Institute for Logic, Language and Computation

Self-Evaluation 2012–2014

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Preface

This report provides a research self-evaluation over the years 2012–2014 by the Institute for Logic, Language and Computation (ILLC), an interdisciplinary research institute that is embedded in two faculties at the University of Amsterdam, the Faculty of Science and the Faculty of Humanities.

As such, the document forms part of the evaluation cycle of the research conducted at the ILLC, regulated by the Standard Evaluation Protocol (SEP) as defined by the Association of Universities in the Netherlands (VSNU), the Netherlands Organisation for Scientific Research (NWO), and the Royal Netherlands Academy of Arts and Sciences (KNAW). This protocol describes the methods and aims of the sexennial research assessment that all research at Dutch universities and KNAW and NWO institutes is subjected to. It is customary that a light research evaluation takes place roughly three years after the last full research assessment, and while the current version of the protocol (SEP 2015–2021) no longer presribes such a midterm review, there is a consensus within the two faculties governing the ILLC that such a reflection is desirable. Since the last full, external assessment of ILLC research took place in 2013, covering the period 2006–2011, the current midterm review will cover the years 2012–2014.

The ILLC midterm review 2012–2014 will be conducted by the institute's Scientific Advisory Panel (WAR), consisting of Prof.dr. Angelika Kratzer (Amherst), Prof.dr. Mark Steedman (Edinburgh, chair), and Prof.dr. Wolfgang Thomas (Aachen). Its purpose is to reflect on the period since the last full assessment (and in particular, to review the follow-up on the recommendations made by the external evaluation committee), and to give a critical evaluation of the institute's strategy for the coming period. The assessment panel will base the midterm review on interviews with the institute's staff and management during a site visit, and on written material provided by the institute, of which this report is the key document.

Over the assessment period the ILLC has witnessed some lively dynamics. Externally, the institutional embedding of the ILLC in the University of Amsterdam went through some turbulence, due to the intensive collaboration sought by the Faculty of Science with its partners at the Vrije Universiteit Amsterdam, and some structural changes in the governance model and research organisation of the Faculty of Humanities. This turbulence did not signify a diminished support of the institute: on March 31, 2015, the deans of the Faculty of Science and the Faculty of Humanities signed a new agreement, securing the position of the ILLC as a joint endeavour of the two faculties, for years to come. Internally, the institute has continued its process of renewing and consolidating its scientific leadership and the rejuvenation of its staff, through the appointment of no less than six new full professors (and by two existing chairs becoming permanent), and by two new associate professors and ten new assistant professors joining the institute. As a consequence, the ILLC has widened its research agenda, and with our mix of established senior staff and up-and-coming young members, we feel that we are well-prepared for the future.

Prof. Yde Venema
Scientific Director
Institute for Logic, Language and Computation

Part A

The Institute

Chapter 1

The Institute for Logic, Language and Computation

1.1 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 (UvA), in which researchers of the Faculty of Science (FNWI) and the Faculty of Humanities (FGw) collaborate. Its scientific mission is to give a formal account of the fundamental processes related to the encoding, transmission and comprehension of the notion of information, broadly conceived. In accordance with its interdisciplinary orientation and scientific mission, the ILLC has a wide academic profile, and it is situated at a crossroad of ideas, disciplines and organisations, locally, nationally, and internationally.

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 fundamental structure and 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 the perception of music. The research aim is to develop theories, logical systems, formal models and computational methods that can handle this rich variety of perspectives on information. ILLC researchers make use of insights stemming from a wide variety of disciplines across traditional academic borders, including the fields of cognitive science, computer science (including artificial intelligence), linguistics, logic, mathematics, philosophy, and the social sciences.

The resulting view of information science transcends traditional boundaries of the university and the wider academic world. In addition to its specific research goals, the ILLC aims to overcome such boundaries between disciplines and to serve as a rallying point for information scientists across traditional research fields. 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 Structure

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

Logic and Language (LoLa) This is a research programme in philosophical logic and the philosophy of language, crossing the borders with linguistics, cognitive science and artificial intelligence. Major topics of investigation are the semantics of natural language, human reasoning, and intelligent interaction, while the research methods are mostly based on logical and conceptual analysis.

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. Transcending this diversity of research areas is a shared reliance on formal tools, such as (modal) logic, game theory, and complexity theory.

Language and Computation (LaCo) Members of this group focus on formal models of human information processing, with a focus on the development of computational methods that are cognitively plausible as well as practically useful. Currently the main research topics are natural language processing, music cognition and digital humanities; statistical and empirical methods have become increasingly important over the years.

There is no fixed structure of the individual programmes, but each of these consists of a small core of permanent scientific staff (full, associate and assistant professors), and a large, varying component of temporary personnel (postdocs and PhD candidates, but also some assistant and associate professors) 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-study.

A more detailed overview of the areas where ILLC researchers are currently active can be found in section 1.2.3.

1.1.3 Organisational Structure

ILLC management The ILLC is headed by a scientific director (currently Yde Venema), who is supported by a secretarial office led by the institute manager (currently Jenny Batson). A central organ in the institute is the ILLC management team consisting of, besides the ILLC director and manager, the programme leaders of the three ILLC programme, the director of

the ILLC Phd programme (currently Sonja Smets) and the director of the Master of Logic (currently Ulle Endriss). The programme leaders in 2012–2014 were:

(*LoLa*) Jeroen Groenendijk/Robert van Rooij and Paul Dekker (deputy)

(*LoCo*) Ulle Endriss and Benedikt Löwe (deputy)

(*LaCo*) Rens Bod and Khalil Sima'an (deputy)

According to the governance model of the University of Amsterdam, the ILLC director takes responsibility for the institute. In practice the ILLC management team, meeting on a biweekly basis, discuss and prepare decisions on all matters of importance to the institute.

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

There is a marked difference in organisational 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 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 candidates at the ILLC generally have different contracts, of different duration, at the two faculties. It also means that the division in time allotted to research, teaching and administration differs for ILLC staff members from the two faculties.

The status of the ILLC as an interfaculty institute (and of the Master of Logic as an interfaculty education programme) is detailed in an agreement between the two faculties. This *Covenant* ("Convenant inzake het onderzoek en onderwijs op het gebied van Logic, Language and Computation") was renewed in April 2015.

Some developments concerning the embedding of the ILLC in the two faculties over the assessment period is described in more detail in section 1.2.4.

Advisory Councils The ILLC has an external advisory committee, the Scientific Advisory Council (Wetenschappelijke Advies Raad), consisting of three members: Prof. Mark Steedman (Edinburgh), Prof. Angelika Kratzer (Amherst), and Prof. Wolfgang Thomas (Aachen). The role of this committee is to advise the ILLC management on general questions of policy, quality control, scientific developments, etc. This Scientific Advisory Panel will conduct the ILLC midterm review (over the period 2012–2014 described in this document).

Internally, as of 2010, the institute has a well-functioning PhD Council, consisting of PhD candidates who advise the ILLC management on all matters relevant to PhD candidates. The institute's management has three to four scheduled meetings with its PhD Council per year.

Training and Teaching The ILLC has a strong commitment to the training of a new generation of academics in its research area. The redesigned PhD programme will be described in detail in Part C of this document.

ILLC staff are also involved in various educational programmes at the University of Amsterdam at Bachelor's and Master's level, but since this self-evaluation only concerns the training at the PhD level, we confine ourselves to a few remarks on the institute's flagship, the Master of Logic (MoL) programme. This programme, which started in 1995, currently attracts around 40 students per year, from all over the world. The intensive, interdisciplinary research training provided by this programme has resulted in many of our students producing significant research output. For instance, roughly a third of all Master's theses have yielded a peer-reviewed research publication. The MoL programme was evaluated in 2013, under the auspices of the Dutch-Flemish Accreditation Organisation (Nederlands-Vlaamse Accreditatie Organisatie, NVAO) and received the rare qualification 'excellent' in 2014.

Location 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 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, while in early 2013, the ILLC moved to a another university building in the Science Park. By now, a large majority of the ILLC staff members have their offices at one single location in the Science Park, but most FGw-members still teach in the city centre, and many have their work place there as well.

1.2 Main developments 2012–2014

1.2.1 Staff

Table 1.1 contains an overview of the fluctuations in staff (both tenured and non-tenured) and PhD candidates working at the ILLC, split over the two faculties.[1]

Most conspicuous about this overview is the growth of research fte over the assessment period with almost 50%, from 52.63 fte in 2012 to 73.85 fte in 2014. At the Faculty of Science, the rise in tenured staff can largely be explained by new appointments, after a temporary freeze of hirings before 2012. At the Faculty of Humanities, most new hirings concerned replacements of retired or departed staff; the institute's growth on this side is mainly an effect of some staff members from other institutes joining the ILLC. The sharp increase (over 50%) in number of PhD candidates could be expected to some degree. Given the fact that most PhD candidates are hired on external funding, large natural fluctuations can be expected, and the institute was at a relatively low point at the beginning of the assessment period. More specific causes for the rise are the investments by the Faculty of Humanities in research priority areas, the arrival of Sonja Smets with two research projects, and the success in the assessment period of Khalil Sima'an, who attracted funding for no less than seven PhD candidates (and five postdocs).

[1] Information specifying the developments per programme is given in Part D (Table 6.1).

Research staff at institute level		2012	2013	2014
Tenured	FGw	4.56	5.18	5.83
	FNWI	7.18	7.38	9.77
	ILLC	11.74	12.56	15.60
Non-tenured	FGw	8.18	8.54	9.82
	FNWI	8.61	10.48	10.32
	ILLC	16.79	19.02	20.14
PhD candidate	FGw	10.31	15.54	17.61
	FNWI	13.78	16.34	20.50
	ILLC	24.10	31.89	38.11
Total research staff		52.63	63.47	73.85
Guest researcher	FGw	0.84	0.25	1.01
	FNWI	5.69	4.06	2.84
	ILLC	6.52	4.31	3.84
Support staff	FGw			0.30
	FNWI	3.04	3.65	3.52
	ILLC	3.04	3.65	3.82
Total ILLC staff (excl. teaching)		**62.19**	**71.43**	**81.52**

Table 1.1: Research staff at institute level

Apart from these numbers, two important developments should be mentioned, viz., the rejuvenation of the institute's research staff, and, related to this, the transfer of leadership to a new generation of researchers. Concerning the latter point, most members of the generation that founded the ILLC, and who were working as full professors at the institute in 2006, retired shortly before 2012 (Remko Scha, Peter van Emde Boas) or during the assessment period (Johan van Benthem, Jeroen Groenendijk, Frank Veltman), while Martin Stokhof will retire in 2015.

At the level of full professors, these retirements were balanced by a large number of new appointments. As the outcome of a special, combined selection procedure across the faculty borders, Arianna Betti and Robert van Rooij were appointed as full professor in Philosophy of Language and Logic and Cognition, respectively. In addition, Francesco Berto, full professor of Metaphysics, joined the institute. Khalil Sima'an was promoted to full professor on a newly installed chair in Computational Linguistics, at the Faculty of Science. Since the chairs of both Rens Bod (Digital Humanities) and Henkjan Honing (Music Cognition) in the Faculty of Humanities were made permanent in the assessment period, the longstanding leadership issue of the Language and Computation group seems to have been resolved. Finally, in small (0.1) appointments, the ILLC attracted Jos Baeten as the chair holder of a newly created chair Theory of Computing, and Fenrong Liu was named professor by special appointment in the

Amsterdam-China Logic Chair, both at the University of Amsterdam's Faculty of Science. In addition to these, Sonja Smets and Jakub Szymanik joined the ILLC as associate professors.

Embodying the rejuvenation of the institute's research staff, the institute attracted no less than ten new researchers at the level of assistant professor: Benno van den Berg, Nick Bezhanishvili, Luca Incurvati, Marijn Koolen, Floris Roelofsen, Federica Russo, Makiko Sadakata, Christian Schaffner, Ivan Titov, and Daniel Wiechmann.

1.2.2 Financing

A summary of the internal and external sources of funding of the institute is provided in Table 1.2.[2] In this table 'direct funding' refers to funding by the University of Amsterdam, 'research grants' concern projects funded by public Dutch financing organisations (such as NWO, KNAW and STW), 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). Concerning expenditure, the category 'Personnel' refers to direct costs for staff salaries, while 'Other' costs concern expenses for travelling (of both ILLC staff and visitors), the organisation of conferences, etc.

	2012		2013		2014	
Funding	*fte*	%	*fte*	%	*fte*	%
Direct funding	22.91	39%	27.66	41%	29.17	38%
Research grants	21.57	36%	23.98	35%	27.51	35%
Contract research	2.58	4%	5.26	8%	9.83	13%
Other	12.08	20%	10.89	16%	11.19	14%
Total	**59.15**	**100%**	**67.78**	**100%**	**77.70**	**100%**
Expenditure	10^3 €	%	10^3 €	%	10^3 €	%
Personnel costs	5,093	93%	5,722	90%	6,756	88%
Other	397	7%	622	10%	920	12%
Total	5,490	100%	6,344	100%	7,676	100%

Table 1.2: Sources of research funding: summary

These figures more or less speak for themselves, displaying first of all the notable growth witnessed by the institute over the assessment period.

The increase in direct funding is most significant on the FGw-side, and is caused by generous (but temporary) investments of the faculty in two of its research priority areas (viz., Brain & Cognition and Digital Humanities), together with the expansion of the institute due to new FGw staff members joining ILLC. After a dip in external funding in 2012 (relative to

[2]More detailed overviews, with the sources of funding split over, respectively, the two faculties, and the three ILLC programmes, can be found in Table 6.2 and Table 6.3 of the appendix.

the previous period), in 2014 the institute was back at a more than acceptable level. Finally, the ratio of direct versus indirect funding is more or less constant, with the ILLC depending for roughly 40% of its income on direct funding by the university, and for 60% on research grants and scholarships.

Given the increase in the institute's funding, the rise in personnel costs needs no explanation; the 'other' costs have more than doubled because of projects involving a large component or even exclusively concerning networking activities (the organisation of events or facilitation of research visits).

1.2.3 Research areas & collaborations

Research at ILLC

As discussed in section 1.2.1, the ILLC has hired and otherwise acquired a large number of new staff over the past couple of years. The selection of new staff members was based on a combination of making strategic choices and seizing unforeseen opportunities. The result of these developments is that the institute has widened its research scope. In the near future, we will be active in the following research areas, some of which criss-cross the three programmes of the institute.

Theoretical Philosophy ILLC researchers are active in various areas within philosophy, including philosophy of language, formal epistemology, analytic metaphysics, philosophical logic and philosophy of science, in particular, philosophy of mathematics.

Semantics and Pragmatics The formal analysis of the meaning and use of natural language, which has traditionally been one of the flagships of the ILLC, will remain a core activity, with research expanding into the development of empirically plausible models.

Cognition Cognition is a research theme of increasing importance within the institute, with various manifestations. The Music Cognition Group investigates the cognitive and biological nature and origin of music; other researchers develop formal and computational models for cognitive aspects of language acquisition, processing and social interaction; and finally, ILLC researchers address philosophical questions concerning human cognition.

Computational/Digital Humanities ILLC research in the Digital Humanities approaches the humanities from a formal and conceptual perspective, focusing on the development of new computational models and methodologies, expanding in particular towards literature, art and history.

Computational Linguistics Computational linguists at ILLC concentrate on the development, implementation and evaluation of computational models and algorithms for various language processing tasks, including the parsing, translation, paraphrasing and summarizing of texts, and the interpretation of dialogue.

Artificial Intelligence and Rational Interaction At the interface of various research areas, including epistemology, game theory, social choice theory, linguistics, logic and

artificial intelligence, a new field has emerged in which the rational interaction of intelligent (either human or artificial) agents is studied. ILLC researchers focus on the logical, philosophical and mathematical foundations of this area.

Theoretical Computer Science Theoretical computer scientists at ILLC are interested in algorithmics, complexity theory and quantum computing, but also study fundamental models of computation, and applications of these topics in cryptography.

Logic The ILLC covers a broad research area from mathematical to philosophical logic; research is directed towards both pure and applied logic, and maintains a strong tradition in modal logic and the foundations of mathematics.

History Finally, many ILLC researchers take an active interest in the history of logic, and that of the sciences and the humanities in general.

Collaborations

Situated at the crossroads of various disciplines, and with its strong local, national and international network, the ILLC and its researchers engage in various collaboration projects. Of these, here we mention the ones in which we are committed at the institutional level.

Amsterdam Brain and Cognition (ABC) is a interdisciplinary centre at the University of Amsterdam which hosts one of UvA's so-called Research Priority Areas, in which the Faculty of Social and Behavioural Sciences collaborates with the Faculty of Science, the Faculty of Medicine, the Faculty of Humanities and the Faculty of Economics and Business. Its overall mission is to come to a better understanding of the mechanisms of cognition, and the *ABC Research Programs* study cognition at the level of neural systems, the level of the regulation and theoretical modelling of behaviour and cognitive disorders. ILLC researchers from all three programmes participate in the ABC, and Henkjan Honing is one of its directors.

Quantum Matter and Quantum Information (QMQI) is another Research Priority Area of the UvA, which is focused on the experimental and theoretical study of quantum matter and applications in quantum information. Harry Buhrman is one of the key scientists directing this initiative, in which researchers from ILLC collaborate with mathematicians and physicists at the Faculty of Science, and the quantum computing group at CWI.

The *Center for Humanities and Technology (CHAT)*is a collaborative public-private partnership between the University of Amsterdam, VU University, the Royal Netherlands Academy of Arts and Sciences (KNAW) and IBM. CHAT is the outcome of a long-term collaboration that started with KNAW's national Computational Humanities programme in 2010, followed by the joint Center for Digital Humanities (CDH) in which UvA, VU, KNAW and Netherlands eScience collaborate on around 20 public-private projects with a variety of different companies. CHAT is geared toward further cooperation with IBM within its Science-Alliance program. Within this cooperation 8 large showcase-projects have been selected, one of which is co-supervised by Rens Bod.

Language in Interaction is a large research project, led by Peter Hagoort (Nijmegen), in which seven Dutch universities and one research institute participate. It received generous funding by NWO for a period of ten years, starting from 2013. The overarching quest of the research programme is to account for, and understand, the balance between universality and variability at all relevant levels of the language system and the interplay with different cognitive systems, such as memory, action, and cognitive control. Johan van Benthem was one of the main co-applicants of the project, and Rens Bod and Robert van Rooij each co-direct one of the seven work packages.

Joint Research Center in Logic. Based on a long-standing history of collaboration, in 2013, Tsinghua University in Beijing and the University of Amsterdam (UvA) set up a joint research centre for logic (JRC). The mission of this centre is to create and maintain an active interface in research and education between the ILLC and colleagues at Tsinghua and elsewhere in China. With support of the Amsterdam University Fund, Fenrong Liu, co-director of this centre together with Johan van Benthem, was appointed full professor to the newly created *Amsterdam-China Logic Chair*.

The *Center for the Study of Language and Information (CSLI)* at Stanford is another long-standing partner of the ILLC, partly through the affiliation of Johan van Benthem as full professor. While there is no formalised agreement of collaboration between ILLC and CSLI, in the near future the ILLC is planning to add more structural support to the currently intensifying contacts with CSLI.

In addition, we mention two international organisations that the ILLC is actively supporting:

FoLLI, the *Association for Logic, Language and Information* advances the practicing of ILLC-style research and education, and is the organisation behind the European Summer School in Logic, Language and Computation (ESSLLI), and the Journal of Logic, Language and Information (JoLLI).

PLM (*Philosophy of Language and Mind*) is a European network of philosophical centres, institutes and departments that was founded in 2010 to further the said areas of philosophy in general, and in particular to foster collaboration between its members, primarily in research but also in teaching.

Finally, we mention three important local partners with whom we have had a long history of collaboration: the *Amsterdam Center for Language and Communication* (ACLC), a research institute (now research school) of linguists with whom we currently collaborate in the area of cognition, for instance through the SMART seminar and conference; the *Centrum Wiskunde & Informatica* (CWI), the national research institute for mathematics and computer science that is strongly linked to the ILLC in the form of four of its staff members with a full (but part-time) professorship at the ILLC; and the *Informatics Institute* (IvI), with which we collaborate in the area of teaching and some areas of research.

1.2.4 Institutional embedding

As mentioned in the preface, the institutional embedding of the ILLC in the University of Amsterdam went through some turbulence, due to developments around the Faculty of Science and inside the Faculty of Humanities. In this section we outline these developments, focussing on their impact on the ILLC. After that we briefly describe the renewal of the Covenant between the two faculties.

UvA-VU collaboration in the science domain

A major development during the assessment period concerned the plan of the two universities in Amsterdam, the University of Amsterdam (UvA) and the Vrije Universiteit (VU) to substantially increase their collaboration via the Amsterdam Academic Alliance (AAA). The flagship of this alliance is an intensified collaboration in the science domain.

In the period from 2011 to the end of 2013, these plans took the shape of an intended merger of the science faculties of both universities into one Amsterdam Faculty of Science (AFS). This AFS would have consisted of a number of (large) departments, each of which would have been formed by merging departments from the constituting three faculties, and/or by recombining various research groups from existing departments. Given the absence of a natural counterpart for the ILLC at the VU and the position of the ILLC as an institute shared by two UvA faculties, one of which was not involved in the merger, the organisational integration of the ILLC in this process was no easy matter. After some unsuccessful discussions with the two informatics institutes of both universities, it was decided that the (FNWI-part of) the ILLC would join the mathematics institutes of UvA and VU to form a new Department of Mathematics and Logic. The FNWI-part of the institute would form a separate section of this department, thus retaining (much of) its organisational and budgettary autonomy, and its integrity as a single research institute, together with the FGw-part of the institute. While in preparation of the emerging AFS, a single dean (Karen Maex) had already been appointed for the three constituting science faculties (two at the VU and one at the UvA), the plans for an integrated Amsterdam Faculty of Science were put to a halt in December 2013 by the combined Works and Student Council of the UvA.

Responding to this setback, the two universities decided to continue the efforts towards intensified collaboration in the science domain, under the new flag of *Science in Amsterdam*. As a marked difference with the earlier plans, scientists of the three faculties that were now headed by a single dean, are encouraged to make proposals for collaboration, both in teaching and in research, in a bottom-up direction. The eventual organisational framework of this collaboration was not clear for some time, but the formation of department-like structures ('virtual departments') across the university borders was stimulated.

To the ILLC the new situation did not present fewer difficulties for deciding its course. Throughout the process, the three main strategic goals of the institute have been (1) to stay together as a research unit, (2) to remain able to implement its research strategy, by persisting as a budget-holding unit, and at the same time (3) to seize opportunities for collaboration in the turbulent academic landscape. Since the FNWI-side of the ILLC may in the long run be viewed as being too small to survive on its own, the institute management decided to stay on course and further explore the possibilities of a (virtual) Department of Mathematics and

Logic. The union with the mathematicians does not only offer a loose but strategic alliance of institutes sharing a very congenial research culture, it also opens new roads for collaborations in for instance logic, theoretical computer science and (quantum) information theory. On the down side, the planned relocation of the UvA Institute for Informatics to (what is now) the VU campus will make collaboration with the computer scientists more difficult, both in research and in teaching.

Restructuring of the Faculty of Humanities

Three developments took place in the Faculty of Humanities during the assessment period: the introduction of a new governance model, a redesign of the research division, and an increasingly worrisome budget.

First of all, the faculty introduced a new governance structure in order to be more in line with the prescribed model of the University of Amsterdam. In a nutshell, the idea behind the new model is that both research and teaching are not organised in the departments, but through independent research and teaching institutes, which are in control of the faculty research and teaching fte, respectively. The people carrying out the respective tasks are supplied by the departments, who remain responsible for the staff (in terms of human resource management) and for the development of the academic disciplines. The main effect of this restructuring concerned a separation of teaching from the departments, while the impact for research, which was already organised separately from the departments, has thus far been relatively small in practice. In the years to come however, the changes could bring about a greater flexibility in the task allocation to staff, with the division between time for research, teaching and administration of individual staff members becoming a topic of negotiation in the triangle of department, research institute and teaching institute.

From a research perspective, a more significant change concerned the redesign of the FGw research division. The purpose of this restructuring was to stimulate collaboration across the faculty, by making the borders between the primary research units more flexible, and enabling researchers to participate in various research units simultaneously. In the old structure, FGw research was split between four research institutes, with individual researchers belonging to exactly one of these. In the new set-up there are (currently) six so-called research schools, one of which comprises the ILLC research at FGw, while the other five schools constitute a single research institute, the Amsterdam Institute for Humanities Research (AIHR). Thus in practice the ILLC mostly functions as one of the research schools within the FGw, while formally ILLC and AIHR are disjoint, which allows for instance the independent organisation of the ILLC PhD programme. As an additional change, researchers can now distribute their research time (in units of 0.1 fte) over different research schools, and thus be affiliated with more than one school simultaneously. However, in order to maintain the integrity of the ILLC as a research community, the distribution of research fte between AIHR and ILLC is somewhat restricted, to the effect that individual FGw staff members can still be clearly identified as 'members' of the ILLC or not. As an outcome of this restructuring, some FGw staff members (Berto, Russo, Wiechmann) decided to reallocate most of their research time to the ILLC, thus effectively becoming ILLC members.

Unfortunately, the implementation of these changes in 2013 and 2014 coincided with an

increasing budget deficit at the Faculty of Humanities, mainly caused by a decline in student numbers, and, more generally, a significant drop in teaching revenues. As a consequence, the good years in which the FGw had ample financial means to invest in teaching and research, came to an end in 2014, and the faculty is now facing severe budget cuts. It is uncertain how these will affect the ILLC, but it is clear that in the near future the direct funding of PhD candidates will not be continued and that temporary contracts may not be renewed. Many ILLC members at the FGw also notice a discrepancy between their allotted research fte and the time that, because of teaching and administrative tasks, they can actually dedicate to research. Fears are that due to the financial pressure this discrepancy will increase.

Renewal of the Covenant

The turbulence described above did not signify a diminished support of the two faculties governing the ILLC. In particular, over the years it had gradually became clear that some of the arrangements concerning the operational management of the institute and the MSc Logic (which is also a co-production of the two faculties) were no longer adequate. Both faculties were very cooperative in assessing these arrangements and negotiating new agreements. These agreements have been added as appendices to the renewed Covenant ("Convenant inzake het onderzoek en onderwijs op het gebied van Logic, Language and Computation") that was signed on March 31, 2015. The Covenant itself outlines the position of the ILLC as an interfaculty institute, and records the intention of the two deans to maintain the institute and the MSc Logic for another sexennial administrative cycle of the UvA. As a consequence, the position of ILLC and the MSc Logic as shared endeavours of the two faculties is secured for years to come.

1.2.5 ILLC PhD programme

While the scientific quality and success rate of the ILLC PhD programme have always been high, this part of the institute's graduate programme used to be less visible and less uniformly organised than its MSc counterpart. This discrepancy was noted by the ILLC management in the Self-Evaluation 2006–2011. In response to this, and following the corresponding recommendation of the ILLC Evaluation Committee 2006–2011, the ILLC management decided to redesign and upgrade the ILLC PhD programme.

With approval of the two faculty boards, the institute is now in control of the training of its PhD candidates, while staying in line as much as possible with the rules and regulations of the two faculties. The new programme has been set up by its director, Sonja Smets, with the help of the institute manager, Jenny Batson and the programme administrator, Tanja Kassenaar. A detailed description of the new programme can be found in Part C of this document.

1.2.6 Research Integrity

In recent years, ethical issues related to academic research have received increasing attention, not only within academia, but also in the public debate. There is increasing awareness that

in every scientific discipline situations occur that could lead to acts that are at odds with proper scientific conduct.

In appreciation of these developments, the ILLC management has installed a small committee, headed by Martin Stokhof, to draw up a *Scientific Integrity Code of Conduct* for the ILLC. A first version of this document, adapted from a similar document used by the Institute for Biodiversity and Ecosystem Dynamics at the Faculty of Science of the UvA, appeared early in 2015. The document is based on a number of more detailed and comprehensive documents dealing with these matters, such as the Netherlands Code of Conduct for Scientific Practice, published by the Association of Universities in the Netherlands (VSNU).

The ILLC management encourages an open debate on all kinds of ethical issues related to research, and we are currently thinking of ways to facilitate such discussions, and, more concretely, to incorporate these in our training programmes.

1.3 Evaluation and Recommendations 2006–2011

1.3.1 Evaluation

In 2012, the ILLC was assessed, according to the Dutch Standard Evaluation Protocol (SEP) 2009–2015 by a review committee consisting of

- Prof. Joan Bagaria i Pigrau, Catalan Institution for Research and Advanced Studies & University of Barcelona, Spain
- Prof. Wiebe van der Hoek, University of Liverpool, UK
- Prof. Sabine Iatridou, Massachusetts Institute of Technology, USA
- Prof. Ewan Klein, University of Edinburgh, UK (Chair)
- Prof. Hinrich Schütze, University Stuttgart, Germany

Drs. Jan Heijn was appointed as the committee's secretary.

On a scale of 1 (unsatisfactory) to 5 (excellent) the committee assessed the ILLC on the aspects quality, productivity, relevance, vitality & feasibility and leadership as follows:

Overall institute evaluation	5
Quality	5
Productivity	5
Relevance	5
Vitality & Feasibility	4
Leadership	5

We also quote the general conclusions of the committee:

> *The ILLC has a well-deserved reputation as an internationally leading centre for interdisciplinary research and training. Research quality and productivity are both*

excellent, and the Institute also maintains vigorous Masters and PhD programmes which attract high calibre students from around the world.

The cross-faculty status of the ILLC, underpinned by the Board of the University of Amsterdam, is arguably a key ingredient in its success, and both Faculties are to be congratulated on providing solid, long-term support for the ILLC.

The interdisciplinary mix of research topics pursued by the ILLC makes it unique, and this variety is successfully tied together within the mission of studying formal approaches to information and interaction. Indeed, the ILLC belongs to a small number of pioneering groups that seek to lay the foundations for what may well become a new discipline of information in coming decades.

We are impressed by the way that the transition to a new generation of ILLC leaders is being managed, and have confidence that the originality and excellence manifested in the institute's distinguished research record will flourish under their care.

1.3.2 Recommendations and follow-up

The evaluation committee also made some recommendations to the institute management and to the deans of the Faculties governing it. Below we briefly list these recommendations, and discuss the follow-up on these.

1. *The main priority with respect to the establishment of the new Amsterdam Faculty of Science is that the organisational integrity of the ILLC should be vigorously protected.*

   As described in section 1.2.4, the blueprint for an Amsterdam Faculty of Science has been replaced by *Science in Amsterdam*, a bottom-up design for collaboration between the two Amsterdam universities in the science domain. While the ILLC still faces difficult strategic choices in this process, the current plans contain no immediate threats to its organisational integrity.

2. *[. . .] Although we felt that division into LoLa, LoCo and LaCo was serving the Institute well, we would like the ILLC management to keep this programme structure under review, and to consider whether further mechanisms could be put in place to encourage cross-programme collaboration.*

   Concerning the first suggestion, the institute intends to have the current programme structure evaluated during the current midterm evaluation. With regard to the second point, the institute actively fosters internal cooperation along various themes. In particular, a sizeable group of researchers, from all three ILLC programmes, is currently working on the theme of Cognitive Modeling and coordinating their efforts through regular meetings and a research seminar. Generally, the institute's hiring policy is explicitly directed towards the recruitment of staff showing a strong affinity with the interdisciplinary research environment at ILLC.

3. *The previous Peer Review Committee drew attention to the continued absence of a Chair of Computational Linguistics, and we have already pointed out that we would like to see*

this post renewed. The ILLC management should also make it clear that they regard this position as a priority.

We are happy to report that in 2014, a new Chair in Computational Linguistics has been installed at the Faculty of Science, and filled by promoting an excellent internal candidate, Khalil Sima'an. At the same time, the ILLC is making every effort to maintain, at the Faculty of Humanities, a presence in Computational Linguistics, next to the chairs of Bod (Digital Humanities) and Honing (Music and Cognition).

4. *The committee understands that steps are already underway to make a new appointment in mathematical logic. Given the centrality of logic to the ILLC, we believe that it is essential to appoint either a senior established figure or a "rising star" to this position.*

   The ILLC is very satisfied with the recent appointment of two assistant professors in mathematical logic (Benno van den Berg and Nick Bezhanishvili). Both are excellent young researchers who can reinvigorate the outstanding UvA tradition of research in the areas of foundations of mathematics and intuitionistic logic.

5. *We understand that the ILLC is aware of the need to have representation of theoretical computer science at a senior level, and that they are exploring possibilities with groups elsewhere on how best to proceed. We encourage them to do so, and stress that this is an important area to keep in good health.*

   Currently, Theoretical Computer Science is represented at the ILLC by one UHD (associate professor) with a full-time appointment, and three full professors with a part-time position. Concerning the full professorships, after the retirement of Krzysztof Apt, the ILLC managed to attract Jos Baeten (director of the CWI) on a part-time appointment on a newly installed chair *Theory of Computing*. In addition, the institute has hired a promising young researcher (Christian Schaffner) on a UD (assistant professor) position. Generally we are making every effort to ensure that this area remains well-represented at the institute, at all levels of seniority.

6. *We would like the Faculty of Humanities to find some means for giving Honing's chair a permanent status.*

   Honing's chair was made permanent in 2014.

In the evaluation report the committee made some further, more implicit recommendations. Two of these the institute would like to respond to explicitly.

(a) On page 11 of the report, the committee comments on the ratio and appointment level of female research staff at the institute.

   We are happy to report that as of January 2012, Sonja Smets joined ILLC as an UHD (associate professor), and that in September 2013, Arianna Betti took up the chair of Philosophy of Language (Department of Philosophy/ILLC). Furthermore Fenrong Liu was named professor by special appointment in the *Amsterdam-China Logic Chair* at the University of Amsterdam's Faculty of Science. Finally, steps are well under way to have another female full professor appointed at ILLC.

Regrettably however, the junior staff that joined ILLC in the assessment period are predominantly male, with the consequence that we did not manage to increase the ratio of female staff members.

(b) On page 9 of the report, the committee discusses the PhD training programme of the institute.

Answering the committee's comments, and implementing earlier announcements in the ILLC self-evaluation report, the institute has completely redesigned and upgraded its PhD programme. A detailed description of this programme can be found in Part C of this document.

1.4 Quality and Relevance

The academic quality and (scientific and societal) 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 three programmes, and give an overview of the most important books published during the assessment period. Here we briefly discuss these issues at the institute level.

1.4.1 Scientific Quality

Academic Reputation The academic reputation of a research institute rests on two pillars: the recognition of the individual quality 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.

- Three of our emeriti (Bartsch, van Benthem and Troelstra) and one of our full professors (Stokhof) are members of the Royal Dutch Academy of Arts and Sciences (KNAW); Betti is a member of the Young Academy. Three of our emeriti (Apt, van Benthem and Vitányi) are members of the Academia Europaea. Baeten, Bod and Honing are members of the Royal Holland Society of Sciences and Humanities (KHMW).
- Johan 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 individual grants in the prestigious Dutch Vernieuwingsimpuls (VI) programme, and, until now to a lesser degree, individual grants in the European Research Council (ERC) programme. Among the ILLC staff members of December 31, 2014, the institute boasts:
  - five laureates of a Vici grant (or its predecessor, Pionier): Bod, Buhrman, van Lambalgen, Sima'an and Venema;

- one holder of an ERC Consolidator grant: de Wolf;
- nine winners of a Vidi grant (or its predecessor, the first-generation VI grant): Aloni, Bod, Dekker, Endriss, Kamps, van Rooij, Sima'an, Smets, and de Wolf;
- two laureates of an ERC Starting grant: Betti and Smets;
- twelve researchers that hold (or held) a Veni grant: Aloni, Betti, Fernández, Gierasimczuk, Honingh, Renne, Roelofsen, Schaffner, Schulz, Szymanik, de Wolf and Zuidema.

Concerning 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 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, when preparing the self-evaluation study for the previous full assessment period in 2013, we gathered quotes from three academics working at internationally leading universities (Stanford, Oxford and Tsinghua). Here we briefly repeat two (shortened) quotes: "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" (Stanley Peters, Director, Stanford); "ILLC is a major centre for logic on the world stage" (Samson Abramsky, Oxford). In the meantime, the third university mentioned, Tsinghua University in Beijing, has shown its recognition of the stature of the ILLC by making a strong commitment to the Joint Research Center in Logic (see page 9 for more details).

Earning Capacity As mentioned in section 1.2.2, during the evaluation period on average around 60% of the ILLC research was covered by external funding through research grants and scholarships. 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 2.1, 3.1 and 4.1). In total, the ILLC and its researchers were awarded over twenty research grants (where we only count those projects enabling the appointment of research staff), for a total amount of roughly ten million euro.

Involving all three ILLC programmes, the *Language in Interaction* project deserves some attention at the institute level. This ten-year project, very generously funded (27.6 M€) through the NWO *Gravitation* programme, was described in section 1.2.3. The ILLC is one of the main partners in this project, and we expect several subprojects to be funded in the internal competition by which the consortium governing the project is distributing funds.

While these results are certainly satisfying for an institute of the size of the ILLC, and we have full confidence in the qualifications of our staff, there are some reasons to be concerned about our earning capacity in the future. Over the assessment period the institute has been less successful than before in acquiring external funding; this includes applications for individual grants, where there have been a significant number of close misses. We believe that this development is largely due to the increasing preference at funding agencies for applied research — significantly, *Language and Computation*, the ILLC programme with the highest potential for direct valorisation, has been the most successful group within the ILLC. The ILLC management will need to step up and address this concern — we refer to section 1.5.2 for our plans in this direction.

Output Over the assessment period, ILLC researchers have produced significant output. Measured quantitatively, the institute has produced 12 authored books (reprints not counted), 29 edited books, 107 book chapters, 195 refereed journal articles, and 226 conference papers (see Table 1.3 for an overview). Information specifying the research output per programme is given in Part D.

Institute for Logic, Language and Computation	**2012**	**2013**	**2014**	$\sum$
Refereed journal articles	48	78	69	195
Non-refereed journal articles	2	7	4	13
Books/monographs	2	5	5	12
Edited books	9	12	8	29
Book chapters	31	32	42	107
PhD theses	10	3	4	17
Conference papers	71	93	77	226
Publications aimed at general public	3	10	4	22
Total publications	176	240	219	635

Table 1.3: Research output at the institute level

These figures show that the institute's output is increasing, as can be expected from the growth of the institute as such. The institute has not undertaken a quantitative analysis of its research output.[3]

As of April 2015, the institute will maintain an online list of the publications of its staff members, searchable by individual, programme, and year, at `http://www.illc.uva.nl/Research/Publications/Searchable-List/`.

The number of PhD theses was very low in 2013 and 2014, naturally following the shrinkage of our population of PhD-candidates in the years before. Given the large number of PhD candidates joining the institute in the years 2011–2014, we expect a significant rise in the number of PhD dissertations in the years to come.

Concerning the *quality* of the ILLC publications, we refer to the chapters of the three ILLC programmes, each of which has selected a short list of key publications. The volume *Johan van Benthem on Logic and Information Dynamics*, which appeared in the Springer series *Outstanding Contributions to Logic* deserves a special mention and bears witness to the decisive influence of van Benthem on the development of logic (in the wider sense) in the past four decades. This 1027-page volume was edited by Alexandru Baltag and Sonja Smets, and contains many chapters by other ILLC staff members.

[3]The 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 institutes research. As 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.

1.4.2 Societal Relevance

ILLC staff members aim at making the results of their research and their research area accessible, available and useful to a wider intellectual community, as well as to society at large. These activities range from active engagement in outreach activities and contributing lemmas to encyclopedias, to collaboration projects with industry and the development of an online game and citizen project. The ILLC management stimulates these efforts, and it is planning to develop a more structured valorisation policy.

In this section we give a more high-level description of the ways in which ILLC engages with society. In the chapters on the three ILLC programmes we will describe various concrete valorisation activities of ILLC staff in more detail.

Impact of ILLC(-type) research Research in core areas where the ILLC is active, such as philosophy of language, mathematical logic, and theoretical computer science, has provided key contributions to the digital revolution which over the last 50 years has profoundly transformed our society, economy, and culture. Current developments in fields like quantum computing, cognitive modelling or the philosophy of mind may very well have a similar impact in the next decades. However, quoting the committee that evaluated the ILLC over the previous assessment period (2006–2011), "it is unrealistic to expect current fundamental research into these topics to have short-term, measurable impact". We would like to add that it would not only be unrealistic to expect such a direct impact, but even counterproductive to demand it. Research in the mentioned areas is fundamental and may be intrinsically motivated in nature, it requires time and intellectual freedom to flourish, and its results may take a long time before spawning effects in society. On the other hand, progress in other areas covered by ILLC research, in particular computational linguistics and digital humanities, has brought applications close to hand, and some ILLC researchers are actively involved in direct valorisation activities. Examples of these will be given in the chapters on the three ILLC programmes.

The ILLC management recognises and appreciates these differences in the nature, timing and scale of the impact that its research areas have in society, and its policy towards the utilisation of research results is based on this appreciation. That is, we actively encourage the economic and societal valorisation of ILLC research, and we stimulate researchers to seek and intensify contact with companies or public organisations in order to foster this. On the other hand, we do not require ILLC researchers to direct their research towards direct applications if this would be unnatural.

Outreach & Dissemination The outreach and dissemination activities of the members of the ILLC are aimed at very diverse audiences. First, activities aiming at a general audience consist of public lectures, debates, radio and TV interviews, documentaries, and articles in newspapers and magazines. As examples we mention the involvement of Benedikt Löwe in the Turing Centenary, and the online courses of Harry Buhrman and Henkjan Honing at the Universiteit van Nederland. Second, as dissemination aimed at a wide intellectual community we mention the books by Rens Bod on the history of the humanities and by Henkjan Honing on musical cognition. 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 and contributions to various hand- and textbooks, and encyclopedias.

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.

1.5 Strategy and Viability

1.5.1 SWOT analysis

Strengths

- The ILLC staff is composed of productive and well-known researchers, with strong research profiles and networks and a high international standing.
- The ILLC covers a wide, coherent and thriving research area, using a variety of research methods. With its position at a crossroads of disciplines, the institute is well prepared to address scientific challenges.
- The recent hiring of a large number of young researchers into permanent positions, and the smooth transfer of the institute's leadership to a new generation, ensures the long-term viability of the institute.
- The institute's research is tightly interwoven with an excellent MSc Logic programme, which attracts talented research students from all over the world.
- The institute is now fully in charge of its PhD training programme, which allows us to gear it directly towards ILLC PhD candidates, and to have more control over its quality.
- The institute is supported by a very dedicated, flexible and competent administrative staff.

Weaknesses

- The institute's growth in size and widening of scope, combined with its geographic spread over various locations, make it harder to maintain its cohesion.

Opportunities

- The future promises good prospects for the ILLC to attract research funding:
  - The central position of the institute in the research profile of the University of Amsterdam should create further opportunities to acquire internal funding for ILLC research related to Research Priority Areas such as Brain & Cognition, and Quantum Matter & Quantum Information.
  - 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.
  - The participation of the institute in the Language in Interaction project offers many opportunities for new research projects in Cognitive Modeling and for collaboration with other disciplines.
  - The new European Framework Programme, Horizon 2020, has opened up more funding opportunities for individual researchers in the ERC scheme. This creates many opportunities for an institute that has an excellent track record in the similar Dutch VI-programme.
  - The institute's contacts with China and India offer possibilities for more intensive research collaboration, in particular for the Joint Research Center with Tsinghua University.
- For some research areas within the ILLC, such as Computational Linguistics and Digital Humanities, there are many opportunities to establish and intensify meaningful contacts with companies and public organisations.

Threats

- The increasing preference at 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.
- The relocation of the UvA Institute for Informatics to (what is now) the VU campus, as part of the UvA-VU collaboration project between the science faculties, will make collaboration with the computer scientists more difficult, both in research and in teaching.
- Given the dire financial situation of the Faculty of Humanities, the ILLC will receive less funding from this side, and fears are that the actual time of FGw staff for research may get under pressure.

1.5.2 Strategy

General The scientific mission of the institute will remain directed towards research that is primarily driven by scientific curiosity concerning the formal modelling of information.

Internally, after a period of great changes in the composition of the ILLC staff, the institute management will strive for consolidation, focussing on the following points: guiding and supporting the new ILLC staff in their career development, in particular when it comes to the acquisition of research funds; increasing the cohesion of the institute by stimulating cross-programme collaboration and activities; and protecting the research time for staff members in times of financial pressure.

Locally, in the framework of *Science in Amsterdam* (the UvA-VU collaboration in the science domain), the institute will continue to explore the formation of a (virtual) Department of Mathematics and Logic, and in particular, to look for opportunities for collaboration with mathematicians in teaching and research, for instance in the areas of quantum information theory, discrete mathematics (networks), and logic. In addition, the ILLC will exploit its strategic position in the academic landscape of Amsterdam via its joint programmes with neighbouring institutes. This applies for instance to the Research Priority Areas of the UvA, such as Brain and Cognition, Quantum Matter and Quantum Computing, and to wider projects such as the Amsterdam Brain and Mind Project, or the Center for Humanities and Technology. The ILLC will also initiate and participate in new initiatives, such as the one in the area of Decision Making.

Nationally and internationally, the ILLC will seek to increase its visibility and strengthen its network, building on existing collaborations with for instance Nijmegen (Language in Interaction), Beijing and Stanford, but also creating new ties with congenial institutes worldwide.

Research Funding In the near future the institute management will evaluate and redesign its policy concerning the acquisition of the research funding it needs to pursue its research mission. The resulting strategic plan will be based on the following pillars:

1. The institute will continue, intensify and streamline its efforts to stimulate and support its staff members to apply for research grants. This concerns individual grants in the NWO VI-programme and the programmes of the European Research Council, but also grants in other programmes, such as the Dutch Open Competition programmes of NWO.

2. The institute management will increase its activities 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.

3. Locally, the ILLC will continue to apply for funding in the framework of the UvA Research Priority Areas, and the Amsterdam Academic Alliance (AAA).

Valorisation In the near future, the ILLC will develop a more structured policy towards the utilisation of its intellectual products. This policy will be based on the following principles:

- In research areas where it is possible, the institute will increase its efforts towards direct valorisation of its results. Concretely, the institute will actively support and seek to

solidify existing contacts with private and public partners, and we are investigating options to train our staff in initiating collaborations outside academia.

- The institute will not infringe on its research areas where applications are less close at hand.
- All ILLC researchers will be stimulated to engage in outreach and dissemination activities, targeting all kinds of audiences, in particular the general public.
- We plan to pay more attention to valorisation in the ILLC training programmes, for instance by bringing non-academic career paths into the picture; we will also investigate the option of allowing and in some cases stimulating non-academic internships.

Part B

The Programmes

Chapter 2

Logic and Language

2.1 Objectives

The programme *Logic and Language* encompasses a broad range of topics in (mostly formal) philosophy, crossing the boundaries of a number of areas ranging from empirical linguistics, epistemology, ontology, philosophy of science to cognitive science. Major themes are natural language meaning, human reasoning, and intelligent interaction. The methods we use for investigation are mostly based on logical and conceptual analysis. Empirical ratification of analytical work is our main ambition and touchstone for success in the work of empirical linguistics. Other parameters such as coherence and consistency play an important role when designing theoretical models. Our research strategy is non-monolithic, allowing for different approaches, but demanding philosophical reflection and internal and external debate.

In our investigations we follow several intertwined research lines, using different instruments from a logical toolbox, of which intensional logic, epistemic logic, many-valued logic, non-monotonic logic, dynamic logic, game and decision theory, formal learning theory and topology are prominent parts. To highlight just one example, let us mention the integration of semantics and pragmatics. The binding force is the conviction that meaning should be studied as a dynamic cognitive process that is embedded both in social practices and the external environment. This view differs markedly from the more traditional one, according to which a theory of interpretation assigns 'static' semantic contents to linguistic structures independently of their use. Hence, the integration of semantics and pragmatics is a dominant research aim.

2.2 Composition

In 2012, LoLa still had a strong representation from ILLC founders, but during the last years the group has witnessed a significant change of personnel and leadership, and as a result a considerable broadening of research profile. Theo Janssen retired in 2013, and Jeroen Groenendijk and Frank Veltman did so in 2014. Martin Stokhof will also retire in the spring of 2016. The chairs of Philosophy of Language (held by Jeroen Groenendijk and Martin Stokhof, at the Faculty of Humanities, Department of Philosophy) and Logic and Cognition

(held by Frank Veltman, at the FNWI) were taken over in 2013 by Arianna Betti and Robert van Rooij, respectively. Together with the appointment of Floris Roelofsen as a new UD in 2014 (at the FNWI), these appointments assured the continuation of the strong position of the LoLa group in the areas of philosophy of language and semantics and pragmatics. But during the last years the LoLa group broadened its scope of research considerably. In 2012, Sonja Smets joined the LoLa group as an Associate Professor (UHD). She strengthened the group's profile in the area of formal epistemology and strengthened the connection with the LoCo group by her work on dynamic epistemic logic. Due to her two projects (a Vidi and an ERC Starting Grant), quite a number of new PhD candidates and postdocs joined the LoLa group working in these areas as well. In 2014 the LoLa group was extended by three new staff-members: Francesco Berto was appointed as the new full professor in metaphysics (at the Faculty of Humanities, Department of Philosophy). His research is logic-oriented, especially in the area of paraconsistent logic. Luca Incurvati joined LoLa in 2014 (as part of the Faculty of Humanities, Department of Philosophy) as a fixed-term assistant professor (UD) on philosophical logic. Due to these two appointments, the LoLa research in philosophical logic has been strengthened considerably. Finally, Federica Russo was appointed as a new assistant professor (UD) in philosophy of science. Causality is her specialty, a topic which gained in popularity among LoLa members in recent years.

Eight PhD candidates graduated in the group between 2012 and 2014. It counted 20 active PhD candidates at the end of 2014.

2.3 Academic Reputation

The group is well known and widely respected as a leading player in the main areas of research it represents. Some of its most senior members have been elected to national and international academies, with Martin Stokhof being a member of the KNAW, Arianna Betti a member of the Young KNAW, and Frank Veltman being a member of the Vici committee Alfa/Gamma and the chairman of the Beth foundation. Others have been recipients of the most prestigious personal grants awarded by the NWO or ERC, namely the PIONIER (predecessor of the Vici) (van Lambalgen), the Vidi (Aloni, Dekker, van Rooij, Smets), the Veni (Aloni, Roelofsen, Schulz), and the ERC Starting Grant (Betti). During the assessment period, Nina Gierasimczuk was awarded an NWO Veni Grant, Robert van Rooij received an FP7 Marie Curie project, and Sonja Smets received an ERC Starting Grant. Furthermore, while still a member of the ILLC, Erik Rietveld obtained an NWO Vidi grant. Finally, Martin Stokhof was appointed member of ERC Scientific Council in 2014.

Members of the group are represented on the editorial boards of many of the leading journals in the relevant fields, e.g., *Journal of Philosophical Logic*; *Journal of Semantics*; *Linguistics and Philosophy*; *Semantics and Pragmatics*; *Review of Symbolic Logic*; *Synthese*; *Dialogue & Discourse*; *Philosophy and Technology*; *Foundation of Science*; *The Reasoner*. They also regularly serve on a large number of Steering and Programme Committees for international conferences and often organise scientific events themselves.

Members of the group also play a leading role in several large-scale national and international scientific bodies. Examples include the ESF Research Networking Programmes

VAAG and Communication and Context, the Marie Curie Training Networks programme ESSENCE, the European Philosophy of Language and Mind-network (PLM), and the NWO funded Gravitation 'Language in Interaction'.

2.4 Valorisation

The LoLa group is mostly involved with fundamental research. Nevertheless, efforts are made by members of the LoLa group to reach other scientific disciplines and the more general public, e.g. by means of public lectures and media interviews.

- Francesco Berto gave public lectures on paraconsistent logic at the 'Wijsgerig Festival' DRIFT and at the *Grandes Conférences des Archives Poincaré* in France (2014).
- Arianna Betti was a member of the think-tank 'Excellentie in Voortgezet Onderwijs' in 2013.
- Arianna Betti developed in cooperation with TU/e GlamMap as a Proof of Concept of her ERC-project. This is a visualisation software which is targeted to the GLAM (Galleries, Libraries, Archives and Musea) sector. GlamMap can display automatically millions of data records about cultural artifacts on geographical maps in an insightful and aesthetically attractive way. Thanks to a business partnership with the company OCLC, GlamMap's visualisation will scale up to the 300 million of book records of WorldCat, the biggest library catalogue of the world.
- In collaboration with researchers from the Psychology Department, Nina Gierasimczuk worked on a logical model for the Mastermind game implemented within a popular Dutch online educational learning system (`http://www.rekentuin.nl/` ('Math Garden') is intensively used in primary schools in The Netherlands). This research was performed in collaboration with Oefenweb B.V., a spin-off company of the University of Amsterdam, established in 2009 and specialised in the development of innovative adaptive e-learning applications.
- In 2013, Michiel van Lambalgen made a video of a lecture on the use of probability in legal proceedings, which was part of the new 'e-learning' curriculum for judges.
- Raquel Fernández did consultancy for Cygnify Solutions (`http://www.cygnify-solutions.com`), providing academic expertise on natural language communication for the evaluation of a speech-enabled navigation app to support drivers.
- The work of Robert van Rooij on vagueness was highlighted in 2014 in the Kennislink article 'De taal van vaag taalgebruik' (`http://www.kennislink.nl/publicaties/de-logica-van-vaag-taalgebruik`). Kennislink is the main website in Dutch which popularises novel scientific work.
- Several members of the LoLa group (Jeroen Groenendijk, Floris Roelofsen, Robert van Rooij, Martin Stokhof and Frank Veltman) were interviewed for Elucidations, A

University of Chicago Philosophy Podcast. The interviews are available at `http://humstatic.uchicago.edu/philosophy/elucidations/`

- Several of the LoLa members have written articles in Encyclopedia (e.g. Stanford Encyclopedia in Philosophy, Berto, Roelofsen, van Rooij) or Handbooks (e.g. Dekker, Fernández, Maat).
- Several members of the LoLa-group have organised workshops or given courses at various summer schools (ESSLLI, NASSLLI) on topics that they work on.
- An important end-product of Maria Aloni's NWO-Vidi project on *Indefinites and Beyond. Evolutionary pragmatics and typological semantics* is a Corpus of Indefinite Uses. This Corpus contains data collected and annotated during the cross-linguistic synchronic and diachronic corpus study of indefinite expressions carried out in the project. It is made publicly available: `http://maloni.humanities.uva.nl/Indefinites/corpus.html`.
- Several members (e.g. Betti, Dekker, Maat) are involved in research that adds a broader perspective to the core research of the ILLC, exploring its historical context and societal relevance. A team comprising Rens Bod (LaCo), Jaap Maat (LoLa) and others founded a new journal entitled 'History of Humanities', published by the University of Chicago Press, which is devoted to the history of a wide range of disciplines, including linguistics and logic.
- Inquisitive Semantics is one of the important and recurrent topics in the 'Questions in Discourse' scientific network, funded by the DFG (6 workshops). The Inquisitive Semantics group (Groenendijk, Roelofsen, Ciardelli, Westera) plays a significant role in this network. Via joint workshops and/of special issues, this group also established connections with other research groups that work on related issues, such as Inferential Erotetic Logic; Hintikka's Interrogative Model of Inquiry, Dependency Logic, and Dynamic Epistemic Logic.
- Several members of the LoLa group play an important role in the connection with China. Several researchers have been there for extended (research) visits (Maria Aloni, Robert van Rooij, Sonja Smets, Martin Stokhof, Frank Veltman), Martin Stokhof was chairman of the joint KNAW-NWO China committee, which is responsible for a range of co-operative programmes with Chinese partners covering the entire range of disciplines, and Sonja Smets and Martin Stokhof play an important role in the newly established Tsinghua-Amsterdam Joint Research Center for Logic, which was established in 2013.

2.5 Research Income

Table 2.1 lists the externally funded research projects acquired during the assessment period, organised by year of acquisition. This list excludes smaller grants, e.g., for the organisation of events, as well as stipends paid directly to guest researchers at the ILLC. It also excludes the project 'Logicas no-transitivas. Una Nueva Approximacion a las paradoxes', awarded in 2014

and financed by the Spanish ministry of Economics (24k€), of which van Rooij was one of the applicants. Finally, it excludes the NWO *Gravitation* project "Language in Interaction", in which all three ILLC programmes participate.

Year	Project	Source	Applicant	Amount
2012	Kant and Wittgenstein on ethics	NWO	Dilek Yamali	184k€
2012	The Logical Structure of Correlated information Change	ERC	Smets	1.381k€
2013	@PhilosTEI	CLARIN-NL	Betti	80k€
2013	GlamMap	ERC	Betti	150k€
2013	SaiVing GlamMap and GlamMap glammed up	KNAW/DJA	Betti	16k€
2013	Formal analysis of multi-agent learning	VENI-NWO	Gierasimczuk	246k€
2013	ESSENCE: Evolution of Shared Semantics in Computational Environments	EU Marie Curie	van Rooij	740k€
2014	Processing vague expressions	NWO	van Rooij	245k€

Table 2.1: Research Income: Logic and Language Programme.

2.6 Highlights

Below we list a small number of highlights for the years 2012 to 2014, covering significant research results, new initiatives, and indicators of external recognition.

- Francesco Berto gave his inaugural lecture *The metaphysical basis of logic* on 14 November 2014 at the University of Amsterdam.

- Frank Veltman gave his valedictory lecture *De Taal der Vooroordelen* on 24 April 2014 at the University of Amsterdam.

- In 2012 Sonja Smets received the Birkhoff-von Neumann Prize for her studies on quantum structures and related epistemic semantics which gave rise to a number of original results. In particular, new light emerged on (i) a dynamical interpretation of quantum-logical connectives, (ii) a link between quantum logic and quantum computation, (iii) a logical analysis of classical and quantum correlations, (iv) an epistemic-logic view of quantum entanglement, (v) a reduction of the complexity of the Soler-Mayet axiomatization.

- The 2012 Sir Karl Popper Prize was awarded to Elliott Wagner for his paper entitled *Deterministic Chaos and the Evolution of Meaning* This prize is awarded for the best paper appearing in the British Journal for the Philosophy of Science.

- Nina Gierasimczuk's logical model for the Mastermind game, implemented within a popular Dutch online educational learning system, was awarded the Best Paper Prize at the Logic & Cognition Workshop at ESSLLI 2012, Opole, Poland.

- Together with Ulle Endriss (LoCo), Raquel Fernández initiated a new research programme on exploiting fundamental principles of social choice theory to design methods for aggregating noisy data collected through crowdsourcing. A paper applying this methodology to the challenge of annotating large corpora in computational linguistics, authored jointly with Master of Logic students Ciyang Qing and Justin Kruger, received an Honourable Mention in the Best Paper Award competition at COLING-2014.

- In 2013 Erik Rietveld was selected as Radical Innovator by a jury from the magazine Vrij Nederland. (While still being a member of the LoLa-group, Erik Rietveld's research project 'The Landscape of Affordances: Situating the Embodied Mind' was awarded an NWO VIDI-grant. Erik Rietveld's VIDI-project is administratively located at the AMC (Academisch Medisch Centrum), but one of his PhD candidates (Jelle Bruineberg) is a member of the ILLC.)

- Inés Crespo's paper entitled *On certainty and subjectivity in taste* received the Werner & Elisabeth Leinfellner Award as a best paper of a young researcher among the accepted papers for the 36th International Wittgenstein Symposium "Mind, Language and Action".

- In 2014, Sonja Smets was appointed fellow at the new Tsinghua-Amsterdam Joint Research Center in Logic. Martin Stokhof and Sonja Smets are also members of the Scientific Oversight Committee of this center.

- Stokhof was appointed as Weilun Visiting Professor at the Department of Philosophy of Tsinghua University.

- The paper *Similarity orders from causal equations* by Johannes Marti and Riccardo Pinosio was selected as the best paper at JELIA 2014. An extended version of it will therefore be presented at IJCAI 2015 in Buenos Aires, in the track "Best papers from sister conferences".

- The Master of Logic student Ciyang Qing has received the Unilever Research Prize 2014. This award, which comes with a sum of 2.500 euros, recognises significant research carried out by students in the natural and social sciences at Dutch universities. Ciang worked on several research projects and his Master of Logic thesis 'Quantitative Social-Cognitive Experimental Pragmatics' was supervised by Michael Franke.

2.7 Key Publications

Below we list a small number of representative key publications that appeared during the assessment period. A full list of publications is available on the ILLC website.

- **M. Aloni** and **F. Roelofsen**. Indefinites in comparatives. *Natural Language Semantics*, 22, 145-167, 2014.

- G. Baggio, **M. van Lambalgen** and P. Hagoort. The processing consequences of compositionally. In W. Hinzen et al. (eds.), *Oxford Handbook of Compositionally*, Oxford UP, 657-674, 2012.

- A. Baltag, A. and **S. Smets**. The dynamic turn in Quantum Logic. *Synthese*, 186(3), 2012.

- **H.A. Bastiaanse**. The Intensional Many - conservativity reclaimed. *Journal of Philosophical Logic*, 43, 883-901, 2014.

- **F. Berto**. On conceiving the inconsistent. *Proceedings of the Aristotelian Society*, 114, 101-119, 2014.

- **I. Ciardelli, J. Groenendijk and F. Roelofsen**. Inquisitive semantics: a new notion of meaning. *Language and Linguistics Compass*, 7(9), 459-476, 2013.

- P. Cobreros, P. Egré, D. Ripley and **R. van Rooij**. Tolerant, classical, strict. *Journal of Philosophical Logic*, 41, 347-385, 2012.

- **M. Franke**, T. de Jager and **R. van Rooij**. Relevance in Cooperation and Conflict. *Journal of Logic and Computation*, 22, 23-54, 2012.

- **N. Gierasimczuk** and D.M.C. De Jongh. On the Complexity of Conclusive Update. *Computer Journal*, 56(3), 365-377, 2013.

- **K. Schulz**. Fake tense in conditional sentences. *Natural Language Semantics*, 22, 117-144, 2014.

2.8 Book Publications

Below we list the books authored by members of the LoLa programme that appeared during the assessment period. A list of edited volumes is available on the ILLC website.

- **P. Dekker**, *Dynamic Semantics*, Springer, New York, 2012.

- **G. Weidman-Sassoon**, *Vagueness, Gradability, and Typicality – The Interpretation of Adjectives and Nouns*, Brill, Leiden, 2013.

- P. Illari and **F. Russo**. *Causality: Philosophical Theory Meets Scientific Practice*. Oxford University Press, 2014.

2.9 SWOT Analysis

Strengths

- The LoLa staff is composed of productive and well-known researchers, with strong research profiles and networks and a high international standing, for instance in the fields of formal semantics and pragmatics, philosophy of language, and formal epistemology.
- The Lola group covers a diverse, interdisciplinary, research area. In particular, it studies information exchange from a diverse, but still integrated, set of methods.
- Members of the LoLa group play an important role in various organisations, locally (as coordinators of the bachelor and master studies in philosophy), nationally (within NWO) and internationally (ERC: European Council, ESSLLI, PLM, editors of journals)

Weaknesses

- During the last years the LoLa-group has witnessed a significant change of personnel, resulting in a considerable broadening of its research profile. The group is still in the process of identifying a set of research objectives that is broader than it used to be but still coherent.
- The LoLa-group does not yet have a strong research profile in distributional semantics, while the connections with cognitive science needs to be further developed.
- The LoLa staff is located in two different buildings, and divided between two different faculties (FGw and FNWI). This has not only an impact on its internal coherence, but also gives rise to organisational stress.

Opportunities

- The LoLa group has recently welcomed a couple of new strong researchers which broadened the scope of its research considerably (e.g. in metaphysics, formal epistemology, philosophical logic, history of analytic philosophy). This will strengthen the international reputation of the LoLa group in these subdisciplines considerably, with new possibilities for cooperation and funding as a result.
- The growing interest in formal analyses of meaning in computational linguistics in general, and within the LaCo group in particular, allows LoLa members with a strong background in this area to develop new forms of cooperation and interaction.
- 'Cognition' has become a research priority area at the UvA, and some members of the LoLa-group play an important role in the very large NWO-funded 'Language in Interaction' project (which will last for 10 years). Both give extra opportunities for research funding, for instance in the area of (experimental) pragmatics.

Threats

- The financial situation of the Faculty of Humanities is rather weak and discussions about how best to ensure a sustainable future for the FGw are currently taking place. The outcome of these discussions could negatively impact the LoLa group in at least two ways: (i) the group may receive less funding from this side, and (ii) the actual time of FGw staff for research may get under pressure.

- Certain computational linguistic applications require a rule-based approach, but a growing body of applications, including keyword based search, require a statistical approach or a combination of the two (see the recent body of work on computational distributional semantics). It will be a challenge for the members of the LoLa group that focus more on logic and rule-based analyses of meaning to not miss these new developments.

2.10 Strategy

One main theme in our strategy for the coming years will be to strengthen the group's research profile and reputation in the areas of philosophical logic on the one hand, and cognitive science on the other. As for the first, we will emphasise the philosophical relevance of semantic models developed by the group (e.g. for causality, philosophical grounding, and truth (making)), show that for the analysis of communication, the modeling of knowledge states of agents developed by some group-members are of great importance, and we will broaden the content of the Amsterdam Colloquium so as to make it an important event not only for formal semanticists, but for philosophical logicians as well. As for the second, some staff members (e.g. van Lambalgen) and some newly hired PhD candidates are already working in these areas and have good contacts with members of the LaCo-group. We want to intensify those contacts (e.g. by having regular joint meetings), hire (perhaps via the 'Language in Interaction' project, or the ABC-Cognition programme of the UvA) more PhD candidates (or post-docs) that work in these areas, and some permanent staff members will further develop their research in this direction (e.g. Fernández, van Rooij and Schulz).

Another change that is currently being investigated is whether the name "LoLa" still covers the broad spectrum of research topics that its members are currently developing. This issue is related to the intention of ILLC to have the current programme structure evaluated during the midterm evaluation.

The LoLa group members intend to maintain visibility in various national and international organisations, and to be available to serve on committees and panels of NWO, ERC and similar organisations.

Chapter 3

Logic and Computation

3.1 Objectives

The Logic and Computation (LoCo) research programme 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, category 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. 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, economic theory, and cognitive science, 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

There have been a number of important changes to the make-up of the LoCo programme in recent years. First, Johan van Benthem and Krzysztof Apt both retired in 2014.[1] Second, Alessandra Palmigiano left the ILLC in 2013 to take up a more senior position at TU Delft. Third, in 2012 Benedikt Löwe reduced his appointment from 0.75fte to 0.5fte, to allow himself to dedicate more time to his professorship at the University of Hamburg.

On the other hand, during the same period the ILLC hired four new full-time senior researchers strengthening the LoCo research programme in several areas. Jakub Szymanik, working at the interface of logic with cognitive science, was hired in January 2013 as Associate Professor (UHD) on a temporary position financed by the Faculty of Humanities. The other

[1] Johan van Benthem will remain professor at both Stanford University and Tsinghua University, and as such maintain close ties with the ILLC.

three appointments all concern regular positions as Assistant Professor (UD). After three years as a postdoctoral researcher on his own NWO Veni project, Christian Schaffner was appointed in September 2013. His area of expertise is quantum cryptography and quantum information theory, complementing existing strengths in quantum computing. Benno van den Berg was appointed in September 2013. This appointment strengthens the group's profile in classical areas of mathematical logic, thereby directly addressing a recommendation made during the most recent research evaluation of the ILLC, and it also facilitates an expansion into new domains, such as homotopy type theory. Finally, Nick Bezhanishvili took up his position in January 2014, also strengthening the group's profile in mathematical logic, particularly in algebraic approaches to modal and intuitionistic logics.

In August 2014, Fenrong Liu of Tsinghua University in Beijing was named professor by special appointment of the Amsterdam-China Logic Chair at the Faculty of Science, a new chair established by the Amsterdam University Fund Foundation. In 2015, immediately after this assessment period, we furthermore appointed Jos Baeten, the scientific director of the CWI, on a 0.1fte professorship on the Theory of Computing, and we hired Benjamin Rin as Assistant Professor on a temporary position funded jointly by the ILLC and the Amsterdam University College (AUC), amongst other things, to strengthen the ILLC's involvement in the logic curriculum offered at the AUC.

Seven PhD candidates graduated in the group during 2012 and 2014, following a particularly high number of PhD graduations in the years just before that period. It counted 16 active PhD candidates at the end of 2014.

3.3 Academic Reputation

The group is well known and widely respected as a leading player in the main areas of research it represents. Some of its most senior members have been elected to national and international academies, with Johan van Benthem being a member of the KNAW, Jos Baeten being a member of the Royal Holland Society of Sciences and Humanities (KHMW), and both Krzysztof Apt and Johan van Benthem being members of the *Academia Europaea*. Several members have been recipients of the most prestigious personal grants awarded by the NWO, namely the Spinoza (van Benthem), the Vici (Buhrman, Venema), the Vidi (Endriss, de Wolf), and the Veni (Schaffner, de Wolf). During the assessment period, Jakub Szymanik was awarded an NWO Veni Grant, Luca Spada and Roberto Ciuni received FP7 Marie Curie Fellowships, and Ronald de Wolf received an ERC Consolidator Grant. Furthermore, just before leaving the ILLC, Alessandra Palmigiano obtained an NWO Vidi Grant.

Members of the group are represented on the editorial boards of many of the leading journals in the relevant fields, e.g., *Logical Methods in Computer Science*; *Journal of Logic and Computation*; *Mathematical Logic Quarterly*; *Journal of Logic, Language and Information*; *Studia Logica*; *Computability*; *ACM Transactions on Computation Theory*; *Theory of Computing*; *Quantum Information and Computation*; *Artificial Intelligence*; *Journal of Artificial Intelligence Research (JAIR)*; and *Journal of Autonomous Agents and Multiagent Systems*. They also regularly serve on a large number of Programme Committees for international conferences (e.g., AiML, CALCO, TACL, FoSSaCS, CiE, STOC, FOCS, ICALP, PODC, ITCS,

CRYPTO, QCRYPT, QIP, TQC, IJCAI, AAAI, ECAI, KR, JELIA, AAMAS, TARK, SAGT, COMSOC), they often organise scientific events themselves, and they take on responsibilities in relevant Steering Committees and similar bodies.

Members of the group also play a leading role in several large-scale international scientific bodies. Examples include the Division for Logic, Methodology and Philosophy of Science of the International Union for History and Philosophy of Science; the ESF Research Networking Programme INFTY on Frontiers of Infinity; and the COST Action on Computational Social Choice, believed to be the largest research network in the Information and Communication Technologies domain funded by the COST Association in its multi-decade history.

3.4 Valorisation

Members of the LoCo programme have been involved in a variety of activities aimed at the valorisation of research results. This includes, in particular, a range of outreach activities, both to other scientific disciplines and the general public.

Examples for outreach to the general public include Christian Schaffner's participation as a panelist in the Faculty of Science's *Beta Break* in October 2013 on the topic of cryptography and the recent scandal surrounding the NSA, and Ulle Endriss' public lecture on "difficult decisions" at the University of Amsterdam's Academic-Cultural Centre at Spui 25 in October 2014. Benedikt Löwe was heavily involved in the organisation of several events that were part of the Turing Centenary in 2012. One example is the symposium `turing100.nl`, featuring several keynote speakers and a public performance of the play *Breaking the Code*, about Alan Turing's life and work, at the Openbare Bibliotheek Amsterdam.

Several members of the group have written popular accounts of their research for magazines or blogs. Beyond the written word, in February 2013, Ronald de Wolf gave the first in a new series of online talks on theoretical computer science called TCS+, presenting work on exponential lower bounds for polytopes in combinatorial optimisation; and in October 2012, Johan van Benthem was interviewed about logical dynamics on *Elucidations*, a monthly philosophy podcast recorded at the University of Chicago.

In terms of educational activities, beyond normal teaching duties towards students in our own disciplines, we have been heavily involved with bringing logic, and more generally formal methods, to the students of the Amsterdam University College (AUC). Johan van Benthem, Ulle Endriss, Fenrong Liu, Benedikt Löwe, Christian Schaffner, and Jakub Szymanik all delivered evening lectures at the AUC. In 2012 and 2014, Benedikt Löwe and Benno van den Berg also contributed to the *Leve de Wiskunde!* event at the Faculty of Science, aimed at highschool teachers in mathematics.

Interaction with the public need not be restricted to science, but sometimes also concerns science policy. In this vein, Krzysztof Apt, together with Wan Fokkink (VU Amsterdam), wrote an article on scientific publishing and open access for the *Groene Amsterdammer* in 2013. A second example is Benedikt Löwe's coordination of a project funded by the International Council for Science on *Cultures of Mathematical Research Training*, in which researchers from philosophy and sociology of mathematics meet with societal stakeholders and policy-makers to discuss the future challenges of the field. A first meeting with representatives

Year	Project	Source	Applicant	Amount
2012	ADAMS: Dual Approach to Many-val. Sem.	FP7 MC	Spada	184k€
2012	Beth and Heyting: Their Influence and Ideas	NWO	Van Ulsen	201k€
2012	COST Action Computational Social Choice	COST	Endriss	719k€
2012	Logic and Automata: Coalgebraic Perspective	NWO VC	Venema	211k€
2012	What Makes Social Interactions Hard?	NWO Veni	Szymanik	250k€
2014	Cultures of Mathematical Research Training	ICSU	Löwe	30k€
2014	Logical Dynamics of Information Exchange	KNAW CEP	Baltag	47k€
2014	WADOXA: Ways of Doxastic Agency	FP7 MC	Ciuni	176k€

Table 3.1: Research Income: Logic and Computation Programme.

of Science Europe, the European Community, the National Science Foundation (USA), and the Deutsche Forschungsgemeinschaft (Germany) was held in Brussels in November 2014.

Harry Buhrman and Christian Schaffner have been consulted by the General Intelligence and Security Service of the Netherlands (AIVD) about the development of quantum computers and their threat to cryptographic security. Finally, several members of LoCo regularly interact with fellow researchers working at global information technology companies, such as Microsoft, IBM, or Xerox (e.g., in the context of the COST Action on Computational Social Choice, coordinated by Ulle Endriss).

3.5 Research Income

Table 3.1 lists the externally funded research projects acquired during the assessment period, organised by year of acquisition. This list excludes projects held by researchers whose main appointment is at the CWI and which therefore are administered there. It also excludes smaller grants, e.g., for the organisation of events, as well as stipends paid directly to guest researchers at the ILLC. Finally, it excludes the NWO *Gravitation* project "Language in Interaction", in which all three ILLC programmes participate.[2]

3.6 Highlights

Below we list a small number of highlights for the years 2012 to 2014, covering significant research results, new initiatives, and indicators of external recognition.

- Johan van Benthem was named *Knight in the Order of the Netherlands Lion* upon his retirement as University Professor of Pure and Applied Logic at the University

[2]LoCo researchers are actively involved in this project. Johan van Benthem was one of the original applicants, and both he and Jakub Szymanik are involved in some of the subprojects financed this way. These subprojects are not included in Table 3.1, as they either started only in 2015 or involve a Principal Investigator from a different research programme.

of Amsterdam on 26 September 2014. Van Benthem received this royal honour in recognition of his myriad of research accomplishments and the leading and inspirational role he has played in the academic community.

- Ronald de Wolf and coauthors showed that linear programs need to be exponentially large if they are supposed to solve hard optimisation problems such as the Travelling Salesman Problem. This closes a 20-year old open problem of Yannakakis, and refutes attempts (that started in the 1980's) to prove P = NP via efficient linear programs. This work received the Best Paper Award at the Symposium on Theory of Computing (STOC) in 2012 and is due to appear in the *Journal of the ACM*.

- Nick Bezhanishvili and coauthors developed a novel algebraic approach to the method of canonical formulas. This new perspective allowed them to extend this method to non-transitive modal logics. This wide class of modal logics has not been covered by the existing theory and extending it to this setting had been considered an important open problem for some time.

- Fabio Zanasi's Master of Logic thesis on the *Expressiveness of Monadic Second-Order Logics on Infinite Trees of Arbitrary Branching Degree*, supervised by Yde Venema and Alessandro Facchini and defended in August 2012, was recognised by the *Italian Association for Logic and its Applications* (AILA) as one of the best Master's theses of the year in the field of logic by an Italian student. This work was presented at LICS-2013 (Logic in Computer Science).

- Together with Raquel Fernández (LoLa), Ulle Endriss initiated a new research programme on exploiting fundamental principles of social choice theory to design methods for aggregating noisy data collected through crowdsourcing. A paper applying this methodology to the challenge of annotating large corpora in computational linguistics, authored jointly with Master of Logic students Ciyang Qing and Justin Kruger, received an Honourable Mention in the Best Paper Award competition at COLING-2014.

- In hiring Benno van den Berg, an expert in proof theory and constructivism, we have started to revive an old tradition in Amsterdam, going back to Brouwer, Heyting, and Troelstra. At the same time, this appointment adds homotopy type theory, a brand new research trend connecting ideas from category theory and constructivism to homotopy theory, an area in core mathematics, to the research portfolio of the group. For instance, van den Berg was an invited speaker at the Homotopy Type Theory Workshop in Oxford in 2014.

- Defending her thesis on *Logics of Communication and Knowledge* on 13 December 2012 at the age of 20, Floor Sietsma became the youngest person in modern history to complete a PhD at a Dutch university. The thesis was supervised by Jan van Eijck and Krzysztof Apt.

- Johan van Benthem and Fenrong Liu were the main speakers at the formal opening of the UvA academic year in September 2013. In their speeches, they emphasised the

century-old ties between China and the Netherlands, paying special attention to the role of logic in both countries.

3.7 Key Publications

Below we list a small sample of representative key publications that appeared during the assessment period. A full list of publications is available on the ILLC website.

- **A. Baltag**, **B. Renne**, and S. Smets. The Logic of Justified Belief, Explicit Knowledge and Conclusive Evidence. *Annals of Pure and Applied Logic*, 165(1):49–81, 2013.
- **H. Buhrman**, N. Chandran, S. Fehr, R. Gelles, V. Goyal, R. Ostrovsky, and **C. Schaffner**. Position-based Quantum Cryptography: Impossibility and Constructions. *SIAM Journal on Computing*, 43(1):150–178, 2014.
- **F. Carreiro**, A. Facchini, **Y. Venema**, and F. Zanasi. Weak MSO: Automata and Expressiveness Modulo Bisimilarity. *Proceedings of the Joint Meeting of the 23rd EACSL Annual Conference on Computer Science Logic (CSL) and the 29th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS)*, 2014.
- **U. Endriss**, **U. Grandi**, and **D. Porello**. Complexity of Judgment Aggregation. *Journal of Artificial Intelligence Research (JAIR)*, 45:481–514, 2012.
- S. Fiorini, S. Massar, S. Pokutta, H.R. Tiwary, and **R. de Wolf**. Linear vs. Semidefinite Extended Formulations: Exponential Separation and Strong Lower Bounds. *Proceedings of the 44th Annual ACM Symposium on Theory of Computing (STOC)*, 2012.
- A. Isaac, **J. Szymanik**, and R. Verbrugge. Logic and Complexity in Cognitive Science. In A. Baltag and S. Smets (eds.), *Johan van Benthem on Logic and Information Dynamics*. Outstanding Contributions to Logic, Springer-Verlag, 2014.
- E. Grädel and **J. Väänänen**. Dependence and Independence. *Studia Logica*, 101(2):399–410, 2013.

3.8 Book Publications

Below we list the books authored by members of the LoCo programme that appeared during the assessment period. A list of conference proceedings and similar edited works is available on the ILLC website.

- **J.F.A.K. van Benthem**. *Logic in Games*. MIT Press, 2014.
- **J.F.A.K. van Benthem**, H.P. van Ditmarsch, **D.J.N. van Eijck**, and J.O.M. Jaspars. *Logic in Action*. Online book available at `http://www.logicinaction.org`, 2014.
- H.C. Doets and **D.J.N. van Eijck**. *The Haskell Road to Logic, Maths and Programming*, 2nd edition. College Publications, 2013.

3.9 SWOT Analysis

Strengths

- The recent hiring of a large number of young researchers into permanent senior positions ensures the long-term viability of the group.
- While small in terms of total fte, the group has a large number of individual members, together providing substantial expertise and making the group highly visible in the various areas of research it represents.

Weaknesses

- The fact that several of the senior members of the group hold part-time appointments is problematic from an managerial point of view, as core administrative tasks can only be taken on by full-time staff.
- The LoCo group has been less successful in obtaining external funding than in the previous assessment period, at least for projects administered at the ILLC itself (there have been several high-profile project acquisitions by LoCo researchers at the CWI). This includes a significant number of near misses: several LoCo researchers have made it to the interview stages of the ERC Starting Grant, NWO Vidi, and NWO Vici competitions, but were ultimately unsuccessful in obtaining a grant.

Opportunities

- The group plays a central role in the *Quantum Matter and Quantum Information* initiative, which has recently been elevated to the status of Research Priority Area at the University of Amsterdam. (Harry Buhrman is one of the five *key scientists* leading this initiative.)
- LoCo researchers have the opportunity to play a more active role in cognitive science activities centered around *Amsterdam Brain and Cognition* as well as within the new initiative of the *Amsterdam Brain and Mind Project* supported by the UvA-VU Amsterdam Academic Alliance Initiative (AAA). (Jakub Szymanik and Johan van Benthem are principal investigators in one of the project's five research themes.)
- The new interdisciplinary initiative on *Decision Making* at the University of Amsterdam, involving researchers at the ILLC as well as Economics, Psychology, Biology, Mathematics, and Computer Science offers a number of opportunities for exploring new research directions. (Ulle Endriss is one of the founding members of this initiative.)

Threats

- The European Commission continues to greatly favour applied research in its funding policy, while the core strengths of the ILLC in general and the LoCo group in particular are in fundamental research. The NWO is now also putting more emphasis on applied

research and has to channel a substantial part of its funding into research addressing the so-called *topsectors*, which greatly favour applied research in narrowly defined areas.

- While the ongoing discussions for a closer cooperation between the Science Faculties of the University of Amsterdam and the VU Amsterdam are intended to achieve the opposite, they may in fact make collaboration between computer scientists and mathematicians in Amsterdam more difficult in the future, with most computer science research of the university likely re-locating to the VU campus and most mathematics moving to the UvA's Science Park.

3.10 Strategy

The Logic and Computation research programme will continue to build on its recognised strengths in mathematical and philosophical logic, theoretical computer science, and artificial intelligence. While maintaining good coverage of these core areas, it will also tighten existing links with other disciplines, such as physics (quantum computing), economics (decision making), and cognitive science (formal modeling). These links can be expected to provide new opportunities for attracting the kind of external funding required to maintain the group's high visibility and productivity. Locally, the group will seek to expand its collaboration activities with computer scientists and mathematicians at both the University of Amsterdam and the VU Amsterdam, so as to be well positioned in the UvA-VU collaboration *Science in Amsterdam*.

Chapter 4

Language and Computation

4.1 Objectives

The Language and Computation group is concerned with computational models of human information processing, especially in the areas of natural language processing, music cognition, and digital humanities. The group aims to develop computational methods which are cognitively plausible as well as practically useful.

An important focus is the further development of statistical methods for natural language processing, building on the group members' experience with early work on the 'Data-Oriented Parsing' model. We used this approach for modeling first and second language acquisition, parsing and machine translation, as well as musical, literary and historical analysis (digital humanities). There is major focus at this moment on statistical machine translation and semantics. In cooperation with the Logic and Language group, we develop models of linguistic processes at the level of semantics and discourse. Here we aim at integrating distributional and compositional semantics.

Another important research area concerns information retrieval. In this area, we develop novel search technology combining textual information with additional structure, such as document structure, web-link structure, and/or contextual information, such as meta-data, anchors, tags, clicks, or profiles.

Our research on music cognition focuses on the temporal and melodic aspects of music using theoretical, empirical and computational methods. Current research concentrates on the question what is shared and what is unique in music versus language processing, and what are the structural and cognitive components that contribute to the memory, recall and transmission of melodies. We also investigate the cognitive mechanisms and neurological correlates of rhythm perception and the building blocks of musicality.

4.2 Composition

There have been a number of significant changes of personnel in the Language and Computation group in the period 2012–2014. Reinhard Blutner retired in 2013. In that same year, Ivan Titov was hired as assistant professor on a structural position at the FNWI. Titov will

significantly strengthen computational linguistics, especially in the field of learning semantic representations, thereby also strengthening the contact between the LaCo group and the LoLa group. Marijn Koolen joined the LaCo group in 2013 as assistant professor on a temporary position at the FGw. His main expertise lies in Digital Humanities and he will strengthen the contact between ILLC and the Center for Digital Humanities. Also in 2013, Makiko Sadakata joined the LaCo group as part-time assistant professor in the FGw on a structural position. She will especially strengthen research in music cognition. In 2014, Daniel Wiechmann joined LaCo. He was appointed as assistant professor on a tenure track position at the FGw, and moved from the ACLC institute to ILLC in 2014. His expertise is in experience- or usage-based models of language.

As to existing staff, in 2012 Rens Bod's professorial position in computational and digital humanities was made permanent, and in 2014 Henkjan Honing's professorial position in music cognition became permanent. Furthermore, in 2014, Khalil Sima'an was promoted from associate to full professor in computational linguistics. Bod and Sima'an both function as programme leaders of the LaCo group.

The group graduated 3 PhD candidates during 2012–2014. This number is relatively low, and can be explained by the fact the group was lacking a full professor in the years just before 2012 (full professors are needed to graduate PhD candidates in the Netherlands). The number of PhD graduations will grow considerably in the near future, as the group counted 20 active PhD candidates at the end of 2014.

4.3 Academic Reputation

The group is well known and a leading player in computational linguistics (esp. data-oriented parsing, machine translation and probabilistic semantics), music cognition and computational humanities. Several members of the group have been recipients of the most prestigious and competitive personal grants by NWO, namely the Vici grant (Bod, Sima'an), the Vidi grant (Bod, Sima'an), and the Veni grant (Honingh, Zuidema). During the assessment period, Henkjan Honing received the fifth Distinguished Lorentz Fellowship (2013). In 2013, Bod and Honing were elected as members of the Royal Holland Society of Sciences and Humanities (KHMW), the oldest learned society in the Netherlands (350 members).

Members of the group are represented on the editorial boards of various leading journals as well as programme membership positions at top conferences in the field. We only list a small sample here: *PLOS ONE, Machine Translation Journal, Journal of Natural Language Engineering, Music Perception, Empirical Musicology Review, Journal of New Music Research, Frontiers in Theoretical and Philosophical Psychology, Brill Open Humanities, Transactions of the ACL, Journal Machine Learning Research, Journal of Language Modeling, ACL, EACL, NAACL, COLING, EMNLP, IJCNLP, CoNLL, IWPT, NIPS, RANLP, LREC, CogSci, ESCOM, TREC, CLEF, ECIR, SIGIR, CLIN, DHBenelux.*

Several of the members of the group were the recipients of international awards: Milos Stanojevic and Khalil Sima'an achieved first position at the International WMT Evaluation Metrics competition 2014, Jaap Kamps obtained the ASIS&T JASIST 2012 Best Paper Award, and Ivan Titov was granted a Google Focused Award on NLP, one of only 7 Focused

Awards ever granted in NLP. Members of the group also held positions in prestigious national and international scientific organizations, such as the NWO funded *Gravitation project* 'Language in Interaction' (27.6 million euro), The NWO funded CLARIAH consortium (12.7 million Euro), the Society of Mathematics and Computation in Music, the Executive Committee of the European Association for Machine Translation (EAMT), and several advisory boards (Meertens, Huygens ING, KNIR, CLARIAH, a.o.).

4.4 Valorisation

While fundamental in nature, much research in the LaCo group can and has been valorised. Below we give a selection of the knowledge utilisation and knowledge dissemination that has emerged from the LaCo group.

Several NLP techniques and machine learning techniques that have been developed within the group are open access, and are being further developed in academia as well as in commercial companies in public-private collaborations. Examples are the collaborations between Khalil Sima'an's group and TAUS, and between Ivan Titov's group and Google. Other private partners with whom members of the LaCo group collaborate include IBM, Elsevier, Spinque, Webmapper, VicarVision and ElephantCandy. Public partners with whom the LaCo group collaborates include the Library of Alexandria , Beeld and Geluid, Rijksmuseum, Allard Pierson Museum of Archaeology, Museo Storico Italiano della Guerra, National Archives of the Netherlands, and the National Library of the Netherlands.

In 2012, the Center for Digital Humanities was founded by Rens Bod with investments from the Faculty of Humanities (`http://www.centerfordigitalhumanities.nl/`). Among other things, this Center funds projects that take as a starting point a question from the humanities which can be approached by computational methods. Since May 2012, the Center is also being co-funded by the KNAW and VU University and is running over 20 projects. Projects in which the LaCo-group is involved include the Amsterdam digital canal ring, Modeling musical similarity, Catchiness of songs (see also below), Evaluating the humanities, and Search engine for parliamentary debates. The Center also actively promotes knowledge dissemination and organizes a yearly Crash Course in Digital Humanities (Bod, Koolen). This course attracts participants from both public and private sectors (esp. creative industries). The Center also initiated a new conference series on Digital Humanities in the Benelux, *DHBenelux* (Koolen, Bod).

Another example of successful valorisation is Henkjan Honing and J. Ashley Burgoyne's online game and citizen science project on what makes music catchy (#HookedOnMusic). This game has had a massive impact on media worldwide, and bootstrapped several initiatives in computational and cognitive musicology, currently explored in collaboration with Manchester Science Museum (MOSI) and the Welcome Trust (`http://hooked.humanities.uva.nl/`). The Hooked game has been used more than 1.500.000 times by more than 100.000 participants from 199 countries, and the game continues to attract media attention – from Jimmy Fallon and *The Lancet* to BBC's *Inside Science.*

In the period 2012–14, members of the LaCo group gave several dozens of interviews and wrote popular articles in newspapers, magazines, popular journals, as well as appearances

on radio and television on (computational) linguistics, music cognition and digital humanities (see `http://www.illc.uva.nl/Research/Publications/Searchable-List/` for further details). Rens Bod published an overview of the history of humanities disciplines from a digital/pattern-searching perspective (Oxford University Press, 2013), which had a worldwide impact both within and outside academia. It featured for instance as a lead review in the *Times Literary Supplement* of June 2014 ("An extraordinarily ambitious undertaking. What Bod has written is not just a 'new' history. It is the first ever history of its kind."). The book was translated into four languages and is currently being used as an introduction to the empirical humanities at universities across the globe. Henkjan Honing published a general introduction to the field of music cognition (Transaction Publishers) that had worldwide attention (e.g., '[R]efreshing, engaging, enlightening and, most importantly, intelligible by all.' *The Psychologist*) and presented an online lecture series for the *Universiteit van Nederland* on the same topic.

Other valorisation activities include public talks such as at the Cheltenham, TEDx and the World Science Festival (Henkjan Honing), a book on mathematical musicology for high school students (Aline Honingh), and several media appearances in NRC Handelsblad, Volkskrant, NOS News, Trouw, De Telegraaf, De Groene Amsterdammer on "The Ten Revolutions in the Humanities" (several LaCo members).

4.5 Research income

Table 4.1 lists the funded research projects obtained by members of the LaCo group during the assessment period. It excludes, however, the NWO *Gravitation project* 'Language in Interaction' in which all three groups participate.

4.6 Highlights

Below we give ten highlights of the Language and Computation group in chronological order:

- On 15 December 2012, Rens Bod delivered his inaugural address as professor of Computational and Digital Humanities, entitled "The End of Humanities 1.0" (Het Einde van de Geesteswetenschappen 1.0).

- Jaap Kamps obtained the ASIS&T JASIST 2012 Best Paper Award.

- The Center for Digital Humanities was founded in 2012, with prominent presence of Language and Computation members: Rens Bod (director), Ashley Burgoyne, Henkjan Honing, Aline Honingh, Jaap Kamps, Marijn Koolen, Jelle Zuidema and Alesia Zuccala all received funding from the Center for their research.

- Henkjan Honing became Distinguished Lorentz Fellow in 2013/14. A prize granted by the Lorentz Center for the Sciences and the Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS).

LaCo	Project Title	Source	Applicant	Amount
2012	CLARIAH Common Lab Research Infrastructure for the Arts and Humanities	NWO	Consortium (including Bod)	12.7M
	Spearpoint Digital Humanities 2 PhD candidates	UvA-FGw	Bod	398K
	Focal point Brain and Cognition 2 PhD candidates	UvA-FGw	Honing	398K
	Data-Powered Domain-Specific Translation Services On Demand	STW	Sima'an	760K
	EXPERT (EXPloiting Empirical appRoaches to Translation)	EU Marie Curie	Sima'an	461K
	New Methods for the Humanities: Empirical, Computational, and Mathematical Advances	NWO	Honing	500K
2013	Legal Structures / Digging Into Data	NWO/NSF	Bod	99.6K
	Postdoctoral position in Language in Interaction (G. Borensztajn)	NWO Gravitation	Bod	208K
	Knowledge Graphs and Compositionality in Web-scale Natural Language Understanding	Google	Titov	109K
	Machine Translators: Teaching Computers to Translate Using Their Own Words	NWO Vici	Sima'an	1479K
	Similar Interesting Music Application (SIMAPP)	UvA-FGw	Honingh	35.5K
	#Hooked! A Game for Uncovering the Mystery of Musical Catchiness	UvA-FGw	Burgoyne	35.5K
	Exploratory Political Search (ExPoSe)	NWO	Kamps	803K
2014	Cracking the Language Barrier	EU H2020	Sima'an	274K
	Hooked! And item-response models	ABC	Burgoyne	90K
	Netherlands eScience CHAT preparatory phase project: Beyond the Book	eScience	Koolen	50K

Table 4.1: Research Income: Language and Computation Programme

- Khalil Sima'an was selected as Vici Laureate at NWO in 2013. Title: "Machine Translators: Teaching Computers to Translate Using their own Words" (Euro 1.5 mln).

- Willem Zuidema and his group developed the 'inside-outside semantics' framework, with world top 3 dependency parsing results and world top 1 unsupervised dependency parsing results.

- Within the KNAW computational humanities project *The Riddle of Literary Quality* (co-supervised by Rens Bod), the literariness of novels was for the first time, as far as known, accurately modelled (by a data-oriented parsing approach) in 2014.

- The BEER Evaluation Metric, developed by Khalil Sima'an's group, won first place during the international competitions at WMT 2014 where at least 18 international teams participated.
- In 2014, Ivan Titov and his group introduced some of the first methods for inducing semantic representations across languages with best results on standard benchmarks, both at the level of individual lexical items (distributed representations of words or phrases) and at the level of event representations (joint induction of semantic roles across languages).
- Since 2014, the Hooked game developed by Henkjan Honing and Ashley Burgoyne to investigate the catchiness of songs has been used more than 1.500.000 times by more than 100.000 participants from 199 countries.

4.7 Key Publications

- S. Frank, **Rens Bod** and M. Christiansen, 2012. How Hierarchical is Language Use? *Proceedings of the Royal Society B*, 297(1747), 4522–4531.
- **Rens Bod**, 2013. Who's Afraid of Patterns? The Particular versus the Universal and the Meaning of Humanities 3.0. *BMGN, 128(4), 171–180.*
- **Henkjan Honing**, C. ten Cate, I. Peretz, & S. Trehub,. (2015). Without it no music: Cognition, biology, and evolution of musicality. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 370 (1664).
- **Henkjan Honing** (2013). Structure and interpretation of rhythm in music. In Deutsch, D. (ed.), *Psychology of Music, 3rd edition* (pp. 369-404). London: Academic Press / Elsevier.
- Lea Frermann, **Ivan Titov** and Manfred Pinkal, 2014. *A Hierarchical Bayesian Model for Unsupervised Induction of Script Knowledge,* Conference of the European Chapter of the Association for Computational Linguistics (EACL)
- Hoang Cuong and **Khalil Sima'an,** 2014. Latent Domain Phrase-Based Translation Models for Adaptation. *Proceedings EMNLP 2014.* Qatar.
- Milos Stanojević and **Khalil Sima'an**, 2014. Fitting Sentence Level Translation Evaluation with Many Dense Features. *Proceedings EMNLP 2014, Short papers,* Qatar.
- **Rianne Kaptein** and **Jaap Kamps**, 2013. Exploiting the category structure of wikipedia for entity ranking. *Artificial Intelligence*, 194:111–129, 2013.
- **Marijn Koolen, Jaap Kamps**, and G. Kazai. Social book search: Comparing topical relevance judgements and book suggestions for evaluation. In *Proceedings of the 21st ACM Conference on Information and Knowledge Management (CIKM 2012*). ACM Press, New York NY, 2012.

- **Phong Le** and **Willem Zuidema**, *The Inside-Outside Recursive Neural Network model for Dependency Parsing,* Proceedings EMNLP'14.

4.8 Book Publications

- **Rens Bod**, 2013. *A New History of the Humanities: The Search for Principles and Patterns from Antiquity to the Present*, Oxford University Press, 2013.

- **Henkjan Honing**, 2013. *Musical Cognition. A Science of Listening.* Transaction Publishers.

- **Aline Honingh** and Michiel Schuijer, 2013. *Muziek uitgedrukt in getallen: De toonklasseverzamelingentheorie en haar toepassingen*, Epsilon uitgaven.

- **Daniel Wiechmann**, 2014. *Understanding Relative Clauses - A Usage-Based View on the Processing of Complex Constructions.* Berlin: De Gruyter Mouton. Trends in Linguistics: Studies and Monographs (TiLSM).

- **Henk Zeevat**, 2014. *Language Production and Interpretation: linguistics meets cognition.* Brill Publishers.

4.9 SWOT Analysis

Strengths

- After several years of uncertainty about its viability, the LaCo group is currently in excellent shape. The group consists of three tenured full professors, in computational linguistics, computational/digital humanities and in music cognition (Sima'an, Bod, Honing). The gap caused by Remko Scha's retirement has thus been filled in a more than satisfactory way.

- The group has also managed to attract world-class new (young) researchers (Titov, Koolen, Sadakata). The current number of PhD candidates is also high (20), and the group has expanded to a total of 41 members at the end of 2014.

Weaknesses

- The LaCo members at the Faculty of Humanities suffer from an increasingly heavy teaching load, which has a negative effect on their research time. The teaching load at humanities is even expected to further increase.

- While the group has been successful in obtaining external funding (including Sima'an's Vici grant), it did not succeed to get in new Vidi's or Veni's, or ERC grants.

Opportunities

- The group is big enough to flourish in three areas (Computational Linguistics/Language Cognition, Music Cognition and Digital Humanities). The group could play a major role in the exceptional growth of Digital Humanities in the Netherlands, especially with respect to the national collaboration which includes the KNAW and VU University, and which should result in the new CHAT (*Center for Humanities and Technology*). In addition, Brain and Cognition continues to be a university-wide research priority area, coordinated by Amsterdam Brain & Cognition (ABC). Together with the recently granted Amsterdam Brain and Mind Project (ABMP; promoting research collaborations between the UvA and VU) there continue to be ample opportunities for LaCo researchers (and ILLC as a whole) to contribute to the cognitive sciences.
- The coherence of the LaCo group as a whole should be secured: all members model human information processing (language, music, literature etc.) by computational means.

Threats

- The budget cuts at the FGw will continue to diminish actual research time of the group's FGw members, possibly resulting in fewer publications with less impact.
- The LaCo group may be growing too fast: it has almost doubled in the last three years, both in terms of permanent and non-permanent staff.
- UvA's computer science department (IvI) will physically move to the campus of the Vrije Universiteit. The LaCo group has some joint projects with IvI-members and there are several common research interests. It will become more complicated to maintain these links.

4.10 Strategy

To continue to flourish, the group should ensure that the allotted research time at the FGw is fully maintained in practice. Group members should apply for personal funds like ERC or NWO so as to guarantee more research time.

The group should make sure that its growth is consolidated and sustainable; its coherence should be closely monitored. In particular, the relation between computational linguistics and language cognition may be strengthened. This is already taking place at the level of semantic learning that crosses machine learning, cognition, parsing and actual input-output human tasks such as translation. In this respect the group should further collaborate with the Logic and Language group – which has been initiated since the last few years in the field of probabilistic semantics (both at the level of senior members and PhD candidates).

There are also excellent opportunities for collaboration between digital humanities and computational linguistics, as well as between music cognition and the other groups. Music cognition is currently (as opposed to ten years ago) well established in the fields of musicology, psychology and computer science. The research ambition of the music cognition group is to

bridge to biology and neuroscience in the coming years, taking advantage of the intrinsically interdisciplinary nature of the cognitive sciences.

Part C

The PhD Programme

Chapter 5

The ILLC PhD Programme

5.1 PhD Programme Description

5.1.1 Objectives of the PhD Programme

The ILLC PhD programme is designed to support and guide PhD candidates in their track to become highly qualified scientific researchers in the areas described by the institute's research mission. Because of the interdisciplinary nature of the ILLC, we host PhD candidates employed at the Faculty of Science, the Faculty of Humanities as well as PhD candidates receiving external funding. The PhD programme was founded in order to treat PhD candidates with varying sources of funding as uniformly as possible and to offer a well-balanced training programme tailored towards their specific needs.

All PhD trajectories at the ILLC are centred around an individual research alignment between the PhD candidate and their supervisors. While research is the main focus, the PhD candidates do participate in various teaching activities at the ILLC, from grading exercises and coordinating lab sessions, to the organisation of MSc 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. Candidates 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.

In this context of research and teaching activities at the ILLC, the ILLC PhD programme has a number of objectives. The first objective of the PhD programme is to enhance the individual research alignment between the candidate and their supervisors and to help guide the PhD candidates towards the successful completion of their PhD project. The ILLC PhD Programme has several tasks, ranging from organizing a well-balanced training programme, performing quality checks, offering assistance in practical matters, mediating in case of problems, as well as offering relevant information. In the paragraphs below, we give an overview of the main tasks.

5.1.2 Task A: PhD Training Programme

Via the ILLC PhD training programme, PhD candidates are given the opportunity to benefit from a rich scientific programme as well as a newly developed transferable skills programme. The ILLC PhD Programme organizes a large part of the PhD training programme within the ILLC, in order to guarantee that these courses are geared specifically towards the background expertise and needs of the ILLC PhD candidates.

Scientific Training Programme

The scientific programme for PhD candidates within the ILLC includes the advanced courses of the Master of Logic programme, many of which are research courses that are in fact 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 organized on ILLC premises. This is complemented by similar events at neighboring institutions, such as the CWI and the ACLC. Third, various national Dutch research schools offer specialized disciplinary courses to PhD candidates.

Besides the courses within the Netherlands, all ILLC PhD candidates are actively encouraged to participate in relevant international summer schools. In section 5.3 we provide more information about the participation of candidates in these national and international research schools.

It is the task of the supervisor(s) to help the PhD candidate in the selection of the (local and international) training activities, which are furthermore listed in the Education and Supervision Plan of each PhD candidate.

Transferable Skills Programme

In line with the advice of the LERU (League of European Research Universities), the ILLC PhD Programme subscribes to the idea that the process of doctoral education requires that the candidate develops a range of skills that reach beyond research training. This broader set of skills refers to "personal and professional training and development" and is important for the career development after the doctoral degree for jobs both within and outside of academia. In particular this means that the above-mentioned scientific programme is complemented with courses providing training in "transferable skills" such as (1) project management, (2) presentation, (3) academic writing, (4) career development, (5) scientific integrity and (6) teaching skills.

The ILLC PhD Programme currently organizes the above-mentioned courses (1–4), which are mandatory for all ILLC PhD candidates, within the ILLC itself. The course on scientific integrity (listed as item 5) is currently under construction and expected to be offered later in 2015. The teaching skills training course (listed as item 6) is offered by the Faculty of Science and directly (only) towards PhD candidates who are assigned teaching assistant duties within the Faculty of Science. In addition to these courses, the Faculty of Humanities and Faculty of Science organize an introductory meeting to welcome the PhD candidates. If the supervisors together with the PhD candidate decide that further additional training in transferable skills is necessary, specific arrangements can be made for the PhD candidate to attend any of the

UvA courses on offer (including training in Dutch, Academic English, PhD Social Skills etc.). The Graduate School of Humanities (`http://gsh.uva.nl`) has a list of optional courses on offer, all of which are open to ILLC PhD candidates.

For the specific implementation of the courses (1–4), the ILLC PhD Programme hires specialized trainers who can teach these courses every year. In the following paragraphs we give a short description of the main course objectives:

Project Management Course
During the time of a PhD track, PhD candidates do face several decision points and deadlines (both deadlines of an administrative nature and research deadlines). Efficient time management and good planning are crucial in order for our PhD candidates to master their own work load within the available time frame. Research planning and setting milestones in an academic context is not easy and demands that one actively take charges of designing and adjusting plans to keep them feasible and up-to-date. This course teaches the basics of effective project and time management.

Presentation Course
Speaking in public can be a daunting experience. Yet public speaking is a skill which can be learned. In this course, we set up a relaxed and stimulating learning environment in which our PhD candidates can stand up and train their presentation skills. They have to speak live, in front of colleagues (with powerpoint, and without). They learn to use voice and gesture, how to structure a story, and how to present with clarity and confidence. They learn by presenting themselves, but also by observing others, and giving feedback.

Academic Writing Course
During this course, the PhD candidates are offered a set of skills which will help them during the writing process of scientific papers. Special attention goes to structuring a scientific paper and to the scientific style of writing. Different writing samples in the areas of the ILLC are analyzed and their structural elements are highlighted. This course includes an active writing task for each PhD candidate. During this course, the candidates receive feedback on the result of their assignment.

Career Development Course
In this course the PhD candidates are offered an overview of possible future career tracks (inside and outside academia). PhD candidates receive further advice on how they can put together a successful job application package (for applications inside and outside academia) as well as advice on how to write a successful post-doctoral grant proposal.

5.1.3 Task B: Information and Facilities

PhD candidates at the ILLC automatically obtain a regulated and controlled PhD track. This track comes with a clear time-line and involves both a scientific and a procedural component. The scientific component deals with a time-line for research and education. The procedural component contains moments when an assessment or evaluation has to take place as well as administrative paperwork surrounding exemption, admission and graduation. One of the

tasks of the ILLC PhD programme is to offer the ILLC PhD candidates and their supervisors all the necessary information about these matters. The website of the PhD programme is used as an interface by which up-to-date information about the candidates' rights and duties and the ILLC's expectations (both scientific and procedural) is provided. In particular, the website includes an outline of a full 4-year PhD track, highlighting the different phases and tasks within this time-line.

The ILLC PhD Programme offers a number of facilities for its PhD candidates. In particular, this includes access to an individual workspace, assistance for new foreign PhD candidates in finding suitable accommodation, access to a travel and training budget (set within well-defined limits), and last but not least: a financial bonus for all candidates who complete their PhD track within the agreed time at the ILLC.

5.1.4 Task C: Quality and Quality Control

The ILLC ensures the quality of this PhD programme in a number of different ways, starting with the PhD candidate's assessment interview and annual evaluations during which matters involving supervision, research, teaching, education, organisation and administration are discussed. Secondly, the PhD training programme, education and work environment of the PhD candidates are evaluated on an annual basis via the PhD Programme eValuation Committee (Dutch abbreviation 'PVC'). The PhD Programme eValuation committee operates independently from the ILLC PhD Programme and compiles an annual report based on individual interviews with each current ILLC PhD candidate. Third, the director of the institute and the director of the ILLC PhD Programme hold regular meetings with ILLC's active PhD council in order to discuss issues regarding the PhD programme and the welfare of the PhD candidates. We highlight here some further details on each of these control mechanisms:

The Assessment Interview and Annual Evaluation Meetings.

In line with the employment contracts of PhD candidates at the ILLC (within either the Faculty of Humanities or the Faculty of Science), the first assessment interview is organized right before the candidate has completed 12 months of employment. Besides the supervisors, the director of the ILLC and/or the director of the PhD Programme do take part in this interview. On the basis of this assessment, a go/no-go decision is made concerning the extension of the candidate's PhD position to the full span of the PhD track (which can be 3 or 4 years depending on the type of PhD employment). In preparation of this assessment interview, the candidate is asked to hand in a pilot study (i.e. a scientific report) after 9 months of employment.

In case the assessment interview leads to a positive decision and to the continuation of the candidate's employment, the supervisors will continue to evaluate the progress of the candidate on an annual basis. These annual meetings play an important role in assessing 1) whether the candidate's research plan is on schedule and 2) whether the candidate has made progress in the necessary soft skill development. During these annual evaluation meetings, the supervisor has the duty to design a plan of action for the future in order to remedy any deficiencies that are reported in the evaluation outcome. The reports of these meetings are

monitored by the director of the ILLC and the director of the ILLC PhD Programme.

The ILLC PhD Council.

The PhD candidates at the ILLC are represented in an active, well-functioning PhD council which has a good overview of the PhD programme and the needs of the PhD candidates. The director of the ILLC and the director of the PhD Programme have at least four meetings every year with (representatives of) the PhD council in order to discuss issues regarding the PhD programme and the welfare of the PhD candidates.

The PhD Programme eValuation Committee.

An important instrument to ensure the quality of the training, education and working environment of the PhD candidates is provided by the ILLC PhD Programme eValuation Committee (PVC). This committee, annually appointed and consisting of about five staff members, holds annual interviews with each ILLC PhD candidate. The point of these interviews is explicitly not to check the candidates' individual progress (this is the topic of the annual talk), but to review whether, conversely, the ILLC meets its proclaimed standards as an environment for conducting research and training. That is, the committee enquires whether the candidate receives adequate research training, finds sufficient attention and advice from the supervisor, is satisfied with the working conditions, is building up a network, etc. The committee draws up a confidential report of each interview, which is sent only to the PhD candidate; in case of individual problems, the committee takes direct action, (for instance by urging the supervisor(s) to improve the frequency of the contacts).

In addition, the Programme eValuation Committee submits an annual report to the director of the institute (and in the future, to the director of the PhD programme). These reports summarize the state of the ILLC PhD programme. In particular, the PVC signals problems (both general and specific) and it may advise the ILLC on possible actions to solve these problems.

As of 2012, the PVC members also serve as confidential advisors, to whom ILLC PhD candidates can turn with questions, worries or complaints that they do not feel comfortable discussing with their supervisors.

5.2 Selection and Admission

There are several ways in which the ILLC recruits new PhD candidates:

All new open positions funded via the ILLC are advertised on the ILLC web pages. Typically, there are about five to ten advertisements for PhD positions per year. These positions may be advertised at any time (there is no particular time of the year for PhD applications). The ILLC advertises two types of positions: 1) positions funded by external funding (NWO, EU, ...) come with a precise project description specifying the PhD thesis topic and the supervisor and 2) positions funded via direct (UvA) funding may specify the area of research but leave the precise project description open. The institute is responsible for putting together a selection committee (consisting of at least three qualified researchers

among which one is a full professor and one female). The role of the committee is to advise the director of the institute in the selection of the best candidate for the advertised position. After a selection has been made, the ILLC support staff contacts the Human Resource Department in order to arrange the employment details.

PhD candidates who have secured funding via an international programme or scholarship from a foreign country (e.g. grants from the Chinese Scientific Council) or who have their own private funding, may send an application requesting their admission into the ILLC PhD programme. The admission procedure consists of an online application form which has to be completed first. The application form is evaluated by the director of the ILLC PhD Programme and if this passes to the next stage, a Skype interview may follow. The Skype interview is conducted by an ILLC staff member and/or the director of the ILLC PhD Programme. Admission to the ILLC PhD Programme will depend on the result of the interview. If the candidate is admitted to the ILLC PhD Programme, he/she is first assigned an academic mentor who helps the candidate during the first period in his/her scientific orientation until an official supervisor has been assigned (within six months). Similar to all other PhD candidates, an assessment interview after 12 months is held during which it is decided whether the PhD candidate can complete his/her doctoral studies at the ILLC.

5.3 Participation in Graduate/Research Schools

The ILLC PhD Programme is recognized by both the Graduate School of Humanities and the Graduate School of Sciences within the university of Amsterdam. New PhD candidates at the ILLC attend the introduction meetings that are organized by these Graduate Schools, via which they become acquainted with the organization of these schools on Faculty level. The Graduate School of Humanities organizes several additional skill courses, which are optional for ILLC PhD candidates. Similarly, the Graduate School of Sciences organizes the teaching skills training for the ILLC PhD candidates who have their main employment in the Faculty of Science.

Via the ILLC PhD Programme, the ILLC PhD candidates are actively encouraged to participate in relevant international summer schools. In this context we mention in particular the summer school series organized by The Association for Logic, Language and Information (FoLLI). The objectives of FoLLI are in close alliance with the aims of the ILLC and can be summarized as "the advancing and practicing of research and education on the interface between logic, linguistics, computer science and cognitive science." FoLLI organizes three summer school series which are regularly visited by ILLC PhD candidates and ILLC staff members. The FoLLI school series comprises the annual European Summer School in Logic, Language and Information (ESSLLI); the biennial North American Summer School for Logic, Language and Information (NASSLLI) and the East-Asian School on Logic, Language and Computation (EASLLC). These schools offer specialized post-graduate courses within the three main research programmes of the ILLC (i.e. Logic and Language (LoLa); Logic and Computation (LoCo) and Language and Computation (LaCo)).

On the national level, ILLC PhD candidates can attend specialized disciplinary courses at various national Dutch research schools, including LOT (Dutch Graduate School in Linguis-

tics), SIKS (Netherlands Research School for Information and Knowledge Systems), OZSW (Dutch Research School of Philosophy), ASCI (Advanced School for Computing and Imaging), and others.

5.4 Success rate of the ILLC PhD track

Our evaluation in Table 5.1 below traces the data on PhD numbers and graduation numbers back to the period of 8 years before the current evaluation period. Between 2004 and 2014 a total number of 123 PhD candidates joined the institute, 97 of which were employed by the University of Amsterdam and 26 PhD candidates were employed elsewhere or self-employed.

About 47% of all the ILLC PhD candidates who successfully graduated in this period were able to finish their work within the offical time frame of four years, the others required a fifth or (exceptionally) even a sixth year. In the framework of our recently established PhD programme, we now closely monitor the progress of the PhD candidates during their PhD track and hope that the percentage that can finish within the offical time frame will increase over the coming years.

Start	F	M	Total	Graduated			Not yet finished	Discontinued
				$\leq$ 4 y	$\leq$ 5 y	$\leq$ 6 y		
2004	2		2		2			
2005	4	4	8	4	3	1		
2006	4	7	11	3	5	1	1	1
2007	3	13	16	5	9	1	1	
2008	2	7	9	4		1	1	3
2009		1	1			1		
2010	1	4	5	1			3	1
2011	3	9	12	1			8	3
2012	7	8	15	2			13	
2013		9	9				9	
2014	1	8	9				9	
	27	70	97	20	19	5		8

Table 5.1: Enrolment and success rates of UvA-employed PhD candidates 2004–2014

Table 5.1 provides numbers on the intake and success rates of PhD candidates with regular employment at the University of Amsterdam. Table 5.2 provides numbers on the intake and success rates of PhD candidates on external scholarships/contracts, or private money. These figures show that of the 97 UvA-employed candidates who started in this period (28% of which were female), 20 finished within four years, 19 finished in their 5th year, and 5 finished in their 6th year. 8 % of UvA-employed candidates left the programme without graduating (8 individuals). The remaining 46% UvA-employed PhD candidates (45 individuals) are still in progress. Of the 26 non-employed PhD candidates, 6 finished within 4 years, 4 finished in

Start	F	M	Total	Graduated			Not yet finished	Discontinued
				≤ 4 y	≤ 5 y	≤ 6 y		
2004	1	2	3	2	1			
2005		1	1		1			
2006		2	2	1	1			
2007	1	1	2		1			1
2008		2	2	1		1		
2009		1	1	1				
2010	1	3	4	1			2	1
2011		1	1				1	
2012	2	3	5				4	1
2013		1	1					1
2014		4	4				4	
	5	21	26	6	4	1	11	4

Table 5.2: Enrolment and success rates of non-employed PhD Candidates 2004–2014

their 5th year and 1 finished in the 6th year. 15% of the non-employed PhD candidates (4 individuals) have discontinued their PhD, while 42% (11 individuals) are still in progress.

Sudent type	F	M	Total	Graduated			Not yet finished	Discontinued
				≤ 4 y	≤ 5 y	≤ 6 y		
Employed	15	32	47	16	19	5	3	4
Non-employed	2	9	11	5	4	1		1
Total	17	41	58	21	23	6	3	5

Table 5.3: Success rate of PhD Candidates starting 2004–2009

In order to draw conclusions on the success rate of the ILLC Programme, consider the 58 PhD candidates who started between 2004 and 2009 — these are the candidates that one could reasonably expect to have graduated before January 2015. Table 5.3, depicting the results of this group, reveals that 21 of these candidates graduated within four years, 44 within five years, and 50 within six years.

These results do compare favourably with average results which we observe within the Faculty of Science at the university of Amsterdam. A recent study shows that only 15% of all UvA-employed PhD candidates who graduated in the year 2012 were able to complete their track within the allotted period of 4 years. In contrast, the above figures at the ILLC show that of the 44 UvA-employed individuals who did graduate within the overall 10 year period (2004–2014), 45% finished their track within 4 years. While this result is positive in comparison with the average figures at the Faculty of Science, there is still room for improvement within our institute as ideally a much higher number of candidates should graduate within 4 years.

When we analyze the gender diversity within the ILLC PhD population, we observe that

in 2012 the figures were very positive but that this is counterbalanced by a very low number of female PhD candidates (only 1 out of 23 individuals) who joined the Programme in the last two years (2013 and 2014). This is an issue of concern and special attention has to be given to gender diversity in future PhD hirings.

The ILLC dissertation series, which has been set up in 1993, currently contains well over 160 items. Figures 5.1 and 5.2 display the nationality of all 80 ILLC PhD candidates who were affiliated with the institute during the assessment period (2012–2014), 26 of them carry the Dutch Nationality.

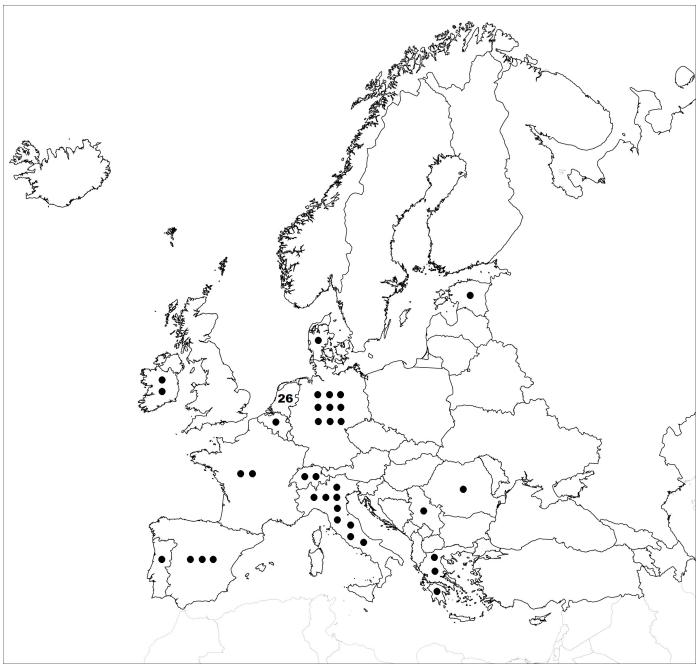

Figure 5.1: Home countries of PhD candidates (inside Europe)

5.5 Career Guidance

The ILLC PhD Programme offers a career development course during which all 3rd year PhD candidates are offered an overview of possible future career tracks and receive information and guidance on the writing of postdoctoral grant proposals.

In the context of career development, the PhD candidates are encouraged to attend the Life after ILLC-event which the PhD council organizes every 2 years. The purpose of this event is to bring ILLC's current students (both MSc and PhD) into contact with alumni that either remained in or left academia after having completed a PhD or a Master in Logic at the ILLC. During this event, several ILLC alumni speak about their current occupation and about the experience they had when looking for a job after their time at the institute.

Figure 5.2: Home countries of PhD candidates (outside Europe)

Further information on the courses offered by the Career Advice Centre (Loopbaanadviescentrum, or LAC) of the University of Amsterdam is offered on the website of the ILLC PhD Programme. LAC organizes courses and workshops (mostly in Dutch) which are focused on the (future) career of the PhD candidate. Topics of the courses organised by the LAC include: career orientation and planning, obtaining external funding, dealing with the press, managing a project, communication and finding a new job.

5.6 Alumni

Table 5.4 gives an overview of the current occupation of the 18 ILLC graduates who defended their thesis after January 2012. We have currently gathered the following information regarding the current occupation of these 18 graduates: 10 have currently obtained employment in academia, 2 of those are employed in industry (ICT), 3 of those are self-employed in ICT and 1 is currently unemployed. In this overview we lack the current information of 2 graduates in this group. Finally, we note that 2 graduates are working both in academia and in either industry or are self-employed.

Table 5.5 gives an overview of the places within academia where 10 PhD graduates have found their 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. Table 5.6 indicates where graduates who are working in ICT have been employed.

Current occupation		%	Remarks
Academia	10	56	
Industry	2	11	2 in ICT
Government and non-profit	0		
Self-employed	3	17	2 in ICT
Other	0		
Unemployed	1	6	
Unknown	2	11	

Table 5.4: Current occupation of PhD alumni 2012–2014

Austria	Colombia	Czech Rep.	France
Vienna	U. del Rosario	Charles U.	Toulouse
			Lille 3
Italy		The Netherlands	Spain
Fondazione Bruno Kessler		UvA IIS	U. Autonoma de Barcelona
		Leiden	U. Pompeu Fabra

Table 5.5: Academic positions of PhD alumni 2012–2014

5.7 SWOT Analysis

Strengths

- In contrast to Faculty-wide programmes, the ILLC PhD programme has been designed in order to gear it directly towards the needs of ILLC PhD candidates.
- The ILLC PhD Programme benefits from the excellent educational environment which hosts the Master of Logic. In this context the ILLC PhD candidates can select from a series of advanced master's courses, many of which are research courses that are in fact taught at PhD level.
- The ILLC PhD Programme benefits from the excellent research environment which offers the expertise of internationally recognized top-level researchers, (almost) all of whom have an extended international research network in which our PhD candidates can be integrated.
- The ILLC PhD Programme has access to the necessary financial means and can offer infrastructure, money for travel as well as a bonus for PhD candidates who finish their track on time.
- One of the essential feedback mechanisms for the PhD Programme is based on the communication with an excellent and well-functioning PhD council in which the ILLC PhD candidates have organised themselves.

France	The Netherlands	Spain
Aldebaran Robotics	Freelance translator	Yahoo Labs
	Lexiful B.V.	
	JorisDormans.nl	

Table 5.6: Non-academic positions of PhD alumni 2012–2014

Weaknesses

- The ILLC PhD Programme is embedded in two different faculties at the University of Amsterdam, each of which has its own set of rules and regulations, which makes it harder to maintain the uniformity and coherence of the ILLC PhD Programme.
- The difference in employment conditions (and the duration of employment contracts) that are imposed by the Faculty of Humanities and the Faculty of Science causes an unequal situation in terms of teaching duties and possibilities, and of the duration of the PhD track among the ILLC PhD population.
- A very low number of female PhD candidates (only 1 out of 23 individuals) joined the PhD Programme in the last two years (2013 and 2014). This is an issue of concern and special attention has to be given to gender diversity in future PhD hirings.

Opportunities

- The focus and structure of the ILLC PhD Programme creates an opportunity for new collaborations and alliances with other international PhD Programmes and PhD schools.
- While the scientific quality and success rate is already high, the ILLC PhD programme is at this moment still less visible than its MSc counterpart. It is a challenge for the PhD Programme to make it as visible and successful as the MSc in Logic.
- The ILLC PhD Programme has the potential to reach out to the ILLC's collaboration partners in industry, as such enhancing the career opportunities for PhD candidates in industry.
- The numerous collaborations (on both international and national level, including e.g. in the framework of the 'Language in Interaction project') among different disciplines of ILLC staff members has the potential to create new research opportunities for PhD candidates.

Threats

- The PhD Programme hosts a large number of foreign candidates who experience a major difficulty in finding suitable and affordable housing in the city of Amsterdam.

- Given the current financial situation at the Faculty of Humanities, there are no directly funded PhD positions in 2015, and this may also be the case for the coming year(s). For this reason, as well as the fact that pre-financing in some Faculty research priority areas has been terminated, the only source of funding for PhD positions at Humanities is via external funding. This will make it harder to ILLC to maintain a balance in the number of PhDs from both faculties.

5.8 Strategy

While the actual implementation of the ILLC PhD Programme started in 2014 and has been very successful until now, there are still a number of items that need to be fine-tuned and further improved. The current collection of transferable skill courses needs to be extended to include a course on scientific integrity, the implementation of which we hope to complete by the end of 2015. We have been evaluating all the transferable skill courses on offer and will continue to do so. The result of these evaluations is our guideline to implement further adjustments to the specific course-design at hand, guaranteeing that these courses are indeed geared directly towards the needs of the ILLC PhD candidates. The well-functioning of our PhD Programme relies on the constructive feedback mechanisms that are currently in place, and that we will maintain in the future.

The PhD Programme will continue to execute its main tasks while guarding the uniformity and coherence of its programme, in as far as this lies in our power. Overall, the programme will continue closely monitoring the progress and needs of its PhD candidates so we can ensure that a larger percentage of candidates will finish their PhD track within the allotted time frame of their appointment. By offering the necessary training and information, and by guaranteeing a timely response to problems whenever they occur (be it on the level of supervision or practical needs), we should be able to give the PhD programme the international visibility and strong position that we aim for. For now our focus is mainly directed inwards, aiming to provide a top ILLC PhD Programme. In time we will actively look for collaborations and alliances with other international PhD Programmes, PhD schools, as well with partners in industry.

Last but not least, the above SWOT analysis lists a few specific challenges, among which the low number of recently hired female PhD candidates is an item of immediate concern. The PhD Programme will signal that there is a need to raise awareness about gender diversity within the context of the ILLC's PhD-hiring policy. The above challenge of our foreign candidates who experience major difficulties finding suitable and affordable housing in the city of Amsterdam, is not unique to the ILLC and is a problem we can discuss at faculty and university level. The same holds for the difference in employment conditions of our ILLC PhD candidates: this is an issue that needs to be discussed at the higher university levels whenever possible. The PhD Programme sees it as its task to report these weaknesses (for which structural changes are needed within the larger university system) to the ILLC management team.

Part D

Quantitative Information

Chapter 6

Tables

In this final part we present a number of tables, following the requirements laid down by the Standard Evaluation Protocol.

6.1 Staff

We first specify the development of the ILLC research staff, specified per programme.

Programme		**2012**	**2013**	**2014**
Logic and Language	Tenured	4,76	5,62	7,23
	Non-tenured	7,37	5,61	4,90
	Phd student	13,04	15,29	14,60
	Total LoLa	25,17	26,52	26,74
Logic and Computation	Tenured	4,18	3,98	5,18
	Non-tenured	4,07	6,34	6,05
	PhD candidate	5,94	6,51	8,96
	Total LoCo	14,19	16,83	20,19
Language and Computation	Tenured	2,80	2,96	3,19
	Non-tenured	5,36	7,07	9,19
	PhD candidate	5,11	10,09	14,55
	Total LaCo	13,27	20,13	26,92
ILLC Total		**52,63**	63,47	73,85

Table 6.1: Research staff at programme level

6.2 Funding

The tables in this section speficy the internal and external sources of funding of the institute, split over, respectively, the two faculties, and the three ILLC programmes.

		2012		2013		2014	
Funding institute level		***fte***	**%**	***fte***	**%**	***fte***	**%**
Direct Funding	FGw	12.26	21%	16.89	25%	17.66	23%
	FNWI	10.65	18%	10.77	16%	11.51	15%
	ILLC	**22.91**	**39%**	**27.66**	**41%**	**29.17**	**38%**
Research grants	FGw	9.34	16%	10.24	15%	12.69	16%
	FNWI	12.23	21%	13.74	20%	14.83	19%
	ILLC	**21.57**	**36%**	**23.98**	**35%**	**27.51**	**35%**
Contract research	FGw		0%	0.33	0%	0.67	1%
	FNWI	2.58	4%	4.92	7%	9.16	12%
	ILLC	**2.58**	**4%**	**5.26**	**8%**	**9.83**	**13%**
Other	FGw	2.29	4%	2.05	3%	3.25	4%
	FNWI	9.79	17%	8.83	13%	7.94	10%
	ILLC	**12.08**	**20%**	**10.89**	**16%**	**11.19%**	**14%**
Total	FGw	23.89	40%	29.52	44%	34.26	44%
	FNWI	35.26	60%	38.26	56%	43.43	56%
	ILLC	**59.15**	**100%**	**67.78**	**100%**	**77.70**	**100%**
Expenditure		10^3 €	%	10^3 €	%	10^3 €	%
Personnel costs	FGw	2,123	39%	2,536	40%	3,090	40%
	FNWI	2,971	54%	3,187	58%	3,666	48%
	ILLC	**5,093**	**93%**	**5,722**	**90%**	**6,756**	**88%**
Other	FGw	95.6	2%	91.4	1%	167	2%
	FNWI	301	5%	530	8%	753	10%
	ILLC	**397**	**7%**	**622**	**10%**	**920**	**12%**
Total	FGw	2,219	40%	2,627	41%	3,257	42%
	FNWI	3,272	60%	3,717	59%	4,419	58%
	ILLC	**5,490**	**100%**	**6,344**	**100%**	**7,676**	**100%**

Table 6.2: Sources of research funding: institute level

In these tables 'direct funding' refers to funding by the University of Amsterdam, 'research grants' concern projects funded by public Dutch financing organisations (such as NWO, KNAW and STW), and 'contract research' refers to funding by third parties, such as com-

panies, 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). Concerning expenditure, the category 'Personnel' refers to direct costs for staff salaries, while 'Other' costs concern expenses for travelling (of both ILLC staff and visitors), the organisation of conferences, etc.

Programme	**Funding**	**2012**	**2013**	**2014**
Logic and Language	Direct funding	10.15	11.01	9.27
	Research grants	10.58	9.26	9.51
	Contract research	2.58	4.33	5.59
	Other	3.94	3.34	3.57
	Total LoLa	**27.26**	**27.95**	**27.95**
Logic and Computation	Direct funding	5.45	6.77	10.36
	Research grants	5.69	5.57	4.45
	Contract research		0.42	1.00
	Other	6.65	6.69	5.76
	Total LoCo	**17.79**	**19.45**	**21.57**
Language and Computation	Direct funding	7.31	9.87	9.54
	Research grants	5.31	9.15	13.55
	Contract research		0.50	3.23
	Other	1.49	0.85	1.85
	Total LaCo	**14.10**	**20.38**	**28.18**

Table 6.3: Sources of research funding: programme level

6.3 Research output

Institute for Logic, Language and Computation	**2012**	**2013**	**2014**	$\sum$
Refereed journal articles	48	78	69	195
Non-refereed journal articles	2	7	4	13
Books/monographs	2	5	5	12
Edited books	9	12	8	29
Book chapters	31	32	42	105
PhD theses	10	3	4	17
Conference papers	71	93	77	241
Publications aimed at general public	3	10	10	23
Total publications	176	240	219	635
Research Programme Logic and Language				
Refereed journal articles	20	28	27	75
Non-refereed journal articles	0	1	1	2
Books/monographs	2	1	1	4
Edited books	4	3	3	10
Book chapters	15	15	21	51
PhD theses	2	2	3	7
Conference papers	29	21	16	66
Publications aimed at general public	0	0	2	2
Total publications	72	71	74	217
Research Programme Logic and Computation				
Refereed journal articles	19	37	34	90
Non-refereed journal articles	2	0	1	3
Books/monographs	0	1	2	3
Edited books	3	6	5	14
Book chapters	9	7	16	32
PhD theses	5	1	1	7
Conference papers	19	32	22	73
Publications aimed at general public	1	1	3	4
Total publications	58	84	84	226
Research Programme Language and Computation				
Refereed journal articles	13	16	15	44
Non-refereed journal articles	0	6	2	8
Books/monographs	0	3	2	5
Edited books	2	3	1	6
Book chapters	7	10	10	27
PhD theses	3	0	0	3
Conference papers	23	43	43	109
Publications aimed at general public	2	9	5	16
Total publications	50	90	78	218

Table 6.4: Research output

Note that for any category in Table 6.4, the sum of the number of publications produced by the three programmes may be higher than the number listed for the institute as a whole. The explanation in such a case is that co-authors were members of different research programmes.

Acronyms

AAA	Amsterdam Academic Alliance
ABC	Amsterdam Brain and Cognition
ACLC	Amsterdam Center for Language and Communication
AFS	Amsterdam Faculty of Science
AIHR	Amsterdam Institute for Humanities Research
CSCA	Cognitive Science Center Amsterdam
CWI	Centrum voor Wiskunde en Informatica (Centre 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)
LAC	Loopbaanadviescentrum (Career Advice Centre)
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 Organiszation)
NWO	Nederlandse Organisatie voor Wetenschappelijk Onderzoek
	(Netherlands Organisation for Scientific Research)
OBP	Opleidings- en BegeleidingsPlan
	(Education and Supervision Plan)
PVC	PhD Programme eValuation Committee
QMQI	Quantum Matter and Quantum Information
research fte	part of fte officially dedicated to research
RPA	Research Priority Area
SiA	Science in Amsterdam
SEP	Standard Evaluation Protocol
STW	Stichting voor de Technische Wetenschappen
	Technology Foundation
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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