

INSTITUTE FOR LOGIC, LANGUAGE AND COMPUTATION; REPORT 2010

INTRODUCTION

The Institute for Logic Language and Computation(ILLC) is an interfaculty institute shared by the Faculty of Science and the Faculty of Humanities. Its research goals and researchers employed are shared between these two faculties. The scientific mission of the ILLC is to study formal properties of information, in particular the logical structure and algorithmic properties of processes of encoding, transmitting and comprehending information.

Information here is to be viewed in its broadest sense, from the flow of information in natural and formal languages to the information contained in music and graphics. The research aim is to develop logical systems that can handle this rich variety of information, making use of insights across such disciplines as linguistics, computer science, cognitive science, artificial intelligence and philosophy. Whenever relevant, additional methods, ranging from statistics to argumentation theory, are actively pursued as well. In addition to its specific research goals, the ILLC aims to overcome traditional boundaries between faculties and disciplines and serves as a rallying point for information scientists across computer science, linguistics, philosophy, and the social sciences.

Though unity and cooperation are among the ILLC's most prominent features, research activities of the ILLC are concentrated nonetheless in its three major programmes: Logic and Language (LoLa), Logic and Computation (LoCo), and Language and Computation (LaCo). Of these programmes, LoLa is predominantly staffed with Humanities researchers, LoCo with Science researchers and LaCo is a true mixture of the Humanities and Sciences. The latter group has gained importance fast in the recent past and continued to do so in 2010, as expressed in, for example, the prestigious KNAW Muller chair awarded to Henkjan Honing, and the still to be realized computational and digital humanities profile chair.

The ILLC partakes in three of the six research focal points or clusters still forming within the Science Faculty. It already played a role in the Brain and Cognition focal point, which is a university wide focal point, and it is now also involved together with the Informatics Institute(IvI) in the forming of a cluster around the theme Information and Meaning. With the Physics Institute(IOP), the ILLC is part of the Quantum Matter and Quantum Information cluster.

One of the main threats mentioned in the self evaluation written for the midterm review that has taken place in 2010 is the transfer of leadership from the first generation of leaders to a new generation of leaders, in a budgetary not too friendly environment. In 2010, the ILLC has made grade strides on this path. New programme leadership has been established, and through both internal promotions and external appointments, the ILLC is now underway of obtaining a firm structure for the coming years. Not only that, but recent appointments have also been favourable to the gender representation in the ILLC staff, which was one of the other points of attention made in the earlier report by the committee in the research evaluation of 2006. In 2006, the ILLC scored three fives and a four, where the four was particularly aimed at prospects of the ILLC. The midterm review of 2010 showed excellent on all points.

The next pages will give a per programme overview of research achievements, key publications and other highlights.

LANGUAGE AND COMPUTATION (LACO)

1. Description Language and Computation programme

This programme is concerned with computational models of human information processing, especially natural language and music. The project aims to develop computational methods that are cognitively plausible as well as practically useful. An important focus is the further development of corpus-based methods for natural language processing (NLP), building on our experience with the 'Data-Oriented Parsing' model. Main application areas are first language acquisition, machine translation and the application of computational models to musical, literary and historical analysis ("Computational Humanities").

Another important application area is concerned with Information Retrieval and Question Answering. In this area, we employ the state-of-the-art retrieval techniques, and focus on improving the practical usefulness of these systems in user-interfaces and cognitive ergonomics. In cooperation with the Logic and Language programme, we develop models of linguistic processes at the level of pragmatics and discourse. Here we employ the framework of Optimality Theory to articulate complex models as hierarchies of competing constraints.

Our research on music cognition focuses on the temporal aspects of music (such as rhythm, timing, and tempo), the role of perception, attention, expectation and memory in the process of listening to music, and we study the cognitive mechanisms underlying musicality. The research involves theoretical, empirical and computational methods.

2. Prizes

- Honorary chair by the Royal Netherlands Academy of Arts and Sciences, KNAW, Henkjan Honing

3. Subsidies

- UvA-CSCA: The role of neural plasticity in conscious perception, CSCA-consortium headed by Victor Lamme, Cyriel Pennartz, Arnold Smeulders & Henkjan Honing.
- EU-COST: TIMELY (Time In Mental activity: theoretical, behavioral, bioimaging, and clinical perspectives), Henkjan Honing.
- NWO: Free Competition, NWO Exact Sciences Board. Project proposal "Machine Translation When Exact Pattern Match Fails", headed by Khalil Sima'an.
- NWO: Regieorgaan Geesteswetenschappen, "Constructions Emerging", supervised by Rens Bod and Arie Verhagen.

4. Key publications

- Reinhard Blutner and Elena Hochnadel. Two qubits for C.G. Jung's theory of personality. *Cognitive Systems Research*, 11(3), 243-259, 2010.
- Rens Bod. *De Vergeten Wetenschappen: Een Geschiedenis van de Humaniora*. Prometheus, Amsterdam, 2010.
- Henkjan Honing. *De ongeletterde luisteraar. Over muziekcognitie, muzikaliteit en methodologie*. Amsterdam: Koninklijke Nederlandse Academie voor Wetenschappen. (Also published by Amsterdam U. Press.), 2010.
- Katja Jasinskaja and Henk Zeevat, Explaining Additive, Adversative and Contrast Marking in Russian and English, *Revue de Semantique et Pragmatique*, vol. 24, pp. 65-91, 2010.
- Marijn Koolen and Jaap Kamps. The importance of anchor-text for ad hoc search revisited. In *Proceedings of the 33rd Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, pages 122-129. ACM Press, New York NY, USA, 2010.
- Markos Mylonakis and Khalil Sima'an. Learning Probabilistic Synchronous CFGs for Phrase Translation Models. In *Proceedings of the Fourteenth Conference on Computational Natural Language Learning*, CoNLL, 2010.
- Willem Zuidema and Arie Verhagen. What are the unique design features of language? Formal tools for comparative claims. *Adaptive Behavior* 18 (1) 48-65, 2010.

6. Significant Collaborations

- ZAS and HU Berlin
- Hungarian Academy of Sciences, MTAPI
- Dept. Computing, Dublin City University
- Centre for Advanced Study, Oslo
- University of St Andrews, Scotland

7. Keynote lectures

- Keynote lecture at "The history of logic in China", 24 November, Amsterdam, Rens Bod
- Keynote talk at "Semantics in the Netherlands", 5 November, Radboud University Nijmegen, Henk Zeevat
- "Is beat induction a fundamental musical skill?", Max Planck Institute Leipzig, 7 July, Henkjan Honing
- "Geometrical models of meaning and compositionality", Copenhagen Business School, 9 December, Reinhard Blutner

8. Outreach activities

- Lecture tour on new book *De Vergeten Wetenschappen* (selected among best books 2010 by NRC and *De Groene Amsterdammer*), Rens Bod
- Interviews in Elsevier, Volkskrant, NRC Handelsblad, and radio and TV interviews on new book, Rens Bod
- Lecture tour on new book, including two evenings in Muziekcentrum Vredenburg, Utrecht, Henkjan Honing
- Weekly column on Dutch Radio, Henkjan Honing
- How do scientists see the immediate future of translation automation? Khalil Sima'an a.o. (<http://www.translationautomation.com/perspectives>).
- Interview in *Trouw*: Theorieën over taal ontkracht, Willem Zuidema

LOGIC AND COMPUTATION (LOCO)

1. Description Logic and Computation programme

The Logic and Computation group strives to gain a deeper understanding of the nature of information and the processes of reasoning and interaction. In the tradition of Brouwer, Heyting, and Beth this naturally leads to the investigation of a wide range of foundational issues in mathematics and computer science. On one side of the spectrum we cover classical areas of mathematical logic and the foundations of mathematics, such as model theory, algebraic logic, and set theory.

In theoretical computer science, we investigate fundamental problems in algorithmics and computational complexity, but also venture into new fields such as quantum computing and coalgebra. At the interface with other disciplines, including formal epistemology, artificial intelligence, and economic theory, we study the dynamics of interaction in groups of agents and problems of social choice.

Transcending this diversity of research areas is a shared reliance on formal tools, including in particular modal logic, game theory, and complexity theory. Below we list a small selection of highlights for the year 2010.

2. Grants and Awards

- Benedikt Löwe, VLAC Fellowship, Royal Flemish Academy.
- Johan van Benthem, Patrick Girard, and Olivier Roy, authors of one of the “ten best articles in Philosophy” published in the previous year by the *Philosopher’s Annual*.
- Erasmus Mundus External Cooperation Window grants for Sanchit Saraf and Sourav Tarafder.

3. Key Publications

- J. van Benthem. *Modal Logic for Open Minds*. CSLI Publications, 2010.
- H. Buhrman, B. Hescott, S. Homer, and L. Torenvliet. Non-Uniform Reductions. *Theory of Computing Systems*, 47(2):317–341, 2010.
- G. Fontaine, R.A. Leal, and Y. Venema. Automata for Coalgebras: An Approach Using Predicate Liftings. *Proc. 37th Internat. Coll. on Automata, Languages and Programming (ICALP-2010)*. Springer, 2010.
- J. Uckelman and U. Endriss. Compactly Representing Utility Functions Using Weighted Goals and the Max Aggregator. *Artificial Intelligence*, 174(15):1222–1246, 2010.
- N.K. Vereshchagin and P.M.B. Vitányi. Rate Distortion and Denoising of Individual Data Using Kolmogorov Complexity. *IEEE Transactions on Information Theory*, 56(7):3438–3454, 2010.

4. Keynote Lectures

- Johan van Benthem gave an invited talk on “Logic, the Balance of Expressivity and Complexity” at the International Joint Conference on Automated Reasoning, Edinburgh, Scotland.
- Ulle Endriss delivered an invited tutorial on “Computational Social Choice” at the European Conference on Artificial Intelligence, Lisbon, Portugal.
- Benedikt Löwe lectured on “Using Empirical Results in the Philosophy of Mathematics” at the The Flemish Academic Centre for Science and the Arts, Brussels, Belgium.

5. Outreach Activities

- Benedikt Löwe is a member of the executive group of the Turing Centenary Advisory Committee, preparing the world-wide celebrations of Alan Turing’s 100th birthday in 2012.
- Yde Venema gave a presentation on “Co-algebraische Ervaringen” at “Leve de Wiskunde!”, an Open Day for highschool children and their teachers at the UvA.
- Johan van Benthem lectured on “Logica voor 7-jarigen” at Naturalis in Leiden.

6. Other Highlights

- We graduated a total of 9 PhD students: Cédric Dégremon, Gaëlle Fontaine, Amélie Gheerbrant, Nina Gierasimczuk, Daisuke Ikegami, Jarmo Kontinen, Jacob Vosmaer, Yanjing Wang, and Jonathan Zvesper.
- We staged a large number of scientific events, including a meeting on Classical and Constructive Set Theory (organised by Jouko Väänänen), bringing some of the world’s foremost set theorists to Amsterdam, and the farewell symposium for Peter van Emde Boas.

LOGIC AND LANGUAGE (LOLA)

1. Description Logic and Language programme

Logic and Language (LoLa) is a broad research programme in logic and the philosophy of language, crossing the borders with linguistics and cognitive science. Human reasoning and the interpretation of natural language are the major themes. Logical and philosophical analysis is the basic scientific method. Empirical ratification of analytical work is the main touchstone for success. Binding force is the conviction that interpretation should be studied as a dynamic cognitive process that is embedded in both social practices and the external environment. Hence, the integration of semantics and pragmatics is a dominant long-term research aim.

Our view on how logic and language connect has obvious philosophical roots in the writings of Aristotle, Leibniz, Frege, Wittgenstein, Montague, and Grice. Systematic and historical study of the works of these intellectual forebears forms a substantial part of the project, also to stimulate critical reflection on current systematic research. The work is carried out under four main headings: Semantics and Pragmatics, Vagueness and Granularity, Logic and Cognition and Philosophical Foundations.

2. Prizes

- Michiel van Lambalgen and Dora Achourioti received the second Faculty of Humanities Education Prize for their course "Kant, logic and cognition".

3. Subsidies

- Raquel Fernández Rovira got awarded an NWO MEERVOUD project "Computing Implicatures in Incremental Dialogue Processing", and a collaborative research network grant awarded by the European Science Foundation EURO-XPRAG scheme on Experimental Pragmatics.
- Katrin Schulz got awarded an NWO-Veni grant for the project: "The semantic anatomy of conditional sentences".

4. Key Publications

- Maria Aloni and Angelika Port, "Epistemic indefinites crosslinguistically", in: Proceedings of NELS 2010.
- Giosuè Baggio, Travis Choma, Michiel van Lambalgen, Peter Hagoort, "Coercion and Compositionality", Journal of Cognitive Neuroscience.
- Ivano Ciardelli and Floris Roelofsen, "Inquisitive logic", Journal of Philosophical Logic.
- Inés Crespo, "Against degree-based semantics for taste" in: X. Arrazola and M. Ponte (ed.), Proceedings of the Second ILCLI International Workshop on Logic and Philosophy of Knowledge, Communication, and Action.

5. International Cooperation

- Members of the LoLa group work together with Keith Stenning (University of Edinburgh), Giosuè Baggio (Trieste), Kathryn Pruitt (University of Massachusetts).
- Paul Dekker is chair of the Standing Committee of the European Summer School in Logic, Language and Information.

6. Keynote Presentations

- Paul Dekker, "Jigsaw Semantics", the Sixth International Symposium of Cognition, Logic and Communication in Riga.
- Jeroen Groenendijk and Floris Roelofsen, "Radical Inquisitive Semantics", 14th Workshop on the Semantics and Pragmatics of Dialogue, Poznan, Poland.
- Michiel van Lambalgen, "Logical form as a determinant of cognitive processes", WoLLIC 2010 (Brasilia).
- Martin Stokhof, "Abstractions and Idealisations", the Sixth International Symposium of Cognition, Logic and Communication in Riga.

7. Outreach activities

- Theo Janssen gives promotional guest lectures on secondary schools about logic and information.
- Michiel van Lambalgen gives classes in mathematics for talented children on the primary school St Antonius (reported on in the newsletter of the Faculty of Humanities March 2011).