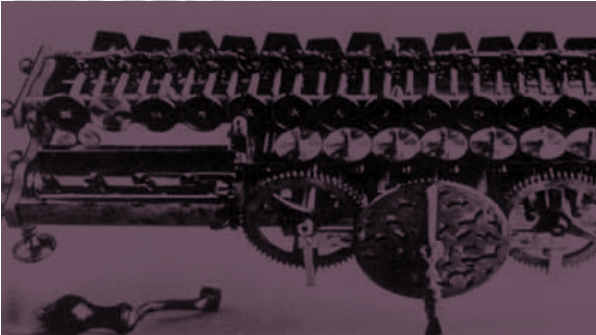
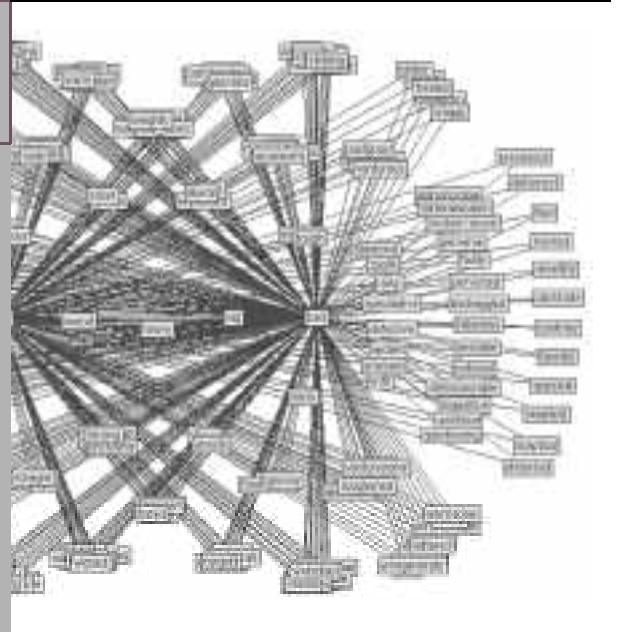
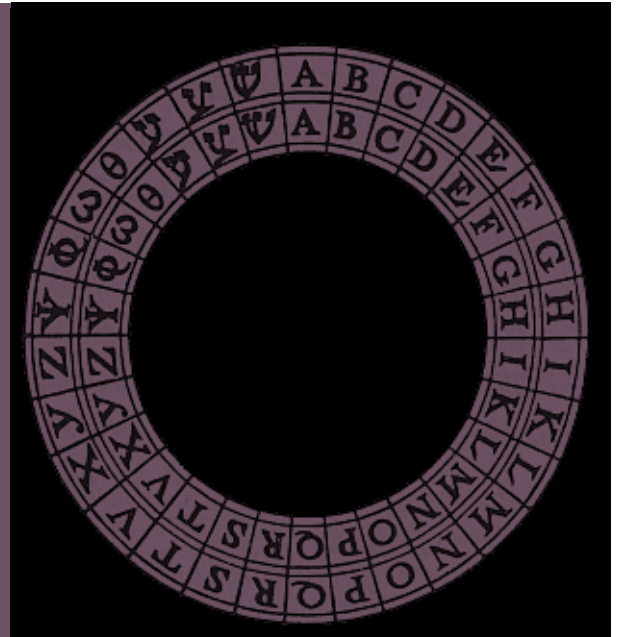


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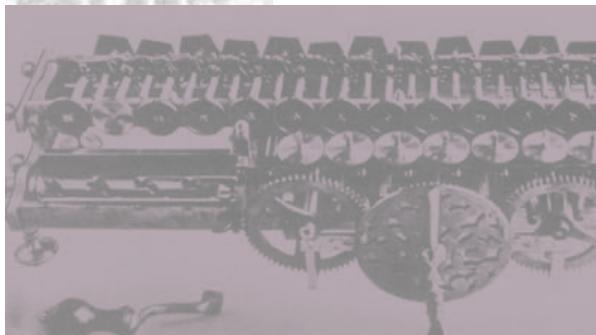


Annual Report 2004



FACULTY OF SCIENCE

UNIVERSITEIT VAN AMSTERDAM



Institute for Logic, Language and Computation

Annual Report 2004

Amsterdam, April 2005

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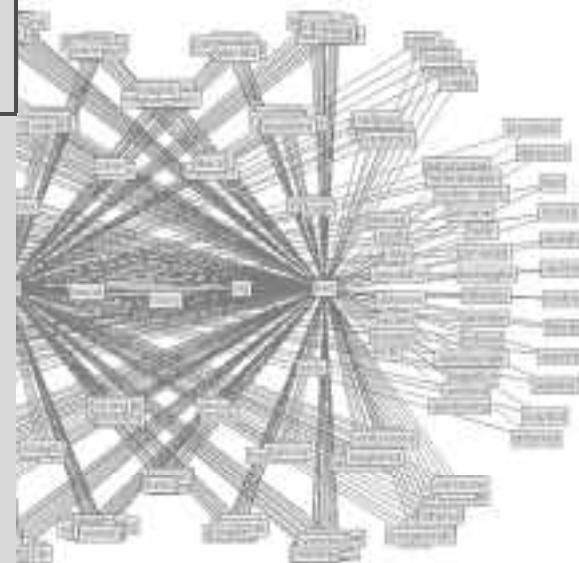


INSTITUTE FOR LOGIC,
LANGUAGE AND COMPUTATION



FACULTY OF SCIENCE

UNIVERSITEIT VAN AMSTERDAM



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1. Annual Survey

1.1 Scientific mission

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 the ILLC sees itself is that of an information science that 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. Developing logical systems that can handle this rich variety of information, making use of insights across such disciplines as linguistics, computer science, cognitive science, artificial intelligence and philosophy are research aims at the ILLC. Whenever relevant, additional methods, ranging from statistics to argumentation theory, are actively pursued as well. In addition to its specific research goals, ILLC aims to overcome traditional borderlines between faculties and disciplines and serves as a rallying point for information scientists across computer science, linguistics, philosophy, and the social sciences. The resulting view of information science transcends the boundaries of the university. The ILLC is also committed to dissemination of its results into the broader world of general education, vocational training and industrial research.

1.2 ILLC in 2004: a year of transition

The Universiteit van Amsterdam is not the only university that employs many logicians, but it is unique in having them all work in one research institute. In other universities you may find logicians in institutes for Computer Science, Mathematics, Philosophy, and sometimes even in institutes for Linguistics. However many of them work rather isolated and in the margin of their institutes, without much contact with logicians of other 'rival' departments. In the ILLC logicians with different backgrounds and orientations work together. All of them have strong ties with at least one other discipline. That is why, within the Universiteit van Amsterdam, the ILLC can serve as a bridge between the humanities and the natural sciences. It is also why the ILLC can take the lead in bringing researchers from different fields together to get new interdisciplinary activities off the ground.

1.3 Teaching

The list of teaching programs in which ILLC participates gets longer every year. In 2004 courses were given in the Betagamma bachelor, the master of Rhetoric,

Argumentation & Philosophy, the master of Cognitive Science and the bachelor and master tracks of Philosophy, Computer science, Artificial Intelligence, Linguistics, and Mathematics.

Still, the focus of our teaching activities is in the Master of Logic, a two year international research master. The wide range of courses in logic and its applications offered in this program attracts many students from all over the world. Currently, we have 38 active students, more than half of which are from abroad.

The MSc in Logic was very successful in the NWO program Mozaiek funding foreign nationals with a Dutch degree for their PhD research. Three of our graduates competed and received excellent reviews. Two of them, Loredana Afanasiev and Reut Tsarfaty, were selected to receive a personal Mozaiek grant and are now working as PhD students at the IvI and the ILLC, respectively. And although she was not selected for Mozaiek, the reviews for Fenrong Liu's project were so excellent that the UvA decided to fund a PhD position for her, and she now started to work at ILLC for her PhD groups.

1.4 Research

As the project reports show, the numbers of refereed publications, invited talks, conferences organized and other types of scientific output continue to be at high levels. Still, the year 2004 had its drawbacks. We were less successful getting funding for our research than we usually are. Last year we proudly announced that no less than six applications with ILLC-members as (co-)applicants had made it to the final round in NWO's Cognition Programme, most with the qualification 'excellent'. Unfortunately, in the end NWO choose to fund only projects with a neuroscientific component, which meant that only one of our proposals got through. It is the project 'Reasoning and the Brain' in which ILLC's Michiel van Lambalgen is co-applicant together with Peter Hagoort of the FC Donders Centre for Cognitive Neuroimaging in Nijmegen. NWO's policy in this matter came as a shock not just for ILLC, but for many research groups in the Netherlands. Our reaction has been to try and get the other projects off the ground anyway. For one of the projects 'The evolution of Meaning in a game theoretical setting' this turned out to be relatively easy since the Belgian partners in this project got funding for the experimental part from the Belgian FWO, while Robert van Rooy got a VIDI grant for the project The Economics of Language: Language Use and the Evolution of Linguistic Convention, which means that many of the theoretical questions of the original project can be addressed anyway.

Outside NWO's cognition programme we were quite successful as the VIDI grant awarded to van Rooy shows. Rens Bod received funding in the open competition of NWO-Exact for the project Unsupervised Stochastic Grammar Induction, and Henkjan Honingh was funded by NWO-Humanities for the project Music as a social, psychological, and acoustical phenomenon: a cognitive revolution in musicology.

1.5 People

Near the end of 2004, two of the people who started the co-operation between philosophers and mathematicians that would eventually lead to the foundation of our research institute gave their goodbye lectures: Renate Bartsch, professor of Philosophy of Language, introduced her newest book in a talk entitled 'Language and Consciousness', and Dick de Jongh, professor of Mathematical logic and the Foundations of Mathematics, gave an overview of his scientific development in 'Completeness and Incompleteness'. Both are emeritus professor now, but they have kept their office and are working hard as ever.

In June Michael Masuch retired. A great propagator of logic in the social sciences, he joined the ILLC with his Applied Logic Lab in 1996. He and Maarten de Rijke founded the Language and Inference Technology (LIT) group in 2001. The group quickly grew to become an award-winning group of over 20 people pursuing foundational, experimental, and applied research in intelligent information access.

In April, one of the most dedicated ILLC members, Maarten de Rijke, and with him a large part of the LIT- group, left ILLC and moved in with the Informatics Institute. At the Informatics Institute, Maarten took up a full professorship in Information Processing and Internet. His PhD-students and post docs moved with him, among them Maarten Marx who also was a very active ILLC-member for quite some time.

Clearly then, ILLC is in a period of transition. In 2005 a new long term research plan will be defined, and the research projects will be restructured so as to encompass the scientific developments in the five last years.



2. Fundamental Research

Annual report 2004

2.1 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 that make up ILLC. The 2004 project reports can be found in chapter 6.

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

The project Language and Inference Technology ended in April when a large part of the LIT group moved to the Informatics Institute. The reader is referred to the Annual Report of the Institute of Informatics for a project report of this group for the entire year 2004. In the Informatics Institute the work of this group is continued under the heading Information and Language Processing Systems.

2.2 Project reports

2.2.1 Theory of Interpretation

Project leaders

Jeroen Groenendijk, Martin Stokhof

Characterization

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

Main Themes

The three main themes in the project are: interpretation in conversation; cognitive aspects; philosophical backgrounds. Research on interpretation in conversation focuses on interpretation as an element in the process of linguistic information exchange. It builds on earlier research on the dynamics of interpretation at sentence level, applying the results of that research to phenomena that play a key role in the structuring of discourse, in particular of conversations. Relevant empirical phenomena that are studied here include

question-answering, the structure of information in conversational exchange, and the use of mood and intonation. Increasingly the research in this theme makes use of decision theory and game theory in the analysis of the procedures used by rational communicative agents in both production and interpretation. This research had strong links with ongoing work on game theory and dynamic logic in the project Constructive and Intensional Logic.

Central in the second theme, cognitive aspects, is the framework of 'dynamic conceptual semantics' (DCS), a formal model of the way in which concepts arise from (relatively) unstructured data. This model is closely connected with the data-oriented approach towards information processing that is used in the project Logic and Cognitive Systems. Currently, research in DCS is directed towards the role of memory (general and specific historical memory) in the understanding of situations and linguistic utterances. Another topic in this theme is concerned with the clarification of the roles of experience and appreciation in skillful coping as source of (linguistic) normativity. 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 origins, development and employment of the notion of an ideal language; backgrounds and status of the principle of compositionality; the status of formal semantics as scientific discipline; Wittgenstein's notion of 'perspicuous representation' in relation to installation art; and the nature and consequences a Wittgensteinian analysis of subjectivity.

2004

Interpretation in conversation

Research within the first theme, interpretation in conversation, saw several interesting developments. In the NWO and KNAW projects Formal Language Games and Games, Relevance and Meaning. Questions, conversational implicatures, and the notion of relevance have been studied further. The focus has been on the particular ways in which linguistic means guide cognitive agents in structuring information in context, and the way in which that fits in with their rational activities and decision making. Innovative is the general perspective on these issues, which takes into account formal (syntactic and prosodic) and pragmatic (conversational) aspects, which pays due attention to the cognitive and social nature of these agents. Systems of dynamic semantics and theories of question-answering and topic/focus have been integrated further, and more in particular the structure of information and strategic inquiry has been investigated from both an internal (qualitative) and external

Annual report 2004

VIDI Grant for Robert van Rooy

Language is one of the most precious gifts nature has bestowed upon us. It allows us to cooperate better with other individuals by enabling us to communicate useful and relevant information. What is it about language and our use of it that allows us to do so? It is the combination of stable linguistic rules and flexible reasoning. On the one hand, what we intend to communicate, – the meaning of the utterance – is to a large extent governed by shared rules that we all make use of. On the other hand, we often communicate more by the use of an expression than can be derived from these linguistic rules alone, and this depends on (features of) context and the assumption that speakers are rational cooperative language users.

The overall aim of this VIDI project is to investigate

- (i) which factors are favorable to the emergence and sustenance of linguistic rules,
- (ii) how we use rationality principles to infer what is communicated in actual conversation, and
- (iii) how we balance interpretation by linguistic rules and by reasoning.

Evolutionary game theory will provide the unified framework in which these issues will be addressed.

Standard game theory and decision theory – the most rigorous and successful explications of rational behavior and decision making we have – will be employed to describe the extra-linguistic information communicated in actual conversation. Evolutionary game theory will be used to give a functional motivation of why linguistic rules that enhance efficient and reliable communication evolve more naturally than ones that don't.

(quantitative) perspective. Methodologically, the connections between dynamic semantics, game theory, and decision theory have been strengthened. Philosophical foundations of such theories are tested by investigating how and to what extent the evolution and use of natural language relies on a balance between cognitive (rationality) and social (conventional) aspects and these are tested in collaboration with colleagues in Brussels. Paul Dekker has established new results on the notion of an optimally informative discourse, while van Robert van Rooy provided a game-theoretical motivation for the evolution of some conversational principles and formalized various notions of relevance making use of decision theory, and compared them with respect to their linguistic use. In joint work with Katrin Schulz, Robert van Rooy also provided a formal analysis of some Gricean conversational implicatures in terms of non-monotonic logic. In 2004, van Rooy was awarded the Hendrik Casimir-Karl Ziegler research grant from the KNAW, and as such he started to cooperate with researchers at the University of Bonn, to set up experiments to test theories of focus-interpretation. Van Rooy also was awarded an NWO VIDI-grant, which will start in 2005. A major milestone was the publication of Alistair Butler and Eric Mathieu's book *The Syntax and Semantics of Split Constructions: A Comparative Study*. Even though the title may suggest otherwise, the impact of this book lies on the interface of both syntax, semantics and pragmatics. Marie Safarova continued experimental work on the semantics of intonation, and achieved experimental results which definitely invite a reconsideration of some truisms in the theoretical linguistic literature. These will be developed further in her thesis due in 2005.

Cognitive aspects

As for the second theme, cognitive aspects, Renate Bartsch completed the manuscript of a new book *Memory and Understanding. Consciousness in Proust's 'A la recherche du temps perdu'*, which will appear in 2005 in the series *Advances in Consciousness Research* with John Benjamins Publishing Company, Amsterdam/Philadelphia. The new book is a further elaboration and application of the theory of Dynamic Conceptual Semantics (1998) and *Consciousness Emerging* (2002) with respect to the general and specific (historical, episodic) memory and its role in understanding. Characteristic for the method of this research is the parallel of a phenomenological and semantic approach with developing a connectionist model of neuro-activation as an architecture that takes into account recent neuro-scientific findings about the working of the memory. Erik Rietveld's work on experience and skilful coping was extended with an investigation of so-called 'utilization behavior' as a possible neurological 'testing ground'.

Philosophical backgrounds

In the third theme, philosophical backgrounds, Jaap Maat continued his research on Leibniz's ideas on rational grammar. A selection of unpublished texts has been translated and annotated and put into historical context; the book manuscript is expected to be completed in early 2005. Theo Janssen broadened his research on Hintikka's logic for information independence to other, related logics. In collaboration with Caicedo (Bogota) and Dechesne (Tilburg) he obtained several results concerning a generalization of Hintikka's original system: it was shown that the traditional prenex normal form theorems do not hold and that a new notion of equivalence is required. These results will be published in 2005. Furthermore applications of Hintikka's logic to quantum mechanics were investigated. Jeroen Groenendijk and Martin Stokhof investigated which philosophical assumptions underlie the use of compositionality in modern semantics; the results will be published in 2005. Tine Wilde published some initial results of her investigation of Wittgenstein's 'perspicuous representation' and his remarks on color; Chantal Bax's research on subjectivity was started in September 2004.

Key publications

Butler, A and E. Mathieu, 2004. *The Syntax and Semantics of Split Constructions: A Comparative Study* Hampshire: Palgrave Macmillan

Dekker, P., 2004. 'The pragmatic dimension of indefinites', *Research on Language and Computation* 2: 365-399

Dekker, P., 2004. 'Grounding Dynamic Semantics'. In A. Bezuidenhout & M. Reimer (eds.), *Descriptions and Beyond: An Interdisciplinary Collection of Essays on Definite and Indefinite Descriptions and other Related Phenomena* Oxford: Oxford University Press, 484-502

Jaap Maat, 2004. *Philosophical Languages in the Seventeenth Century: Dalgarno, Wilkins, Leibniz* New Synthese Historical Library, Volume 54. Dordrecht: Kluwer.

Roosj, R. van, 2004. 'Signalling games select Horn strategies', *Linguistics and Philosophy* 27: 493-527

Roosj, R. van and K. Schulz, 2004. 'Exhaustive interpretation of complex sentences', *Journal of Logic, Language and Information*, 13: 491-519

Wilde, T., 2004. 'Wittgensteins reflectieve dynamiek', *Algemeen Nederlands Tijdschrift voor Wijsbegeerte*, 96: 85-113

2.2.2. Cognitive Systems and Information Processing

Project leaders

Michiel van Lambalgen, Remko Scha

General characterization.

CSIP collects a number of researchers who engage in empirically oriented investigations on language, logical reasoning, and music. These empirical methods include use of large corpora, psychological experiments and brain imaging, in addition to developing mathematical and computational models for the data obtained. The researchers in this project share a commitment to the philosophy of science: reflections on what constitutes good models form part of our daily activities. The output of the research can vary from the usual scientific articles and books to software and diagnostic tests for medical use.

2004

Music cognition

Most of the research on music cognition takes place within the framework of the NWO Vernieuwingsimpuls-project awarded to Rens Bod: Towards a Unifying Model of Linguistic, Musical and Visual Processing. This NWO project is concerned with the development of computational models that analyze both linguistic, musical and visual input. It aims to do so by combining memory-based approaches and rule-based approaches in the context of the Data-Oriented Parsing (DOP) framework. A number of psychological experiments have been carried out to investigate the persistence of previously heard musical chunks. A DOP model was developed that can accurately model these experiments.

The notion of convexity was developed for musical items. It turned out that all known scales, chords, harmonic reductions and pitch classes form either convex or star-convex sets. This fascinating geometrical structure of music cries out for an explanation, which hitherto has not yet been found (apart from proposing the preference for convex structures as an underlying cognitive principle). Henkjan Honing's research project is concerned with the computational modeling of music cognition, focusing on the temporal aspects of music such as rhythm, timing and tempo. This research focused on a comparison of two families of computational models (kinematical and perceptual) of rhythm, timing and tempo in music. In addition, the comparison was used as a methodological case study in model selection. While the most common way of evaluating a computational model is by showing a good fit with the empirical data, recent literature on theory testing criticizes the assumption that this is

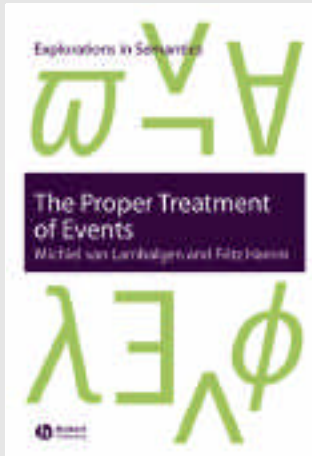
actually strong evidence for a model. The two approaches (kinematical and perceptual) were compared using four different model selection criteria: goodness-of-fit, model's simplicity, falsification, and the amount of surprise in the predictions. In the light of what accounts as strong evidence for a theory — i.e. making precise (i.e. constrained), non-smooth, and relatively surprising predictions — the perception-based models were argued to be in a much stronger position than the kinematical models, even though the latter might seem simpler and more natural.

Data-oriented parsing

The NWO funded project Learning Stochastic Tree-Grammars from Treebanks (LeStoGram) aims at devising methods for automatic learning of statistical syntactic analyzers (parsers) for natural languages. The focus is on methods for statistical estimation that are theoretically well-behaved and that can be evaluated empirically. The Treebank-Grammar approach to natural language analysis (and in particular, our own Data Oriented Parsing paradigm) was analyzed from a statistical point of view, looking properties such as bias and consistency. It turns out that empirically adequate versions of DOP should be described in terms of non-parametric estimation. The work in 2004 also produced the first method that is proven to be well-behaved and to empirically outperform other existing methods on actual data. Along another line, our work on probabilistic models for morphological analysis of Semitic languages, especially Modern Hebrew, continued in 2004 in cooperation with the Technion, Haifa, Israel. After four years of foundational work that built the necessary corpora, our cooperation finally produced in 2004 the first such analyzer that achieves useful performance on actual newspaper text. For this topic, a highly competitive NWO -Mozaiek grant was acquired for Reut Tsarfaty. Also, a new NWO-Exact projects started this year: Unsupervised Stochastic Grammar Induction. This project aims at solving the problem of automatic language acquisition by integrating DOP and language evolution models. The convergence of DOP over several (simulated) language generations has been investigated resulting in a number of new estimation techniques.

Discourse and optimality theory

Continuing earlier research on applying bidirectional Optimality Theory to the domain of semantics and pragmatics (Blutner and Zeevat, 2004), the draft version of a new book entitled Optimal Communication has been finished (joint work with Helen de Hoop (Nijmegen) and Petra Hendriks (Groningen)). The publication by CSLI is planned for 2005. In this book, ideas from Optimality Theory are applied to the domain of interpretation. The central idea of



From the cover of the book

"This fine book is a welcome addition to the Explorations in Semantics series. The coverage of the very complex literature in the area is very good. Content, style, and presentation are all excellent, and tutorial exercises of the kind appropriate for use as a basis for a graduate seminar are included." *Mark Steedman, University of Edinburgh*

"This elegant book redefines the traditional study of temporal reasoning. Merging insights from cognitive science, computer science, and linguistics, the authors propose an event calculus for natural language that is computationally tractable and logically appealing. This original synthesis of AI and linguistic

semantics feels like a natural fit from the start." *Johan van Benthem, University of Amsterdam and Stanford University*

"This volume helps to bring the study of tense and aspect, and the correlative study of events in linguistic semantics, within the purview of algorithmic conceptions of meaning, and other notions derived from abstract computer science. It will be an important companion to classical logical and syntactic studies, contributing to what we may hope will be an eventual unification of the computational and classical viewpoints." *James Higginbotham, University of Southern California*

The Proper Treatment of Events offers a novel approach to the semantics of tense and aspect motivated by cognitive considerations. The book begins by presenting data about the human conceptualization of time, proposing that planning is important in this regard, and hence equally for the linguistic encoding of time as tense and aspect. It then introduces a formal theory of planning, a combination of an event calculus as developed in Artificial Intelligence with a truth theory and logic programming techniques. The combined system is then applied to detailed analyses of tense, grammatical and lexical aspect, coercion, and different types of nominalizations.

The book is accompanied by a website (<http://staff.science.uva.nl/~michiell/>) that provides slides for instructors and background material for students.

Optimality Theory is that surface forms of language reflect a resolution of conflicts between competing constraints. A grammatical form is the optimal form incurring the least serious violations of a set of hierarchically ranked constraints. Applying this idea to the domain of interpretation, meanings are viewed as the result of a process of conflict resolution between competing constraints as well. The ultimate interpretation is obtained through an optimization process determining the optimal meaning on the basis of a set of constraints that are not only syntactic but also semantic and pragmatic in nature. The framework of Optimality Theory thus allows for an integration of pragmatic knowledge into semantic theory in a very straightforward fashion. The second area of research is centered around the investigation of formal systems that are suitable for grounding the formal basis for a unified symbolist-connectionist theory. Recently, Smolensky and Legendre have proposed an integrated connectionist/symbolic cognitive architecture (ICS) that promises to overcome this gap. Reinhard Blutner's 2004 ILLC report discusses parts of this monumental oeuvre. The conclusion is that, while ICS is mainly concerned with reducing the symbolic system (the OT Grammar) to plausible neural models, this is not enough – in particular by criticizing the ICS approach to the innateness question.

Cognitive approaches to semantics

This research takes place in the framework of the NWO-funded program Logic meets psychology: nonmonotonicity. Together with Fritz Hamm (Tübingen) Michiel van Lambalgen published the book *The Proper Treatment of Events* (Blackwell, 2004) in which a formal semantics for tense and aspect is proposed, based on a cognitively motivated theory of time which takes the capacity for planning to be underlying the construction of time, and its representation in language.

The empirical component of the program was strengthened by the award of an NWO-Cognition grant to a project entitled Reasoning and the brain, a joint venture of ILLC, F.C. Donders Centre Nijmegen and the Psychiatry Department of the University Medical Centre Nijmegen. One goal of the project is to investigate mental processing of temporal expressions (including tense and aspect) by means of EEGs, in order to test some predictions of the model proposed in the aforementioned book. Another goal is to investigate reasoning processes in autistic patients, which will hopefully result in improved diagnostic tests.

Time and tense also plays a role in the work of the Mood and Modality group headed by Frank Veltman, where it is investigated in relation to counterfactuals. Another important topic of investigation here is the (in)possibility of mixing

moods and modalities. Examples are furnished by sentences such as 'Drop that knife or I'll shoot' (felicitous mixing of imperative and indicative mood), 'Maybe you should stop judging books by their cover' (felicitous mixing of deontic and epistemic modality) and '* It ought to be case that he might be ill' (infelicitous mixing of deontic and epistemic modality). The task here is to investigate these patterns in several languages via a typological study and then to provide a formal semantics for the data.

Key publications

Blutner, R., 2004. 'Pragmatics and the lexicon'. In: L. R. Horn and G. Ward (Eds.) *Handbook of Pragmatics* Oxford, Blackwell

Hinzen, W., 2004. 'Origins of Truth', *Linguistics and Philosophy*26: 760-780.

Hollink, V., J. Kamps, C. Monz, and M. De Rijke, 2004. 'Monolingual document retrieval from European languages', *Information Retrieval*, 7:33-52

Jongsma, M. L., P. Desain, and H. Honing, 2004. 'Rhythmic context influences the auditory evoked potentials of musicians and nonmusicians'. *Biological Psychology*66: 129-152

Lambalgen, M. van, and F. Hamm, 2004. *The proper treatment of events* Oxford, Blackwell

Stenning, K, and M. van Lambalgen, 2004. 'A little logic goes a long way', *Cognitive Science*28:481-529

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2.2.3 Constructive and Intensional Logic

Project leaders

Johan van Benthem

Characterization

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

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

Traditionally, the main mathematical models covered were intuitionistic and modal logic, and this historical perspective is honoured in the terms "Constructive" and "Intensional" in the project title. Current research extends beyond this traditional scope to include game-theoretic and set-theoretic approaches and combine them with the constructive and intensional techniques. More specifically, our project deals with the themes Logic of Communication and Learning, Logic and Games, Mathematical theory of modal logic, and Foundations of Mathematics. There are many links between these four themes that allow to see our research as aspects of one important foundational question.

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

2004

Logic of Communication and Learning.

Modal logics are well-suited for analyzing knowledge, action and communication in systems with many agents. We study a wide range of modal

systems for information update and interaction, aiming for a framework combining broad coverage with elegant mathematical foundations.

In her PhD thesis (supervised by Larry Moss, Bloomington IN), Maricarmen Martínez made case studies concerning the plausibility of using state spaces and the theory of Barwise-Seligman information flow in the modeling of pragmatic aspects of commonsense reasoning. She received her PhD degree in 2004 before joining the ILLC staff. In this year, she isolated all of the logical rules observed to be relevant to these case studies, and used those to formulate a proof-search formalism that successfully models several of the context and meaning dependent effects which are associated with everyday inference.

With Jan van Eijck and Barteld Kooi, Johan van Benthem found a complete dynamic-epistemic logic of actions with common knowledge. Its compositional reduction axioms apply to complex scenarios such as email with bccs, using Kleene's characterization of regular languages in an essential way.

Yoav Seginer studied unsupervised learning algorithms that (without prior knowledge of a language) induce grammatical information from adult speech directed at children. The algorithms were tested on adult speech extracted from the CHILDES corpus. In the next stage of the research, these induced grammatical properties will be used as the first stage in bootstrapping a parser for the input language.

The month of December 2004 was bustling with research activity surrounding this theme (in connection with the theme Logic and Games): Boudewijn de Bruin's PhD defense was combined with the ninth workshop on Games in Logic, Language and Computation (GLLC 9) at which international speakers as Rabinowicz (Lund) and Pauly (Toulouse) spoke. A few days later, Olivier Roy organized a special event entitled The Dynamics of Reason. In the same month, four PhD students from Stanford (Girard, Sadzik, Sarenac and Snyder) visited our group with a special week of workshops for all researchers (organized by Roy).

Logic and Games.

It is well-known that the concept of a game is useful for social sciences and in economics, and it has been via game theory that mathematical methods have been strongly introduced to these sciences. But there has also been a strong interaction between foundational work in mathematical logic and the theory of games. One important interest of recent years has been the analysis of more liberal game concepts: imperfect information games, many player games, games with uncertainty, and others.

Stefan Bold and Benedikt Löwe have continued their work on the consequences of game-theoretic axioms for infinitary combinatorics. Bold had spent the

Highlight Constructive and Intensional Logic

Infinite games have been investigated by mathematical logicians for many decades, but mostly neglected by game theorists. One of the goals of the conference was to bring the two communities closer together. We are very proud to realize that our conference was highly successful on that account. As Adam Brandenburger put it after the conference, "game theorists should not work on the foundations of mathematical game theory while ignoring the work done in logic on the same topic. It is necessary that these two communities grow together, but we should not expect this to happen in a few weeks. This conference was a most important first step for this." We received high praise from all of the participants of the conference. Kevin Kelly wrote "it was the first conference where the participants didn't feel like outsiders. Meeting this thematically connected group of very smart people at individual events would have taken years."



academic year 2003/04 at the University of North Texas (UNT) as a guest of Steve Jackson and came to Amsterdam in August 2004. The goal of the technical project (funded in the bilateral programme of the NWO with the DFG) they are working on is to understand the distribution of Jónsson cardinals under the assumption of the axiom of determinacy. In summer 2004, Bold and Löwe succeeded in giving a very simple inductive construction for computing more Jónsson cardinals that was presented by Bold at international conferences in Torino and Heidelberg. Löwe visited UNT in October 2004 and developed a very fruitful approach together with Jackson that promises to allow a full analysis of the distribution of Jónsson cardinals.

Brian Semmes received a DAAD grant for a three-month visit to Bonn. During this time, he worked on a joint paper with Löwe determining conditions under which an infinite game admits a combinatorial labelling. After the summer, Semmes started working on eraser games. This continues work by Löwe going back to 2003. Together with the MSc student Samson Tikitu de Jager, Löwe has improved his algorithmic applications of the many-player games to yield a linear time algorithm for asymmetric combinatorial games.

In December 2004, Boudewijn de Bruin received his PhD degree with a thesis entitled *On the Logic of Game Theoretic Explanation*, thereby linking game-theoretic research to questions of rationality and communication. In a similar line of research and motivated by de Bruin's criticism of rationality concepts in games, Löwe started a wide-ranging collaboration with Perea (Maastricht) and Pacuit (New York) on belief-revision and games. Equally related were Johan van Benthem's and Fonrenge Liu's results on dynamic-epistemic logic in an imperfect information context allowing for a stepwise extension of expressive power for communication processes. Liu got the support of the University of Amsterdam to start doctoral research on the topic of logic and games in 2005.

Mathematical theory of modal logic.

Our general goal is to obtain a deeper understanding of the properties of modal formalisms by embedding modal logic in its wider mathematical environment. Modal languages are designed to strike a balance between reasonable expressive power and manageable computational complexity. An in-depth study of this trade-off links modal logic with areas like automata theory, and (finite) model theory. Algebraic logic, the study of systematic connections between logic and classes of algebras, is another key perspective for understanding modal logic: our investigations center around questions of correspondence, duality and canonicity. And finally, a promising recent perspective on modal logic that we are taking on modal logic is that of coalgebra, the study of state-based systems in their most abstract form.

Yde Venema wrote a seminal paper in which he reevaluates the fruitful connections between automata and logic. These connections have been used in research for many years, but no one has so far properly investigated and exploited the coalgebraic flavour of the connection. Venema developed this coalgebraic theory of automata in detail and connected it with game-theoretic questions. In cooperation with Clemens Kupke, he showed that certain useful closure properties can be proven for these automata, in particular that one can always transform an alternating coalgebra automaton into an equivalent non-deterministic one. This provides some evidence that it is reasonable to study automata on this level of abstraction. Furthermore Kupke continued working on modal logics for coalgebras together with Kurz and Pattinson.

In addition to that, Venema continued his joint research with researchers around the world, for instance, in a joint paper with Gehrke and Harding (Las Cruces NM) on MacNeille completions.

Important progress in the investigation of the relationship between modal logic and first-order logic was achieved by Balder ten Cate, who proved results on preservation under ultrapowers, the guarded fragment and hybrid logic. Together with Nick Bezhanishvili, ten Cate defined the notion of a hybrid companion of a modal logic and investigated the properties that transfer from a modal logic to its hybrid companion. Among other things, they proved that in many cases complexity, (uniform) interpolation and finite axiomatization transfer from a modal logic to its hybrid companion. Also van Benthem was working on the guarded fragment and found a new proof that guarding quantifiers and using generalized assignment semantics for a first-order language amount to the same thing. In addition to that, van Benthem finalized a model theoretic characterization theorem for operators defining minimal predicates satisfying some given first-order description, providing an alternative to standard fixed-point languages.

Löwe solved a question of Albert Visser on categories of interpretation: Visser had conjectured that the theories ZF and ZFU are homotopic but not synonymous. Löwe refuted Visser's conjecture by constructing a synonymy between ZF and ZFU. In July 2004, together with Joel Hamkins (New York), he worked on determining the modal logic of forcing and proved that it is stronger than S4.2 but weaker than S4.3 and S4.2.1. He received an NWO travel grant to visit Hamkins in New York in 2005 in order to continue this line of research.

Foundations of Mathematics.

Historically, logic is strongly connected to philosophical questions about the

foundations of mathematics. These questions connect to research in the project in multiple ways: some parts of the research is direct philosophical investigations into foundational questions, other parts concern the investigation of logics that correspond to different philosophical foundational positions (e.g., intuitionistic logic).

Löwe and Müller (Bonn & Oxford) have continued their philosophical research on mathematical knowledge. They organized a research network called PhiMSAMP (Philosophy of Mathematics: Sociological Aspects and Mathematical Practice) centered around Bonn and Amsterdam with nodes in Bremen, Brussels, Darmstadt, Erlangen and Konstanz, and worked out their characterizations of mathematical knowledge assertions in terms of skill models and contextualism during a research visit of Müller in Amsterdam in December 2004. Dick de Jongh studied with Rosalie Iemhoff (Vienna) and Chunlai Zhou sublogics of the preservativity logic of Heyting arithmetic (HA) and determined the fragments with one model operator of these logics with the aim of getting a better understanding of the relationship between the preservativity and the provability logic of HA. The results were presented at CombLog '04 in Lisboa, July.

Key publications

Benthem, J. van, 2004. 'What One May Come to Know', *Analysis*64: 95-105

Goldblatt, R., I. Hodkinson and Y. Venema, 2004. 'Erdős graphs resolve Fine's canonicity problem', *Bulletin of Symbolic Logic* 10: 186-208.

Kupke, C., A. Kurz and Y. Venema, 2004. 'Stone coalgebras', *Theoretical Computer Science* 327: 109-134.

Bezhanishvili, N. and I. Hodkinson, 2004. 'All normal extensions of S5-squared are finitely axiomatizable', *Studia Logica*, 78: 443-457.

Iemhoff, R., D. de Jongh and C. Zhou, 2004. 'Properties of Intuitionistic Provability and Preservativity Logics', 2004. In: W.A. Carnielli, F.M. Dionisio and P. M. Mateus (Eds.), *CombLog'04, Workshop on Combination of Logics: Theory and Applications* Departamento de Matemática - Instituto Superior tecnico, Lisboa, 39-46

Löwe, B., 2004. 'The Simulation Technique and its Consequences for Infinitary Combinatorics under the Axiom of Blackwell Determinacy', *Pacific Journal of Mathematics* 214: 335-358

2.2.4 Algorithms and Complexity Theory

Project leaders

Peter van Emde Boas, Leen Torenvliet

Characterization

The Algorithmic approach is a unifying paradigm between alpha, beta and gamma disciplines. Potential domains of interaction with other sciences range from quantum computing (physics and technology), games (economics and social sciences), learning theory (cognitive sciences) and nature based computing (biology and physics). Algorithmic methods and Complexity Analysis are core themes of our project.

More specific topics which have recurred over the past years in our project are:

Time, space, and communication trade-offs between quantum and classical computation models. The minimal description Length principle as a guiding ideology for improved data compression methods, object classification and learning. Kolmogorov Complexity and its use in improving complexity estimates both for specific algorithmic problem and in some more abstract structural context. Games, both as computational models and in the context of providing a more algorithmically based foundation for solution concepts.

2004

Krzysztof Apt (during 2004 residing in Singapore - he has joined our project after the transition of the LIT project to the Institute for Informatics) succeeded in applying ideas from Term Rewriting Systems to the problem of the sensitivity for order of application in rules for elimination of strategies in strategic games. Through his active involvement in the Theory of Constraint Solving Systems we had a ph.d. granted on this topic in 2004 and one more forthcoming in 2005. He also co-edited a post-conference proceedings in this field.

Harry Buhrman was involved with a number of projects on improving the results on separation between classical and quantum computational complexity bounds in time, space and communication. Some of these considerations on the non-locality phenomenon in quantum mechanics actually lead to possible improved experiments for testing the predictions of Quantum Theory. Troy Lee investigated the trade-off between quantum computing and classical

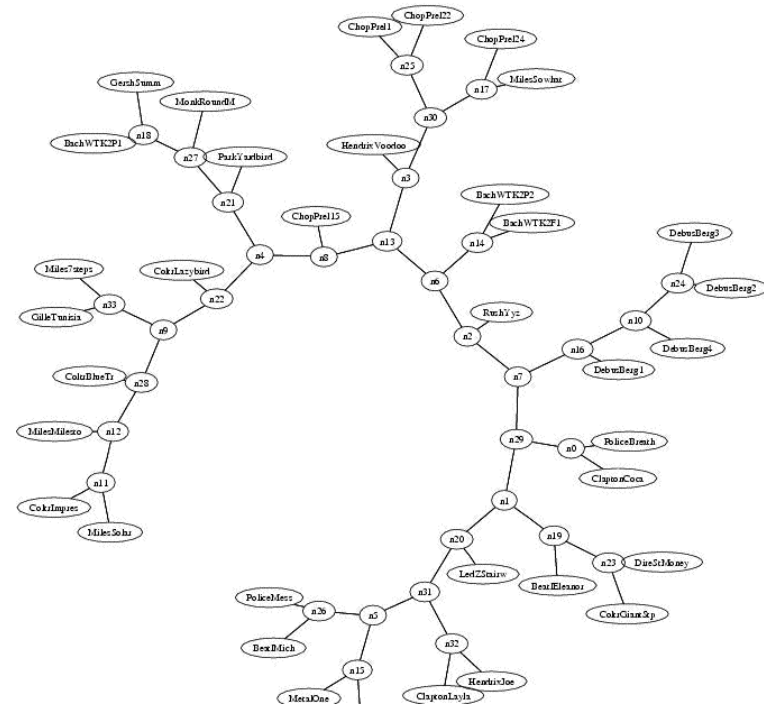
computing in the traditional field of query computing, using the adversary model. The gap is shown to be quadratic.

A project under supervision of prof. Vitanyi, together with R. Cilibrasi, which collected a substantial amount of exposure, even in popular media is the use of mutual information distance (a Kolmogorov Complexity based notion) for classification of concrete objects of an arbitrary nature, ranging from music pieces to genome fragments of infectious viruses. Though the distance involved is incomputable, an approximation based on commercially available data compression tools works well enough to obtain impressive results. Vitanyi and Grunwald together continued their research linking the MDL principle with the theory of Kolmogorov's Structure function - the last project initiated by this famous Russian Scientist. Together with Buhrman he supervised a PhD. thesis on quantum computing which was defended in 2004. Merlijn Sevenster invented a semantics for IF logic based on the idea of weakly dominated strategies. It is believed that this provides us with an alternative approach to Theo Janssen's concept of uniform strategies, which was introduced to cope with a number of counterintuitive validities in the more traditional game theoretical semantics for IF logic.

Leen Torenvliet continued with Buhrman the project on structural properties of complete sets for complexity classes, with the Post project based aim of finding properties which actually prove conjectured but yet unknown separations between complexity classes. The approach seems viable grace to the fact that the techniques don't relativise. Together with a team at the TUD (Vree and students) he was also involved in the more empirical project of trying to reconstruct the structure of the internet from measurements of transmission delays.

During 2004 a number of very interesting master student projects were completed within our project. Stephanie Wehner investigated amongst other a quantum computing based method for information transmission granting absolute anonymity to all participants. For this and other work she collected the 2004 Bakkenist prize for the best Computer Science master student. Boaz Leskes completed his joint master study in computational science and logic with a thesis on an agreement based boosting strategy for computational learning. Finally Gijs Krimp, graduating in Artificial Intelligence, succeeded in providing a proof of principle for automated tactical training for the Dutch Navy when he design a small board game which is both tactically realistic (from the perspective of the Military), didactically relevant (from the perspective of the Human

Factors division of TNO) and computational tractable in the sense that a complete database for the relevant positions has been computed with assistance of our IKAT colleagues in Maastricht and has been used for opponent modeling in this game.



** Picture from the publication: "Cilibrasi, R., P. Vitanyi, R. de Wolf, 2004. 'Algorithmic clustering of music based on string compression', Computer Music Journal, 28: 49-67"

Key publications

Ambainis, A., H. Buhrman, Y. Dodis, H. Röhrig, 2004. 'Multipart Quantum Coin Flipping'. Proceedings of IEEE Conference on Computational Complexity 2004: 250-259

Buhrman, H. Torenvliet, Leen, 2004. 'Separating Complexity Classes Using Structural Properties'. IEEE Conference on Computational Complexity (CCC): 130-138

Buhrman, H., T. Lee, D. van Melkebeek, 2004. 'Language Compression and Pseudorandom Generators'. IEEE Conference on Computational Complexity (CCC) 2004: 15-28

Cilibrasi, R., P. Vitanyi, R. de Wolf, 2004. 'Algorithmic clustering of music based on string compression', Computer Music Journal, 28: 49-67 **

Vereshchagin, N. and P. Vitanyi, 2004. 'Kolmogorov's Structure Functions and Model Selection'. IEEE Trans. Inform. Theory, 50: 3265-3290



3 Applied Research and Education

3.1 MSc in Logic 2004

The MSc in Logic is one of the oldest Master programmes in the country. It started in 1996 and had its first graduates in 1997. During the first seven years of its existence it was organized solely by the ILLC as a purely international programme and it developed into the foremost interdisciplinary logic programme in the world, combining philosophy, mathematics, computer science and linguistics in the unique fashion that underlies the excellence of the ILLC. One of the distinguishing features of this programme was its dedicated mentoring system: every student was assigned a mentor who discusses all choices of courses with him or her, advises the student in academic questions up to the choice of a Master's thesis supervisor. In 2003, the MSc in Logic was transformed into a regular Master programme organized by the educational institute for information science.

Student Population

As opposed to other international programmes, it is not the foreign students but the Dutch students that are a new experience for the MSc in Logic. In the academic year 2003/04, the MSc in Logic had Dutch students for the first time. We had 25 students entering during that academic year, of which four were Dutch (16%). In the following academic year 2004/05, there were 13 Dutch students out of an entering class of 29 students (44.8%). We expect that the ratio of Dutch vs foreign students of the academic year 2004/05 is representative of the years to come. As can be seen from these figures, the MSc in Logic does not suffer from the general problem of low student numbers. Currently (as of March 2005), we have 38 active students in our programme (some started in 2003, some in 2004; the difference is due to graduations of students and some drop-outs after the academic year 2003/04).

In the first year, there were some problems with the integration of the Dutch students into the MoL student community. Traditionally, the logic students have been a close-knit community. It took a while for the Dutch students to realize that they had become part of a new social network that goes beyond attendance of classes. The integration of the Dutch students into the MoL student community worked much better in the academic year 2004/05.

Teaching Team & Mentorship

The MSc in Logic had a fully developed and highly effective mentor system since its conception in 1996. During the period from 2003 to 2005, this mentor system (originally called MentoL) was transformed into a Teaching Team in the

style of the educational institute for information science. In the MSc in Logic, it is mainly the task of the director of education to plan the course schedule for the next year. The Teaching Team continues to advise the OD and serves as personal mentors of the students. Every new student is assigned a mentor and discusses personal strength and weakness and specific interests with his or her mentor. After that, the mentor gives the student a list of classes to attend for the next semester. Typically, the mentor would meet with the student two to three times per semester.

About two times per semester, the Teaching Team gathers and discusses the progress of every individual student: the mentor gives a brief report on the progress of the student, and the other members of the teaching team add their personal experiences with this student. This way, the Teaching Team ensures that every student can take the courses that are most adapted to his or her strengths and lead most directly to the best education result.

Excellence

The MSc in Logic reached an agreement with the Evert Willem Beth Stichting which pays an annual Beth Scholarship for an excellent student working in "logic in a broad sense, philosophy of the exact sciences or history of logic". So far, the MSc in Logic had four Beth Scholars, three of them graduated in 2004: Elizabeth Birchall (Canada) graduated on March 16, 2004 with a thesis entitled Duality for Distributive Modal Algebras with an application on subdirect irreducibility supervised by Y. Venema, Fenrong Liu (China) graduated on August 30th, 2004 with a thesis entitled Dynamic Variations: Update and Revision for Diverse Agents supervised by J. van Benthem, and Ji Ruan (China) graduated on October 7th, 2004 with a thesis entitled Exploring the Update Universe supervised by J. van Benthem and J. van Eijck. In addition to the Beth Scholarship, the ILLC has been funding an additional excellence grant, the ILLC Grant for the best student in any given year. In 2004, this grant was given to S. de Jager (New Zealand) who will graduate in summer 2005.

The MSc in Logic was tremendously successful in the NWO programme Mozaiek funding foreign nationals with a Dutch degree for their PhD research. Three graduates of the MSc in Logic (L. Afanasiev, graduated Dec 18, 2003; F. Liu, graduated Aug 30, 2004; R. Tsarfaty, graduated Jan 26, 2005) competed and received excellent reviews. Two of them (Afanasiev and Tsarfaty) were selected to receive a personal Mozaiek grant and are now working as PhD students at the IvI and the ILLC, respectively. In the entire country, distributed over all

subjects, only 21 candidates were selected, among them four UvA students. We are very proud that two of those 21 are graduates of the MSc in Logic. Although she was not selected for Mozaiek, the reviews for Liu's project were so excellent that the UvA decided to fund a PhD position for her, and she now started to work at the ILLC for her PhD.

In addition to that, we have 5 HUYGENS scholars, one DELTA scholar, one JSPS (Japan Society for the Promotion of Science) scholar, one FNRS (Fonds National de la Recherche Scientifique, Belgium) scholar and one CNCT (Consejo Nacional de Ciencia y Tecnologia, Mexico) scholar among our students.

The MSc in Logic intends to apply to become one of the national Centres of Excellence, and we are currently discussing this matter internally with FNWI and the UvA administration.

Graduations

In 2004, we had nine graduations of students (mostly students from the period before the switch of the MSc in Logic to the educational institute for information science as the incoming class of 2003 will graduate in 2005). Of these nine graduations, eight were cum laude.

Katrin Schulz graduated on February 11 with a thesis entitled "A Case Study on the Paradox of Free Choice Permission" supervised by F. Veltman. She is now a PhD student at the ILLC.

Andreas Zollmann graduated on May 18 with a thesis entitled "A Consistent and Efficient Estimator for the Data-Oriented Parsing Model" supervised by K. Sima'an. He is now a PhD student of Language Technologies at Carnegie Mellon University (Pittsburgh, USA).

Giosuè Baggio graduated May 25 with a thesis entitled "Two ERP studies on Dutch temporal semantics" supervised by M. van Lambalgen.

Elizabeth Birchall graduated March 16 with a thesis entitled "Duality for Distributive Modal Algebras" supervised by Y. Venema. She is now a PhD student of philosophy at Princeton university.

Fenrong Liu graduated August 30 with a thesis entitled "Dynamic Variations: Update and Revision for Diverse Agents" supervised by J. van Benthem. She is now a PhD student at the ILLC.

Thuy Linh Nguyen graduated September 28 with a thesis entitled "Rank Consistent Estimation: The DOP Case" supervised by K. Sima'an. She has been accepted as a PhD student of Language Technologies at Carnegie Mellon University (Pittsburgh, USA).

Piotr Labenz graduated September 17 with a thesis entitled "Event-calculus semantics of Polish aspect" supervised by M. van Lambalgen.

Ji Ruan graduated October 7 with a thesis entitled "Exploring the Update Universe" supervised by J. van Benthem and J. van Eijck.

Spencer Gerhardt graduated October 6 with a thesis entitled "A Construction Method for Modal Logics of Space" supervised by J. van Benthem and D. de Jongh.

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VENDELSTRAAT 8



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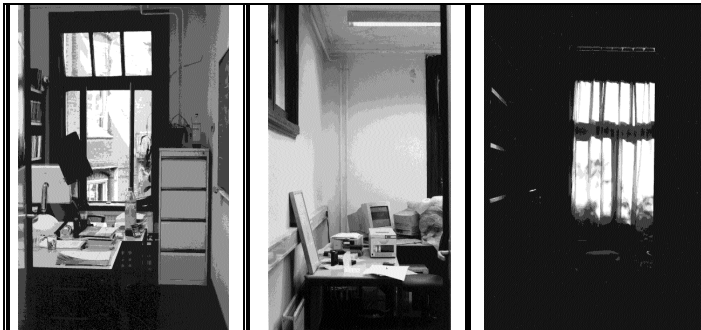
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Department of Philosophy



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This is what you see when you **open the door** of the offices of the philosophical community at **Vendelstraat 8**, second floor on the **right**.

The members of this philosophical community

Balder, Boudewijn, Chantal, Darrin, Erik, Fabrice, Frank, Hartmut, Henk, Henri, Jaap, Jeroen, Karen, Kata, Katrin, Marc, Maria, Marian, Marie, Marieke, Martin, Michiel, Network-Andries, Paul, Pieter, Reinhard, Renate, Robert, Rosja and Tine

invite you to try the URL below and find out what they have to tell you about themselves and their workplace.

[http://www.illc.uva.nl/hum/corrido\(o\)r](http://www.illc.uva.nl/hum/corrido(o)r).

4. Management

Annual report 2004

4.1 Organization

Due to the many changes the actual personnel situation at 01-01-2005 is given below:

Participating Faculties:

Faculty of Science

Faculty of Humanities

International Scientific Advisory Board

Solomon Feferman (Stanford), Wilfrid Hodges (London), Hans Kamp (Stuttgart), Gordon Plotkin (Edinburgh), Jörg Siekmann (Saarbrücken)

Scientific director

Frank Veltman

Deputy scientific director

Leen Torenvliet

Managing director

Ingrid van Loon

Management support

Tanja Kassenaar, Marjan Veldhuisen, Marco Vervoort

Graduate Program in Logic

Benedikt Löwe (director), Tanja Kassenaar (program manager)

Scientific staff, Students, Guests

■ **Faculty of Science**

Senior Staff

Krzysztof Apt, Johan van Benthem, Reinhard Blutner, Harry Buhrman, Peter van Emde Boas, Theo Janssen, Michiel van Lambalgen, Benedikt Löwe, Maricarmen Martinez, Maarten de Rijke, Khalil Sima'an, Leen Torenvliet, Yde Venema, Paul Vitanyi

Postdocs

Rens Bod, Massimo Franceschet, Detlef Prescher, Jelle Zuidema

PhD students

Nick Bezhanishvili, Mart de Graaf, Willem Jan van Hoeve, Aline Honingh, Clemens Kupke, Troy Lee, Steven de Rooi, Hein Röhrig, Yoav Seginer, Merlijn Sevenster, Neta Spiro, Maarten Stol

Associated researchers/Guests

Brian Semmes, Stefan Bold, Ka Wo Chan, Rudi Cilibrasi, Lex Hendriks, Joop Niekus, Arjen Poutsma, Oliver Roy, Robert Spalek, Petrucio Viana

Emeritus

Anne Troelstra, Dick de Jongh

■ Faculty of Humanities

Senior Staff

Reinhard Blutner, Jeroen Groenendijk, Wolfram Hinzen, Henkjan Honing, Jaap Kamps, Karen Kwast, Michiel van Lambalgen, Remko Scha, Martin Stokhof, Frank Veltman, Henk Zeevat

Postdocs

Maria Aloni, Paul Dekker, Jaap Maat, Robert van Rooij

PhD students

Kata Balogh, Chantal Bax, Balder ten Cate, Marian Counihan, Hartmut Fitz, Darrin Hindsill, Rosja Mastop, Fabrice Nauze, Erik Rietveld, Marie Safarova, Katrin Schulz, Tine Wilde

Emeritus

Renate Bartsch

4.2 Finance

The financial situation of the ILLC is good. The institute closed the year with a positive net result. The deficit between the prognoses and the final result was strongly influenced, in a positive way, by the vacancies created by the transition of Maarten de Rijke to the Informatics Institute and the appointment of Johan van Benthem as University Professor.

NWO and KNAW funded several new projects in 2004 (see Appendix 3 for an overview)

Annual report 2004

4.3 Human Resources

4.3.1 Personnel 2004 / fte

2004	Funding	FGW	FNWI	Total					
Full Professor	1	3.5	2.2	5.7					
	2								
	3								
	4								
Associate Professor	1	2.5	1.6	4.1					
	2								
	3								
	4								
Assistant Professor	1	2.5	5.1	8.3					
	2								
	3								
	4								
Postdoc	1	3.7	3.4	7.1					
	2								
	3								
	4								
PhD student	1	7.1	3.4	10.5					
	2				4.0	6.6	10.6		
	3							0.3	0.3
	4								
Guests	1								
	2								
	3								
	4				1.4	1.4			
Total	23.3	30.7	55.0						

4.3 Human Resources

4.2.2 Appointments

New ILLC PhD Students: Olivier Roy, Mark Ka-Wo Chan and Stefan Bold

As of September 1, Olivier Roy (Canada) and Ka-Wo Chan (Hongkong) started their PhD program at the Faculty of Sciences. Olivier will be mentored by Johan van Benthem, Mark Ka-Wo Chan will be mentored by Yde Venema. Stefan Bold is a PhD (joint) student of the University of Bonn and the UvA, working under supervision of Benedikt Loewe.

New ILLC Postdoc: Jelle Zuidema

As of August 1, Jelle Zuidema is appointed a NWO postdoc position on the project 'Unsupervised Grammar Induction' in cooperation with Rens Bod.

New ILLC PhD student: Chantal Bax

As of September 1, Chantal Bax is appointed a PhD student at the Faculty of Humanities. She will work under the supervision of Martin Stokhof on "Subjectivity after Wittgenstein".

New ILLC Lecturer: Maricarmen Martinez

As of September 1, Maricarmen Martinez is appointed lecturer in the field of Mathematical Logic for the period of one year.

4.4 Management Systems

The ILLC will act as a pilot institute in the project "Personal METIS". METIS (formerly known as OZIS) is the system used by all Dutch universities in which all scientific output is stored.

Previously, these data were entered centrally after we had processed the output received through the famous ILLC web forms. This was double work and therefore inefficient: first the ILLC system was fed through web forms, then METIS was fed by the central administration. In this project it is possible for the staff to enter the data in METIS themselves.

We expect that the first time the staff will use it, it may take some more time and effort than they were used but we are sure that at the end it is much more effective for the administration of the scientific output of our staff. The pilot will run at the beginning of 2005.



5. Assessment

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5. Assessment

Scientific Advisory Board

Solomon Feferman (Stanford), Wilfrid Hodges (London), Hans Kamp (Stuttgart), Gordon Plotkin (Edinburgh), Jörg Siekmann (Saarbrücken)

The scientific board plays an important role in strategic matters. In 2004 it was consulted in connection with the vacancy left by the retirement of Dick de Jongh. In 2005 the scientific board will be consulted in connection with the new Research Plan 2005-2009.

In October the report of the Review Committee for Computer Science, written under the auspices of the Quality Assurance Netherlands Universities (QANU), was published. It concerns the period 1996-2002. The conclusions of the committee were clear: The quality of Computer Science at the University of Amsterdam is 'very good'. This holds in particular for the three ILLC research projects that were reviewed: Algorithms and Complexity Theory, Constructive and Intensional Logic, and Language and Inference Technology.

As the above illustrates, up until 2004 research assessment in the Netherlands was organized by scientific discipline, which for an interdisciplinary institute like ILLC meant that each time only part of the research was reviewed. Fortunately, policies have changed. In 2006 ILLC will be reviewed in its totality, so that the 'extra' that interdisciplinary research has to offer will be brought to the fore.

6. Facts and Figures

Annual report 2004

6 Facts and Figures

Research Input Personnel 2004

2004	Funding	FGW	FNWI	Total
Full Professor	1	1.55	2.12	3.67
	2			
	3			
	4			
<hr/>				
Associate Professor	1	0.9	0.77	1.67
	2			
	3			
	4			
<hr/>				
Assistant Professor	1	1.08	2.55	3.62
	2			
	3			
	4			
<hr/>				
Postdoc	1	2.23	3.08	5.31
	2			
	3			
	4			
<hr/>				
PhD student	1	6.01	2.56	8.57
	2			
	3			
	4			
<hr/>				
Guests	1		1.40	1.40
	2			
	3			
	4			
<hr/>				
Total		14.97	23.78	38.75

Appendices

Annual report 2004

Appendix 1 Staff

Contact Information (situation 01-01-2005)

Last Name	Initials	E-mail	Phone 020.	Project	Location
Aloni	M.D.	Maria M.D.Aloni@uva.nl	525 4556	ToI	ND15
Apt	K.R.	Krzysztof apt@science.uva.nl	525 5358	ACT	CWI
Balogh	K.	Kata K.Balogh@uva.nl	525 4544	ToI	ND15
Bax	Ch.	Chantal C.Bax@uva.nl	525 4542	ToI	ND15
Benthem van	J.F.A.K.	Johan johan@science.uva.nl	525 5807	CIL	PM24
Bezhanishvili	N.	Nick nbezhani@science.uva.nl	525 6925	CIL	PM24
Blutner	K.R.	Reinhard K.R.Blutner@uva.nl	525 4528	CSIP	ND15
Bod	L.W.M.	Rens rens@science.uva.nl	525 5360	CSIP	PM24
Bold	S.	Stefan sbold@science.uva.nl	525 6054	CIL	PM24
Buhrman	H.M.	Harry buhrman@cwi.nl	592 4076	ACT	CWI
Chan	K.W.	Mark kchan@science.uva.nl	525 5356	CIL	PM24
Cilibrasi	R.	Rudi cilibrar@cwi.nl	592 4232	ACT	CWI
Counihan	M.E.	Marian M.E.Counihan@uva.nl	525 4531	CSIP	ND15
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Appendix 2 Dissertations

PhD defenses

15 December 2004, Hedde Zeijlstra
 Sentential Negation & Negative Concord
 Promotor: Hans Bennis, Jeroen Groenendijk
 Copromotores: Hans den Besten
 Universiteit van Amsterdam

7 December 2004, Boudewijn de Bruin
 Explaining Games. On the Logic of Game Theoretic Explanations
 Promotor: Johan van Benthem, Martin Stokhof
 Universiteit van Amsterdam

3 December 2004, Sebastian Brand
 Rule-based Constraint Propagation: Theory and Applications
 Promotor: Prof. Dr K. Apt
 Universiteit van Amsterdam

26 November 2004, Joost J. Joosten
 Interpretability formalized
 Promotores: Prof. dr. Albert Visser and Prof. dr. Dick de Jongh
 Copromotor: dr. Lev D. Beklemishev
 Universiteit Utrecht

27 January 2004, Röhrig, H.P.
 Quantum Query Complexity
 Promotores: Prof. dr. H.M. Buhrman and Prof. dr. P.M.B. Vitanyi
 Universiteit van Amsterdam

Appendix 3 New Projects and Awards

2004 Bakkenist Jong Talent Afstudeerprijs Informatica

The 2004 Bakkenist Jong Talent Afstudeerprijs (successor to the CIVI afstudeerprijs - a reward of 10000 Euro) has been awarded to our master student Mrs. S.D.C. Wehner, who graduated last July on a master thesis on the subject of Quantum Computing. The award ceremony was held on Thursday 25 November in the building of the "Koninklijke Hollandse Maatschappij voor Wetenschappen" in Haarlem.

NWO project proposal by Rens Bod has been granted

NWO has granted a project proposal by Rens Bod in the Open Competition (NWO Exact). The project will deal with modeling language acquisition and language evolution with the DOP model, and will last three years. Jelle Zuidema (from the University of Edinburgh) will start on August 1st as a postdoc in this project.

DAAD Grant for Brian Semmes "Rationality in Infinite Games"

Brian Semmes has received a DAAD (German Academic Exchange Service) grant (A/04/33952) for an extended visit (Date: May to August 2004) at the RhFWU Bonn (Germany), for a research project entitled "Rationality in Infinite Games" supervised by Benedikt Löwe and Peter Koepke (Bonn). NWO has granted a PhD position within the MOZAIIEK competition. The Netherlands Organization for Scientific Research (NWO) awards Reut Tsarfati with a grant for a 4 year Ph.D position within the MOZAIIEK competition. The mozaiek programme is designed to attract more ethnic minority graduates into academic research.

The MOZAIIEK competition is an NWO initiative targeting students with a foreign background. In the first round, 40 short proposals were selected from among 194 that were submitted from all disciplines of science at universities in the Netherlands. In a series of workshops organized by NWO, the 40 pre-selected proposals were worked out into full proposals. Finally, the NWO Mozaiek committee selected 21 candidates for a grant.

Reut's proposal, jointly with Khalil Sima'an (mentor), concerns probabilistic models for morphological and syntactic processing of Modern Hebrew Texts. The Ph.D. project will be conducted under the supervision of Remko Scha (promotor) and Khalil Sima'an (co-promotor), and in cooperation with Yoad Winter (Technion, Haifa, Israel).

NWO Vidi Grant for project Robert van Rooij

NWO has awarded Robert van Rooij the prestigious VIDI subsidy for his project "The Economics of Language: Language Use and the Evolution of Linguistic Conventions".

Arthur Elsenaar and Remko Scha Win the 2003 Leonardo Award for Excellence

Arthur Elsenaar and Remko Scha's article "Electric Body Manipulation as Performance Art: A Historical Perspective," published in *Leonardo Music Journal* 12, has been named the winner of the 2003 Leonardo Award for Excellence.

Elsenaar and Scha's winning article traces the historical development of using electrically manipulated human bodies for theatrical display. Addressing the controversial aspects of this sometimes destructive art form, they extend their inquiry to investigate the implications of electrical executions. More often, they note the stimulating effects of electricity upon the body, studying Transcutaneous Electrical Nerve Stimulation as implemented in the 19th Century by Duchenne and continued in practice today by artists such as Stelarc and co-author Elsenaar. Citing technological advances that enable interactive nerve stimulation, Elsenaar and Scha point toward a future of computer-generated dance and theater performances.

The Leonardo Award for Excellence was originally established by chemist and inventor Myron Coler and Leonardo publisher Robert Maxwell. The 2003 Leonardo Award for Excellence is co-sponsored by the Technoculture Studies Department and the Art Department at the University of California, Davis, where it will be presented at a prize award lecture on campus during the Spring 2004 session.

Robert van Rooij received the 2004 Hendrik Casimir - Karl Ziegler Research Stipendium

Robert van Rooij received the 2004 Hendrik Casimir - Karl Ziegler Research Stipendium awarded by the KNAW. This enables him to spend some time at the Institut fuer Kommunikationsforschung und Phonetik (IPK) in Bonn (Germany) to enhance the already existing cooperation between the ILLC and the interfaculty research group 'Wissensformate: Information, Representation, Kognition' (Formats of Knowledge) in Bonn.

NWO-Humanities funding

Henkjan Honingh was funded by NWO-Humanities for the project Music as a social, psychological, and acoustical phenomenon: a cognitive revolution in musicology. Henkjan himself will be the main researcher working on this project.

In addition we received funding for the next conferences and workshops:

- CIE 2005: New Computational Paradigms (NWO);
- Changing Minds, Computational and Logical Approaches to Belief Change (NWO)
- Philosophy of Information (NWO/KNAW)
- The State of the Art in Modal Logic (NWO)

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Appendix 4 DIP Colloquium

DIP Colloquium

The DIP is a bi-weekly colloquium of the ILLC members at the Department of Philosophy, Universiteit van Amsterdam. The program of the colloquium reflects the current research interests of the group: cognition and reasoning, formal semantics and pragmatics, computational linguistics and philosophy of language.

Below the DIP Colloquia in 2004

Tuesday December 21, 2004,

Jelle Gerbrandy

Bisimulation versus Epistemic Equivalence

Friday December 10, 2004

Jelle Zuidema (ILLC/University of Edinburgh)

Language, Evolution & the Theory of Games

Friday November 19, 2004

Fred Keijzer (University of Groningen)

Embodied cognition: Opportunities and problems

Wednesday October 27, 2004

Claudia Casadio (Università degli studi G. d'Annunzio)

Quantifiers and Scope in Pregroup Grammar

Friday October 15, 2004

Jason Mattausch (ZAS, Berlin)

Bias & the Optimization of Grammar

Friday September 24, 2004

Emar Maier (University of Nijmegen)

De se vs de re belief reports under quantification

Friday September 10, 2004

Yoad Winter (Technion, Computer Science Department)

How strong is the Strongest Meaning Hypothesis?

Friday June 25 2004
David Ahn (ILPS)
Bi-polar domain restriction in adverbial quantification

Wednesday June 9 2004
Gennaro Chierchia (University of Milan)
Domain Widening and its implicatures. A new look at negative polarity vs. free choice and the grammar/pragmatics interface

Friday June 4, 2004
Beáta Gyuris (Research Institute for Linguistics, Hungarian Academy of Sciences; ZAS, Berlin)
A new look at the semantics/pragmatics of contrastive topics in Hungarian
Friday Mei 14, 2004
Hans-Christian Schmitz (University of Bonn)
Optimal accentuation

Friday April 23, 2004
Henriette de Swart (Utrecht University)
Marking and interpretation of negation: a bi-directional OT approach.

Friday April 16, 2004
Andreas Haida (ZAS, Berlin)
Focus in Interrogatives

Friday April 2, 2004
Anna Mlynarczyk (University of Utrecht)
An aspectual classification of Polish verbs

Friday March 19
Kris De Jaegher (Vrije Universiteit Brussel)
Costly signaling conversations in the electronic mail game

Friday March 12, 2004
Gerlof Bouma (University of Groningen)
Pronoun Resolution in Optimality Theory

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Special DIP talk: Workshop on Questions
Friday February 13, 2004
Jonathan Ginzburg (King's College London)
The Simplest Theory of Interrogative Meaning

Friday January 30, 2004
Regine Eckardt (ZAS, Berlin)
Particles in Questions

Friday January 9, 2004
Laura Alonso i Alemany (University of Barcelona)
A feature-based characterization of discourse markers for shallow NLP

Appendix 5 The Logic Tea

The Logic Tea is a series of talks for students in philosophy, mathematics, computer science, artificial intelligence and related fields of interest. The series covers a large variety of topics reflecting the interdisciplinary character of the institute. Speakers include Masters and PhD students from our institute as well as from other universities and research institutions. Most of the talks aim at being accessible to the entire ILLC audience.

9 November 2004, Logic Tea, Marie Duzi, Tu Ostrava
Title: Epistemic Closure and Inferable Knowledge

2 November 2004, Logic Tea, Tine Wilde
Title: When Art Meets Science

12 October 2004, Logic Tea, Boudewijn de Bruin
Title: Logic, Games and Paradoxes

28 September 2004, Logic Tea, Barteld Kooi
Title: The Hangman Paradox in Dynamic Epistemic Logic

14 September 2004, Logic Tea, Stefan Bold
Title: Sets and Games

17 June 2004, Logic Tea, Detlef Prescher
Title: Probabilistic Grammars

22 April 2004, Logic Tea, Alessandra Palmigiano
Speaker: Alessandra Palmigiano (Barcelona)
Title: Selfextensional logics, duality and coalgebras

15 April 2004, Logic Tea, Sieuwert van Otterloo
Speaker: Sieuwert van Otterloo (Liverpool)
Title: Preferences in Game Logics

1 April 2004, Logic Tea, Francien Dechesne, Universiteit Tilburg/TU Eindhoven
Title: IF-Logic and The Art of Theorem Reconstruction

11 March 2004, Logic Tea, Krister Segerberg
Title: The getting of knowledge or some remarks on epistemic logic

26 February 2004, Logic Tea, Fabio Paglieri
Title: AGM Belief Revision vs. Cognitive Models

19 February 2004, Logic Tea, Paul Harrenstein
Speaker: Paul Harrenstein (Utrecht University)
Title: Control and Preference in Propositional Logic

29 January 2004, Logic Tea, Yoav Seginer, ILLC
Title: Learning Theory and Natural Language

January 2004, Logic Tea, Aline Honingh, ILLC
Title: Just Intonation in Music: a Group-Theoretic Approach

Appendix 6 The Colloquium on Mathematical Logic

Starting in the Academic Year 2003/2004, the ILLC and the Mathematics and Philosophy Departments of the Universiteit Utrecht will be jointly organizing a biweekly Colloquium on Mathematical Logic. This joint colloquium revives the tradition of the InterCity seminar of the 1970s and 1980s and will be a venue for talks by external guests, researchers from Amsterdam and Utrecht, and last but definitely not least, students from Amsterdam and Utrecht.

10 December 2004, Colloquium on Mathematical Logic, Guram Bezhanishvili
Title: MacNeille completions in modal logic
Date and time: Friday 10 December 2004, 16.00-17.00

19 November 2004, Colloquium on Mathematical Logic, Rineke Verbrugge
Speaker: Rineke Verbrugge (Groningen)
Title: Strong completeness for non-compact hybrid logics

24 September 2004, Colloquium on Mathematical Logic, Andrés Perea
Speaker: Andrés Perea (Maastricht)
Title: Minimal belief revision leads to backward induction

10 September 2004, Colloquium on Mathematical Logic, Alexander Leitsch
Speaker: Alexander Leitsch (Vienna)
Title: CERES: Cut-Elimination by Resolution

14 May 2004, Colloquium on Mathematical Logic, Andreas Weiermann
Speaker: Andreas Weiermann (Utrecht)
Title: Classifying the phase transition for Ackermannian Paris Harrington - functions

16 April 2004, Colloquium on Mathematical Logic, Nick Bezhanishvili
Title: The logic of the Rieger-Nishimura ladder

26 March 2004, Colloquium on Mathematical Logic, Alfred Jurcka ()
Speaker: Alfred Jurcka (Canceled)
Title: Cardinal Characteristics of the Continuum

12 March 2004, Colloquium on Mathematical Logic, Claire Kouwenhoven
Speaker: Claire Kouwenhoven (Utrecht)
Title: The algebraic set theory of the effective topos

2 March 2004, Colloquium on Mathematical Logic, Nicola Gambino
Speaker: Nicola Gambino (Cambridge)
Title: Wellfounded Trees, Fixpoints and Free Monads

13 February 2004, Colloquium on Mathematical Logic, Klaas Pieter Hart
Speaker: Klaas Pieter Hart (Delft)
Title: Embeddability of the measure algebra

30 January 2004, Colloquium on Mathematical Logic, Jan Wolenski
Speaker: Jan Wolenski (Kraków)
Title: The status of T-sentences

23 January 2004, Colloquium on Mathematical Logic, Sergei Artemov
Speaker: Sergei Artemov (New York)
Title: Reflexive Combinatory Logic

Appendix 7 Other Events and Lectures

Amsterdam-Utrecht Workshops

This event is organized under the auspices of the Utrecht Institute of Linguistics (UiL OTS) at the Utrecht University, and Institute of Logic, Language and Computation (ILLC) at the University of Amsterdam. The initiative was proposed in 2001 by Johan van Benthem and Michael Moortgat with the intent of increasing the collaboration between the ILLC and OTS researchers. Since then this proposal has been materialized in a growing number of jointly organized and successful workshops. Amsterdam-Utrecht *Workshop 2004*

Cognitive approaches to syntax and semantics - Wednesday, January 28th, 2004

13-16 December 2004, ILLC's Stanford Visitors: Seminars, Room 3.27, Euclides Building (P), Plantage Muidersgracht 24, Amsterdam

Four Stanford Ph.D. students: Patrick Girard, Darko Sarenac, Josh Snyder, and Tomasz Sadzik, are visiting the ILLC this week and the week after. On this occasion, we are organizing a series of technical seminars on update, space-time, games and complexity. The seminars will be real working sessions (not 'sales talks'), consisting of a one hour talk followed by discussion among expert students and researchers.

11 December 2004, Special ILLC Event

Title: The Dynamics of Reason

With a workshop around this year's annual Beth Lecturer & Vienna Circle Lecturer Michael Friedman we start a new series of SPECIAL ILLC EVENTS

Michael Friedman (Bloomington & Stanford) is a well-known philosopher of science and historian of philosophy with special interests in Kant and the Vienna Circle. He will speak about his new book "The Dynamics of Reason" which brings together insights on scientific progress from Carnap and Kuhn, in a Kant-inspired perspective.

Other speakers were Boudewijn de Bruin, Henk de Regt, Jan-Willen Romeyn, Rens Bod, and Johan van Benthem.

6 December 2004, Ninth Workshop on Games in Logic, Language, and Computation

GLLC9 is an informal workshop about applications of game theory in logic, linguistics, and computer science, and on the logical foundations of game and

decision theory. Speakers include Wlodek Rabinowicz (Lund University) and Marc Pauly (Toulouse).

29 October 2004, Workshop on Belief Revision: 'Changing Minds', Room A-303, University of Amsterdam, Roetersstraat 15, Amsterdam

Belief revision theory was first developed to give a formal answer to this question, following a long tradition of philosophical work on theory change. In the last two decades, belief revision has become one of the most active areas of research, at the confluence between cognitive science, logic, philosophy, and AI. Nevertheless, the most crucial features of belief revision still remain unsolved - and the main reason lies in a serious lack of integration between the 'formal side' and the 'cognitive side' of the problem, i.e. between approaches first developed in logic, computer science and philosophy, and theoretical models and empirical evidences gathered in the field of cognitive science and experimental psychology.

This workshop brought together leading experts in several related fields to discuss these issues and compare distinct approaches. Different paradigms need not to merge, since they might turn out to address complementary aspects of belief change. But in this workshop they were confronted with each other, to clarify differences and synergies - with special emphasis on the primacy of cognitive studies. Belief revision is perhaps the most fundamental of our cognitive skills: therefore, its formal understanding cannot abstract from empirical data on belief change in humans.

29 November 2004, Maagdenhuis op maandag, Johan van Benthem

Title: Natuurlijke en kunstmatige talen: therapie of huwelijk?

26 October - 14 December 2004, Een Interdisciplinaire Collegereeks

Speakers: Johan van Benthem and Robbert Dijkgraaf

Title: Denkpatronen, hoe wiskunde en logica werken

Target group: students (alfa, beta en gamma) and other interested parties

2 September 2004, Annual ILLC Boat Trip

The Master of Logic Programme will be organising an introduction for the new students on Thursday 2nd of September. Part of the Master of Logic programme is a boattrip through the canals of Amsterdam. The boat will depart at 16.30 sharp from behind Euclides (same as last year).

14 May 2004, Leve de Wiskunde! Passie voor het vak (Open dag)

On Friday 14 May the Korteweg-de Vries Institute for Mathematics and the Institute for Logic, Language and Computation will host an Open Day for teachers of mathematics, students, and other interested parties. 'Leve de Wiskunde' is the opportunity to become acquainted with the renowned research programs in mathematics and logic at the UvA.

20 April 2004, ILLC 'TEST-TALKS' MOSAIEK, Fenrong Liu, Reut Tsarfati, Loredana Afanasiev

NWO organized three workshops to guide and evaluate the candidates and their proposals. On the 23rd of April the third workshop will take place and it involves talks by the candidates that will play a role in evaluating the candidates and their proposals for this final round of selection. In this preparatory meeting, the three ILLC candidates will present their talks and invite comments.

Max duration is 1 hour 30 minutes, up to 30 minutes per candidate. The candidates and titles of talks:

- 1) Fenrong Liu; Logic of Social behavior
- 2) Reut Tsarfati; Beyond Trees: Morphological and Syntactic Ambiguity Resolution for Hebrew
- 3) Loredana Afanasiev; Model checking based algorithms for efficient query evaluation on XML documents

2 April 2004, ILLC Meeting on Intuitionism

At the ILLC there were 6 persons who had some actual relation with intuitionism. A meeting was organized in which they presented their interests in an introductory way to each other and to other ILLC members.

15 March 2004, Maagdenhuis op maandag

Speaker: Rens Bod

Title: De unificatie van taal, beeld en muziek

10 - 11 March 2004, Expert workshop "The State of the Art in Modal Logic"

A group of leading researchers in Modal Logic met in Amsterdam, to discuss their contributions to the upcoming Handbook of Modal Logic. The Handbook, edited by Johan van Benthem, Patrick Blackburn and Frank Wolter, provides an authoritative document concerning the scope and uses of modal logic today, while also creating new perspectives on most promising future research developments.

28 January 2004, The Fifth Amsterdam-Utrecht Workshop: Psycholinguistics

This was already the fifth workshop in the series of 'Amsterdam - Utrecht workshops', that were initiated to further improve the interaction between the ILLC and OTS. For this occasion, the topic we have decided on is psycholinguistics. The program consists of talks on various subjects in this field such as: acquisition of tense, ellipsis processing, autism and an afternoon session on aphasia.

Appendix 8 Outreach

Noorderlicht (VPRO Radio) on AI and music cognition

VPRO reporter Sam Verhaert decided to test 'The Continuator', interactive music software made by Francois Pachet of Sony Computer Science Laboratories, and invited Henkjan Honing (ILLC), Music critic Koen Schouten (Volkskrant) and pianist Albert van Veenendaal to do an informal, yet musical version of the Turing Test.

Why do some melodies stick in your mind?

It is a phenomenon not yet fully understood. Since if we would, we could make a computer model that generates songs that would be guaranteed to stick. Luckily, in this case, few people would mind. Nieuwslicht (the science program of Vara Television) of 12 November contained a short item on related music cognition research.

2004, Muziekcognitie in Hoe?Zo! Dutch Television, science programme

Hoe?Zo!, The Teleac/NOT science programme was at 28 May 2004 in 15 minutes dedicated to music cognition