lower
     bounds by polynomials. In *Proceedings of 16th IEEE Conference on
     Computational Complexity*, pages 120-130, 2001. cs.CC/9910010.

■   V. Halava, M. Hirvensalo and R.M. de Wolf. Marked PCP is decidable. *Theoretical Computer Science*, 255:193-204, 2001. Earlier version in STACS'99.

■   I. Newman, H.M. Buhrman, L. Fortnow and H. Röhrig. Quantum property testing. Technical Report 2001-080, NEC research institute, 2001.

APPENDIX 2 RESEARCH REPORTS, TECHNICAL NOTES AND MASTER OF LOGIC THESES

MoL = Master of Logic Thesis
PP = Prepublication Series
X = Technical Notes

- MoL-2001-01:
  Levan Khavtasi: *Extending Focus Theories: Particles in Focus.*

- MoL-2001-02:
  Iouri Netchitailov: *An Extension of Game Logic with Parallel Operators.*

- MoL-2001-03:
  Marie Nilsenová: *Uncertainty in the Common Ground.*

- MoL-2001-04:
  Jason Mattausch: *On Optimization in Discourse Generation.*

- MoL-2001-05:
  Rasa Leijting - Paulékaité: *Intentional Identity and the Edelberg Asymmetry.*

- MoL-2001-06:
  Jon Ragetli: *Towards Concept-based Structuring of Electronic Information.*

- MoL-2001-07:
  Ben Rodenhäuser: *Updating Epistemic Uncertainty: an essay in the logic of information change.*

- MoL-2001-08:
  Alexander Bergo: *Text Categorization and Prototypes.*

- MoL-2001-09:
  Nick Arevadze: *Finite Projective Formulas.*

- MoL-2001-10:
  Marcello Vavassori: *Isn't my question a real question? A Pragmatic Approach to Polar Questions.*

- MoL-2001-11:
  David Gabelaia: *Modal definability in topology.*

- MoL-2001-12:
  Darrin Hindsill: *On the Turning Verbs into Nouns.*

- MoL-2001-13:
  Troy Lee: *Is Multiplication Harder than Addition? Arithmetical Definability over Finite Structures.*

- MoL-2001-14:
  Andreas P. Giannakoulopoulos: *Frog Leaps and Human Noises: An Optimality Theory Approach to Cultural Change.*

- PP-2001-01:
  Maarten Marx: *Complexity of Intuitionistic Predicate Logic with One Variable.*

- PP-2001-02:
  G. Goguadze, C. Piazza, Y. Venema: *Simulating polyadic modal logics by monadic ones.*

- PP-2001-03:
  Renate Bartsch: *Consciousness at the Cutting Edge between World and Brain: The Interaction between Perception, Imagination, Thought, and Language.*

- PP-2001-04:
  Maarten Marx: *Relation Algebra with Binders.*

- PP-2001-05:
  Michael Morreau: *The Good, the Bad and the Far-fetched.*

- PP-2001-06:
  Michael Morreau: *What Vague Objects are like.*

■   PP-2001-07:
    Renate Bartsch: Generating Polysemy: *Metaphor and Metonymy.*

■   PP-2001-08:
    C Areces, R. Bernardi: *Analyzing the Core of Categorial Grammar.*

■   PP-2001-09:
    Lex Hendriks, Dick de Jongh: *Characterization of Strongly Equivalent Logic Programs in Intermediate Logics.*

■   PP-2001-10:
    Maarten Marx, Szabolcs Mikulas: *An Elementary Construction for a Non-elementary Procedure.*

■   PP-2001-11:
    Paul Dekker: *Meaning and Use of Indefinite Expressions.*

■   PP-2001-12:
    Paul Dekker: *Dynamics and Pragmatics of 'Peirce's Puzzle'.*

■   PP-2001-13:
    Paul Dekker: *'She' 's Character.*

■   PP-2001-14:
    Paul Dekker: *On If and Only.*

■   PP-2001-15:
    Paul Dekker, Robert van Rooy: *Bi-Directional Optimality Theory: An Application of Game Theory.*

■   PP-2001-16:
    J. Kamps, M. Marx: *Words with Attitude.*

■   PP-2001-17:
    P. Blackburn, J. Kamps, M. Marx: *Situation Calculus as Hybrid Logic: First Steps.*

■   PP-2001-18:
    M. Aiello, J. van Benthem, G. Bezhanishvili: *Reasoning About Space: The Modal Way.*

■   PP-2001-19:
    C. Areces, P. Blackburn, M. Marx: *Repairing the Interpolation Theorem in Quantified Modal Logic.*

■   PP-2001-21:
    Giovanna D'Agostino, Giacomo Lenzi: *Comparing Levels of Bisimulation Quantifiers Logic with the mu-calculus.*

■   PP-2001-22:
    Giovanna Corsi: *A Unifying Completeness Theorem in Quantified Modal logic.*

■   PP-2001-23:
    Marco Aiello, Johan van Benthem: *A Modal Walk Through Space.*

■   X-2001-01:
    A.H. Budiyanto: *Introduction to Turing Nonrigidity.*

APPENDIX 3 WORKSHOPS, EVENTS

Workshops

Second ILLC Alumni Event
Location: Amsterdam
Date: 2 March 2001
Organization: Peter Blok, Ingrid van Loon, Martin Stokhof

Tableau for Dynamic And Modal Logics.
Location: Amsterdam
Date: April 5 and April 6, 2001
Organization: Jan van Eijck, Breanndán Ó Nualláin, Maarten de Rijke

Algebraic Logic Meeting
Location: Amsterdam
Date: 22 May 2001
Organization: Yde Venema

Launch of the Book 'Modal Logic' by Patrick Blackburn,
Maarten de Rijke and Yde Venema
Location: Amsterdam
Date: July 4
Organization: Maarten de Rijke, Yde Venema

The Fourth International Tbilisi Symposium on Language, Logic and
Computation
Location: Borjomi, Georgia
Date: 23-28 September 2001
Organization: Paul Dekker, Dick de Jongh, Ingrid van Loon, Henk Zeevat

OzsL Schoolweek
Location: Nunspeet
Date: 22-26 October 2001
Organization: Jan van Eijck, Eva Hoogland

Workshop 'Learning Logic and Grammar'
Location: Amsterdam
Date: 23 November 2001
Organization: Raffaella Bernardi, Paul Dekker

Methods for Modalities 2 (M4M-2)
Location: Amsterdam
Date: 29-30 November 2001
Organization: Maarten de Rijke, Carlos Areces

Workshop on Games and Logic
Location: Amsterdam
Date: 12 December 2001
Organization: Paul Harrestein

Thematic Afternoon on Constructivism
Location: Amsterdam
Date: 14 December 2001
Organization: Anne Troelstra

The Thirteenth Amsterdam Colloquium
Location: Amsterdam
Date: 17-19 December 2001
Organization: Rosja Mastop, Robert van Rooy, Martin Stokhof

A Farewell to the Spinoza project 'Logic in Action'
Location: Amsterdam
Date: 20 December 2001
Organization: Johan van Benthem, Ingrid van Loon

Regular Events

The Computing with LLI Seminar
An almost weekly series of talks that focuses on a wide variety of themes in
computational logic and computational linguistics. The Computing with LLI
Seminar homepage can be found at
http://www.illc.uva.nl/LIT/News/ seminar.html
Organization: Jaap Kamps, Maarten de Rijke

The DIP Colloquium
The DIP Colloquium meets bi-weekly. It aims to bring together researchers
and students who are interested in semantics, pragmatics and discourse analysis,
and to encourage discussion, collaboration and cross-fertilization of ideas.
The DIP homepage can be found at *http://www.illc.uva.nl/dip/*
Organization: Balder ten Cate, Marie Nilsenová

The Logic Tea

The Logic Tea, a series of one-hour talks designed for students of mathematics, computer science, artificial intelligence, and philosophy, and the students of the Master of Logic program of the ILLC, with discussion, tea and cookies afterwards.

The Logic Tea homepage can be found at

http://turing.wins.uva.nl/~debruin/logic_tea.html

Organization: Boudewijn de Bruin, Marc Theunissen

APPENDIX 4 OTHER CONTRIBUTIONS

ILLC Project: Theory of Interpretation

Principal Researchers
M.D. Aloni, R.I. Bartsch, E.C. Brouwer, A.J. Butler, B.D. ten Cate,
P.J.E. Dekker, J.A.G. Groenendijk, H.L.W. Hendriks, T.M.V. Janssen, J. Maat,
M. Nilsenova, A. Pilatova, R.A.M. van Rooy, M.J.B. Stokhof, H.P. Stein.

Lectures
- M.D. Aloni, *Optimization Games: An application*, TARK 2001, 8 July, Siena, Italy; *Topical Domain Restrictions*, The 4th International Tbilisi Symposium on Language, Logic and Computation, 25 September, Borjomi, Georgia; *Pragmatics for propositional Attitudes*, Amsterdam Colloquium 2001, 18 December, Amsterdam.
- A.J. Butler, *Sentences with exhaustification,* IWCS-4, 10 January, University of Tilburg; *Intervention effects in questions*, Szklarska Poreba Workshop, 18 March, Szklarska Poreba; *Intervention effects in questions with Multipair Readings*, LAGB Spring Meeting, 6 April, University of Leeds; *Degree relatives are ordinary relatives*, SALT XI, 13 May, New York University.
- B.D. ten Cate, *The dynamics of information exchange dialogues*, FG/MOL 2001, 11 August, Helsinki; *Information exchange as reduction*, ESSLLI 2001 student session, 22 August, Helsinki; *Interpreting Uncertain or Inconsistent Information using Belief Networks*, AICS 2001, 7 September, Maynooth; *Relevance and relatedness of questions*, LLC 2001, 26 September, Tbilisi; *On the semantics of unrestricted how-questions*, CLIN 2001, 30 November, Enschede; *Expressivity of extensions of dynamic predicate logic*, AC 2001, 19 December, Amsterdam.
- P.J.E. Dekker, *Dynamics and Pragmatics of 'Peirce's Puzzle'*, DIP Colloquium, January, Amsterdam; *Who is having an Individual Concept here?*, workshop on the Structure of Doxastic Alternatives, February, Konstanz; *Formal Language Games,* ILLC Alumni Event, March, Amsterdam; *On If and Only*, SALT 11, May, New York; *Beyond the Frege Boundaries*, LEGO Seminar, June, Amsterdam; *Skolem Functions and Individual Concepts*, workshop on Choice Functions and Natural Language Semantics, ESSLLI XIII, August, Helsinki; *On If and Only*, The 4th International Tbilisi Symposium on Language, Logic and Computation, September, Borjomi; *Meanwhile, Within the Frege Boundary*, Sinn und Bedeutung VI, October, Osnabrück; *Formal Semantics Like in the Old Days*, OZSL Schoolweek, October, Nunspeet.

- T.M.V. Janssen, *On the definition of independence in logic*, ESSLLI'01 Workshop on logic and games, 22 August, Helsinki; *Computational aspects of IF logic*, 4th workshop on computational semantics, 11 January, Tilburg.
- H.L.W. Hendriks, *Raising Alternatives*, Prosody in Processing. International workshop on the interaction between prosody and other components of the langage faculty, 6 July, Utrecht.
- J. Maat, *Drijfzand of rotsbodem: logische vorm in Leibniz' rationele grammatica*, Tussen taalwetenschap en taalonderwijs, 31 October, Leiden; *Leibniz's texts on rational grammar*, The History of Linguistics in Texts and Concepts, 16 November, Potsdam.
- M. Nilsenova, *Modelling Corrections with Bayesian Networks*, Semantics in the Netherlands, June, Leiden; *Representing Model Conversation Failures with Belief Networks*, 12th Irish Conference on Artificial Intelligence & Cognitive Science, September, Maynooth, Ireland; *Recognizing Intentional Non-cooperativity*, The 4th International Tbilisi Symposium on Language, Logic and Computation, September, Borjomi, Georgia; A Belief Network for Natural Language Interpretation, BNAIC '01, October, Amsterdam; *On the semantics of unrestricted how-questions*, Computational Linguistics in the Netherlands, November, Enschede.
- A. Pilatova, *Identity Statements*, GROLOG, 20 October, Groningen; *Descriptive Semantics*, PCCP, 6 June, Groningen.
- R.A.M. van Rooy, *The Pragmatics of Mention Some readings of Questions*, Fourth International Workshop on Computational Semantics, 10 January, Tilburg; *Bidirectional OT: an application of Game theory*, Potsdam colloquium, 30 January, Potsdam, Germany; *Implicatures and Relevance in Bidirectional OT*, Formal Pragmatics, 16 March, Berlijn, Germany; *Information and Optimality*, CSLI LLC Workshop, 25 May, Stanford, USA; *Relevance of Communicative Acts*, Tark, 8 July, Siena, Italy; *Questions and Answers in cooperative and non-cooperative settings*, Workshop at ESSLLI 2001, 23 August, Helsinki, Finland; *Conversational Implicatures*, Sigdial, 1 September, Aalborg, Denmark; *Topical Domain Restriction*, The 4th International Tbilisi Symposium on Language, Logic and Computation, 25 September, Borjomi, Georgia; *Signalling Games and Optimal Coding*, Sinn und Bedeutung, 9 October, Osnabrück, Germany.

Scientific Functions
- M.J.B. Stokhof, OZSL, Member of the Board.

Editorships
- P.J.E. Dekker, *Journal of Semantics*; Linguistics and Philosophy.
- J.A.G. Groenendijk, *Linguistics and Philosophy*, Associate Editor Semantics; *Current Research in the Semantics Pragmatics Interface*, Advisory Editor; *Language and Computation*, Member Editorial Board.
- M.J.B. Stokhof, *Linguistics and Philosophy*, Associate Editor Semantics; *Natural Language Semantics*, Member Editorial Board; *Logic and Computation*, Member Editorial Board; *Current Reserach on the Semantics-Pragmatics Interface*, Member Editorial Board.

Program Committees
- P.J.E. Dekker, *Sinn und Bedeutung 6*, Member of Program Committee, October, Osnabrück.
- J.A.G. Groenendijk, *Amsterdam Colloquium*, Member of Program Committee, 18-22 December, Amsterdam.
- M.J.B. Stokhof, *Semantics and Linguistic Theory XI, NYU, New York*, Member of Program Committee.

Scientific Events Organized
- P.J.E. Dekker, *Fourth International Tbilisi Symposium on Language, Logic and Computation*, September, Borjomi; workshop *'Learning Logic and Grammar'*, November, Amsterdam; *workshop 'Games in Language and Logic'*, December, Amsterdam.
- R.A.M. van Rooy, *Thirteenth Amsterdam Colloquium*, 17-19 December, Amsterdam.
- M.J.B. Stokhof, *Thirteenth Amsterdam Colloquium*, 17-19 December, Amsterdam.

ILLC Project: Cognitive Systems and Information Processing

Principal Researchers
R. Bod, K.L. Kwast, M. van Lambalgen, N. van Leusen, N. Massios,
R. Mastop, R.J.H. Scha, Y. Seginer, K. Sima'an, A.M. Tamminga,
F.J.M.M. Veltman, H.W. Zeevat.

Lectures
- K.L. Kwast, *Kunstmatig Bewustzijn*, Psychologie Collequium, 22 May, Amsterdam.
- M. van Lambalgen, *Moschovakis' notion of meaning as applied to linguistics*, Logic Colloquium 2001, August, Vienna.
- N. Massios, *A strategy for robot surveillance using the hierarchical structure of the environment*, IJCAI'01 workshop 'Reasoning with Uncertainty in Robotics', 4 August, Seattle, USA.
- R. Mastop, *Reasoning with Imperatives*, First International Workshop on Semantics, Pragmatics and Rhetorics, 22 November, San Sebastian; *On the Semantics of Unrestricted How-Questions*, Computational Linguistics in the Netherlands 2001, 30 November, Enschede.
- R.J.H. Scha, *The Computational Semiotics of Human Facial Expression,* COSIGN 2001 1st International Conference on Computational Semiotics in Games and New Media, 10 September, CWI, Amsterdam; *The Future of Digital Audio-Broadcasting*, Symposium 'The Future of Radio in the Era of Digital Transmission', 28 November, Bilthoven; *Computer Art vs. New Media*, Sonic Acts Conference 'The Art of Programming', 10 December, Royal Conservatory, The Hague; *Artificial Art, Dynamic Design, Artificial Architecture*, Symposium 'Research in Motion', 27 March, TU Delft.
- K. Sima'an, *Robust Data Oriented Parsing for Speech Understanding*, International Workshop on Parsing technologies, 20 October, Beijing China.
- F.J.M.M. Veltman, *The Counterfactual Mood*, First International Workshop on Semantics, Pragmatics, and Rhetoric, 23 November, San Sebastian.
- H.W. Zeevat, *An Optimality Theoretic Reconstruction of DRT*, Formal pragmatics, 17 March, Berlin; *Comparative and Empical Discourse Theory. A programme in Discourse Studies*, Bi-dialog, 15 June, Bielefeld; *Splitting Topics*, Sinn und Bedeutung, 15 October 2001, Osnabrück; *The Semantic Contribution of Particles*, Amsterdam Colloquium 2001, 20 December, Amsterdam.

Scientific Functions

- ■ R. Bod, *EPSRC (Engineering and Physical Sciences Research Council), United Kingdom*, Member of the Peer Review College.
- ■ R.J.H. Scha, *NWO Priority Programme 'Music Mind Machine'*, Member Advisory Board; *NWO-EZ Research Programme Interactive Multimodal Information Extraction*, Member Preparatory Committee.

Editorships

- ■ M. van Lambalgen, *Journal of Logic, Language and Information*, Editor.
- ■ K. Sima'an, *Proceedings of the Computational Linguistics in the Netherlands: Rodopi publications*, (Co-)Editor.
- ■ F.J.M.M. Veltman, *Argumentation*, Member Editorial Board; *Journal of Applied Non-classical Logics*, Member Editorial Board.
- ■ H.W. Zeevat, *Journal of Semantics*, Member Editorial Board.

Program Committees

- ■ R. Bod, *CogSci'2001*, Member of Review Committee, 20 August, Edinburgh; ACL'2001, Member of Review Committee, 2 July, Toulouse; *North American Chapter of the ACL'2001*, Member of Review Committee, 10 June, Pittsburgh.
- ■ M. van Lambalgen, *CogSci 2001*, Member of Program Committee, 1-5 August, Edinburgh.
- ■ F.J.M.M. Veltman, *The Thirteenth Amsterdam Colloquium*, Chairman, 17-19 December, Amsterdam.
- ■ H.W. Zeevat, *Formal Pragamtics*, Member, 16-18 March, Berlin; *The 4th International Tbilisi Symposium on Language, Logic and Computation*, Member, 23-28 September, Borjomi; *Bi-Dialog*, Member, 14-16 June, Bielefeld.

Scientific Events Organized

- ■ R. Bod, LSA'2001 *Workshop on Probability Theory in Linguistics*, 6 January, Washington D.C.
- ■ M. van Lambalgen, *Workshop Semantics and Cognition*, AC2001, December, Amsterdam.
- ■ R. Mastop, *Workshop Logica en Ethiek*, 19 September, Amsterdam; *13th Amsterdam Colloquium*, 17-19 December, Amsterdam; R. Mastop, ^=, Evening Lectures and Discussions for Students in (philosophical) Logic and Philosophy of Language, Amsterdam.
- ■ R.J.H. Scha, *Symposium 'The Future of Radio in the Era of Digital Transmission'*, 28 November, Walter Maashuis, Bilthoven.

■ H.W. Zeevat, *Bi-dialog*, 14-16 June, Bielefeld; *Szklarska Poreba Workshop*, 18-22 March, Szklarska Poreba, Poland; *The 4th International Tbilisi Symposium on Language, Logic and Computation*, 23-28 September, Borjomi, Georgia.

Visiting Professorships
■ M. van Lambalgen, *ZAS Berlin*, June; *HCRC, Edinburgh*, August; *Department of Mathematics*, University of Athens, November.
■ R.J.H. Scha, *Frank Mohr Institute*, Groningen, May-July.
■ H.W. Zeevat, *Linguistics, Stockholm University*, February-March.

Scientific Awards
■ K. Sima'an, *FoLLI 2000 prize*, European Foundation of Logic, Language and Computation, 21 August, Helsinki Finland.

Miscellaneous Scientific Functions or Activities
■ M. van Lambalgen, Refereeing for: Information and Computation, Journal of Symbolic Logic.
■ R.J.H. Scha, Jury Member, KION National Award for the best Master's Thesis in Artificial Intelligence.
■ K. Sima'an, Conference Article Reviewing: (1) Association of Computational Linguistics-01, (2) North American ACL NAACL-01, (3) Computational Linguistics in the Netherlands-Proceedings 2001; Journal Article Reviewing: (1) Journal of Computational Linguistics (2) Journal of Natural Language Engineering; Other Activities: (1) Submission of Project Proposal to KNAW (N.B. accepted) (2) Ongoing Cooperation Project with Technion (Haifa, Israel) on building a Hebrew tree-bank

ILLC Project: Constructive and Intensional Logic

Principal Researchers
M. Aiello, A. Baltag, J.F.A.K. van Benthem, A.M. Bleeker, B.P. de Bruin,
H.C. Doets, D.J.N. van Eijck, A. Hendriks, E. Hoogland, R. Iemhoff,
D.H.J. de Jongh, J.M. Niekus, M. Pauly, A.S. Troelstra, Y. Venema,
D. Zambella, D. Zwart.

Lectures
- M. Aiello, *Computing Spatial Similarity by Games*, Conference of the
  Italian Association for Artificial Intelligence (AI*IA-01), 24 September,
  Bari, Italy; *Document Image Analysis via Model Checking*, Ws on AI
  Techniques in Pattern Recognition, 22 September, Bari, Italy.
- A. Baltag, *Logics for Insecure Communication*, Theoretical Aspects of
  Rationality and Knowledge (TARK'01), 9 July, Siena, Italy; *Epistemic
  Actions and Information Flow in Games*, Tenth LLC Workshop on
  'Logic and Games', 15 May, Stanford, USA.
- J.F.A.K. van Benthem, *Logic and Communication*, Ernst Schroeder
  Colloquium, January, TU Darmstadt; *Does Logic have a Future?*,
  Nederlandse Vereniging voor Logica, February, Utrecht; *Update Logics
  for Communication*, Computing Lab, February, Oxford; *Logic and Game
  Algebra*, CUNY graduate colloquium, March, New York; *Logical
  Dynamics and Games*, IRCS colloquium, March, Philadelphia; *Language
  as the Engine of Cognition*, Annual Meeting Academia Europaea, June,
  Rotterdam; *Update Logics*, TARK, July, Siena; *Logic Games and Game
  Theory*, IMGTA 11, July, Ischia; *What is Logical Dynamics?*, Dynamics
  2001, September, Prague.
- D.J.N. van Eijck, *Context Semantics for NL*, WCS-IV, 12 January 2001,
  Tilburg, Constrained *Hyper Tableaux*, Zuidelijk Interuniversitair
  Colloquium, 20 March, Eindhoven; *Model Generation from Constrained
  Free Variable Tableaux*, IJCAR, 22 June, Siena; Constrained Hyper
  Tableaux, Computer Science Logic, 11 September, Paris; Reasoning *With
  Tableaux*, OzsL Schoolweek Tutorial, 22 October, Nunspeet; *Hyper
  Tableaux*, OzsL Tableau Extravaganza, 23 October, Nunspeet;
  Quantification and Reference in Dynamic Semantics, Learning, Logic,
  and Grammar, 23 November, Amsterdam; *Update on Context Semantics
  for Natural Language*, CLIN, 30 November, TUT, Enschede; *Equality
  Clause Reduction*, LLLC-LORIA Exchange, 7 December, Nancy,
  France.
- A. Hendriks, *Explorations in extensions of intuitionistic propositional
  logic*, Methods for Modalities 2, 30 November, Amsterdam.

- E. Hoogland, *A general picture of definability*, General Mathematics Colloquium, 26 September, Amsterdam; *Definability*, Intermediate Problems of Model Theory and of Universal Algebra, 25 June, Novosibirsk, Russia; *A general picture of definability*, LLC Workshop, 26 May, Stanford; *Beth Definability*, Algebraic Logic Meeting, 22 May, Amsterdam; Beth Definability, The Logic Tea, 7 June, Amsterdam.
- D.H.J. de Jongh, *Intuitionistic propositional logic: results of the last decade,* Università di Siena Mathematics Seminar, 22 February, Siena; *Intuitionistic propositional calculus, the results of the last decade*, Novikov 100, Mathematical Logic, Algebra and Set Theory, 30 August, Moscow; *Recent advances in intuitionistic propositional calculus*, The 4th International Tbilisi Symposium on Language, Logic and Computation, 24 September, Borjomi, Georgia; *Logic Programs and Intermediate Logic*, CLLI Seminar, 16 November, Amsterdam; *Pseudo-valuations and splittings: the birth of Beth's semantic tableaux in 1954*, LED-LIT Research Alliance Inaugural Meeting, 7 December, Inria Lorraine, Nancy
- M. Pauly, *Coalitional Ability in Multi-Agent Systems: A Logical Approach*, AAAI Symposium on Game and Decision Theoretic Agents, March, Stanford, USA; *On the Complexity of Coalitional Reasoning*, Logic, Game Theory and Social Choice, June, St. Petersburg, Russia.
- A.S. Troelstra, *Hundert Jahre Wahlfolgen*, Festkolloquium J. Diller, 2 November, Münster i. Wf.
- Y. Venema, *Game Algebras*, Colloquium Department of Mathematical Sciences, New Mexico State University, 20 April, Las Cruces, USA; *Frames and Algebras*, Colloquium Department of Mathematical Sciences, New Mexico State University, 24 April, Las Cruces, USA; *Atomless Varieties*, Algebraic Logic Meeting, 22 May, Amsterdam; *Representing Game Algebras*, Workshop on Logic and Games, 21 August, Helsinki; *Game Logics and Game Algebras*, Seminari de Logica de Barcelona 14 November, Barcelona; *Atomic Boolean algebras with operators*, Seminari de Logica de Barcelona, 21 November, Barcelona.

Scientific Functions
- A. Baltag, *Association of Symbolic Logic*, Member.
- J.F.A.K. van Benthem, *International Federation for Computational Logic*, Vice-President; TARK: *reasoning about knowledge and rationality*, Board of Directors; *Vienna Circle Archive*, Chairman of the board; *E.W. Beth Foundation*, Treasurer; *NWO National Initiative in Cognitive Science*, Chairman of Program Committee.

Editorships
- M. Aiello, *ACM Transactions on Computational Logic (TOCL)*, Information Director.
- J.F.A.K. van Benthem, *The Philosopher's Annual*, Nominating Editor; *Journal of Philosophical Logic*, Editorial Board; *Studia Logica*, Editorial Board; *Studies in Linguistics and Philosophy*, Editorial Board; *Logic Journal of the Interest Group in Pure and Applied Logics*, Editorial Board; *Logic and Computation*, Editorial Board; Language and Computation, Editorial Board; *Cognitive Science Quarterly*, Editorial board; *Amsterdam University Press*, Member Oversight Committee.
- D.H.J. de Jongh, *ILLC Scientific Publications*, Editor.

Program Committees
- A. Baltag, *Coalgebraic Methods in Computer Science*, Member of Program Committee, 6-7 April, Genova, Italy.
- J.F.A.K. van Benthem, *TARK VIII*, Program Chair, 8-10 July, Siena; *10th CSLI Workshop on 'Logic, Language and Computation'*, Member of Program Committee, 30 May-1 June, Stanford; *TIME 2001*, General Chair, 14-16 June, Udine.
- D.H.J. de Jongh, *The 4th International Tbilisi Symposium on Language, Logic and Computation*, Chairman, 23-28 September, Borjomi, Georgia.
- Y. Venema, *International Symposium on Temporal Reasoning and Planning (TIME2001),* Member of Program Committee, 14-16 June, Cividale del Friuli; *ESSLLI 2001* student session, Member of Program Committee, 13-24 August, Helsinki.

Scientific Events Organized
- D.J.N. van Eijck, *Schoolweek OzsL*, 21-26 October, Nunspeet.
- E. Hoogland, *Schoolweek OzsL*, 21-26 October, Nunspeet.
- D.H.J. de Jongh, *The 4th International Tbilisi Symposium on Language, Logic and Computation*, 23-28 September, Borjomi, Georgia.
- Y. Venema, *Algebraic Logic Meeting*, 22 May, Amsterdam.

Scientific Awards
- J.F.A.K. van Benthem, *Member*, Institut International de Philosophie, June, Paris; *Spinoza Award, 1996-2001*, NWO National Research Council, October, Den Haag.

Miscellaneous Scientific Functions or Activities
- J.F.A.K. van Benthem, Member Academia Europaea, since 1991; Member Royal Dutch Academy of Arts and Sciences, since 1992; Doctor Honoris Causa, Liege University, 1998.
- D.J.N. van Eijck, Chairman of the VSNU Visitation Committee for Dutch University Curricula in Artificial Intelligence, Fall 2001.

ILLC Project: Language and Inference Technology

Principal Researchers
K.R. Apt, C.E. Areces, S. Brand, C. Caracciolo, R. Gennari,
J.M. Heguiabehere, W.J. van Hoeve, G.J. van der Hoeven, G.G. Infante Lopez,
J. Kamps, M.J. Marx, J.M.F. Masuch, R.J. Mokken, C. Monz, G. Musillo,
B. Ó Nualláin, M. de Rijke, M.C. Stol, I.E. Vermeulen.

Lectures
- K.R. Apt, *Constraint Propagation Revisited*, Meeting of DEDUGIS, 14 February, Venice; *A Primer on Constraint Programming*, Theory Day of NVTI, 23 March, Utrecht: *A Uniform Framework for Constraint Propagation Algorithms*, Working Visit at the University of Oxford, 28 May, Oxford; *A Uniform Framework for Constraint Propagation Algorithms*, Working Visit RRIAI, 23 August, Moscow, Russia; *The Alma Project, or How Logic Can Help Us in Imperative Programming*, Working Visit RRIAI, 24 August, Moscow, Russia; *Constraint Programming viewed as Rule-based Programming*, Meeting of Cotic, 16 November, Amsterdam; *How to Write a Good Paper, the PhD Program during the CP 01 Conference*, CP 01, 26 November Paphos, Cyprus; *A Uniform Framework for Constraint Propagation Algorithms*, Working Visit at the Weizmann Institute, 4 December, Rehovot, Israel.
- C.E. Areces, *Description Logics, Hybrid Logics and The Land in Between*, Grolog Seminar, 24 January, Groningen; *Tree Heuristics for Modal Theorem Proving*, BNAIC'02, 25 October, Amsterdam; *HyLoRes: A resolution based prover for hybrid logics*, Learning Logic and Grammar, 23 November, Amsterdam; *Hybrid Logics: What, Why, How and How Much?*, Workshop on Logic, Philosophy and Belief Revision, 2 October, Buenos Aires.
- C. Caracciolo, *Organizing and Accessing Online Handbooks*, CLiP 2001, 7 December, Duisburg, Germany; *Logic and Language Links: disseminating electronic information,* OzsL school week, 24 October, Nunspeet.

■   R. Gennari, *Constraint Propagation from a Mathematical Perspective*, Doctoral Program of CP01, 1 December, Cyprus; *Beyond Hard Constraints (II)*, Logic & Constraints Seminars, 12 February, Amsterdam; *Beyond Hard Constraints (I)*, Logic & Constraints Seminars, 29 January.

■   J.M. Heguiabehere, *Pre- and postcondition reasoning with Dynamic FOL*, Workshop on Tableaux for Dynamic and Modal Logics, 5 April, Amsterdam; *The Random Modal QBF Test Set*, IJCAR '01 workshop: Issues in the Design and Experimental Evaluation of Systems for Modal and Temporal Logics, 19 June, Siena, Italy; *The Random Modal QBF Test Set*, Student Accolade, OzsL Autumn School, 21 October, Nunspeet; *Prefixed Resolution for Modal Logics: The HyLoRes Prover*, Tableau Extravaganza, OzsL Autumn School, 23 October, Nunspeet; *Direct Resolution for Hybrid Logics: The HyLoRes prover*, Workshop: Learning Logic and Grammar, 23 November, Amsterdam; *Direct Resolution for Hybrid Logics: The HyLoRes prover*, Inaugural Meeting of the LED-LIT Research Alliance, 7 December, Nancy, France.

■   Ir. W.J. van Hoeve, *The Alldifferent Constraint: A Survey*, Sixth Annual Workshop of the ERCIM Working Group on Constraints, 18 June, Prague.

■   M.J. Marx, *Situation calculus as hybrid logic: first steps*, 10th Portuguese Conference on Artificial Intelligence, EPIA'01, 17 December, Porto, Portugal; *Hybrid Logic and natural language*, Amsterdam Colloquium, 18 December, Amsterdam; *Tableaux for Quantified Hybrid Logic*, Methods for Modalities (M4M) Workshop, 29 November, Amsterdam; *Repairing the interpolation theorem in first order modal logic*, The Fourth International Tbilisi Symposium on Language, Logic and Computation, 23 September, Borjomi, Georgia; *Tolerance Logic*, Conference on Logic, Language and Logistics. Modelling and Cross-Disciplinary Discourse, 6 January, Las Cruces, New Mexico, USA.

■   R.J. Mokken, *Massive graphs and small worlds*, Network Analysis: New Perspectives, 14 February, Amsterdam; *The Dutch corporate network 1976-1996*, Conference on Corporate Governance in a Globalizing World: Changes in Structure and Strategy, 23 April, NIAS, Wassenaar.

■   C. Monz, *University of Amsterdam at CLEF 2001*, Cross Language Evaluation Forum Workshop, 9 September, Darmstad, Germany.

■   B. Ó Nualláin, *Ensemble-based prediction of SAT search behaviour*, SAT 2001: Theory and Applications of Satisfiability Testing, 14 June, Boston, MA, U.S.A.; *Constraint Tableaux*, Tableau Methods with Applications to Dynamic and Modal Logics, 5 April, Amsterdam; *Constraint Tableaux*, Tableau Extravaganza, 23 October, Nunspeet; *Almost Certain Proof*, Adult Accolade, 26 October, Nunspeet; *Constraint Tableaux*, LED-LIT Research Alliance Inaugural Meeting, 7 December, Nancy.

■   M. de Rijke, *Computing with Meaning*, NWO, February, Den Haag,
    Computing with Modal Logics, Department of Computer Science, Udine,
    March, Udine; *Experiments in Expressive Power*, IRCS, University of
    Pennsylvania, May, Philadelphia; *Light-Weight Inference in
    Computational Semantics*, IRCS, University of Pennsylvania, May,
    Philadelphia; *Tree-Based Practical Algorithms for Modal Logics*, IRCS,
    University of Pennsylvania, May, Philadelphia; *Towards a Test Set for
    Modal Logic*, ICoS-3, June, Siena; *The Modal QBF Test Set*, IJCAR
    Workshop on Issues in the Design and Evaluation of Modal Solves, June,
    Siena; *Information Retrieval*, ESSLLI, August, Helsinki; *8 Slides on
    WordNet*, CLLI Seminar, October, Amsterdam; *From Computational
    Logic to Language and Inference Technology*, Logic in Action Farewell
    Event, December, Amsterdam; *Language and Inference Technology*,
    LED/LIT Alliance, December, Nancy.
■   M.C. Stol, *Local Search and Modal Logic*, KI-2001/Modal Logic and AI,
    18 September, Vienna, Austria; *Adaptive Model Generation for Modal
    Logic*, BNAIC-2001, 25 October, Amsterdam.
■   I.E. Vermeulen, *Market Dynamics as an Evolving Network: Competition
    between Internet Search Engines*, ISCORE seminar, 14 December,
    Utrecht; *Organizational Differentiation: The Population of Web Search
    Engines*, Computational Analysis of Social and Organizational Systems,
    6 July, Pittsburgh, USA.

Scientific Functions
■   K.R. Apt, *Association for Logic Programming*, Member of the Executive
    Committee; *ERCIM Working group on Constraints*, Chairman
■   C.E. Areces, *European Association for Logic, Language and Information*,
    Information Officer.
■   R.J. Mokken, *Netherlands Institute for Advanced Study in the Social
    Sciences at Wassenaar*, *Netherlands*, NIAS Fellow.
■   C. Monz, *Special Interest Group on Computational Semantics (SIGSEM)*,
    Information Officer.
■   M. de Rijke, *Advances in Modal Logic*, President; *FoLLI,* Chief Executive
    Officer; *ESSLLI Standing Committee*, Chair; *Inference in Computational
    Semantics*, Member of Steering Committee; *Advances in Modal Logic,*
    Publicity Chair; *Methods for Modalities*, Member of Steering Committee;
    IFCoLog, Member of Executive Committee.

Editorships

■ K.R. Apt, *ACM Transactions on Computational Logic*, Editor-in-Chief and Founding Editor: *Journal of Logic and Computation*, Editor; *Theory and Practice of Logic Programming*, Editor.

■ J.M.F. Masuch, *Computational and Mathematical Logic*, Area Editor (Formal Logic and Mathematical Models).

■ M. de Rijke, *ACM Transactions on Computational Logic*, Editor; *Journal of Language and Computation*, Editor; *Journal of Logic, Language and Information*, Review Editor; *Studies in Logic, Language and Information*, Managing Editor.

Program Committees

■ K.R. Apt, *Journees Francophones de Programmation en Logique et de Programmation par Contraintes, JFPLC 2001*, Member of Program Committee, April, Paris, France; *Seventeenth International Conference on Logic Programming, ICLP 2001*, Member of Program Committee, November, Paphos, Cyprus.

■ C.E. Areces, *Methods for Modalities 2*, Chair, 29-30 November, Amsterdam.

■ R. Gennari, *CP01*, Member of Program Committee, 1 September, Cyprus; *Esop02*, Member of Program Committee, September; *SAC02*, Member of Program Committee, September.

■ M. de Rijke, *Inference in Computational Semantics 3*, Member of Program Committee, June, Siena, Italy; *TIME 2001*, Member of Program Committee, July, Udine, Italy; *BNVKI 2001*, Co-Chair of Program Committee, October, Amsterdam; *Methods for Modalities 2*, Co-Chair of Program Committee, November, Amsterdam; *LPAR 2001*, Member of Program Committee, December, Havana, Cuba.

Scientific Events Organized

■ K.R. Apt, *Sixth Annual Workshop of the ERCIM Working Group on Constraints*, 18-20 June, Prague, Czech Republic.

■ C.E. Areces, *Method for Modalities*, 29-30 November, Amsterdam.

■ M.J. Marx, *The 4th International Tbilisi Symposium on Language, Logic and Computation*, 25 September, Borjomi, Georgia.

■ C. Monz, *ACL Student Research Workshop (Co-Chair)*, 6 July, Toulouse, France.

■ B. Ó Nualláin, *Tableau Methods with Applications to Dynamic and Modal Logics*, 5-6 April, Amsterdam.

■   M. de Rijke, *Belgisch-Nederlandse Vereniging voor Kunstmatige Intelligentie (BNVKI 2001)*, October, Amsterdam; *Methods for Modalities 2*, November, Amsterdam.

Visiting Professorships

■   C.E. Areces, *Universidad de Buenos Aires. Buenos Aires. Argentina*, September-October.
■   M. de Rijke, *Department of Computer Science, University of Udien*, March; *IRCS, University of Pennsylvania*, May.

Scientific Awards

■   C. Caracciolo, *scholarship for participating in the Summer School on Digital Libraries*, CNR Italy, 9 July, Pisa, Italy.
■   M. de Rijke, *NWO GW Grant 220-80-001 'Computing with Meaning'*, NWO, February; *NWO EW Grant 612.000.106 'Complex Knowledge Base Classification'*, NWO, July; *NWO GW Vervangingssubsidie 365-20-005 'Redeneermethoden voor modale logica's'*, NWO, January.

Miscellaneous Scientific Functions or Activities

■   C. Caracciolo, Development of the prototype for the project: 'Logic and Language Links', Programming in Perl; Summer School on Digital Libraries, 9-14 July, Pisa.
■   Dr.ir. J. Kamps, (Co-)Organizer CLLI Seminar Series.
■   M. de Rijke, Principal Grantholder NWO Project 612.000.106: 'Complex Knowledge Base Classification', 2001-2004; Principal Grantholder NWO Project 220-80-001: 'Computing with Meaning', 2001-2006; Principal Grantholder NWO Project 365-20-005: 'Redeneermethoden voor modale logica's', 2000-2002; Principal Grantholder with Jan van Eijck Elsevier Science funded project: 'Logic and Language Links', 2001-2004; Principal Grantholder NWO project 612.069.006: Simulation and Testing for Feature Interaction, 2000-2004; Principal Grantholder NWO project 612.013.001: 'Underspecified Deduction for Information Extraction and Retrieval', 1999-2003; Co-Organizer CLLI Seminar.

ILLC Project: Algorithms and Complexity Theory

Principal Researchers
P.W. Adriaans, H.M. Buhrman, P. van Emde Boas, L. Torenvliet,
P.M.B. Vitanyi, R.M. de Wolf.

Lectures
■   P.W. Adriaans, *Sailing as a machine learning challenge*, ESCAPE,
     17 October, Groningen; *Semantic Induction with EMILE, Opportunities
     in Bioinformatics*, WLT19, Information Extraction in Molecular Biology,
     13 November, Enschede.
■   H.M. Buhrman, *Quantum Communication Complexity*, ACCS Seminar,
     19 January, Amsterdam; *Simultaneous message passing with quantum bits*,
     DIMACS/Rutgers Theory Seminar, 27 February, New Brunswick;
     Quantum Computing, NEC theory seminar, 8 March, Princeton;
     Quantum Computing, IBM Zurich seminar, 12 March, Zürich; *Shor's
     factoring algorithm*, Quantum Computing Seminar Princeton University,
     16 June, Princeton; *Quantum Computing*, New approaches toward
     computing, 9 November, Brussels; *Quantum Fingerprinting*, Physics
     Seminar, 22 November, Amsterdam.
■   P. van Emde Boas, *Imperfect Information Games*, *looking for the right
     model*, EIDMA Workshop on Cryptography, 7 December, Utrecht;
     Imperfect Information Games; looking for the right model, Workshop
     Games and Logic, 12 December, Amsterdam.
■   L. Torenvliet, *The communication complexity of enumeration, elimination
     and selection*, University of Rochester, Computer Science Department
     Seminar, 10 September, Rochester, NY; *Enumerations of the Kolmogorov
     Function*, Rochester Theory of Computer Science Seminar, 24 September,
     Rochester NY; *Communication Complexity*, Computer Science Seminar,
     SUNY Buffalo, 17 September, Buffalo, NY.
■   P.M.B. Vitanyi, *Algorithmic Statistics*, Neurocolt II Workshop on
     Computational Complexity Aspects, 23 March, Sestriere, Italy; *The
     Quantum Computing Challenge*, Santa Barbara Seminar, 30 May, Santa
     Barbara, California; *Time and Space Bounds for Reversible Simulation*,
     ICALP, 29 June, Hersonissos Greece; *Algorithmic Statistics*, Workshop
     on Algorithmic Information Theory, 25 September, Marseille;
     The Quantum Computing Challenge, Comp. Science Department
     Lisbon, 26 September, Lisbon, Portugal; *Optimal Multireader Registers*,
     Workshop on Distributed Algorithms, 2 October, Lisbon, Portugal;
     Algorithmic Statistics, Conference on Computational Learning Theory,

6 July, Amsterdam; *Dat Compression in Model Selection and Prediction*, NIPS 2001, 3 December, Whistler, Canada; *Algorithmic Statistics*, NIPS 2001, 8 December, Whistler, Canada.

- R.M. de Wolf, Quantum Fingerprinting, *Simultaneous Message Passing, and Data Structures*, QIP 2001, 11 January, Amsterdam; *Quantum Lower Bounds*, Fields Institute QC Summer School, 17 May, Toronto, CA; *Quantum Lower Bounds*, Waterloo Combinatorics Colloquium, 8 May, Waterloo, CA; *Communication Complexity Lower Bounds by Polynomials*, IEEE Complexity 2001, 19 June, Chicago.

Scientific Functions

- P.W. Adriaans, *Stichting HPCN*, Member of the Board; *Stuurgroep NWO onderzoek programma Cognitie* Member.
- H.M. Buhrman, *Fifth Framework QAIP*, Coordinator; *Annual Conference on Quantum Information Processing*, Member of the Steering Committee; *Annual Conference on Computational Complexity*, Member of the Steering Committee.
- P. van Emde Boas, *International Advisory board SOFSEM*, Member.
- P.M.B. Vitanyi, *Encyclopedia of Mathematics*, Member of the Scientific Board; *EU fifth Framework QAIP,* Member; *Network of Excellence QUIPROCONE*, Member; *ESF QiT programme*, Member; *ESPRIT BRA VI NeuroColt II Working Group*, Amsterdam Site Manager; *International Workshop on Distributed Algorithms,* Member of the Steering Committee; *IFIP WG 12. Descriptive Complexity*, Member; *IFIP WG 1.4 Computational Machine Learning*, Co-Chair.

Editorships

- P. van Emde Boas, *Information and Computation*, Editor; *RAIRO Informatique theorique*, Editor.
- L. Torenvliet, *Dutch Association for Theoretical Computer Science*, Member of the Board.
- P.M.B. Vitanyi, *Journal of Computer and System Sciences*, Guest Editor; *International Journal of Foundations of Computer Science*, Editor; *Distributed Computing*, Editor; *Theory of Computing Systems*, Editor; *Information Processing Letters*, Editor; *Parllel Processing Letters*, Editor; *Journal of New Generation Computer Systems*, Editor; *Frontiers in Computing Systems Research*, Editor.

Program Committees
- H.M. Buhrman, *Mathematical Foundations of Computer Science*, Member of Program Committee, 31 December, Marianske Lazne; *International Symposium on Theoretical Aspects of Computer Science*, Member of Program Committee, 31 December, Antibes-Juan le Pins; *Foundations of Software Technology and Theoretical Computer Science,* Member of Program Committee, 30 December, Bangalore; *Conference on Computational Complexity*, Member of Program Committee, 31 December, Montreal.
- P. van Emde Boas, *MFCS 2001*, Member, 26-31 August, Marianske Lazne Czech republic; S*OFSEM 2001*, Member, 24-30 November, Piestany Slovakia.
- P.M.B. Vitanyi, *13th European Conference on Machine Learning*, Member of Program Committee, 31 December, Helsinki; *COCOON 02*, Member of Program Committee, 31 December, Singapore; *ICALP*, Member of Program Committee, 31 December, Malaga; *Complexity and Inference*, Member of Program Committee, 31 December, DIMACS.

Scientific Events Organized
- P.M.B. Vitanyi, *Workshop on Complexity and Inference*, 31 December, Rutgers University.
- R.M. de Wolf, *Quantum Information Processing 2001*, January, Amsterdam.

Visiting Professorships
- L. Torenvliet, *University of Rochester*, September 2001-October 2002.

Miscellaneous Scientific Functions or Activities
- P.W. Adriaans, Chair of the Taskgroup Next Generation Scenario for Multimedia of the Dutch Ministry of Economic Affairs; Member of the Taskforce ICT-en-Kennis of the Dutch Ministry of Economic Affairs and the Ministry of OC&W; Member of the NWO Programmavoorbereidingscommissie Biomoluculaire Informatica.
- P.M.B. Vitanyi, Publiciteitscommmissie van het Wiskundig Genootschap; Advisor Monash Key Center for Computational Data Analysis; Advisor and Evaluator for the Japanese Discovery Science Project; Member of the Dutch Robosoccer committee; Project Leader various projects in Machine Learning: Multiple Computing Agents, Cryptography and Randomness, Quantum Computing.

APPENDIX 5 CONTACT INFORMATION

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Projects

ToI = Theory of Interpretation
CSIP = Cognitive Systems and Information Processing
CIL = Constructive and Intensional Logic
LIT = Language and Inference Technology
ACT = Algorithms and Complexity Theory

Work locations

PM24 = Plantage Muidergracht 24; 1018 TV Amsterdam; fax 020 525 5206
ND15 = Nieuwe Doelenstraat 15; 1012 CP Amsterdam; fax 020 525 4503
NA166 = Nieuwe Achtergracht 166; 1018 WV Amsterdam; fax 020 525 2800
CWI = Centrum voor Wiskunde and Informatica; Kruislaan 403; 1098 SJ Amsterdam; fax 020 592 4199
S134 = Spuistraat 134; 1012 VT Amsterdam; fax 020 525 4429

APPENDIX 6: OBTAINING FURTHER INFORMATION

All information concerning the institute can be obtained from the ILLC Bureau:

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Please contact the bureau if you would like to obtain one of the following (series) of documents:
- ILLC Research Reports and Master theses
- ILLC Dissertations
- ILLC Research plan 2001-2004
- ILLC Brochure Graduate Program in Logic
- ILLC Brochure Logic in Action
- ILLC Annual Report
- Proceedings of scientific events (such as the Amsterdam Colloquia) organized by ILLC
- Other documentation, e.g. concerning visits or scholarships

Information about activities based at or represented by ILLC can be obtained from the following persons or www-addresses:

- *Folli:* Ria Rettob
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- *Graduate Program in Logic:* Peter Paul de Witte
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