

Institute for Logic, Language and Computation

Self-Evaluation 2006–2011

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Part A

The Institute

Chapter 1

The Institute for Logic, Language and Computation

The Institute for Logic, Language and Computation (ILLC) is an interdisciplinary research institute at the University of Amsterdam, in which researchers of the Faculty of Science (FNWI) and the Faculty of Humanities (FGw) cooperate. Its scientific mission is to give a formal account of processes related to the encoding, transmission and comprehension of information, broadly taken. In accordance with this interdisciplinary orientation and scientific mission, the ILLC has a wide academic profile, and is situated at a crossroads of ideas, disciplines and organisations, locally, nationally, and internationally.

1.1 Objectives and Research Area

1.1.1 Mission of the ILLC

The scientific mission of the Institute for Logic, Language and Computation (ILLC) is to study formal properties of information, viz. the logical structure and algorithmic properties of processes of encoding, transmitting and comprehending information. The latter notion is to be viewed in its broadest sense, covering not only the mathematical and algorithmic properties of formal languages, but also the flow of information in natural language processing, and human cognitive activities such as reasoning and music cognition. The research aim is to develop theories, logical systems and computational models that can handle this rich variety of information, making use of insights across such disciplines as linguistics, computer science (including artificial intelligence), philosophy, mathematics (including statistics), and cognitive science.

The resulting view of information science transcends traditional boundaries in the university and the wider academic world. In addition to its specific research goals the ILLC aims to overcome such boundaries between faculties and disciplines and to serve as a rallying point for information scientists across computer science, linguistics, mathematics, philosophy, and the social sciences. In particular, the ILLC strives to build strong alliances with local, national and international organisations that share this view.

An important part of the mission of the ILLC concerns the education and training of a new generation of researchers in the interdisciplinary area of Logic, Language and Computation. The institute is strongly committed to its graduate programme, at the level of both MSc and PhD studies. More generally, the ILLC is also dedicated to the dissemination of its results, not only through specialised academic publications but also into the broader world of academic and general education, industrial research and the public debate.

1.1.2 Research area & research structure

In accordance with its interdisciplinary orientation and its scientific mission, the ILLC has a broad scientific profile. Its research spans a number of disciplines ranging from philosophical analysis to computational complexity and from psycholinguistics to game theory. More information on the research area of the ILLC can be found in section 1.3, where we discuss the research environment and embedding of the institute.

Three ILLC Programmes The research at the ILLC comprises three programmes, each of which covers a broad area of logic and adjacent areas:

Logic and Language (LoLa) This is a research programme in philosophical logic and the philosophy of language, crossing the borders with linguistics and cognitive science. The group takes human reasoning and the interpretation of natural language as the major themes, and logical and philosophical analysis as the basic scientific method.

Logic and Computation (LoCo) This group strives to gain a deeper understanding of the nature of information and the processes of reasoning and interaction. The research of this group covers classical areas of mathematical logic, theoretical computer science, and artificial intelligence, but also ventures into economics and physics.

Language and Computation (LaCo) Members of this group focus on computational and cognitive models of human information processing, especially natural language processing, music cognition, and information retrieval. This research concerns computational linguistics, cognitive science, and information science.

The individual programmes have no uniform, fixed structure, but each consists of a small core of permanent scientific personnel (full, associate and assistant professors), and a large, varying component of temporary personnel (postdocs and PhD students) in projects that are largely financed by external (i.e., non-university) sources. The research activities and output of these three groups will be described separately in this self-evaluation.

Unifying ILLC Themes Various kinds of cooperation between the three programmes take place as well. While this is generally dynamic and spontaneous in nature, one can identify a few clear common lines of research shared by the programmes. During the evaluation period, the two most prominent themes were the following:

Logic & Games In the study of information, the concept, the development, but also the *exchange* of information are major topics. In this view, game theory and ‘social’ aspects of information naturally come into play. Most strikingly, this has led to crucial contacts between logic and game theory, bringing an entirely new set of disciplines into the scope of logic: viz., economics and the social sciences. One particular area where interaction is crucial to intelligent behaviour is natural language, where notions from (evolutionary) game theory are used to chart the actual use of language between different agents. In fact, game-theoretic research methods permeate most areas covered by ILLC research, while on the other hand, formal properties of games themselves are objects of study at the ILLC.

Cognitive Modelling While much of the research at the ILLC is abstract and seemingly far removed from everyday practice, there is the reality of human performance. Nowadays, disciplines such as neurophysiology and cognitive psychology are increasingly concerned with human information processing and make great progress in unravelling its underlying psychophysical mechanisms. These results are of immediate relevance to logic in the broad sense as it is conceived within the ILLC. Conversely, insights from logic turn out to be important for cognitive science and neurosciences, providing high-level models for cognitive functions, and leading to new questions and insights that suggest new experimentation at the level of brain processes. Also, computational work done at the ILLC has witnessed a cognitive turn. In the fields of computational linguistics and music cognition, for example, the focus is on the development of computational models of human information processing that are cognitively plausible as well as practically useful.

Of the many other recurrent themes running through the ILLC research we mention Modal Logic, Complexity Theory, Dynamic-Epistemic Logic, and Quantum Computing and Information Flow.

Collaboration projects Within the University of Amsterdam, the ILLC has several ongoing collaboration projects with other institutes, in particular with the Informatics Institute and the Amsterdam Center for Language and Communication. An important and long-standing external partner is the CWI (Center for Mathematics and Computation), four of whose researchers hold part-time professor positions at the ILLC. More recently, the ILLC is at the centre of a collaboration project between the Faculty of Humanities with the KNAW (Royal Netherlands Academy of Arts and Sciences) and the VU (Vrije Universiteit) in the area of Digital Humanities.

1.2 Composition

1.2.1 Organisational structure and management

The ILLC is headed by a scientific director (currently Prof.dr. Yde Venema), who is supported by a management support staff led by the institute manager (currently Jenny Batson MA).

The ILLC is an interfaculty research institute, governed by the Faculty of Science (FNWI) and the Faculty of Humanities (FGw) at the University of Amsterdam. Each of these Faculties is presided over by a dean, currently Prof.dr. Bart Noordam for the Faculty of Science, and Prof.dr. Frank van Vree for the Faculty of Humanities. While the former Faculty is the administrative host of the institute, the director of the institute reports to the deans of both Faculties, and participates in meetings and decision-making processes at both Faculties.

The three ILLC programmes are each directed by a programme leader and a deputy programme leader. Currently these programme leaders are: Prof.dr. Jeroen Groenendijk and Dr. Paul Dekker (LoLa), Dr. Ulle Endriss and Prof.dr. Benedikt Löwe (LoCo), and Prof.dr. Rens Bod and Dr. Khalil Sima'an (LaCo). These six programme leaders, together with the director and the manager, form an institute board that meets bi-monthly to discuss strategy and current affairs. In this meeting, the PhD students and postdocs have representatives since 2010. As of 2012, the three programme leaders, Groenendijk, Endriss and Bod, together with the director and the manager, form a management team that holds short, bi-weekly meetings.

The ILLC has an external advisory committee, the Scientific Advisory Council (Wetenschappelijke Advies Raad), consisting of three members: Prof.dr. Mark Steedman (Edinburgh), Prof.dr. Angelika Kratzer (Amherst), and Prof.dr. Wolfgang Thomas (Aachen). The role of this committee is to advise the ILLC management on general questions of policy, quality control, scientific developments, etc. In 2010, this Scientific Advisory Panel conducted the ILLC midterm review (over the period 2006-2008). Internally, as of 2010, the ILLC has a PhD council, consisting of PhD students who advise the ILLC management on all matters relevant to PhD students.

An overview of the organisational structure of the ILLC is given in Figure 1.1. This diagram includes all staff members with a position at the level of assistant, associate or full professor, over (part of) the evaluation period.

Besides the above councils, committees and persons that are all directly or indirectly involved in the decisions made at the ILLC, its staff and students are involved in various other administrative tasks. The PhD Progress Committee (Dutch acronym: PVC), consisting of four or five staff members, talks to each PhD student annually, and reports to the ILLC director about the quality of the PhD programme. Concerning education at the Bachelor and Master level, the ILLC is first and foremost involved in the MSc Logic programme. The institute provides the programme director of this programme, currently Dr. Ulle Endriss, and the chairs and members of the Examinations Board (Examencommissie) and the Education Quality Committee (Opleidingscommissie). Finally, the ILLC is also involved in other educational programmes, both in the Faculty of Science and in the Faculty of Humanities, both in Bachelor and in Master programmes, and both in teaching and in organisation.

A recent but important development concerns the plans of the two universities in Amsterdam, the University of Amsterdam (UvA) and the Vrije Universiteit (VU), to increase their collaboration substantially via the Amsterdam Academic Alliance (AAA). A key pillar of this alliance is the intended integration of the Science faculties of both universities into one entity, the Amsterdam Faculty of Science (AFS). At the time of writing this self-evaluation report, the internal organisational structure of this new entity, and its relation with its two

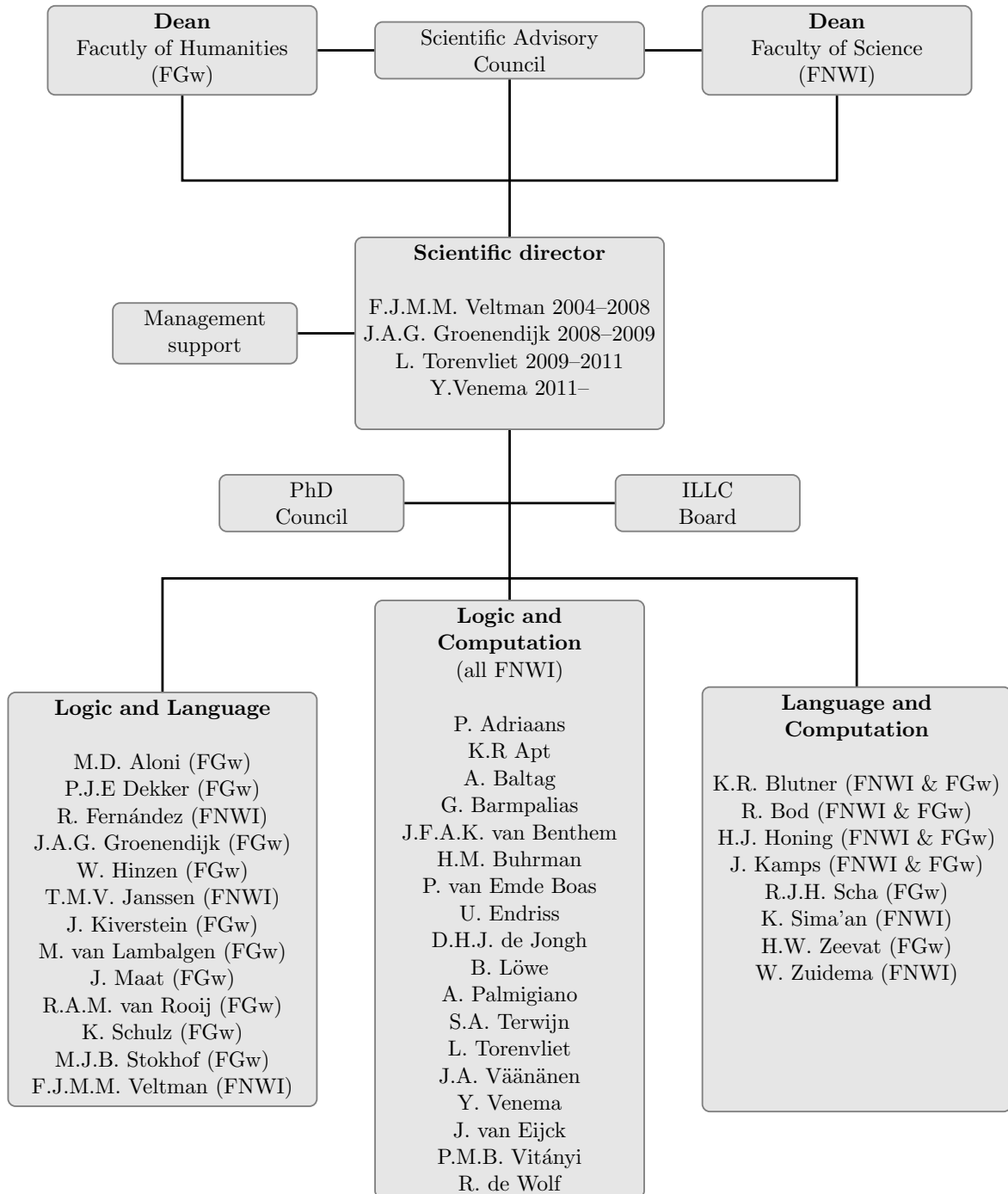


Figure 1.1: Organisation chart ILLC

mother universities has not been determined yet, but the proposed merger will clearly have an impact on the organisational position and structure of the ILLC. Most probably, the Faculty of Science part of the ILLC will join the Amsterdam Faculty of Science, while the other leg of the institute will remain part of the Faculty of Humanities at UvA.

1.2.2 Staff

Table 5.1 on page 66 contains a detailed overview of the fluctuations in staff (both tenured and non-tenured) and PhD students working at the ILLC, split over the two faculties. Table 1.1 below provides a summary in terms of research fte:

	2006	2007	2008	2009	2010	2011
Tenured	9.11	9.51	9.58	10.23	10.50	11.32
Non-tenured	7.96	8.27	11.29	13.02	14.47	16.54
PhD student	32.17	41.27	45.89	41.35	30.51	26.11
Total research staff	49.24	59.06	66.76	64.60	55.48	53.97
Guest researcher	3.95	7.67	8.22	7.53	12.75	10.05
Support staff	2.96	3.33	2.94	2.94	2.94	3.10
Total ILLC staff	56.15	70.06	77.92	75.07	71.17	67.12

Table 1.1: Research staff: summary

Most conspicuous about these numbers is the fairly sharp rise and fall of the number in PhD students, and the steady rise of non-tenured staff members. The latter development is mostly due to the institute's success in acquiring external research funding for projects involving postdoctoral researchers. Concerning the PhD students, we believe that for an institute of the size of the ILLC, an average number of 30-35 PhD students (amounting to 25-30 research fte) is reasonable. Given the fact that most PhD students are hired on external funding, natural fluctuations around this number are to be expected, and because of the small size of the institute, these fluctuations can be relatively large. In the evaluation period the institute was very successful in acquiring a number of large research grants, including the Marie Curie GLoRiClass project (eight PhD students), and two Vici grants (five PhD students). The low number of students in 2011 has been counterbalanced again in 2012: on April 1, 2012, the institute counts 36 PhD students, roughly corresponding to 30 research fte. In September 2012 we expect an influx of 18 PhD students.

Table 1.1 also shows that the number of tenured researchers affiliated with the institute has been more or less constant. Nevertheless, two important developments should be mentioned.

First, the ILLC is now in the middle of transferring its scientific leadership to a new generation of researchers. All members of the generation that founded the institute, and who were working as full professors at the institute in 2006, have retired in the past few years (Remko Scha and Peter van Emde Boas), or will do so in the next few years (Frank Veltman, Jeroen Groenendijk, Johan van Benthem and Martin Stokhof). Furthermore, the position

of the new appointment of Prof.dr. Jouko Väänänen was reduced to 0.1 fte. Partly due to budget constraints at both Faculties, not all of these vacant positions could or can be filled on a permanent basis. Nevertheless, the Faculty of Humanities secured funds to appoint, for a fixed time period, two full-time professors in the Language & Computation group (Rens Bod and Henkjan Honing). At the Faculty of Science, the ILLC was able to appoint a full-time professor in the Logic & Computation group (Yde Venema). For the leadership of the Logic & Language group, an application procedure has been started to find two successors for the positions of Groenendijk, Stokhof and Veltman. In addition, while one of ILLC's part-time professors with a main position at CWI retired (Paul Vitányi), we were able to attract two CWI researchers (Ronald de Wolf and Jan van Eijck) for a 0.2 fte professorship at the ILLC. In addition, four researchers were hired at (or promoted to) the level of associate professor: Ulle Endriss, Khalil Sima'an, Alexandru Baltag, and Sonja Smets. In all, we believe that these steps provide a sound basis to consolidate the institute's scientific leadership.

Second, over the assessment period, the institute has been significantly improving its female/male ratio through a number of new hirings. Of the eight staff members that the ILLC attracted on tenured positions in the reported period (Maria Aloni, Paul Dekker, Robert van Rooij, Alessandra Palmigiano, Raquel Fernández, Alexandru Baltag, Katrin Schultz and Sonja Smets), five are women.

The ILLC as an interfaculty institute There is a difference in organisation structure between the two faculties sharing the ILLC. The primary administrative division of the Faculty of Humanities is in six *departments* that do not coincide with its four research institutes, whereas at the Faculty of Science, the eight research institutes coincide with the departments, and thus also form the basic administrative units. A manifestation of this difference within the ILLC is that the institute has its own budget to act as an employer at the FNWI side, while this is not the case at the FGw side, where the departments are leading. This means for instance that PhD students at the ILLC generally have different contracts, of different duration, at the two faculties. It also means that the research/teaching/administration division is different for ILLC staff members from the two faculties; the following table shows the general figures of time dedicated to research at the two faculties.

	FNWI	FGw
full professor	0.5	0.4
associate professor	0.5	0.4
assistant professor	0.5	0.4
postdoc	0.9	1.0
PhD student		
4 years	0.8	0.8
3 years	1.0	1.0

Table 1.2: Employment time dedicated to research

While these differences may at times cause wonder and complications, the institute realises that these are but a small price to pay for the benefits of fruitful collaboration across the faculty borders.

In the past, this split between the faculties corresponded with a geographical division. However, since a few years the Faculty of Science of the UvA is housed in a brand new building in the Science Park in Amsterdam. In 2009, many (but not all) of the ILLC staff employed at the Faculty of Humanities joined the FNWI-part of the institute in moving to this new building, so that by now, most of the ILLC staff members have their offices at one single location in the Science Park. (The exceptions to this move were Kamps, van Lambalgen, and Stokhof, with their students and postdocs.)

1.2.3 Overview of various sources of financing

Table 1.3 below provides an overview of the internal and external sources of funding of the institute.¹

	2006		2007		2008		2009		2010		2011	
Funding	<i>fte</i>	%	<i>fte</i>	%	<i>fte</i>	%	<i>fte</i>	%	<i>fte</i>	%	<i>fte</i>	%
Direct funding	17.99	39%	18.09	33%	17.87	30%	15.49	27%	14.91	30%	16.19	36%
Research grants	18.11	39%	21.46	39%	28.19	47%	32.87	57%	29.95	61%	26.79	59%
Contract research	4.66	10%	8.48	16%	8.43	14%	5.42	9%	2.23	5%	0	0%
Other	5.17	11%	6.33	12%	5.93	10%	4.19	7%	2.30	5%	2.25	5%
Total	45.93	100%	54.36	100%	60.42	100%	57.97	100%	49.39	100%	45.23	100%
Expenditure	€	%	€	%	€	%	€	%	€	%	€	%
Personnel costs	3.872	91%	4.418	93%	4.667	89%	4.247	89%	4.058	85%	3.833	90%
Other	405	9%	332	7%	599	11%	534	11%	720	15%	421	10%
Total	4.277	100%	4.750	100%	5.266	100%	4.781	100%	4.778	100%	4.254	100%

Table 1.3: Sources of research funding: summary

Three conclusions may be drawn from the above figures. First of all, the table clearly shows that the ILLC is a relatively small institute, depending for roughly one third of its income on direct funding by the university, and for over 60% on research grants. Second, the evaluation period has seen a small but steady decline in direct funding, reflecting the trend in the Dutch national research policy whereby research funding has been transferred from the universities to grant-giving organisations. This decline has been partly balanced in 2011 by investments by the FGw in UvA research priority areas such as Brain and Cognition, and in designated faculty research fields ('speerpunten') such as the Digital Humanities.

Third, the table shows a fairly sharp rise and fall of the amount of external funding. This can be explained by the fact that right before and at the beginning of the evaluation period, the ILLC had been very successful in winning some large external grants (for, among others, two NWO Vici projects, and the Marie Curie project GLoRiClass). These projects were in

¹A more detailed overview, with the sources of funding are split over the two faculties, can be found in Table 5.2 on page 68. There we also explain the terminology used.

full swing in the middle of the evaluation period and finished towards the end of it (in the case of GLoRiClass, this also explains the amount of ‘contract research’ being reduced to zero in 2011). In the near future the amount of external funding will rise again, with the start of four young researchers on Veni projects and the arrival of Sonja Smets in January 2012 with both a Vidi project in progress and a new ERC Starting Grant.

1.3 Research Environment and Embedding

The ILLC is not a standard research institute. Within the Dutch academic landscape it has no counterpart with a comparable research profile, and even internationally there are only very few institutes that bring together the humanities and the sciences in a similar way. In this section we discuss the interdisciplinary nature of the ILLC in some detail, and we position the institute in this research landscape, by surveying our (inter)national activities and contacts.

1.3.1 Connecting disciplines

In Section 1.2 we already described the formal status of the ILLC as an *interfaculty* research institute, shared by the Faculty of Humanities and the Faculty of Science at the University of Amsterdam. This status is the organisational reflection of the boundary-crossing nature of the research conducted at the institute. The specific research profile of the ILLC fits a long-standing tradition in Amsterdam and very much determines the *identity* of the ILLC. Hence, in order to sketch the research environment and embedding of the institute, a discussion of this interdisciplinary nature is in order.

Historical background A major feature in the almost century-long tradition behind the ILLC is the important role of logic, a discipline that throughout its history has connected mathematics and philosophy. It was this combination that led to the seminal work of Gottlob Frege, Bertrand Russell, and Kurt Gödel that not only revolutionised our understanding of the foundations of mathematics, but also showed how philosophy can be an exact discipline. Logic also seamlessly merges into computation, as is shown by the work of the logician Alan Turing, whose achievements as one of the founding fathers of computer science are being celebrated this very year.

Against this background, the University of Amsterdam has long been a leading force, setting an international agenda. The mathematical work of Luitzen Brouwer in the first half of the twentieth century gave us intuitionism, an information- and computation-based view of proof and reasoning, which constitutes one of the leading schools of thought, not just in philosophy of mathematics, but in many areas in which logic plays a central role. And in the 1950s, the philosopher Evert Willem Beth added deep links with definability and expressive power in formal languages, as well as techniques for automated deduction that still flourish today. His broad, interdisciplinary programme explored many new connections between the new logical insights and techniques, and age-old problems in philosophy.

A striking feature of the Amsterdam tradition is that this role of cross-fertilisation of disciplines has continued, as successive new generations of researchers felt attracted to this intellectual environment. Starting from the 1970s, new areas of logic-inspired interdisciplinary

research attracted wide international attention. One was the study of logical patterns in the expressive power and reasoning capacities of natural language, an area where the ILLC has become a leading institution worldwide with researchers such as Jeroen Groenendijk, Martin Stokhof and Frank Veltman. Another innovative discovery was the surprising extent of the deep analogies between natural and formal (programming) languages, brought to light by Peter van Emde Boas, Theo Janssen and others, which has profoundly influenced our understanding of both linguistics and computer science. Undoubtedly the most influential research that not only defined the shape of the ILLC, but in fact helped define the profile of modern logic as a truly interdisciplinary field, was conducted by Johan van Benthem. Van Benthem explored the various interactions between reasoning, computation and information exchange in natural language and formal settings, using and newly developing a wide range of logical concepts and techniques.

ILLC: early years All this came together in the informal foundation of the ILLC in 1986, when a number of researchers joined forces. Anne Troelstra, working in the tradition of Brouwer and Heyting in mathematical logic; van Benthem, then recently appointed to a chair in logic; Renate Bartsch, who had pioneered the logical approach in semantics since the mid seventies, and Peter Van Emde Boas, who explored ties between theoretical computer science, logic and other fields. Together with Dick de Jongh, Theo Janssen, Jeroen Groenendijk, Martin Stokhof, Leen Torenvliet and Frank Veltman they formed an interdisciplinary research institute that would nurture and expand the cooperative ties that had already started to form at the beginning of the eighties. When research institutes entered the Dutch university system as legal entities in the early 1990s, the ILLC was one of the first to be instituted by the University of Amsterdam.

Since its founding, this relatively small community, somewhat later joined by computational linguist Remko Scha, and theoretical computer scientist Krzysztof Apt, has produced a steady stream of innovative ideas that attracted an international following. Some highlights in this development are ‘dynamic semantics’, a view of natural language as a meaning- and information-producing device for communication, inspired by analogies with imperative programming languages. By now, dynamic semantics is also becoming a force on the philosophical scene as a new theory of meaning. A more mathematical and computational example is the development of modal logic, originally a theory of cognitive attitudes in philosophy, but now also a general theory of both finite and infinite processes. The ‘Amsterdam School’ in modal logic is widely known for its specific methodology, which has influenced many areas of computer science, but also the philosophy of action. As a third example, (but our list is by no means complete), one can mention the innovative paradigm of ‘data-oriented parsing’ that has changed traditional views of natural language processing by merging statistical pattern-recognition methods with logical rule-based grammars to produce a cognitively appealing view of linguistic behaviour and reasoning in which the roles of experience and logical skills are merged. Several of these developments have also found their way into research on human cognition, in such areas as reasoning, linguistic information processing, and music cognition.

Embedding a coherent research area A great history is not enough. The primary reason underlying the existence of the ILLC is the shared conviction that ‘Logic, Language and Computation’ constitutes a *coherent research area* that thrives on combining research methods from various origins. Developments in recent years show that this works, now as well as ever. When considering the present research profile of the ILLC, one sees a new generation of theories and emerging research areas, such as: game-based interactive semantics for natural language pioneering new contacts between linguistics and game theory; dynamic-epistemic logics that describe events of information flow and communication, and that are now beginning to play a role in formal epistemology and philosophy of science; digital and computational humanities, applying the vastly increasing power of computational methods to answer both old and new questions in the humanities; logical systems of game play and social behaviour with computational implementations in social choice and social software; algorithmics based on the new paradigm of information processing in quantum computing, and logics for describing the information flow in such processes; co-algebra as a foundational theory of state-based evolving systems, providing a mathematically simple, unifying framework for never-ending processes of various kinds.

All these specific new ideas are hard to imagine without the kind of free and open contacts between disciplines that the ILLC stands for, making it no coincidence, for example, that the ILLC has been the birth place for the Handbooks of Logic and Language, Modal Logic, and the Philosophy of Information. Moreover, the interdisciplinary mix is still growing, making the ILLC even more of a crossroads of disciplines at the University of Amsterdam. The third-generation topics described in the above also involve contacts with the exact, natural and social sciences, and a significant widening of the application area of ‘ILLC-style’ research in the humanities. The range of applications in terms of disciplines and research questions may be wide, but the perspective that the ILLC brings to bear on them is coherent: it is logic in a broad sense, as the study of information and information exchange, that ties all these specific projects together. Finally, what makes the ILLC special is that it brings all these research activities together *in one institute*, not only shortening the lines of communication between traditionally separate disciplines, but also facilitating collaboration on ILLC-wide themes such as game theory, and cognitive modelling (as mentioned in Section 1).

The ILLC in the UvA research profile In accordance with the policy of the Dutch Ministry of Science and Education, which requires the Dutch universities to individually sharpen and collectively coordinate their research profiles, the University of Amsterdam has identified a number of Research Priority Areas (RPAs), clustered in seven themes that together form the UvA research profile. Similarly, the two faculties governing the ILLC have designated their own (additional) special areas on which they intend to focus their research efforts. It is the intention that eventually these areas will cover a large part of the research conducted at the university (respectively, the faculties).

While at the time of writing this self-evaluation the process of research clustering has not completely crystalized, it is clear that the ILLC is well represented in these themes, RPAs and research focal areas. At the university level, the institute is highly visible in two of the seven UvA themes. This applies most of all to the theme *Communication and Information*, which naturally embeds much of the ILLC research. In particular, this theme covers some of the

recent initiatives in which the ILLC takes a leading role: ‘Information and Meaning’ (a joint project of ILLC and the Informatics Institute, which is recognised as an FNWI focal area), ‘Digital Humanities’ (one of the main special research areas of the FGw), and ‘The Language Blueprint’ (a joint research programme of the ILLC and its adjacent research institute at the Faculty of Humanities, the Amsterdam Center for Language and Communication (ACLC)). The second UvA theme with a strong ILLC involvement is *Cognition, Socio-Economic Behaviour and Neuroscience*. This theme covers the RPA ‘Brain and Cognition’, a programme in which the ILLC embeds its research on cognitive modelling, again joining forces with the ACLC. The ACLC and ILLC are among the participating research institutes in the Cognitive Science Center Amsterdam (CSCA), a research centre taking an interdisciplinary approach towards understanding the mechanisms of cognition. Finally, next to the already mentioned participation of the ILLC in various special research areas of its two faculties, the institute also collaborates with the Institute of Physics in the FNWI special research area ‘Quantum Matter and Quantum Information’.

Institutional status It should not be underestimated how much the stability provided by the formal organisational status of the ILLC has contributed to its reputation and success. The ILLC has become something of an international brand in its research area, and this prestige, too, is a major factor in attracting and tying creative young researchers to this environment, often despite offers for better positions elsewhere. Similarly, the ILLC’s institutional back-up has contributed to the success of its researchers in terms of attracting external funding for their research projects. Many of those, such as the EU Marie Curie project GLoRiClass on logic and games, would have been quite difficult to imagine as the successful enterprises they have turned out to be without the stability of the research environment that the ILLC offers. The same applies to the success of the MSc Logic programme (to be described in more detail in section 1.10), which would be impossible to run without the continuous support of the institute. An essential contribution to the organisational strength of the ILLC is made by the dedication, competence and flexibility of its support staff.

1.3.2 Connecting a community

ILLC’s individual staff members all have a wide network of colleagues with closely related research interests at universities in the Netherlands and abroad. An overview of these contacts will be provided at the level of the institute’s programmes. Here we survey the international position of the ILLC as a whole.

(Inter)national organisations First, many of the national and international initiatives in the ‘Logic, Language and Computation’ area would not have been possible, or not as successful, were it not for the continuous driving force of the ILLC. At the national level, the ILLC has played a pivotal role in the establishment, first of the PhD-training network in Logic and Language, and later in the founding of one of the first officially recognised national graduate schools, the ‘Onderzoeksschool Logica’, initiated and run by the ILLC from 1992 to 2005, when it was taken over by Utrecht University for a number of years. At an international level, the impetus for the establishment of the Foundation for Logic, Language

and Information (FoLLI) was largely due to the efforts of ILLC members, and FoLLI was run by the ILLC from its establishment in 1991 until 2004. Organised under the umbrella of FoLLI, the annual European Summer Schools in Logic, Language and Information (ESSLLI) has been of immense value for the advancement of research, and for the establishment of an international research community. From the very beginning, the ILLC has been one of driving forces behind ESSLLI, guaranteeing its continuity; for instance, Paul Dekker has been the ESSLLI Standing Committee Chair since 2007, and ESSLLI 2008, which was held in Hamburg, was largely organised by the ILLC. Thanks to the international contacts of Johan van Benthem and other ILLC staff members, the ESSLLI initiative has been taken up globally, with counterparts in North America (NASSLLI) and East Asia (EASSLLC).

Events Second, the ILLC regularly hosts scientific events that have helped make Amsterdam a rallying point for the international research community. The clearest example is the Amsterdam Colloquium, one of the foremost conferences in semantics, which has been organised by researchers affiliated with the ILLC and its predecessors since 1976. During the assessment period, members of the ILLC have launched several new initiatives: in 2006 the inaugural edition of the International Workshop on Computational Social Choice was held in Amsterdam; 2008 saw the launch of *The Making of the Humanities*, an international conference series devoted to the history of the humanities; and 2008 was also the year the new annual Amsterdam Graduate Conference in Philosophy, an event conceived and organised by PhD students at the ILLC, took place for the first time. Other important events organised at the ILLC included the 8th Conference on Logic and the Foundations of Game and Decision Theory (LOFT) in 2008 and the 4th Conference on Topology, Algebra and Categories in Logic (TACL) in 2009.

Contacts with similar institutes The ILLC has a long tradition of various contacts and partnerships with research institutes around the world that are similar in spirit. These contacts take various different shapes, including exchange programmes, collaborative research projects, individual researchers with joint affiliations, the organisation of joint workshops, or staff moving from one institute to the other.

- In particular, the *Center for the Study of Language and Information* (CSLI) at Stanford University has been a long-standing research partner, partly due to the fact that Johan van Benthem has held positions at this institute since 1992.
- With the *Institute for Logic and Cognition*, (ILC) at Sun Yat-Sen University, Guangzhou, China, the ILLC has been engaged in an exchange programme for lecturers and students since 2005.
- Contacts of various kinds have existed with the *Institute for Language, Cognition and Computation*, and other institutes at the University of Edinburgh. Presently, Mark Steedman is the chairman of the Scientific Advisory Panel of the ILLC.

- More recent contacts include the *Munich Center for Mathematical Philosophy* headed by Hannes Leitgeb, and the *Center for Formal Epistemology* at Carnegie Mellon University in Pittsburgh, headed by Kevin Kelly.
- An interesting future partner will be the interdisciplinary institute that is on the planning table of researchers at Tsinghua University, with whom many contacts already exist; in particular, Johan van Benthem has been appointed Distinguished International Expert at Tsinghua University, by the Chinese Ministry of Education.

Guests Finally, another clear indication that the ILLC is a world player in its research area is the geographic diversity of its research contacts. During the evaluation period the institute has hosted more than one hundred guests (where we count as ‘guest’ any research visitor staying at the institute for a period of two weeks or more). Figures 1.2 and 1.3 display where these researchers came from.



Figure 1.2: Home institutes of ILLC guests (inside Europe)

1.4 Quality and Scientific Relevance

The academic quality and scientific relevance of the research conducted at the ILLC is discussed in detail at the programme level, where we give several examples of research highlights, provide a short list of key publications that are representative for the work in each of the



Figure 1.3: Home institutes of ILLC guests (outside Europe)

three programmes, and give an overview of the most important books published during the assessment period.

1.5 Output

During the evaluation period, ILLC researchers have produced a large number of publications: 28 authored books, 76 edited books, 171 book chapters, 333 journal articles, and 548 conference papers. Table 1.4, which provides an overview of the institute’s scientific output, shows that the number of publications of ILLC staff is more or less constant — the decrease in 2011 naturally follows the decrease in research fte in 2009/2010.

Institute for Logic, Language and Computation	2006	2007	2008	2009	2010	2011	SUM
Refereed journal articles	49	63	55	52	55	59	333
Non-refereed journal articles	2	2	3	3	4	1	15
Books/monographs	4	4	3	4	5	8	28
Edited books	14	10	14	11	13	14	76
Book chapters	36	31	23	28	25	28	171
PhD-theses	8	5	11	13	12	11	60
Conference papers	82	96	88	104	111	67	548
Professional publications	13	6	8	1	6	2	36
Publications aimed at general public	7	5	7	3	0	6	28
Total publications	215	222	212	219	231	196	1295

Table 1.4: Research output at institute level

The institute has not undertaken a quantitative analysis of its research output.² In any case, the overwhelming majority of the journal and conference publications are peer-reviewed,

²The reason for this lies in the interdisciplinary nature of the ILLC, and the fact that the culture of communicating scientific results differs hugely between the disciplines covered by the institute’s research. As

and many of these have appeared in high-ranking journals and conference proceedings.

In years 2006–2011, the institute witnessed the graduation of 56 PhD students.³ At the end of the evaluation period, there were 35 ongoing PhD projects at the ILLC. Further information about the ILLC graduate programme can be found in section 1.10.

1.6 Earning Capacity

As mentioned in section 1.2.3, during the evaluation period on average almost two-thirds of the ILLC research funding was covered by external funding through research grants. We will supply more information about the earning capacity of the ILLC at the level of the three ILLC programmes, providing some details about the various research grants (see the Tables 2.3, 3.3, 4.3). In total, the ILLC and its researchers were awarded more than 45 research grants (where we only count those projects enabling the appointment of research staff), for a total amount⁴ of 17.4 M€.

Internally at the University of Amsterdam, the strategic position of the ILLC in the university's research profile has been advantageous for the institute. In particular, the Faculty of Humanities is currently exploiting its temporarily exceptional financial position to invest in the university's research priority areas, and in its own special research areas. The ILLC has benefited from this by the appointment of a temporary assistant professorship in Digital Humanities, and in 2012 it will obtain two temporary associate professorships, in respectively cognitive modelling and digital humanities.

When it comes to external research funding, two trends are visible. First of all, at the national level, during the evaluation period research funds have been transferred from the universities to national funding agencies, in particular to NWO; in addition, the European Union is becoming more and more important as a source of research funding. Second, both nationally and internationally, research funding is channelled through two kinds of schemes: programmes that are directed towards individual researchers (in particular, the Dutch Innovative Research Incentives Scheme (Vernieuwingsimpuls, Dutch acronym: VI)⁵ or the European

yet, there is no reliable bibliometric method that would do justice to the full research spectrum of the ILLC, or even to the research area of the institute's three individual programmes. Similarly, the list of journals and conference proceedings where ILLC staff members aim to publish is so diverse and scattered that a reasonable selection of the top 10% or top 25% publication media does not seem possible.

³Table 1.4, which lists 60 PhD theses, also includes 4 dissertations which are published in the ILLC Dissertations Series, written by PhD students who were supervised by ILLC members but who graduated at another university.

⁴Calculating the exact amount of research income from grants is not a straightforward exercise. Some grants, in particular the VI grants, involved financial *matching* by the university, faculty and/or institute. The rules for this have changed over time, and because of the different administrative status of the ILLC in the Faculty of Humanities and the Faculty of Science, they worked out differently in the two parts of the institute. As a guideline for determining the income from a grant we have taken the total amount of money that (1) has become available for research because of the grant, and (2) is not paid for by the institute itself. Following this guideline, we have also listed as research grants some of the investments made by the FGW in their research focal areas.

⁵NWO's VI programme is an attractive and prestigious subsidy scheme for stimulating individual researchers in different stages of their scientific career. The programme is subdivided in Veni, Vidi and Vici grants: Veni grants are meant for young researchers who have recently taken their PhD, to allow them to continue to develop

ERC scheme), and funding that is given to large-scale conglomerates of research groups, often involving industrial partners. While the ILLC has been very successful in acquiring the first kind of research funding, this is somewhat less so in the second. The ILLC management recognises this situation, and will address it.

1.7 Academic Reputation

The academic reputation of a research institute rests on two pillars: the recognition of the individual qualities of its staff members, and the (international) appreciation of the institute as a whole.

The first aspect will be discussed mainly at the programme level, where we list the awards that individual programme members have won, the editorial boards and programme committees in which they participate, etc. Here we confine ourselves to a quick summary, listing the most obvious indicators of the academic reputation of individual staff members.

- Two of our emeriti (Bartsch and Troelstra) and two of our full professors (van Benthem and Stokhof) are members of the Royal Dutch Academy of Arts and Sciences (KNAW); Honing currently holds the KNAW Muller chair. One of our emeriti (Vitányi), one of our full professors (van Benthem) and one of our part-time professors (Apt) are members of the Academia Europaea.
- One of our members (van Benthem) received the NWO Spinoza prize, the highest award in the Dutch academic world which is awarded annually to three researchers who belong to the absolute international top in their field.
- The ILLC has been very successful at winning grants in the prestigious Dutch *Vernieuwingsimpuls* (VI) programme, see footnote 5. Laureates in this programme are assumed to belong to the very top of their peer group, and hence the academic reputation of an institute can be measured by its success in this grant scheme. Among the ILLC staff members of January 1, 2012, the institute boasts:
 - four laureates of a Vici grant (or its predecessor, PIONIER): Bod, Buhrman, van Lambalgen, and Venema;
 - nine winners of a Vidi grant (or its predecessor, the first-generation VI grant): Aloni, Bod, Dekker, Kamps, van Rooij, Endriss, Sima'an, Smets, and de Wolf; in addition, Smets won an ERC Starting Grant;
 - eleven researchers that hold (or held) a Veni grant: Aloni, Franke, Fernández, Honingh, Palmigiano, Renne, Roelofsen, Schaffner, Schulz, de Wolf and Zuidema.

With respect to the stature of the institute as a whole, it is exactly its interdisciplinary nature that has gained the ILLC a world-wide reputation as an anchor in its research area

their ideas. Vidi grants are for researchers who want to pursue an innovative line of research, and appoint one or more researchers. Vici grants, finally, are open for applications by senior researchers who want to build up their own research group.

of Logic, Language and Computation/Information. In fact, the name ‘ILLC’ has become something of a brand name in the area. Since this aspect of our academic reputation is hard to quantify, we have gathered three quotes from academics working at internationally leading universities, one hosting a similar institute as the ILLC (Stanford University), one where no such entity exists (Oxford University), and one where plans have been made to set up a similar institute (Tsinghua University):

ILLC is a very important institute to which CSLI and its associated Stanford faculty members look for innovative and influential developments in a broad range of disciplines associated with logic, language, computation, and the cognitive sciences. The impressive stream of scientific results emanating from ILLC, together with your highly visible interdisciplinary events and the flow of very bright and extremely well educated post-graduate students ILLC crucially helps UvA provide to the international community make your institute and its affiliated researchers indispensable partners in the international scholarly community. My colleagues at Stanford and elsewhere look forward expectantly to a long future of highly rewarding and mutually beneficial academic interaction with ILLC.

*Prof.dr. Stanley Peters, Professor of Linguistics,
Director of the Center for the Study of Language and Information,
Stanford University*

ILLC is a major centre for logic on the world stage. It is distinguished in particular by its critical mass of excellent researchers, and by its multi-disciplinary breadth, transcending the usual divisions between the physical and social sciences and the humanities. My interactions with ILLC researchers over the years have been very valuable to me, and have helped to sustain and broaden my own view of logic.

I would also like to mention the Master’s in Logic programme, which is a unique European resource, and has an excellent track record of training researchers from all over the world who have gone on to have productive careers in logic.

*Prof.dr. Samson Abramsky, Professor of Computing,
Oxford University*

The Tsinghua Logic Circle, for now an informal organisation, has been very active. We are hosting a continuing series of logic research activities, covering a broad range of themes from pure logic to outreach in philosophy, linguistics, cognitive science and artificial intelligence. With the support of the Deans of Tsinghua, we are now planning to establish some official interdisciplinary institute in the future, inspired by the ILLC model.

It is our intention to stay in close contact with researchers at the ILLC. In particular, we appreciate the effort and support provided by Professor Johan van Benthem, as the Distinguished International Expert appointed by the Ministry of Education in China, in building up the community.

*Prof.dr. Fenrong Liu, Professor of Logic,
& Prof.dr. Junren Wan, former Dean of the Department of Philosophy;
currently Dean of the Institute for Advanced Studies in Virtues and Religions,
Tsinghua University, Beijing*

1.8 Societal Relevance

Far more than just reporting their findings in scientific publications, ILLC staff aim at making the results of their research accessible, available and useful to a wider intellectual community, as well as to society at large. Where possible, these efforts involve direct valorisation, and, as we will explain towards the end of this section, the institute is increasing its activities in this direction.

Given the theoretical nature of most research conducted at the ILLC, however, in general these efforts cannot be expected to be aimed at direct, short-term applications. Results in areas such as philosophy of language, mathematical logic, theoretical computer science, and linguistics may take a long time before spawning effects in society. Nevertheless, these effects may be profound. A clear-cut example is the digital revolution, which has completely transformed our society, economy, and culture, and which could not have taken place without the 20-th century developments in precisely the above mentioned research areas. In particular, logicians (Church, Post, Turing) first defined the concepts of algorithm and computability, and the impact of theoretical linguistics on the development of programming languages, though less well known, is undeniable. Similarly, new concepts like quantum computing, while still lacking an experimental basis, could have another revolutionary impact on the digital society; in fact, during the week that we were preparing this text, the two most popular television talk shows in the Netherlands (‘De Wereld Draait Door’ and ‘Pauw & Witteman’) featured new developments in quantum computing.

Nonetheless, the work of the ILLC also bears direct, measurable societal impact. We will divide the various contributions that constitute the societal relevance of the work of the ILLC and its members into three categories: outreach & dissemination, education & training, and valorisation.

Outreach & Dissemination The outreach and dissemination activities of the members of the ILLC are aimed at very diverse audiences. Taking the targeted audience as a criterion, we distinguish the following categories.

First, activities aiming at the general audience consist of public lectures, debates, radio and TV interviews, documentaries, and articles in newspapers and magazines. These activities are so numerous and diverse in nature that we confine ourselves to mentioning three examples here (more details can be found at the programme level):

- As a member of the executive committee of the Turing Centenary Advisory Committee, Löwe was heavily involved in preparations for outreach activities to be organised as part of the Turing Year in 2012.
- Several staff members gave public lectures to a lay audience. Examples include Buhrman’s

lecture on *Quantum Computing and Science Fiction* at the Science Café Nijmegen in 2008, van Benthem’s lecture on *Logic for Children* at the Museum Naturalis in Leiden in 2010, and Honing’s lecture *What makes us musical animals* at TEDxAmsterdam in 2011.

- The ILLC supports and co-organises *Leve de Wiskunde!* and *Viva Informatica!*, annual events aimed at attracting high-school pupils and their teachers to the areas of Mathematics and Computer Science, respectively.

Second, as dissemination aimed at a wide intellectual community we mention the books, ‘De vergeten wetenschappen: een geschiedenis van de humaniora’ (‘The forgotten sciences: a history of the humanities’) by Rens Bod, and ‘Iedereen is muzikaal: Wat we weten over het luisteren naar muziek’ (‘Music cognition: a science of listening’) by Henkjan Honing, both of which received a lot of attention in the press (over a hundred reviews in newspapers and magazines).

Finally, ILLC staff members have also been very active in the dissemination of ideas towards a general, but academic audience. Under this heading we list the production of various hand- and textbooks, including the Handbook of Spatial Reasoning, the Handbook of Modal Logic, and the Handbook of Philosophy of Information.

Education & Training The ILLC participates in many programmes at the University of Amsterdam, in regular Bachelor and Master programmes, such as linguistics, mathematics, computer science, AI, musicology, philosophy, and cognitive science, but also in the prestigious Amsterdam University College.

The ILLC graduate programme contributes directly to society through its philosophy of integrating the sciences and the humanities that creates a versatile type of graduate who is directly capable of functioning in various positions in science and industry. While the majority of our MSc and PhD graduates opt for an academic career and are successful in obtaining PhD positions, often at highly prestigious universities, other popular career choices include management consulting, software engineering, and teaching. The institute recognises the increasing importance of such career choices, and intends to increase its efforts to prepare its graduates for a career outside academia accordingly.

Direct Valorisation The ILLC is also involved in projects aiming at a more direct valorisation of its academic research and culture.

First, there is an influential line of applied research on developing novel tools for information access to cultural heritage (attracting around 3 million Euros of national and European funding). This line, directed by Jaap Kamps, has resulted, among other things, in (1) techniques for integrated access to cultural and scientific resources across languages and mediatypes (together with the Institute for Informatics), (2) an experimental lab for evaluating new technology, in particular 3D reconstructions, in a museum and on museum web sites (in collaboration with the Allard Pierson Museum of Archaeology, and Special Collections of the University Library), (3) novel search techniques for Web archives tailored to the need of humanities scholars (in collaboration with the Koninklijke Bibliotheek, Den Haag, and

CWI, Amsterdam), and (4) exploratory search tools for the parliamentary proceedings (in collaboration with the Center for Digital Humanities and the UvA Institute for Informatics).

Second, the emergence of the research area of Digital Humanities is paving the way for new public-private initiatives between academia and society. The growing availability of digital corpora and digital methods allow humanities researchers to discern new patterns in language, arts, music and other visual, textual and auditory data. This has led to new scientific questions and results that are also of interest to industry. Together with the Vrije Universiteit Amsterdam and the KNAW, the Faculty of Humanities has initiated a public-private Center for Digital Humanities, directed by Rens Bod. The Center is currently (May 2012) running five projects, each of which involves collaboration between the University of Amsterdam and a commercial company. These public-private collaborations, which cover various areas of the humanities, will result in concrete, commercial products that are driven by a question from the humanities. Algorithms and tools from computational linguistics play a key role here. In the course of 2012, the Center will start up seven additional projects.

Third, in cooperation with the Institute for Informatics and a commercial partner, the BlueBubbleLab, Leen Torenvliet initiated an undertaking aimed at producing software for commercial applications. In this undertaking, named *The Code Factory*, computer science students, under professional guidance, take on real-life programming projects stemming from orders obtained from the portfolio of the commercial partner. The mission of this undertaking is, among other things, to allow students to obtain real work experience and learn skills that are useful for society but that cannot be obtained in academia, and to make the Computer Science programme more in line with societal demands on our alumni, not all of whom will end up in a research position.

1.9 Viability

For two decades now, the ILLC has been one of the world's major centres in the interdisciplinary research area of logic, language and computation. Far from resting on these laurels, the institute keeps thriving scientifically, continuously innovating its research agenda without compromising its identity. Internationally, the ILLC is highly visible in most if not all of its research areas, and in some fields it is world leading. It has made some successful appointments in the recent past, and keeps attracting talented young researchers at the PhD and postdoc level (for instance, in 2011 no less than four junior ILLC researchers managed to obtain a Veni grant). As a result of this, the institute's community of researchers and students displays a healthy balance of excellent researchers in all age groups.

As discussed in the previous section on earning capacity, the institute has a more than satisfactory track record when it comes to the acquisition of research funding. Given the institute's research profile, there are ample opportunities to continue this success, provided that the institute increasingly directs its activities towards European funding agencies, and joins larger research conglomerates.

The main challenges that the institute is facing concern its organisational structure and the continuation of its leadership. While the ILLC is strategically well-positioned at the University of Amsterdam, the pending merger of the science faculties of the two Amsterdam universities

into a new, fairly independent Amsterdam Faculty of Science, will increase the administrative distance between the science and humanities parts of the ILLC, and will make (the science part of) the institute a rather small player in the AFS. This may cause complications for the internal organisational structure of the institute, and may reduce the influence of the institute in the local academic constellation. On the other hand, the merger will also offer new possibilities for collaboration and possibly for research funding, and the institute may also play a key role in maintaining the links between the new AFS and its mother universities.

Concerning the institute's academic leadership, the transfer of leadership to a new generation is now in full swing. The decision of the two faculties to agree on a joint selection committee for two full professorships in the Logic and Language programme provides an excellent opportunity to renew the leadership of that programme. The investment of the Faculty of Humanities in two professorships for the Language and Computation group is also a promising sign, but the fact that for the time being these positions are only temporary is still a matter of concern.

Summarising, scientifically the institute is in excellent shape, it has good prospects to stay successful in acquiring research funding and, provided that the mentioned organisational challenges are addressed in a satisfactory manner, the ILLC has every reason to be optimistic about the future.

1.10 Next Generation

The ILLC is very dedicated to the training of a new generation of researchers in the area of Logic, Language and Computation. In particular we take our full Graduate Programme into consideration, including our MSc Logic programme, and we shall also make a few remarks on our postdoctoral researchers.

1.10.1 The Master of Logic Programme

The ILLC contributes to many degree programmes at the University of Amsterdam, but the institute's flagship is the Master of Logic (MoL). The MoL has been offered by the ILLC since 1995, initially as a one-year programme attracting only students from abroad and since 2003 (with the introduction of the Bachelor-Master system in the Netherlands) as a regular two-year programme. It provides intensive interdisciplinary research training for excellent students with a first degree in Mathematics, Computer Science, Philosophy, Linguistics, or a related discipline.

The MoL has always been very successful in attracting new talent. Indeed, only around 10% of our incoming students hold a Bachelor's degree from the University of Amsterdam, while around 75% come from abroad. At any given time, there typically are over 25 nationalities represented in our student population. Around 30% of our students are female. During the assessment period of 2006–2011, 101 students graduated from the MoL programme. Many of our students have produced significant research results while here; for instance, 30–40% of all Master's theses result in a publication. Roughly 70% of our graduates opt for an academic career and are successful in obtaining PhD positions, often at highly prestigious universi-

ties. Other popular career choices include management consulting, software engineering, and teaching. The general philosophy of the ILLC is deeply entrenched in the MoL programme. This means that our graduates become ambassadors of the institute's interdisciplinary and open-minded approach to logic when they leave the ILLC to pursue a career elsewhere. The institute is proud still to be in contact with a large number of its MoL graduates.

The MoL was accredited in 2007, under the auspices of the Dutch-Flemish Accreditation Organisation (Nederlands-Vlaamse Accreditatie Organisatie, Dutch acronym: NVAO), during the first wave of accreditations of Master's programmes in the Netherlands, and achieved one of the very best results of any programme in the country. The committee assessing the MoL specifically emphasised and judged as excellent (a) the programme's integration with research, (b) the track record of its staff in terms of research, (c) the student support provided by ILLC staff, and (d) the level achieved in terms of job prospects for our graduates and in terms of global recognition of the programme.

1.10.2 The ILLC's PhD Programme

PhD positions at the ILLC come in various shapes and forms, depending on their source of funding and the faculty at which the candidates are appointed. First, there are the PhD students funded directly by the university. At the Faculty of Science, such a position is typically a four-year full-time position, whereas at the Faculty of Humanities a standard PhD position is four years 0.8 fte, or, in the case of a full-time arrangement, three years and three months. (For a complete picture it should be added here that while PhD positions at the Faculty of Science include teaching tasks, PhD-students funded by the Faculty of Humanities are not required to teach but can often augment their 0.8 fte position with teaching activities.) Second, students hired on research projects funded by NWO generally have four-year positions, while European grants typically fund a three-year appointment for a PhD student. The ILLC endeavors to help the latter students in finding complementary funding to attain a four-year position. Third, some students are funded by international programmes, such as *Erasmus Mundus*, or by scholarships from foreign countries (e.g., grants from the Chinese scientific council). Finally, there are also a few candidates who support their PhD studies using private funding.

Figures 1.4 and 1.5 display the nationality of all ILLC PhD students who were affiliated with the institute during the assessment period.

Education and Training

The main task of a PhD student at the ILLC is to do excellent research, to publish this research, and to produce a dissertation. The training provided by the ILLC to support PhD students in view of this task takes a variety of forms. The most important role in this respect is that of the supervisor(s), who work intensively with the student over several years. By its very nature, much of this process cannot and should not be regulated, but the ILLC nevertheless provides some checks and balances. For instance, within the first few months of their appointment, each student and their supervisor put together an Education and Supervision Plan (Dutch acronym: OBP), which outlines the PhD project and formulates the



Figure 1.4: Home countries of PhD students (inside Europe)



Figure 1.5: Home countries of PhD students (outside Europe)

student's tasks and goals. After about a year (the precise moment depending on the nature of the appointment), an assessment of the student's progress takes place, on the basis of which a go/no-go decision is made concerning the continuation of the project. After this, the supervisor evaluates the progress of the student on an annual basis. These evaluations are monitored by the ILLC support staff.

PhD students at the ILLC have the opportunity to benefit from a rich scientific training programme. First, this includes the courses of the Master of Logic programme, many

of which are advanced research courses taught at PhD level. Second, the ILLC is home to several seminar series and colloquia. During a typical week during term time there will be at least three research talks organised on ILLC premises. This is complemented by similar events at neighbouring institutions, such as the CWI and the ACLC. Third, various national Dutch *research schools* offer specialised disciplinary courses to PhD students. ILLC PhD students have attended such courses of LOT (Dutch Graduate School in Linguistics), SIKS (Netherlands Research School for Information and Knowledge Systems), the OZSL (Dutch Research School in Logic, presently not active), and others. Fourth, all PhD students are actively encouraged to participate in relevant summer schools, such as the annual European Summer School in Logic, Language and Information (ESSLLI). This scientific programme is complemented with non-academic courses providing training in “soft skills” such as presenting, academic English, or project management, offered by the University of Amsterdam, or the faculty with which the student is affiliated. In particular, since 2011, the Faculty of Humanities has a skills curriculum for all its PhD students.

Finally, the ILLC encourages students to participate in various teaching activities, from grading exercises and coordinating lab sessions, to the organisation of student projects and occasional lecturing. PhD candidates are also encouraged to devote time to service tasks such as paper refereeing and organising workshops or colloquia. Students on a fully funded four-year position are expected to devote up to 20% of their time to teaching and other tasks that are not immediately related to their own research. Experience in this respect proves to be highly advantageous when finding employment after completion of the PhD, both within and outside of academia.

Quality and Quality Control

Tables 5.4 and 5.5 on page 71 provide numbers on intake and success rates of PhD students with regular employment at the University of Amsterdam and those on scholarships, contracts, or private money, respectively.

Start	F	M	Total	Graduated after				Disc.	Ongoing
				≤ 4 y	≤ 5 y	≤ 6 y	≤ 7 y		
2002	5	8	13	1	5	4	2	1	
2003	1	5	6		3	3			
2004	3	2	5	2	3				
2005	4	6	10	4	4	1		1	
2006	4	8	12	3	6	1		1	1
2007	4	15	19	5	10			2	2
Total	21	44	65	15	31	9	2	5	3

Table 1.5: Enrollment and success rate of PhD students

Table 1.5 summarises the results on the cohorts starting between 2002 and 2007 (65

students in total). Of these, 15 (22%) finished within four years. After five years, the number of graduates was 46 (69%), after six years, 55 (84%), and after seven years, 57 (88%). Only 8% left the programme without graduating (five individuals). The remaining three PhD projects are still in progress. These results compare favourably with average results in the Netherlands: a recent study suggests that around 25% of PhD candidates in the Netherlands drop out prematurely and the average time to graduation is almost five years in the natural sciences and almost six years in the humanities.⁶

In order to ensure the quality of the training and education of our PhD students, the institute employs two instruments.

First, the PhD students at the ILLC have their representation in a very active *PhD council*. The PhD council organises various activities, be it social, scientific, or informative with respect to career planning, and assists in the allocation of teaching assistantships. The council has a good overview of the needs of PhD students, and is represented at the bimonthly meetings of the ILLC management board, in order to discuss issues regarding the ILLC PhD programme, and the welfare of the PhD students. The ILLC PhD council also has representatives in the PhD councils of the Faculty of Humanities and the Faculty of Science.

Second, the institute invests a substantial amount of time in the activities of the PhD Progress Committee (*Promotievoortgangscommissie*, Dutch acronym: PVC). This committee, consisting of about five staff members, holds annual interviews with each ILLC PhD student, in order to review whether the student receives adequate research training, has sufficient contact with his/her supervisor, is satisfied with the working conditions, and so forth. The PVC committee reports to the ILLC director on general issues concerning the PhD programme, and takes direct action in case of individual problems. In 2011 the PVC committee convened for the 14th time. We believe that this committee has a considerable positive effect on the well-being of our students, and on the success rate of our PhD track.

Graduates

On the pages 33–36 we display the covers of the 56 dissertations⁷ that were defended at ILLC during the evaluation period.

Table 1.6 gives an overview of the current occupation of these 56 ILLC graduates. Of the 50 graduates for which we have information regarding their current occupation, 12 have obtained permanent employment or describe their own situation as providing a long-term perspective (including 2 of those in academia, 6 of those in industry, and 2 of those that are self-employed).

Most alumni have had more than one job since their PhD (1.9 on average). Importantly, this data concerns a population that includes individuals for whom their PhD appointment ended as far back as five years ago as well as individuals who graduated only a few months before completion of this report.

⁶H. Oost and H. Sonneveld. *Rendement en duur van promoties in de Nederlandse onderzoekscholen*. Ministerie van Onderwijs, Cultuur en Wetenschap, 2005.

⁷Another 4 PhD students who graduated at other institutions were supervised by members of the ILLC and their dissertations are included in the ILLC dissertation series, which is why Table 5.3 lists 60 theses in total.

Current occupation		%	Remarks
Academia	29	52	
Industry	8	14	6 in ICT
Self-employed	4	7	2 in ICT
Other	2	3	
Unemployed	7	13	
Unknown	6	11	

Table 1.6: Current occupation of PhD alumni 2006–2011

Academic Positions (Research Institutes and Universities)

Netherlands	United Kingdom	Germany	Denmark	France	Finland	Sweden	Spain	USA	China	Singapore
ILLC	Cambridge	Tübingen	Roskilde	Toulouse	Helsinki	Stockholm	Seville	NYU	Tsinghua	Singapore
CWI	Oxford	Munich	Copenhagen			Uppsala		Johns Hopkins	Peking	
UvA Psych	Edinburgh	Düsseldorf						New School Soc. Res.		
UvA AUC	Leicester	Bochum						UC Berkely		
UvA FGw	Imperial College							UC Santa Cruz		
UvA AMC	Royal Holloway London							UMass Amherst		
UvA ACLC	City U. London							Ohio State		
Groningen								Harvard		
Utrecht										
Tilburg										
Nijmegen										

Non-Academic Positions

Netherlands	Germany	Switzerland	Denmark	USA
Rietveld Landscape Architecture	FOEBuD	FOITT	SorøAkademi	Philips
Instituut voor Filosofie	Speech Concept			Flurry Inc.
Philips				HP/Palm WebOS Group
Live Presence				Intertrust
Tomtom				
G. Rietveld Academie				
Mondria Technologies				
Lightbox Technologies				

Table 1.7: Places where ILLC PhD alumni work

Table 1.7 gives an overview of the places where our PhD graduates found employment. The most common routes for finding a job have been to exploit one’s personal network of contacts (built up during their time at the ILLC) and applying for publicly advertised positions. Thirteen graduates obtained a position through writing a grant proposal themselves.

Almost all alumni still keep in touch with other (ex-)ILLC members and fellow PhD students, both on a social and an academic basis. Also, in a recent survey, a majority reported to be satisfied (or almost satisfied) about their time at the ILLC. Most missed was

a better preparation for a career outside of academia. Most appreciated was the preparation for an academic career through support for writing papers and grant proposals.

1.10.3 Postdoctoral Researchers

At the ILLC, postdocs receive a considerable amount of guidance from senior members of staff as well as from one another. For instance, the ILLC postdocs regularly meet and discuss possibilities for and experiences in grant applications (e.g., for Veni projects). A representative of the postdocs participates in the bimonthly ILLC management board meetings.

Like PhD students, postdocs are not only expected to conduct research, but are also encouraged to partake in the ILLC's educational mission, for instance, by offering projects related to their research to Master of Logic students. The institute considers this a mutually beneficial arrangement, which enables the MoL students to interact with young and very active researchers, while the postdocs can further improve their CV by obtaining teaching experience.

The quality of the postdoc research community at the ILLC is excellent. One indicator for this is the high number of Veni grants held by researchers from this group. During the assessment period of 2006–2011, no fewer than eleven postdocs working at the ILLC obtained such a grant. But also several of the other postdocs at the institute have been either the sole or joint author of the research proposal funding their own position. ILLC postdocs are also highly successful in obtaining tenure-track or permanent positions after their time as a postdoc. For instance, Maria Aloni, Raquel Fernández, Alessandra Palmigiano, Katrin Schulz, and Jelle Zuidema have all obtained senior positions at the ILLC. Eric Pacuit (after having obtained a Vidi grant) is now assistant professor at the University of Maryland; Catarina Dutilh Novaes (after having obtained a Vidi grant) is now assistant professor at the University of Groningen; Bas Terwijn is now assistant professor at the University of Nijmegen; Davide Grossi is now a lecturer at the University of Liverpool; and Stéphane Airiau will take up a position as assistant professor at Paris-Dauphine University in 2012.

1.11 SWOT-analysis

Strengths

1. The ILLC staff is composed of productive and well-known researchers, many of whom are international leaders in their respective fields. Accordingly, the institute has an excellent track record in obtaining research funding.
2. The ILLC covers a wide, coherent and thriving research area. With its position at a crossroads of disciplines, the institute is well prepared to address scientific challenges.
3. The institute has a large and strong network, locally, nationally and internationally.
4. The institute's research is tightly interwoven with an excellent MSc Logic programme, which attracts talented students from all over the world.

5. The institute is supported by a very dedicated, flexible and competent administrative staff.

Weaknesses

1. The relatively small number of permanent staff, combined with the fact that the institute has attracted many grants that come with a relief of teaching and administrative duties (and, in the case of the LoCo group, the presence of many researchers with a part-time appointment), is somewhat problematic from an organisational perspective: many tasks rest on few shoulders.
2. While the scientific quality and success rate of the PhD programme is high, this part of the ILLC graduate programme is less visible and uniformly organised than its MSc counterpart. Partly due to a suboptimal functioning of the Dutch Research School in Logic (Onderzoeksschool Logica), the research training of ILLC PhD students at a national level is increasingly scattered over various research schools.
3. While most of the ILLC staff is now located at the new Faculty of Science building in the Amsterdam Science Park, the institute is still divided over various locations, which has an impact on its internal coherence.

Opportunities

1. The future promises good prospects for the ILLC to attract research funding:
 - (a) The central position of the institute in the research profile of the University of Amsterdam (and of the Faculties of Humanities and Science) should create further opportunities to acquire internal funding for ILLC research related to the Research Priority Areas.
 - (b) Given the large and strong network of the institute and its academic reputation in interdisciplinary research, the institute has excellent opportunities to participate in large-scale national and European research projects.
 - (c) The new European Framework Programme, Horizon 2020, will open up more funding opportunities for individual researchers in the ERC scheme (Starting and Advanced Grants). This creates many opportunities for an institute that has an excellent track record in the similar Dutch VI-programme.
 - (d) The institute's contacts with China and India offer possibilities for more intensive research collaboration.
2. The pending merger of the science faculties of the two Amsterdam universities offers new opportunities for collaboration in the science domain (mathematics, computer science, physics).
3. The joint search committee for two full professorships, in Philosophical Logic and in Philosophy of Language, across the borders of the two Faculties that share the ILLC,

creates an excellent opportunity to strengthen and renew the LoLa research programme, and to consolidate the leadership of the institute as a whole.

Threats

1. The pending merger of the science faculties of the two Amsterdam universities may create complications in the organisational structure of the institute and its graduate programme, and, given the small size of the ILLC, may decrease its visibility in the new Amsterdam Faculty of Science.
2. The increasing preference at (national) funding agencies for applied research (in particular, the government policy to focus on research directed at strengthening the Dutch economic ‘top sectors’), while creating opportunities for some parts of the institute, threatens the access to research funding for more fundamental research in, e.g., mathematical logic or philosophy of language.
3. Both professorial positions in the LaCo group (Bod and Honing) are not fixed on a permanent basis, but for a five-year period only; as a consequence, the continuity of the group’s leadership is still not fully guaranteed.

1.12 Strategy

In the coming years, the strategy of the ILLC will be focused on the following.

Mission The scientific mission of the institute will remain directed towards research that is primarily driven by scientific curiosity concerning the formal modelling of information. In areas where it is possible (such as Digital Humanities or Logic and Artificial Intelligence), the institute will increase its efforts towards valorisation of its results, without infringing on research areas, such as philosophy of language or mathematical logic, where applications are less close at hand.

Research Funding In order to acquire the funding that the ILLC needs in order to pursue its research mission, the institute’s strategy will be based on the following three pillars:

1. The ILLC will exploit its strategic position, via its joint programmes with neighbouring faculties/institutes, in the academic landscape of Amsterdam that will most probably be redefined through the merger of the science faculties. These efforts will be directed towards investments in the central university’s Research Priority Areas, the special research areas of the Faculty of Humanities, and new initiatives at the Amsterdam Faculty of Science.
2. The institute will continue to stimulate and support its staff members to apply for personal research grants in the NWO VI-programme, and increasingly also in the European programme for ERC Starting and Advanced grants. The same applies to other programmes, such as the Dutch Free Competition programme of NWO.

3. The institute management will increase its efforts to find partners and allies with whom to join forces in order to acquire, at the national and European level, research funding in programmes aiming at large-scale research conglomerates.

Organisational Structure Internally, the ILLC will complete the process of renewing its scientific leadership. In the Language and Computation programme, the institute's main aim is to upgrade the temporary professorships to a permanent status.⁸ The leadership of the Logic and Language programme will be renewed by the joint selection committee for the two full professorships in Philosophy of Language and Philosophical Logic.

This double appointment is also an excellent opportunity to strengthen the internal coherence of the institute, across the two participating faculties. In general, with each future appointment the ILLC will take care to attract staff that are not only excellent researchers in their own field, but will also actively support the interdisciplinary research mission and coherence of the institute. In addition, the ILLC has also started to organise more institute-wide events, not only scientific meetings (ILLC colloquium), but also informative and social gatherings.

In the changing constellation of the Amsterdam universities, the institute's strategy will be directed towards consolidating and possibly strengthening its position as an interfaculty institute, in the future between the Faculty of Humanities of the UvA and the new Amsterdam Faculty of Science. The ILLC intends to increase its collaboration with neighbouring institutes, in particular the linguists at the Faculty of Humanities, and the computer scientists, mathematicians and physicists at the new Amsterdam Faculty of Science. It will endeavour to strengthen the ties between this AFS and its two mother universities, for instance by building new alliances with other interdisciplinary institutes, such as the Network Institute at the Vrije Universiteit.

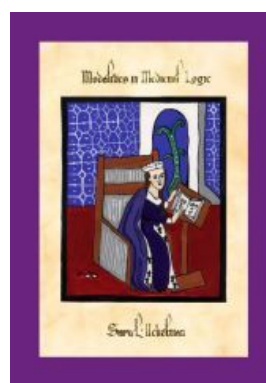
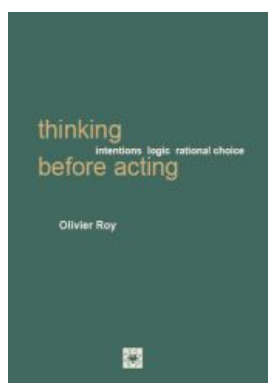
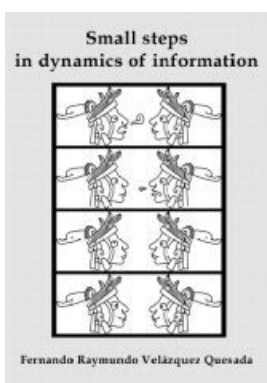
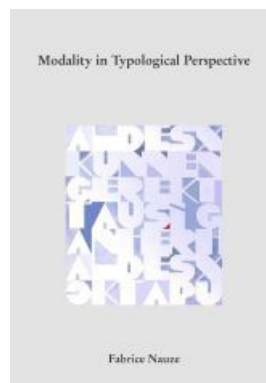
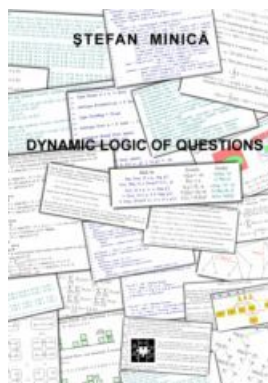
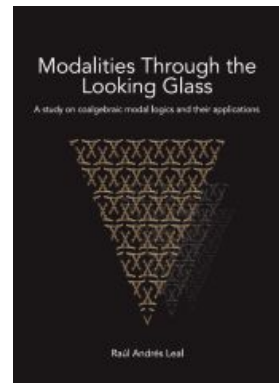
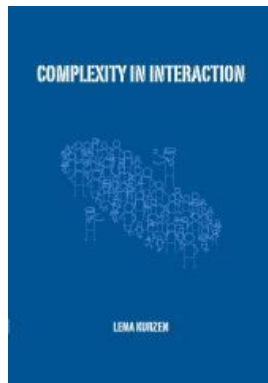
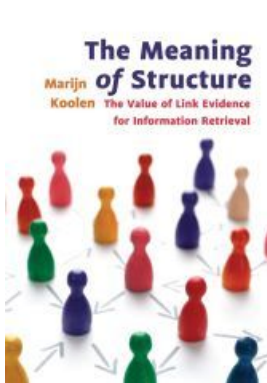
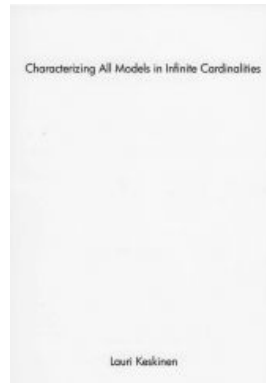
Concerning its relatively small size, the ILLC will seriously consider options to grow. For obvious reasons the institute will not change its successful strategy to acquire individual research grants that come with a relief of non-research duties; to counter the ensuing shortage of teaching staff, it will assign teaching tasks to postdocs and/or continue its policy of hiring temporary staff with a somewhat higher teaching load.

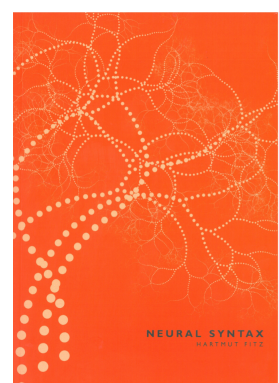
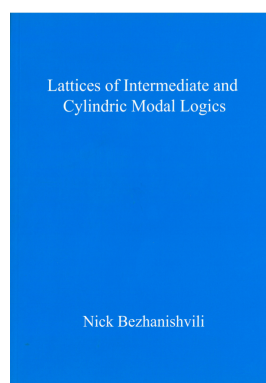
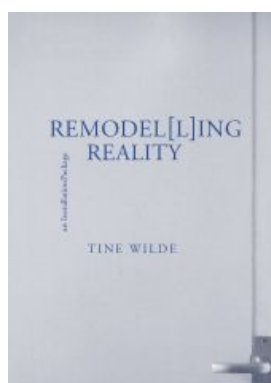
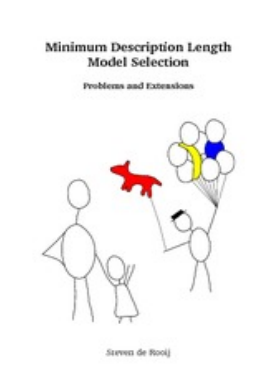
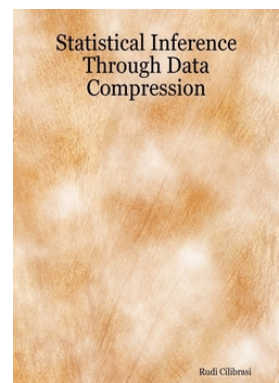
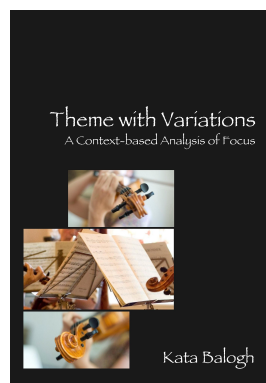
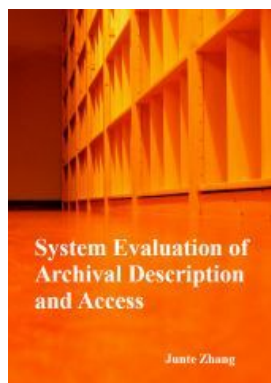
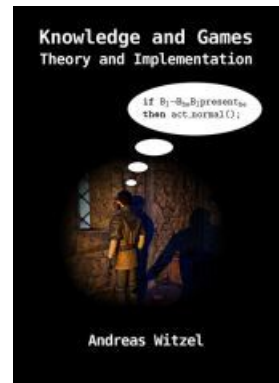
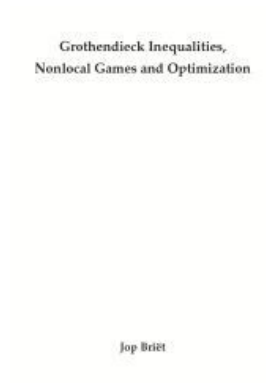
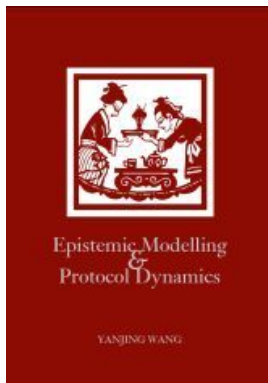
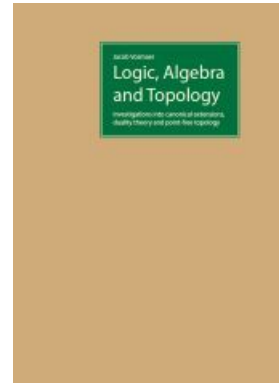
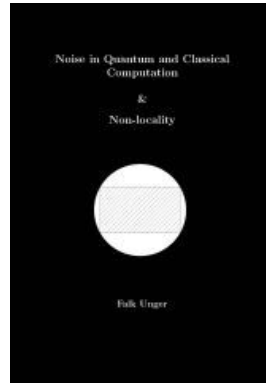
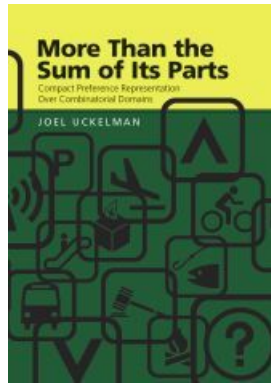
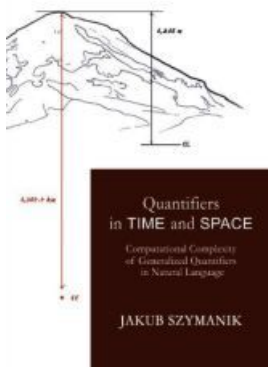
Graduate Programme The institute intends to fortify its training of a new generation of researchers in a more coherent Graduate Programme in Logic, Language and Computation. The ILLC will invest maximal effort to consolidate the MSc Logic at the new Faculty of Science, while maintaining its interdisciplinary character through the continued participation of the Faculty of Humanities,

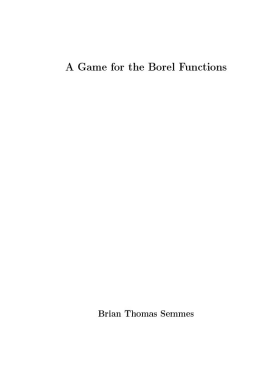
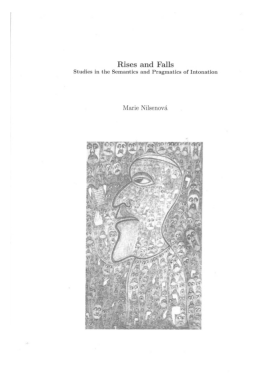
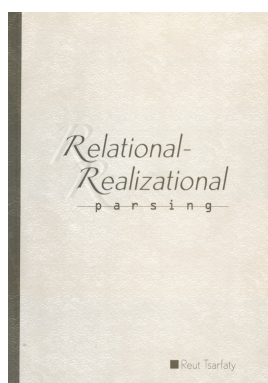
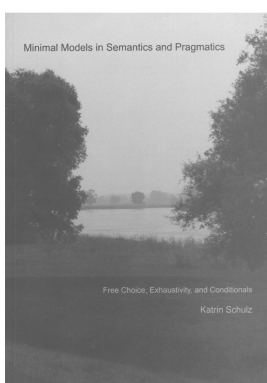
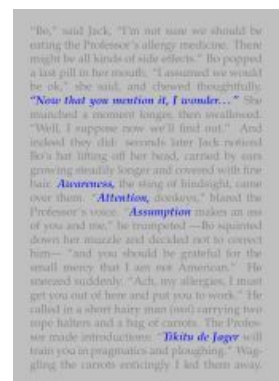
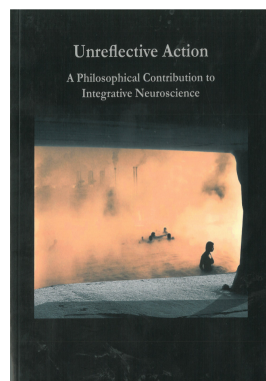
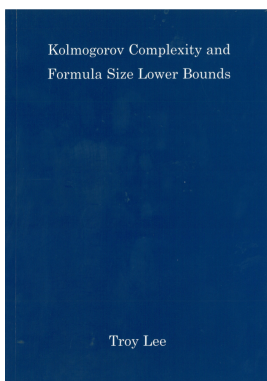
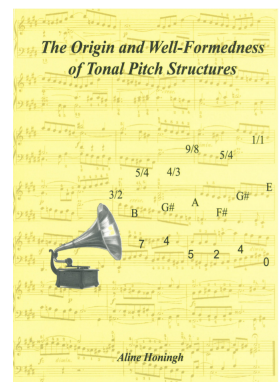
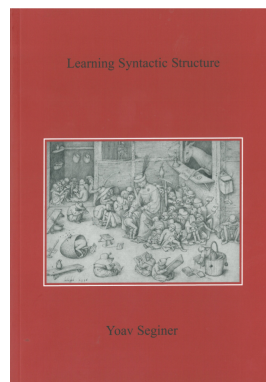
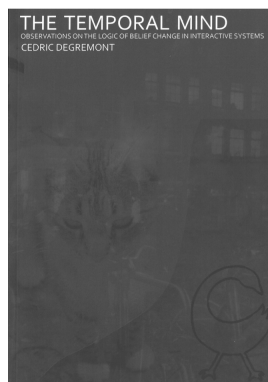
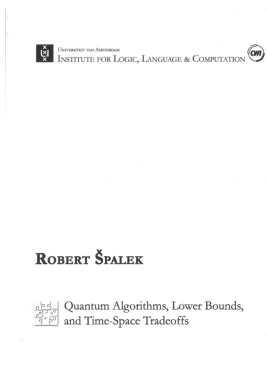
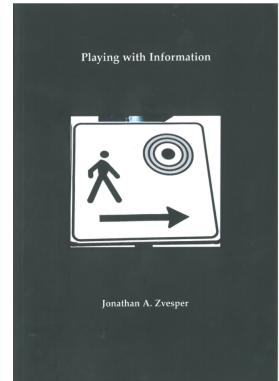
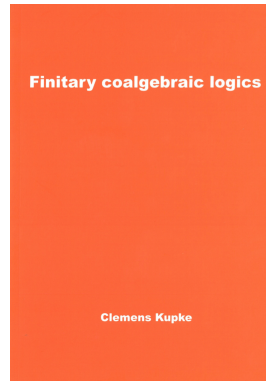
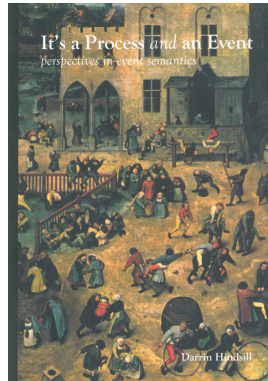
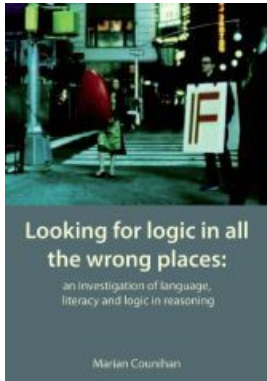
The institute intends to reshape its PhD programme. It will continue to support successful features, such as the PhD Progress Committee and the PhD Council, but it will streamline the academic training, give the programme a clearer organisational structure headed by a programme director, and make it more visible as an ILLC programme. In addition, the

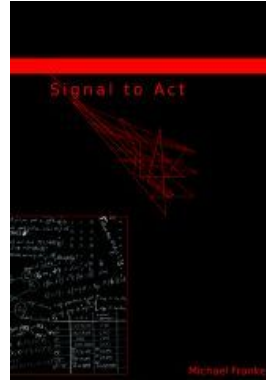
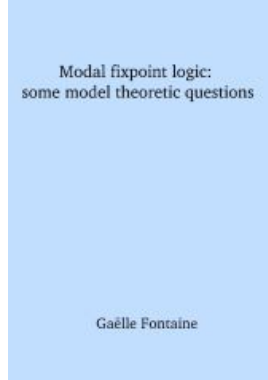
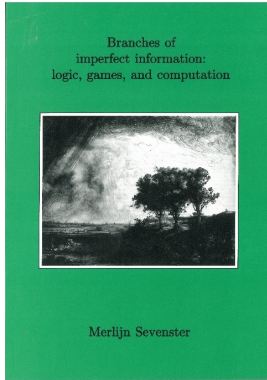
⁸A very recent development, which constitutes a major step in the desired direction, is the intended decision of the Faculty of Humanities and the Board of the University of Amsterdam to give Bod's professorial position a permanent character by creating a non-structural, so-called personal chair.

institute is considering to revive the Research School in Logic (Onderzoeksschool Logica), by taking its administration back to the ILLC.



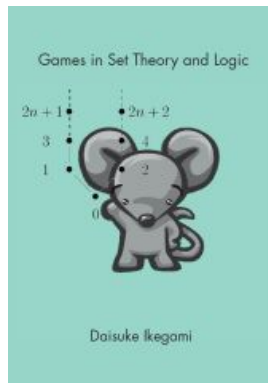






Knowing Om's Limits
Logical Analysis of Imperfect Information

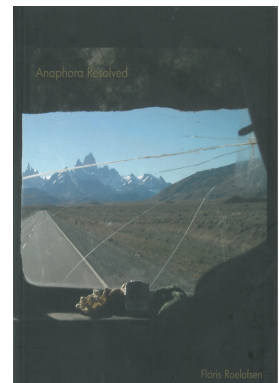
Nina Gismatuzik



Stit, It, and Deontic Logic for Action Types

Martin Moser Bontas

SECTION FOR PHILOSOPHY AND SCIENCE STUDIES
BONHEUR UNIVERSITY



Part B

The Programmes

Chapter 2

Logic and Language

2.1 Objectives and Research Area

Logic and Language 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. The various systematic investigations concentrate on empirical phenomena that are intrinsically related to the way in which information is structured in conversations.

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 programme, also in order to stimulate critical reflection on current systematic research.

2.2 Composition

At the end of 2011 the tenured staff the Logic and Language research group consisted of four full or associate professors (Groenendijk, van Lambalgen, Stokhof, Veltman), six assistant professors or senior researchers (Aloni, Dekker, Fernández, Janssen, Maat, van Rooij, Schulz). The non-tenured staff of the group consisted of one assistant professor (Kiverstein) and four postdocs (Dutilh Novaes, Franke, Roelofsen, Weidman Sassoon). The group counted fourteen PhD students.

As compared to 2006, the main differences are that Aloni, Fernández, van Rooij, and Schulz got tenured positions during the assesment period, and Kiverstein was newly appointed as (temporary) assistant professor in 2011.

Table 2.1 gives a specification of LoLa staff in terms of research fte.

Staff	2006	2007	2008	2009	2010	2011
Tenured	2.67	2.40	2.47	2.50	2.90	2.90
Non-tenured	2.05	3.16	5.14	5.76	4.46	5.56
Phd Student	11.80	13.31	14.15	11.66	7.36	8.16
Total	16.52	18.88	21.75	19.92	14.72	16.72

Table 2.1: LoLa staff in terms of research fte

2.3 Research Environment and Embedding

An important aspect of the research environment and embedding of the LoLa group is that most of its members are employed by the Philosophy Department of the Faculty of Humanities. A substantial part of the LoLa programme belongs to the “classical” research area of philosophy, more in particular philosophy of language, and logic. But just as important as the philosophical roots of the LoLa research are its connections with other research areas, in particular linguistics and cognitive science. The embedding of these interdisciplinary research activities in the ILLC provides an optimal institutional environment. Within the ILLC there are several links with the LoCo programme through common interests in philosophical logic and game theory, and links with the LaCo programme through common interests in modelling linguistic processes at the level of pragmatics and discourse. Within the university, members of the LoLa group and linguists at the ACLC (Amsterdam Center for Language and Communication) cooperate in the area of cross-linguistic semantics. Members of the LoLa and the LaCo group and researchers at the ACLC jointly cooperate with the CSCA (Cognitive Science Center Amsterdam) in the area of brain and cognition.

All these interactions create a stimulating research atmosphere, which attracts students and guest-researchers from abroad, which further enhances the quality of the research environment, as do the many incidental and regular research events which are organised by the group. Among the regular events are two bi-weekly colloquia, an internal research colloquium where members of the group present new work, and the external DIP (Discourse Processing) Colloquium for which external speakers are invited. Bi-annually we organise the international *Amsterdam Colloquium*, which had its 18th installment in December 2011, and in 2009 a new yearly series of *Amsterdam Graduate Philosophy Conference* was started.

2.4 Quality and Scientific Relevance

2.4.1 Research highlights

- Van Rooij introduced a permissive consequence relation, whereby logical consequence is no longer preservation of some designated truth-value, but rather a weakening of standards when going from premises to conclusion. This notion of permissive consequence was originally intended to solve the sorites paradox, and more generally to account for the semantics and pragmatics of vague predicates, but it soon became apparent that it

could also be applied in a natural way to the treatment of the semantic paradoxes, in particular to the Liar Paradox.

- Veltman and Harald Bastiaanse developed a new principled account to deal with the conflicts between default rules that abound in non-monotonic reasoning. They did so in two ways: semantically within a circumscriptive theory, and syntactically by supplying an algorithm for inheritance networks. The latter is sound and complete with respect to the first.
- Van Rooij, together with local and international colleagues, derived Gricean Quantity implicatures in a signalling games framework, thereby establishing a link between the theory of non-monotonic reasoning and rational game theory. It is shown that game theory is a suitable framework to extend pragmatics to non-cooperative situations and that signalling games are also of use for the analysis of language structure: in particular for the emergence of so-called ‘natural properties’ using Gärdenfors’ theory of conceptual spaces.
- For decades, there have been two leading competing paradigms for the semantics of questions: partition semantics and Hamblin-semantics. Although from a logical-philosophical perspective the former is arguably superior, most empirical linguists tend to opt for the latter. Groenendijk, Roelofsen, and Ciardelli developed a new general paradigm of inquisitive semantics which has a wider empirical range than each of its predecessors. It is accompanied by a deeper logical-philosophical analysis of the semantic and pragmatic properties of informativeness and inquisitiveness, in which both earlier approaches can be accommodated.
- Against the general negative judgement of his logic, Achourioti and van Lambalgen have shown that Kant’s ‘transcendental logic’ is a logic in the strict formal sense, albeit with a semantics and a definition of validity that are vastly more complex than that of first-order logic. Kant’s Table of Judgements in the Critique of Pure Reason, is indeed, as Kant claimed, complete for the kind of semantics he had in mind. Kant’s ‘general’ logic is a distinguished subsystem of first-order logic, namely what is known as geometric logic.
- Stokhof and van Lambalgen initiated a critical methodological debate on *abstraction and idealization* as constructions of proper scientific entities in linguistics in general, and semantics in particular. Contrary to the common view, they argue that modern linguistic theory constructs its core notions (such as ‘language’, ‘competence’, ‘meaning’) in a way which differs significantly from the way this is done in science. An issue of *Theoretical Linguistics* has been devoted to the discussion, which is still very much alive.

2.4.2 Key publications

- **M. Aloni** (2007), Free choice, modals, and imperatives, *Natural Language Semantics* 15(1), pp. 65-94.

- **E. Rietveld** (2008), Situated normativity. The normative aspect of embodied cognition in unreflective action. *Mind* 117(468), pp. 973-1001.
- **I. Ciardelli** and **F. Roelofsen** (2011), Inquisitive logic, *Journal of Philosophical Logic* 40(1), pp. 55-94.
- **T. Achourioti** and **M. van Lambalgen** (2011), A formalisation of Kant's transcendental logic, *The Review of Symbolic Logic* 4(2), pp. 254-289.
- **K. Schulz** (2011), "If you'd wiggled A, then B would've changed." Causality and counterfactual conditionals, *Synthese*, 179(2), pp. 239-251.

2.4.3 Books

- **W. Hinzen** (2006), *Mind Design and Minimal Syntax*, Oxford, Oxford University Press.
- **R. van Rooij** (2006), *Attitudes and Context Change*, Dordrecht, Springer, Synthese Library.
- **M. Aloni**, **A. Butler** and **P. Dekker** (eds) (2007), *Questions in Dynamic Semantics*, Current Issues in the Semantics/Pragmatics Interface 17, Amsterdam, Elsevier.
- **M. van Lambalgen** and K. Stenning (2008), *Human Reasoning and Cognitive Science*, Cambridge MA, MIT Press.
- **C. Bax** (2011), *Subjectivity after Wittgenstein*, London, Continuum.

2.5 Output

During the assessment period researchers in the Logic and Language group have produced a total of 18 books, 60 book chapters, 70 refereed articles, 84 conference papers, and 18 other publications. In the same period the group graduated 16 PhD students. In December 2011 there were 14 ongoing PhD projects affiliated with the programme.

2.6 Earning Capacity

The group has been successful in attracting external funding, especially within NWO's Innovative Research Incentive Schema: two Vidi's (Aloni, Smets) and five Veni grants (Dutilh Novaes, Fernández, Schulz, Franke, Roelofsen). One more Veni (Rietveld) and one more Vidi (Dutilh Novaes) were obtained by LoLa researchers who carry out their project elsewhere. Three projects were obtained within NWO's Free Competition programme (Hinzen, Groenendijk and Veltman). The project awarded to Fernández is part of the NWO-programme that advances More Women Researchers as University Lecturers (MEERVOUD). Van Rooij obtained two ESF/NWO projects. Smets obtained a European ERC project which means a considerable strengthening of the group.

Logic and Language	2006	2007	2008	2009	2010	2011	Sum
Refereed journal articles	7	18	15	8	8	14	70
Non-refereed journal articles	1	1	1	1	2	0	6
Books/Monographs	2	1	2	0	0	2	7
Edited books	2	4	0	0	3	2	11
Book chapters	13	12	7	8	10	10	60
PhD-theses	1	2	5	6	2	0	16
Conference papers	11	18	13	19	17	6	84
Professional publications	3	3	2	0	0	0	8
Publications aimed at general public	1	2	1	1	0	0	5
Total publications	41	61	46	43	42	34	267

Table 2.2: Research Output: Logic and Language Programme

In Table 2.3 we list all the major externally funded projects that are administered at the ILLC and which fund at least one position.¹ We list all projects that were acquired or started during the assessment period (the year shown in the table is the year when a project was acquired). The total amount of the acquired research income in the assessment period of the Logic and Language group was 5.371 k€.

2.7 Academic Reputation

The senior researchers of the group are regularly invited for keynote lectures at conferences and workshops, and shorter and longer visits at other universities. The junior researchers are successful in submitting papers for international conferences. Two dissertations won prizes in the assessment period: Schulz' dissertation was awarded the public prize of the LOT research school, and Bax won the prestigious Research Prize of the Premium Erasmianum Foundation for her dissertation; Furthermore, Szymanik won the price for Young Scientists awarded by the Foundation for Polish Science.

Members of the Logic and Language group held many editorial positions, e.g., in the boards of the major journals in its research field, such as the *Journal of Semantics*, *Linguistics and Philosophy*, *Natural Language Semantics*, *Semantics and Pragmatics*, the *Journal of Philosophical Logic*, *Synthese*, *Argumentation*, *Dialogue and Discourse*, *Journal of Applied Logic*, *Journal for research on language and computation*. Apart from being responsible for the organisation of the bi-annual Amsterdam Colloquium, members of the group are involved in many organisation committees and programme committees of numerous international conferences, workshops, and summer schools. Dekker, for example, is chair of the standing committee of the European Summer School in Logic, Language and Information (ESSLLI).

¹A full specification of funding for LoLa is given in table 5.2 on page 68.

Year	Project	Source	Applicant	Amount
2006	The Origins of Truth and the Sentence	NWO VC	Hinzen	375 k€
2007	Philosophical Foundations of Formal Languages in Logic	NWO Veni	Dutilh Novaes	208 k€
2007	Indefinites and beyond	NWO Vidi	Aloni	600 k€
2008	Change and Coordination via Dialogue Interaction	NWO Veni	Fernández	141 k€
2008	On vagueness – and How to be Precise Enough	NWO VC	Veltman	330 k€
2008	Vagueness, Approximation and Granularity	ESF-NWO	van Rooij	200 k€
2009	The Inquisitive Turn	NWO VC	Groenendijk	600 k€
2010	The Semantic Anatomy of Conditional Sentences	NWO Veni	Schulz	240 k€
2010	Computing Implicatures in Incremental Dialogue Processing	NWO	Fernández	200 k€
2011	Communication in Context	ESF-NWO	van Rooij	200 k€
2011	How psychological and social factors influence the evolution of language	NWO Veni	Franke	250 k€
2011	Interpreting questions: fine-grained compositional semantics	NWO Veni	Roelofsen	250 k€
2011	Reasoning about Quantum Interaction	NWO Vidi	Smets	550 k€
2011	The Logical Structure of Correlated Information Change	ERC	Smets	1,380 k€

Table 2.3: Research Income: Logic and Language Programme

Fernández is co-president of the standing board of the SemDial workshop series on the Semantics and Pragmatics of Dialogue.

In particular the senior members of the group have fulfilled several positions in national and international research organisations, quality assessment committees. For example, Stokhof is an elected member of the Dutch Royal Academy of Sciences (KNAW) and of the Institut International de Philosophie, and was chair of the Humanities Council of NWO, and of several other Dutch and European research organisations; Veltman was chair of the NWO-Vidi committee, of which Groenendijk was a member, and Veltman is a member of the Humanities Council of NWO. Dekker was also a member of the NWO-Vidi selection committee in 2011.

2.8 Societal Relevance: quality impact and valorisation

Since the research of the LoLa group is mainly theoretical, the societal relevance is by and large intellectual and educational. It covers a broad area of interests, and its theoretical contribution has indirect impact on linguistic and computational applications, economical

investigations and artistic endeavours. The impact is, of course, hard to measure. The following indicative list may nevertheless serve to give an idea of the areas in which some of the members of the group are involved.

- Veltman is member of the Expert Panel Philosophy and Theology, National Fund for Scientific Research (FWO), Belgium.
- Stokhof is chair of the KNAW-NVAO accreditation committee of research masters in the humanities, and of the KNAW & NWO China Committee.
- Janssen and van Lambalgen gave introductions to logic at primary and secondary schools.
- Two logic courses in the Bachelor of Philosophy, ‘Logic and the Linguistic Turn’ and ‘Logical Analysis’ were elected as course of the year in the Humanities Faculty and Van Lambalgen and Achourioti’s course ‘Kant, Logic and Cognition’ won the second prize in that same annual contest.
- van Rooij published in the Journal of Economic Methodology.
- Tine Wilde had a philosophical art performance at her PhD defense and related exhibitions CORRIDO[O]R at the department of Philosophy and in *Arti et Amicitiae*.

2.9 Viability

The group is in a crucial transition period, during which a large part of the permanent staff, and leaders and founders of the group and the ILLC at large, Janssen, Groenendijk, Stokhof, Veltman, will (officially) retire in the next couple of years. Partly in anticipation of this course of events several of our most successful young researchers have obtained (van Rooij, Schulz) or will obtain (Aloni) permanent positions as assistant professors in philosophical logic and philosophy of language in the Philosophy Department within the Faculty of Humanities, despite the difficult financial situation of that faculty. The group was also recently extended with a new temporary assistant professorship in Philosophy and Cognition (Kiverstein). At the Faculty of Science Fernández has obtained a permanent position after having succeeded in NWO’s competitive MEERVOUD programme. As from the beginning of this year, the biggest expansion in the history of the group was realised, when Sonja Smets joined the LoLa group, together with her group working on her NWO-Vidi and ERC project; this almost doubled the external funding of the group’s research. Also at the end of 2011 two new Veni grants were obtained by postdocs in the group (Franke and Roelofsen). Last but not least, both the Faculty of Humanities and the Faculty of Science have made the exceptional decision to install a joint selection committee for two full professorships in Philosophical Logic and Philosophy of Language in anticipation of the retirement within 2-3 years of the current group-leaders Groenendijk, Stokhof, and Veltman. These developments show that the university supports and takes optimal responsibility for the future viability of ILLC’s Logic and Language group, where it should be mentioned that this is not only motivated by the reputation of its research, but also by its considerable contribution to the education programmes of both faculties.

Chapter 3

Logic and Computation

3.1 Objectives and Research Area

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 broad aim naturally leads to the investigation of a wide range of foundational issues in mathematics and computer science. At one end 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; and in artificial intelligence we contribute to the development of the fields of multiagent systems and knowledge representation. At the interface with other disciplines, including formal epistemology 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.

3.2 Composition

At the end of 2011 the LoCo programme consisted of seven senior scientists with their main appointment at the University of Amsterdam: two professors (van Benthem, Venema), three associate professors (Baltag, Endriss, Torenvliet), and two assistant professors (Löwe with 0.75fte, Palmigiano). Importantly, van Benthem occupies the prestigious position of *University Professor*, which is financed directly by the university rather than the ILLC. Three part-time professors (Apt, Buhrman, de Wolf, all 0.2fte) have their main appointment at the Centrum Wiskunde & Informatica (CWI) and one part-time professor (Väänänen, 0.1fte) has his main appointment at the University of Helsinki. This adds up to a total of 7.45fte (roughly 50% of which is for research funded by the university). In 2006 this figure was 7.6fte (seven full-time staff, including three professors, and three part-time professors from CWI). Of the four emeritus professors currently affiliated with the programme (van Emde Boas, de Jongh, Troelstra, Vitányi), two retired during the assessment period (van Emde Boas,

Vitányi). Two part-time professors (Adriaans, van Eijck) only joined at the very end of the assessment period, and their contribution will not be covered here.

Table 3.1 gives a specification of LoCo staff in terms of research fte.

Staff	2006	2007	2008	2009	2010	2011
Tenured	3.87	4.20	4.22	4.73	4.60	5.42
Non-tenured	0.90	1.43	2.40	3.49	5.81	6.12
Phd Student	15.67	22.02	22.75	20.91	15.98	11.02
Total	20.44	27.64	29.37	29.13	26.39	22.56

Table 3.1: LoCo staff in terms of research fte

3.3 Research Environment and Embedding

The LoCo programme is an interdisciplinary research programme. In terms of well-defined “classical” research areas it covers significant parts of mathematical logic, philosophical logic, theoretical computer science, and artificial intelligence. At the same time it reaches out to areas outside of mathematics and computer science, notably economics (with our work on game theory and social choice) and physics (with our work on quantum computing). Through common interests in philosophical logic, there are links to the institute’s LoLa programme and through common interests in cognitive science there are links to the LaCo programme. There are also very strong links to the CWI, helped both by its close geographical proximity and by the fact that several LoCo researchers have their primary appointment at the CWI.

All of this creates a lively research atmosphere. One indicator for the quality of the research environment is the frequency and the breadth of the regular research seminars organised by the LoCo programme. This includes the *Colloquium on Mathematical Logic*, organised together with colleagues from the University of Utrecht; the *Computational Social Choice Seminar*; and the the *LIRA Seminar on Logic and Rational Interaction*. The *LogicTea*, a seminar series organised by PhD and Master’s students at the ILLC, also often covers topics that are at the heart of the LoCo research agenda. A second indicator for the quality of the research environment created by the LoCo programme is the large number of visiting scientists who choose to spend time at the institute each year to collaborate with members of both this and the other two research programmes. These visitors, in turn, make a significant contribution to the research environment.

3.4 Quality and Scientific Relevance

3.4.1 Research highlights

Research highlights in the LoCo group range from important results answering specific technical questions, to carrying out large research programmes, often bringing together ideas from a diverse range of fields. Below is a small selection of examples.

- Jointly with Hamkins (CUNY), Löwe determined the *Modal Logic of Forcing*: this result is doing, for the set-theoretic technique of forcing, the same that Solovay did for the notion of provability (1976), thereby bringing together the two major branches of mathematical logic represented at the ILLC, modal logic and set theory.
- Together with many collaborators, Venema isolated and studied a fundamental distributive law in coalgebraic logic, a logical principle with many manifestations and applications, in proof theory, algebraic logic, (pointfree) topology, and the theory of automata operating on infinite objects.
- In joint work with Gehrke (Nijmegen) and Jansana (Barcelona), Palmigiano unified two largely independent theories in algebraic logic, namely the theory of canonical extensions and abstract algebraic logic, by defining the widest setting in which the canonical extension construction can be meaningfully linked with logic.
- A new logical approach to dependence and independence concepts in various fields of science and the humanities was launched with Väänänen's book *Dependence Logic*. This topic has become the focus of intensive research by computer scientists, philosophers, and mathematicians, and the ILLC is at the center of this development.
- Endriss and colleagues carried out a comprehensive research programme on the interplay between logic and social choice theory, ranging from the use of formal languages for the compact representation of choice problems, to applications of automated reasoning in social choice, to the complexity-theoretic analysis of problems in judgment aggregation.
- Since joining the ILLC, Baltag has initiated a research programme on *Epistemic Topology*, investigating issues such as empirical and induction-based knowledge as well as learnability in a very general setting that combines topological concepts, modal (dynamic-epistemic) logic, and the theory of belief revision.

3.4.2 Key publications

- G. Brassard, **H. Buhrman**, N. Linden, A.A. Méthot, A. Tapp, and **F. Unger**. Limit on Nonlocality in any World in which Communication Complexity is not Trivial. *Physical Review Letters*, 25(4):250401, 2006.
- **U. Endriss**, N. Maudet, F. Sadri, and F. Toni. Negotiating Socially Optimal Allocations of Resources. *Journal of Artificial Intelligence Research*, 25:315–348, 2006.
- **G. Fontaine**, **R. Leal**, and **Y. Venema**. Automata for Coalgebras: An Approach Using Predicate Liftings. *Proc. ICALP-2010*, pp. 381–392, Springer, 2010.
- J.D. Hamkins and **B. Löwe**. The Modal Logic of Forcing. *Transactions of the American Mathematical Society*, 360(4):1793–1817, 2008.
- **A. Palmigiano** and R. Re. Groupoid Quantales: A Non-étale Setting. *Journal of Pure and Applied Algebra*, 215(8):1945–1957, 2011.

3.4.3 Books

We list the most important authored books published during the assessment period as well as major editorial projects, particularly handbooks.

- **P. Adriaans** and **J.F.A.K. van Benthem**. *Handbook of the Philosophy of Information*. Elsevier, 2008.
- M. Aiello, I. Pratt-Hartmann, and **J.F.A.K. van Benthem**. *Handbook of Spatial Logics*. Springer, 2007.
- **K.R. Apt**. *Principles of Constraint Programming*. Cambridge University Press. Paperback edition, 2009.
- **K.R. Apt**, F.S. de Boer, and E.R. Olderog. *Verification of Sequential and Concurrent Programs*. Texts in Computer Science, Springer. Third edition, 2009.
- **K.R. Apt** and M.G. Wallace. *Constraint Logic Programming using ECLiPSe*. Cambridge University Press, 2006.
- **J.F.A.K. van Benthem**. *Modal Logic for Open Minds*. CSLI Publications, 2010.
- **J.F.A.K. van Benthem**. *Logical Dynamics of Information and Interaction*. Cambridge University Press, 2011.
- P. Blackburn, **J.F.A.K. van Benthem**, and F. Wolter. *Handbook of Modal Logic*. Elsevier, 2007.
- E. Grädel, P. Kolaitis, L. Libkin, M. Marx, J. Spencer, M. Vardi, **Y. Venema**, and S. Weinstein. *Finite Model Theory and its Applications*. Texts in Theoretical Computer Science, Springer, 2007.
- L.A. Hemaspaandra and **L. Torenvliet**. *Theory of Semi-Feasible Algorithms*. Monographs in Theoretical Computer Science, Springer. Paperback edition, 2010.
- M. Li and **P. Vitányi**. *An Introduction to Kolmogorov Complexity and its Applications*. Springer. Third edition, 2008.
- **J. Väänänen**. *Dependence Logic*. Cambridge University Press, 2007.
- **J. Väänänen**. *Models and Games*. Cambridge Studies in Advanced Mathematics (No. 132), Cambridge University Press, 2011.

3.5 Output

During the assessment period researchers in the LoCo group have produced a total of 12 authored books, 47 edited books, 87 book chapters, 207 journal articles, 229 conference papers, and 1 patent. Around 95% of these journal and conference papers are peer-reviewed publications. As is well known, in computer science publications in conference proceedings

Logic and Computation	2006	2007	2008	2009	2010	2011	Sum
Refereed journal articles	31	40	30	28	34	36	199
Non-refereed journal articles	0	1	2	2	2	1	8
Books/Monographs	1	3	1	3	2	2	12
Edited books	10	5	11	7	5	9	47
Book chapters	17	16	13	14	13	14	87
PhD-theses	6	2	6	6	9	7	36
Conference papers	35	41	34	42	50	27	229
Professional publications	8	3	3	0	2	1	17
Publications aimed at general public	4	2	3	2	0	0	11
Total publications	112	113	103	104	117	97	646

Table 3.2: Research Output: Logic and Computation Programme.

are comparable to journal publications in terms of impact and esteem. This research output is also summarised in Table 3.2. Much of this output has been published in first-rate journals and the proceedings of selective international conferences.¹ The (minor) fluctuations in the number of publications over the years can be explained in terms of the fluctuations of the number of researchers affiliated with the programme over the same period (see Table 5.1 on page 66), which in turn are a consequence of the fact that a large part of the research taking place at the ILLC is financed by externally funded projects.

In the same period, we graduated 32 PhD students. (Table 3.2 lists 36 PhD theses; this figure includes the theses of PhD students supervised by ILLC members who graduated at another university, but who published their thesis in the ILLC Dissertation Series.) In December 2011 there were furthermore 12 ongoing PhD projects affiliated with the LoCo programme.

3.6 Earning Capacity

Despite its focus on theory and fundamental research, the group has been very successful at attracting external funding. Maybe the clearest evidence for the healthy earning capacity of the group is its success in the NWO's Innovational Research Incentives Scheme (Veni, Vidi, Vici). During the assessment period, the group hosted (or co-hosted together with CWI, in case of researchers whose main affiliation is with the CWI) two Vici grants (Buhrman,

¹The drawbacks of relying on impact factors and citation analyses to evaluate research productivity in the areas covered by the LoCo programme are well known and we do not repeat them here. The international committee of experts entrusted with the *Research Assessment of Computer Science in the Netherlands* in 2010, for instance, referred to impact factors as being “at best meaningless”, due to the poor coverage of computer science conference proceedings in the bdata used to calculate those impact factors. This problem is only exacerbated by the interdisciplinary nature of the LoCo programme.

Year	Project	Source	Applicant	Amount
2005	Algebra and Coalgebra	NWO Vici	Venema	980 k€
2006	Marie Curie Research Training Site GLoRiClass	EC	Löwe	1,250 k€
2006	Complexity Thresholds in Computer Games	NWO VC	van Benthem	172 k€
2007	Collective Decision Making in Combinat. Domains	NWO Vidi	Endriss	470 k€
2007	Dualities for Quantales	NWO Veni	Palmigiano	163 k€
2007	Making Guesswork Precise	NWO Mosaic	Khomskii	180 k€
2008	Norm Implementation via Mechanisms	NWO Veni	Grossi	163 k€
2008	LogiCCC: Computational Foundations of COM-SOC	ESF/NWO	Endriss	200 k€
2008	LogiCCC: Dialogical Foundations of Semantics	ESF/NWO	Löwe	200 k€
2008	LogiCCC: Logic for Interaction	ESF/NWO	Väänänen	200 k€
2011	Evidence-based Belief Revision	NWO Veni	Renne	250 k€
2011	Quantum Cryptography beyond Key Distribution	NWO Veni	Schaffner	250 k€
2011	Aggregation of Preferences over Uncertain Outcomes	NWO VC	Endriss	223 k€

Table 3.3: Research Income: Logic and Computation Programme.

Venema), two Vidi grants (Endriss, de Wolf), and four Veni grants (Grossi, Palmigiano, Renne, Schaffner). Another important source of income has been the Marie Curie Research Training Site GLoRiClass (coordinated by Löwe), which funded eight PhD students in the area of Logic and Games (six of whom were part of the LoCo programme). The ILLC has also been instrumental in the creation of the European Science Foundation’s *Modelling Intelligent Interaction* (LogiCCC) programme (van Benthem was one of the proposers), and three of the projects eventually funded involved researchers from the LoCo group.

In Table 3.3 we list all of the major externally funded projects that were administered at the ILLC (i.e., this list excludes projects held by researchers whose main appointment is at the CWI) and which funded at least one position (i.e., the significant income generated by smaller grants, e.g., for the organisation of events, is not included).² We list all projects that were acquired or that started during the assessment period (the year shown in the table is the year when a project was acquired). This adds up to a total grant income of 4.7 M€. Note that Table 3.3 does not include stipends paid directly to guest researchers at the ILLC (e.g., an NSF International Research Fellowship and several Erasmus Mundus grants, adding up to several hundreds of thousands of euros).

²A full specification of funding for LoCo is given in Table 5.2 on page 68.

3.7 Academic Reputation

Several of the senior members of the LoCo group have been the recipients of important national and international honours. For example, Apt, van Benthem and Vitányi are members of the *Academia Europaea*; van Benthem is also member of the KNAW. Vitányi received the royal honour of *Ridder in de Orde van de Nederlandse Leeuw* in 2007.

Other important recognitions include van Benthem's appointment as a *Distinguished International Expert* by the Ministry of Education in China; a fellowship at the Vlaams Academisch Centrum of the Royal Flemish Academy of Belgium for Löwe in 2010; a Foundation for Polish Science Prize awarded to our PhD student Nina Gierasimczuk in 2008; a prestigious invitation to the PhD Colloquium of the German Logic Society for our PhD student Daisuke Ikegami in 2010; and the Silver Core Award of the International Federation for Information Processing (IFIP) given to Vitányi in 2008. Endriss and coauthors received the Best Paper Award at AAMAS, the premier international conference in the field of multiagent systems, in 2011 and a paper published in the *Journal of Philosophical Logic* coauthored by van Benthem and our PhD student Olivier Roy was selected by the *Philosopher's Annual* as one of the ten best papers in Philosophy of 2009.

Members of the group held editorial positions at a large number of journals. We only list some of them here: *Journal of Logic and Computation*; *ACM Transactions on Computational Logic*; *Logical Methods in Computer Science*; *Journal of Logic, Language and Information*; *Mathematical Logic Quarterly*; *Journal of Artificial Intelligence Research*; *Theory of Computing*; *Information Processing Letters*; *Quantum Information and Computation*; *Synthese*. They also regularly served on the programme committees of major international conferences (e.g., FOCS, STACS, ICALP, Complexity, CSL, IJCAI, AAI, ECAI, AAMAS, KR), and they have chaired or organised important events, such as Advances in Modal Logic (AiML); the International Conference on Topology, Algebra, and Categories in Logic (TACL); the Conference on Theoretical Aspects of Rationality and Knowledge (TARK); the International Workshop on Logic, Rationality and Interaction (LORI); the International Workshop on Computational Social Choice (COMSOC); the European Summer School in Logic, Language and Information (ESSLLI); and the European Agent Systems Summer School (EASSS).

Finally, members of the group occupied important positions in international organisations, such as the Association for Logic, Language and Information (FoLLI); the *Computability in Europe* network; the COST Action on Algorithmic Decision Theory; the European Mathematical Society; the European Set Theory Society; and the Division for Logic, Methodology and Philosophy of Science of the International Union for History and Philosophy of Science.

3.8 Societal Relevance: quality, impact and valorisation

The societal relevance of the work of the LoCo group is exemplified by a broad range of diverse activities. We list some of them here:

- As a member of the executive committee of the Turing Centenary Advisory Committee, Löwe has been heavily involved in preparations for outreach activities to be organised as part of the Turing Year in 2012.

- Van Benthem was one of the initiators of the national research programme *Talentkracht* (“Talent Power”), investigating opportunities to support the development of creativity and reasoning skills in young children.
- Several members of the group gave public lectures to a lay audience. Examples include Buhrman’s lecture on *Quantum Computing and Science Fiction* at the Science Café Nijmegen in 2008 and van Benthem’s lecture on *Logic for Children* at the Museum Naturalis in Leiden in 2010.
- Members of the group are involved in the production of educational materials for use beyond the confines of our own class rooms. Examples include the textbooks by Apt, van Benthem, and Vitányi listed above; the open course project *Logic in Action* of the Open University led by van Benthem (also used at Amsterdam University College, Stanford On-Line High School, and Tsinghua University); and the widely used interactive logic teaching tool WinKE developed and distributed by Endriss.
- Endriss organised a session on *Computational Social Choice* at the European Future Technologies Conference and Exhibition in Budapest in 2011, for an audience of academics, technology practitioners, European Commission officials, and journalists.
- Torenvliet has been involved in setting up *De CodeFabriek* (“The Code Factory”), a pilot project for creating a software company run by computer science students who work on orders from a commercial partner, while being supported by scientists from the ILLC and the UvA’s Institute for Informatics.

3.9 Viability

The group is very active and well-known in a number of fields that are now internationally booming, such as logic and games, computational social choice, and quantum computing, while at the same time maintaining its stronghold in areas in which the ILLC has a long established track record, such as modal logic and complexity theory.

While the group has been understaffed during part of the assessment period, with the appointments of Palmigiano in 2009 and Baltag and de Wolf in 2011 it is now back to the size it had at the beginning of this period. Since the retirement of Peter van Emde Boas, however, the area of theoretical computer science is underrepresented in terms of research fte. The group is well balanced in terms of age, which ensures viability also over the coming years. Most of the senior members of the group have experience in obtaining prestigious grants in highly competitive funding programmes, which will ensure continuity in terms of the number of funded positions for PhD students and postdocs. Also within the UvA the group is well positioned, given its close involvement with the research priority programmes *Information and Meaning* as well as *Quantum Matter and Quantum Information*.

Chapter 4

Language and Computation

4.1 Objectives and Research Area

The Language and Computation group is concerned with computational models of human information processing, especially natural language processing and music cognition. The methods employed by this group build on formal theories of linguistic syntax and logical semantics, but extend these with a variety of more performance-oriented techniques, such as probabilistic grammars, data-oriented parsing and computational models of human Gestalt perception. The group aims to develop computational methods which are cognitively plausible as well as practically useful. An important focus is the further development of corpus-based processing methods for natural language, building on the ‘Data-Oriented Parsing’ model. We used this approach for modelling first language acquisition, language change and machine translation, as well as music and visual analysis. Another important application area is concerned with Information Retrieval and Question Answering. In this area, we employ the state-of-the-art retrieval techniques, and focus on improving the practical usefulness of these systems through innovations in user-interfaces and cognitive ergonomics. In cooperation with the Logic and Language group, 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 an aspect of music which is fundamental but ill-understood: the perception of the temporal aspects of music, such as rhythm, tempo and timing. We develop computational models which implement mathematically articulated theories, and which are validated through psychological experiments with human listeners.

4.2 Composition

At the end of 2011 the Language and Computation group consisted of seven senior scientists: two full professors (Bod, Honing), two associate professors (Sima’an, Zeevat), two permanent assistant professors (Blutner, Kamps) and one temporary assistant professor (Zuidema). The only emeritus professor (Scha) is still active in research projects. The group currently hosts five postdoctoral researchers, and several research assistants. The group is perfectly balanced

between the Faculty of Science and the Faculty of Humanities, its members being equally distributed in both faculties.

Compared to 2006, the current number of staff in the Language and Computation group has remained stable. One staff member retired (Scha) and one new staff member has joined the group (Zuidema). Instead of one full professorship in 2006, the group hosts now two full professorships.

Table 4.1 gives a specification of LaCo staff in terms of research fte.

Staff	2006	2007	2008	2009	2010	2011
Tenured	2.58	2.91	2.89	3.00	3.00	3.00
Non-tenured	5.01	3.69	3.75	3.77	4.19	4.77
Phd Student	4.70	5.94	8.99	8.79	7.17	6.92
Total	12.28	12.54	15.64	15.56	14.37	14.69

Table 4.1: LaCo staff in terms of research fte

4.3 Research Environment and Embedding

The Language and Computation group has a strong position in two of the seven university research themes: Cognition and Neuroscience, and Communication and Information (especially with respect to Digital Humanities, Computational Linguistics and Music Cognition). The group is embedded in national cultural heritage research, with several projects in the NWO CATCH domain. There are joint projects with virtually all departments in the Faculty of Humanities. The group has two research seminars, the Computational Linguistics Seminar (CLS) and the Music Colloquium, and it is the main organiser of the SMART Cognitive Science series and the bi-annual international conference *The Making of the Humanities*. The group has connections with numerous international labs and universities: among others there are collaborations with Dublin City University, Hungarian Academy of Sciences, University College London, University of Edinburgh, Microsoft Research, Technion Haifa, Humboldt University Berlin and King's College London.

4.4 Quality and Scientific Relevance

4.4.1 Research Highlights

- It was shown by means of computational simulation of language acquisition that children's grammars grow more abstract with age (Borensztajn et al. 2008; best paper award CogSci 2008). This result is in opposition with the (previously) widely accepted 'continuity hypothesis' which stated that children have, at least in competence, the same syntactic categories and rules as adults.

- Based on our earlier, computational work on beat induction, and in collaboration with colleagues from the Hungarian Academy of Sciences, it was found that two-day old newborns are able to detect the beat in music (Honing et al. 2009; Winkler et al. 2009). These results suggest that beat induction is innate or possibly learned already in the womb. Beat induction is thus probably fundamental to the origins of music.
- The first overarching history of the humanities was produced (Bod 2010), showing that there is continuous tradition in the quest for patterns in the humanistic disciplines from antiquity till today in all regions of the world. The work has been translated into English (Oxford University Press, in press), and is currently being translated into German, French, Russian, Polish and Chinese.
- The first well-founded and effective statistical method for learning a hierarchical structure for syntactic reordering (transfer) in machine translation was developed (Mylonakis and Sima'an 2011). This learning method paves the way for automatic induction of recursive structure for statistical composition in machine translation which directly impacts a wide-range of memory-based models in Computational Linguistics, including Phrase-based translation and DOP (Zollmann and Sima'an 2006).
- A comprehensive analysis of Wikipedia link structure has led to new insights in the role and importance of link evidence in informational search (Kamps et al. 2009).
- It was shown that a sentence's hierarchical structure, unlike many other linguistic sources of information, does not noticeably affect the generation of expectations about upcoming words (Frank and Bod 2011). This result challenges the usefulness of hierarchical phrase structures in language.

4.4.2 Key publications

- **Mylonakis, M.** and **K. Sima'an**, 2011. Learning Hierarchical Translation Structure with Linguistic Annotations. *Proceedings of The 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies (ACL:HLT 2011)*
- Van Heijningen, J., De Visser, **W. Zuidema** and K. Ten Cate, 2009, Simple rules can explain discrimination of putative recursive syntactic structures by a songbird species, *Proceedings of the National Academy of Sciences*, vol. 106, no. 48, pp. 20538–20543.
- **Arampatzis, A.**, **J. Kamps**, and S. Robertson, 2009. Where to stop reading a ranked list? threshold optimization using truncated score distributions. In James Allan, Javed A. Aslam, Mark Sanderson, ChengXiang Zhai, and Justin Zobel, editors, *Proceedings of the 32nd Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, pages 524-531. ACM Press, New York NY, USA.
- Winkler, I., G. Haden, **O. Ladinig**, **I. Sziller**, I., and **H. Honing**, 2009. Newborn infants detect the beat in music. *Proceedings of the National Academy of Sciences*, PNAS, 106, 2468-2471.

Language and Computation	2006	2007	2008	2009	2010	2011	Sum
Refereed journal articles	11	5	10	16	13	9	64
Non-refereed journal articles	1	0	0	0	0	0	1
Books/Monographs	1	0	0	1	3	4	9
Edited books	2	1	3	4	5	3	18
Book chapters	6	3	3	6	2	4	24
PhD-theses	1	1	0	1	1	4	8
Conference papers	36	37	41	43	44	34	235
Professional publications	2	0	3	1	4	1	11
Publications aimed at general public	2	1	3	0	0	6	12
Total publications	62	48	63	72	72	65	382

Table 4.2: Research Output: Language and Computation Programme

- **Frank, S.** and **R. Bod**, 2011. Insensitivity of the Human Sentence-Processing System to Hierarchical Structure, *Psychological Science*, 22(6), 829-834.

4.4.3 Books

- **Honing, H.**, 2011. *Musical Cognition. A Science of Listening*. New Brunswick, N.J.: Transaction Publishers.
- **Bod, R.**, 2010. *De Vergeten Wetenschappen: Een Geschiedenis van de Humaniora*. Prometheus. (English translation in press with Oxford University Press).
- **Blutner, K.R.**, Hendriks, P.C.J. & de Hoop, H. (2006). *Optimal communication* (paperback edition). Stanford University: CSLI.
- **Bod, R., Maat, J.** & Weststeijn, T. (Eds.). (2010). *The Making of the Humanities*. - Vol. 1: Early Modern Europe. Amsterdam: Amsterdam University Press.
- **Honing, H.** (2009). *Iedereen is muzikaal: Wat we weten over het luisteren naar muziek*. Amsterdam: Nieuw Amsterdam Uitgevers.

4.5 Output

During the assessment period researchers in the Language and Computation group have produced a total of 9 monographs, 18 edited books, 24 book chapters, 64 refereed articles in journals, 235 refereed articles in conference proceedings, and 32 other publications. As is well known, in the field of computer science refereed conference publications are comparable to journal publications in terms of impact and esteem. In the same period, the group graduated

8 PhD students. In December 2011 there were furthermore 9 ongoing PhD projects affiliated with the programme.

Most of the output has been published in first-rate journals and in the proceedings of highly competitive conferences. The relatively low number of PhD graduations during the evaluation period can be partly explained by the fact that (in 2009) the only full professor of the group (Scha) retired and was not followed up at the FGw (in the Netherlands only full professors have the right to graduate PhD students). Since 2011 the Language and Computation group has 2 full professors (Bod, Honing), and the number of PhD graduations has increased dramatically since then and is expected to stay at this number in 2012 and afterwards.

4.6 Earning Capacity

The group has been highly successful at attracting external funding, the clearest evidence of which is the group's success in NWO's very competitive Innovational Research Incentives Scheme (Veni, Vidi, Vici), both in the NWO-humanities and NWO-science. During the assessment period, one Vici (Bod), two Vidi's (Kamp, Sima'an) and two Veni's (Honingh, Zuidema) have been awarded. Additionally, a total of five projects were awarded in NWO's Free Competition scheme (both in humanities and science), two EU projects in the FP scheme, two projects in the KNAW Computational Humanities programme, and four projects in other schemes (CATCH, CSCA). The total amount of earning capacity of the LaCo group (on account of the ILLC) during the assessment period was 7.3 M€.¹

4.7 Academic Reputation

Members of the Language and Computation group held editorial positions at a large number of journals as well as programme membership positions at top conferences in the field. We only list a small sample here: *Machine Translation Journal*, *Journal of Natural Language Engineering*, *Music Perception*, *Empirical Musicology Review*, *Journal of New Music Research*, *Frontiers in Theoretical and Philosophical Psychology*, ACL, EAACL, NAACL, COLING, EMNLP, IJCNLP, CoNLL, IWPT, RANLP, LREC, CogSci, ESCOM, TREC, CLEF, ECIR, SIGIR. Several of the members of the group were the recipients of international awards, such as best paper award at CogSci (Borensztajn et al.), a young investigator's award at ESCOM (Honingh), a best paper award at BNAIC (Mylonakis and Sima'an). Additionally, Honing was awarded a KNAW-Hendrik Muller chair by the Royal Netherlands Academy of Sciences (KNAW) in 2010. Members of the group also held positions in prestigious international organisations, and gave high-profile keynote lectures at international conferences among which IEEE Spoken Language Technology, TED, Opening Academic Year of the Unione in Rome (42 international research institutes).

¹A full specification of funding for LaCo is given in Table 5.2 on page 68.

Year	Project	Source	Applicant	Amount
2006	Priors for the Estimation of Probabilistic Grammars from Incomplete Natural Language Data	NWO Vidi	Sima'an	470 k€
2006	Towards an experience-based model of early syntax generation	NWO VC	Scha	550 k€
2006	Integrating Cognition	NWO Vici	Bod	1,250 k€
2006	Multiple-collection Searching Using Metadata MuSeUM	NWO CATCH	Kamps	583 k€
2007	Effective Focused Retrieval Techniques EffoRT	NWO VC EW	Kamps	408 k€
2007	Discovering Grammar: statistical models of sequence learning in humans, animals and machines	NWO Veni	Zuidema	141 k€
2007	Retrieving Encoded Archival Descriptions More Effectively README	NWO Vidi	Kamps	600 k€
2009	Machine Translation When Exact Pattern Match Fails	NWO VC EW	Sima'an	216 k€
2010	Zwaartepunt Brain & Cognition	UvA-FGw	Honing	220 k€
2010	Multilingual/Multimedia Access to Cultural Heritage	EU FP7	Kamps	392 k€
2010	Virtual Museum Transnational Network project	EU FP7	Kamps	246 k€
2011	Web Archive Retrieval Tools (WebART)	NWO CATCH	Kamps	706 k€
2011	Representing Music: a new basis for computational musicology	NWO Veni	Honingh	235 k€
2011	COgnition Guided Interoperability beTween Collections of musical Heritage COGITCH	NWO CATCH	Honing	210 k€
2011	Tunes and Tales: Modeling Oral Transmission	KNAW CH	Honing	220 k€
2011	The Riddle of Literary Quality	KNAW CH	Bod	220 k€
2011	Statistical Translation of Novel Constructions	NWO VC EW	Sima'an	230 k€
2011	Segments and rules: a comparative study into the computational mechanisms underlying language acquisition	NWO VC	Zuidema	210 k€
2011	Speerpunt Digital Humanities (2 postdocs)	FGw	Bod	320 k€

Table 4.3: Research Income: Language and Computation Programme

4.8 Societal Relevance: quality, impact and valorisation

During the assessment period, members of the Language and Computation group gave over ninety interviews in popular journals, magazines, as well as appearances on radio and television on (computational) linguistics, music cognition, digital humanities and history of the humanities. The books by Bod and Honing have been reviewed in over a hundred news-

papers and magazines. Several NLP techniques and machine learning techniques developed within the group are open access, and are being further developed in academia as well as in commercial companies in public-private collaborations. Recently, the Faculty of Humanities has founded a public-private Center for Digital Humanities, directed by Rens Bod. As of May 2012, the Center is running four projects each of which involves a collaboration between the University of Amsterdam and a commercial company. The projects cover various areas from the humanities: art history (Amsterdam canal project), musicology (modelling musical similarity), film studies (emotion analysis) and media studies and computational linguistics (search engine for parliamentary debates). The public-private collaborations should result in a concrete product that is driven by a question from the humanities. Investments are being made by both university and four industrial partners. In the course of 2012, the Center will start up six additional private-public projects.

4.9 Viability

The group has a high international profile in the fields of natural language processing, computational linguistics and music cognition, and is building a similar profile in the upcoming fields of computational and digital humanities, as well as the history of the humanities. After the retirement of Remko Scha, the group has been strengthened by two professorships (Bod, Honing). Maximum effort will be given to prolong and keep these appointments. The group has recently been extended with an assistant professorship in digital humanities. An additional structural assistant professorship in natural language processing will be filled, as well as two temporary associate professorship positions in respectively cognitive modelling and digital humanities.

Part C

Quantitative Information

Chapter 5

Tables

In this section we present a number of detailed tables, as required by the Standard Evaluation Protocol. Some of the tables are split not only between the programmes, but also along the faculty lines.

Research Staff at institute level							
		2006	2007	2008	2009	2010	2011
Tenured	FGw	4.17	4.18	4.25	3.80	4.20	4.70
	FNWI	4.94	5.34	5.33	6.43	6.30	6.62
	Total	9.11	9.51	9.58	10.23	10.50	11.32
Non-tenured	FGw	3.61	4.91	7.18	5.95	4.62	6.24
	FNWI	4.36	3.37	4.11	7.07	9.85	10.30
	Total	7.96	8.27	11.29	13.02	14.47	16.54
PhD student	FGw	12.51	14.82	17.91	14.76	10.56	11.87
	FNWI	19.65	26.45	27.99	26.59	19.96	14.23
	Total	32.17	41.27	45.89	41.35	30.51	26.11
Total research staff		49.24	59.06	66.76	64.60	55.48	53.97
Guest researcher	FGw	0.13	1.63	0.96	0.54	0.42	0.25
	FNWI	3.82	6.04	7.27	6.98	12.33	9.80
	Total	3.95	7.67	8.22	7.53	12.75	10.05
Support staff	FNWI	2.96	3.33	2.94	2.94	2.94	3.10
	Total	2.96	3.33	2.94	2.94	2.94	3.10
Total ILLC staff		56.15	70.06	77.92	75.07	71.17	67.12

Research Staff at programme level							
Programme		2006	2007	2008	2009	2010	2011
Logic and Language	Tenured	2.67	2.40	2.47	2.50	2.90	2.90
	Non-tenured	2.05	3.16	5.14	5.76	4.46	5.56
	Phd Student	11.80	13.31	14.15	11.66	7.36	8.16
	LoLa Total	16.52	18.88	21.75	19.92	14.72	16.72
Logic and Computation	Tenured	3.87	4.20	4.22	4.73	4.60	5.42
	Non-tenured	0.90	1.43	2.40	3.49	5.81	6.12
	Phd Student	15.67	22.02	22.75	20.91	15.98	11.02
	LoCo Total	20.44	27.64	29.37	29.13	26.39	22.56
Language and Computation	Tenured	2.58	2.91	2.89	3.00	3.00	3.00
	Non-tenured	5.01	3.69	3.75	3.77	4.19	4.77
	Phd Student	4.70	5.94	8.99	8.79	7.17	6.92
	LaCo Total	12.28	12.54	15.64	15.56	14.37	14.69
ILLC Total		49.24	59.06	66.76	64.60	55.48	53.97

Table 5.1: Research staff at institute and programme level in terms of research fte.

The table at the institute level includes guest researchers and support staff. Guest researchers are included if they spent at least 1 month at ILLC. Since visitors often are guests of the institute as a whole, or of staff members from more than one group, and the ILLC

administrative support staff also works for the institute as a whole, we have not included these categories in the second table.

		2006		2007		2008		2009		2010		2011	
Funding		<i>fte</i>	%	<i>fte</i>	%	<i>fte</i>	%	<i>fte</i>	%	<i>fte</i>	%	<i>fte</i>	%
Direct funding	FGW	10.89	54%	9.73	46%	8.76	33%	6.74	28%	6.07	32%	7.63	39%
	FNWI	7.10	28%	8.36	25%	9.11	27%	8.75	26%	8.84	29%	8.56	33%
	ILLC	17.99	39%	18.09	33%	17.87	30%	15.49	27%	14.91	30%	16.19	36%
Research grants	FGW	9.32	46%	11.29	53%	16.85	63%	16.52	69%	13.17	68%	11.95	61%
	FNWI	8.79	34%	10.17	31%	11.34	34%	16.35	48%	16.78	56%	14.84	58%
	ILLC	18.11	39%	21.46	39%	28.19	47%	32.87	57%	29.95	61%	26.79	59%
Contract research	FGW	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	FNWI	4.66	18%	8.48	26%	8.43	25%	5.42	16%	2.23	7%	0	0%
	ILLC	4.66	10%	8.48	16%	8.43	14%	5.42	9%	2.23	5%	0	0%
Other	FGW	0	0%	0.3	1%	1.00	4%	0.75	3%	0	0%	0	0%
	FNWI	5.17	20%	6.03	18%	4.93	15%	3.44	10%	2.30	8%	2.25	9%
	ILLC	5.17	11%	6.33	12%	5.93	10%	4.19	7%	2.30	5%	2.25	5%
Total	FGW	20.21	44%	21.32	39%	26.61	44%	24.01	41%	19.24	39%	19.58	43%
	FNWI	25.72	56%	33.04	61%	33.81	56%	33.96	59%	30.15	61%	25.65	57%
	ILLC	45.93	100%	54.36	100%	60.42	100%	57.97	100%	49.39	100%	45.23	100%
Expenditure		€	%	€	%	€	%	€	%	€	%	€	%
Personnel costs	FGW	1.538	94%	1.591	96%	1.405	91%	1.331	86%	1.257	83%	1.063	93%
	FNWI	2.334	88%	2.827	91%	3.262	88%	2.916	90%	2.801	86%	2.770	89%
	ILLC	3.872	91%	4.418	93%	4.667	89%	4.247	89%	4.058	85%	3.833	90%
Other	FGW	98	6%	68	4%	141	9%	208	14%	264	37%	86	7%
	FNWI	307	12%	264	9%	458	12%	326	10%	456	14%	335	11%
	ILLC	405	9%	332	7%	599	11%	534	11%	720	15%	421	10%
Total	FGW	1.636	38%	1.659	35%	1.546	29%	1.539	32%	1.521	32%	1.149	27%
	FNWI	2.641	62%	3.091	65%	3.720	71%	3.242	68%	3.257	68%	3.105	73%
	ILLC	4.277	100%	4.750	100%	5.266	100%	4.781	100%	4.778	100%	4.254	100%

Programme	Funding	2006	2007	2008	2009	2010	2011
Logic and Language	Direct funding	9.39	7.95	6.98	5.59	5.24	7.14
	Research Grants	6.13	6.28	8.72	10.63	7.89	7.70
	Contract research	0.92	1.75	2.00	1.09	0.92	
	Other		0.30	1.33	1.75	0.67	
Total LoLa		16.43	16.28	19.03	19.06	14.72	14.84
Logic and Computation	Direct funding	6.03	7.07	7.70	6.90	6.81	5.35
	Research Grants	4.50	6.88	7.84	9.79	10.69	9.66
	Contract research	2.85	5.83	5.75	4.34	1.30	
	Other	4.17	5.67	4.20	2.40	1.63	2.25
Total LoCo		17.55	25.45	25.49	23.43	20.44	17.27
Language and Computation	Direct funding	2.58	3.07	3.19	3.00	2.87	3.69
	Research Grants	7.47	8.30	11.63	12.45	11.37	9.43
	Contract research	0.90	0.90	0.68			
	Other	1.00	0.37	0.40	0.04		
Total LaCo		11.95	12.63	15.90	15.49	14.23	13.12

Table 5.2: Research funding at institute (fte and %) and programme (fte) level

In this table (and in its summary, Table 1.3) ‘direct funding’ refers to funding by the University of Amsterdam, ‘research grants’ concern projects funded by NWO or KNAW, and

‘contract research’ refers to funding by third parties, such as companies, but also the European Union. The category ‘Other’ refers to researchers who are not employed by the university, but work at the institute on individual grants (e.g., Erasmus Mundus or scholarships of the Chinese government).

A note on expenditure: In 2006 the UvA changed to a full-cost model. In 2009 part of the overhead costs were transferred from “Personnel” to “Other costs”. As of 2009, the FNWI uses an allocation model for university funding based on performance indicators such as the number of BSc, MSc and PhD degrees awarded, the amount of external funding acquired, etc.

Institute for Logic, Language and Computation	2006	2007	2008	2009	2010	2011	SUM
Refereed journal articles	49	63	55	52	55	59	333
Non-refereed journal articles	2	2	3	3	4	1	15
Books/monographs	4	4	3	4	5	8	28
Edited books	14	10	14	11	13	14	76
Book chapters	36	31	23	28	25	28	171
PhD-theses	8	5	11	13	12	11	60
Conference papers	82	96	88	104	111	67	548
Professional publications	13	6	8	1	6	2	36
Publications aimed at general public	7	5	7	3	0	6	28
Total publications	215	222	212	219	231	196	1295
Research Programme Logic and Language							
Refereed journal articles	7	18	15	8	8	14	70
Non-refereed journal articles	1	1	1	1	2	0	6
Books/Monographs	2	1	2	0	0	2	7
Edited books	2	4	0	0	3	2	11
Book chapters	13	12	7	8	10	10	60
PhD-theses	1	2	5	6	2	0	16
Conference papers	11	18	13	19	17	6	84
Professional publications	3	3	2	0	0	0	8
Publications aimed at general public	1	2	1	1	0	0	5
Total publications	41	61	46	43	42	34	267
Research Programme Logic and Computation							
Refereed journal articles	31	40	30	28	34	36	199
Non-refereed journal articles	0	1	2	2	2	1	8
Books/Monographs	1	3	1	3	2	2	12
Edited books	10	5	11	7	5	9	47
Book chapters	17	16	13	14	13	14	87
PhD-theses	6	2	6	6	9	7	36
Conference papers	35	41	34	42	50	27	229
Professional publications	8	3	3	0	2	1	17
Publications aimed at general public	4	2	3	2	0	0	11
Total publications	112	113	103	104	117	97	646
Research Programme Language and Computation							
Refereed journal articles	11	5	10	16	13	9	64
Non-refereed journal articles	1	0	0	0	0	0	1
Books/Monographs	1	0	0	1	3	4	9
Edited books	2	1	3	4	5	3	18
Book chapters	6	3	3	6	2	4	24
PhD-theses	1	1	0	1	1	4	8
Conference papers	36	37	41	43	44	34	235
Professional publications	2	0	3	1	4	1	11
Publications aimed at general public	2	1	3	0	0	6	12
Total publications	62	48	63	72	72	65	382

Table 5.3: Research output at institutional and programme level

Start	F	M	total	Graduated after										Disc.		not yet finished	
				≤ 4 y		≤ 5 y		≤ 6 y		≤ 7 y		≤ 8 y			%		%
					%		%		%		%		%				
2002	4	8	12	1	8	5	50	3	75	2	92			1	8		
2003	1	4	5			3	60	2	100								
2004	3	1	4	1	25	3	75										
2005	3	6	9	3	33	4	78	1	89					1	11		
2006	4	7	11	3	27	5	73	1	82					1	9	1	9
2007	3	14	17	5	29	10	88									2	12
2008	2	6	8	1	13									2	25	5	63
2009		2	2													2	100
2010	2	3	5											1	20	4	80
2011	2	7	9													9	100
Total	24	58	82														

Table 5.4: Enrollment and success rates of PhD Candidates (employed)

Start	F	M	total	Graduated after						Disc.		not yet finished	
				≤ 4 y		≤ 5 y		≤ 6 y			%		%
					%		%		%				
2002	1		1					1	100				
2003		1	1					1	100				
2004		1	1	1	100								
2005	1		1	1	100								
2006		1	1			1	100						
2007	1	1	2							2	100		
2008		2	2									2	100
2010		1	1							1	100		
2011	1	2	3									3	100
Total	4	9	13										

Table 5.5: Enrollment and success rates of PhD Candidates (not on contract)

Acronyms

AAA	Amsterdam Academic Alliance
ACLIC	Amsterdam Center for Language and Communication
AFS	Amsterdam Faculty of Science
CSCA	Cognitive Science Center Amsterdam
CWI	Centrum voor Wiskunde en Informatica (Center for Mathematics and Computer Science)
ERC	European Research Council
ESF	European Science Foundation
FGw	Faculteit der Geesteswetenschappen (Faculty of Humanities)
FNWI	Faculteit der Natuurwetenschappen, Wiskunde en Informatica (Faculty of Science)
fte	full time equivalent (1.0 fte = 38 work hours/week)
ILLC	Institute for Logic, Language and Computation
KNAW	Koninklijke Nederlandse Academie van Wetenschappen (Royal Netherlands Academy of Arts and Sciences)
LaCo	Language and Computation
LoCo	Logic and Computation
LoLa	Logic and Language
MEERVOUD	Meer vrouwelijke onderzoekers als UD (More Women Researchers as University Lecturers)
MoL	Master of Logic
NVAO	Nederlands-Vlaamse Accreditatie Organisatie (Dutch-Flemish Accreditation Organization)
NWO	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Netherlands Organisation for Scientific Research)

OBP	Opleidings- en BegeleidingsPlan (Education and Supervision Plan)
PVC	Promotie Voortgangs Commissie (PhD Progress Committee)
Research fte	Part of fte officially dedicated to research
RPA	Research Priority Area
SEP	Standard Evaluation Protocol
UvA	Universiteit van Amsterdam University of Amsterdam
VC	Vrije Competitie (NWO's Free Competition grant scheme)
VI	Vernieuwingsimpuls (NWO's Innovative Research Incentives Scheme)
VU	Vrije Universiteit

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