Institute for Logic, Language and Computation (ILLC)

Self Evaluation 2012–2017

November 7, 2018

Contents

1 Introduction

We are proud to present the self-evaluation report over the years 2012–2017 by the Institute for Logic, Language and Computation (ILLC).[1] The ILLC is home to a thriving community of analytic philosophers, theoretical computer scientists, logicians, mathematicians, physicists, linguists and cognitive scientists who share a deep passion for the use of formal methods in the interdisciplinary study of information. While 'information' is a crucial theme for scientific studies across many disciplines, ILLC focuses in first instance on fundamental research and investigates the basic building-blocks and foundational principles that regulate different types of informational processes. By combining the techniques and arguments used in the humanities and the exact sciences, and by building on a strong tradition of logic research in Amsterdam, researchers at the ILLC have succeeded to create a unique oasis for interdisciplinary studies in logic, language and computation, an oasis which continuously attracts visiting international scholars and students from all over the world.

ILLC's researchers engage in different local, national and international collaborations. Local partners with whom the ILLC has on-going collaborations and strong research ties include the Amsterdam Center for Language and Communication (ACLC), the Centrum Wiskunde & Informatica (CWI, the national research institute for mathematics and computer science), the Informatics Institute (IvI), the Korteweg-de Vries Institute for Mathematics (KdVI) and the Institute of Physics (IoP). Besides these local collaborations, the ILLC runs an active Joint Research Center in Logic together with Tsinghua University in Beijing, participates in the Research Center QuSoft for Quantum Software, has a long-standing collaboration with the Center for the Study of Language and Information (CSLI) at Stanford University and with different researchers in informatics at the University of Edinburgh.

An important part of the activities 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. ILLC researchers contribute to a wide range of educational programmes at the UvA, including different tracks in at least 18 Master and Bachelor programmes, among them most notably the MSc in Logic, the BSc AI, the MSc AI and the programmes in Philosophy. More generally, the ILLC is 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.

2 Scientific Profile of the ILLC

The scientific mission of the ILLC is to advance the information sciences in the area of research devoted to logic, language and computation as well as their intersection, specifically by insuring the interaction of different formal methods. Researchers at the ILLC study the formal properties of information, viz. the logical structure and algorithmic properties of processes of encoding, transmitting and comprehending information. The notion of information is here conceived in its broadest possible 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 resulting view of information science transcends the traditional disciplinary boundaries of the university and the wider academic world.

In accordance with its interdisciplinary orientation and its scientific mission, the ILLC has a broad scientific profile. Its research spans a number of disciplines ranging from philosophical analysis to computational complexity and from psycholinguistics to social choice theory. More information on the research area of the ILLC can be found in Section 3, where we discuss ILLC's three research programmes in detail.

2.1 Organisation, Composition and Management

Founded in 1991 as an interfaculty institute at the University of Amsterdam, the ILLC is 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. Peter van Tienderen for the Faculty of Science, and Prof. Fred Weerman for the Faculty of Humanities. While the former faculty is the administrative host of the institute, the ILLC reports to both deans, and participates in meetings and decision-making processes in both faculties.

[1] This research evaluation is organized under the auspices of the board of the University of Amsterdam and carried out as outlined in the Standard Evaluation Protocol (SEP) 2015–2021.

The ILLC consists of 84.2 FTE research staff and 7.4 FTE visiting fellows divided over three research programmes and 5.8 FTE support staff at the end of this evaluation period (see Tables 2 and 3 in the Appendix). It is headed by a scientific director (currently Prof. Sonja Smets), who is supported by an administrative office led by the institute manager (currently Jenny Batson). The director is supported by the ILLC management team consisting of the manager and the leaders of the three ILLC programmes, the director of the ILLC PhD programme (currently Dr. Luca Incurvati) and the director of the Master of Logic (currently Dr. Maria Aloni). The current three programme leaders are:

(LoLa) Prof. Robert van Rooij and Dr. Paul Dekker (deputy)
(LoCo) Prof. Yde Venema and Prof. Benedikt Löwe (deputy)
(LaCo) Dr. Jelle Zuidema and Prof. 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, discusses and prepares decisions on all matters of importance to the institute. Concerning its general policy, quality control and scientific developments, ILLC is advised by the Scientific Advisory Board (Wetenschappelijke Adviesraad), consisting of five members: Prof. Mark Steedman (University of Edinburgh), Prof. Angelika Kratzer (University of Massachusetts), Prof. Hannes Leitgeb (Ludwig-Maximilians-Universität München), Prof. Valeria de Paiva (Nuance Communications) and Prof. Moshe Vardi (Rice University).

2.2 Financing

The ILLC was exceptionally successful in obtaining external funding during the evaluation period, with a total of almost 29 million euros awarded in 70 grants (an increase of almost 60% compared to the 17 million euros awarded in 46 grants in the previous evaluation period). Appendix 12.3.4 contains the details of ILLC's earning capacity in Table 7 and provides an overview of awarded grants. Table 5, showing the sources of ILLC's funding, indicates that in 2017, about 35% of the personnel (FTE) were directly funded by the government via the university, and about the same percentage were funded by grants acquired from national research agencies. The percentage of personnel financed by European research grants has increased steadily over the years (from 4%, in 2012 to 14%, in 2017). We are happy to report that newly appointed assistant professors were successful in obtaining grants (B. van den Berg, R. Fernández, L. Incurvati, F. Roelofsen, I. Titov, C. Schaffner, J. Zuidema), as well as the newly appointed professors F. Berto and A. Betti.

3 Research Programmes and Objectives 2012–2017

As outlined below, the research at the ILLC comprises three programmes which are united in their common focus on the use of formal methods, including the development of theories and the design of logical systems and computational models to handle a rich variety of perspectives on information. This common ground, established by the use of different formal methods, is the core engine behind the main collaborations across ILLC's different programmes and makes it possible to continuously trigger new insights, to approach a problem from multiple perspectives and to keep advancing our work in Logic, Language and Computation. Various kinds of cooperation exist between researchers at the ILLC. While these cooperations generally emerge spontaneously, two long-standing themes include research on 'Logic and Games' and 'Cognitive Modelling' (themes that reappear in ILLC's future targets for cross-programme research collaborations in section 7.2). Other collaborations between the different programmes take place in the framework of ILLC's participation in several of UvA's research priority areas (as listed in section 3.4) as well as different research consortia including the Gravitation programme 'Language in Interaction'.

3.1 Logic and Language (LoLa)

The LoLa programme studies different aspects of the representation of knowledge and information transmission by communication through meaningful language use. The group has been, and continues to be, a leading force within formal semantics and pragmatics, as widely practiced by both linguists and philosophers. The 'secret' behind the success of LoLa has always been to set its own research agenda(s) and create followers, rather than following popular research trends. Examples of the past include dynamic semantics and game theoretic pragmatics. Currently, among others, Inquisitive Semantics fulfill this role. In recent years, the LoLa group strengthened its position within more strictly philosophical oriented themes concerning meaning and communication. Examples include the logical analysis of opinion diffusion, the

construction of a proof theoretical analysis of meaning and speech acts, an analysis of vagueness and other semantic paradoxes based on a non-transitive logic, a computational analysis of the meaning and temporal development of philosophical concepts, and more. LoLa's research strategy is non-monolithic, allowing for different approaches and requiring philosophical reflection and internal and external debate. In their investigations, the members of LoLa 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, inquisitive logic, causal inference, game and decision theory, formal learning theory, expressivist and inferentialist semantics, and topology are prominent parts.

Objectives Reached: The LoLa programme continued to build on its strong reputation in formal philosophy and in particular in formal semantics, while it strengthened its profile in philosophical logic and cognitive science. The programme emphasised the philosophical relevance of semantic models, the interpretation of natural language, human reasoning, intelligent interaction and analytic ontology in connection to the semantics of natural language. LoLa's efforts in cognitive science were strengthened by its participation in the Gravitation consortium 'Language in Interaction' and in UvA's research priority area 'Amsterdam Brain and Cognition'.

3.2 Logic and Computation (LoCo)

The LoCo programme strives to gain a deeper understanding of the nature of information and the processes of reasoning and interaction. The group is well known and widely respected as a leading player in formal research on foundational issues in mathematics, computer science and AI. At one end of the spectrum, LoCo builds on a strong tradition of research in logic in the Netherlands and covers classical areas of mathematical logic and the foundations of mathematics, such as model theory, category theory, modal logic, algebraic logic, and set theory. In theoretical computer science, LoCo researchers investigate fundamental problems in algorithmics and computational complexity, but also venture into new fields such as quantum computing and coalgebra. In AI, LoCo contributes to the fields of multi-agent systems, formal learning theory and social choice theory. At the interface with other disciplines, including formal epistemology, economic theory, and cognitive science, we place the study on the dynamics of interaction in groups of agents, higher-order cognitive functions and collective decision processes. Transcending this diversity of research areas is a shared reliance on formal tools, including techniques used in modal logic, game theory, and complexity theory.

Objectives Reached: The LoCo programme built further on its recognised strengths in mathematical logic, theoretical computer science and AI. While maintaining an excellent coverage of these core areas, it tightened links with other disciplines, such as physics (quantum computing), economics (decision making), and cognitive science (formal modelling). As expected, these links helped to attract the external funding required to maintain the programme's high visibility and productivity. Locally, the team expanded its collaboration with computer scientists, physicists and mathematicians in neighbouring institutes, a.o. by co-initiating QuSoft (the Research Center for Quantum Software, launched by CWI, UvA and VU in 2015) and by its participation in the UvA/FNWI research priority area 'Quantum Matter and Quantum Information'.

3.3 Language and Computation (LaCo)

The LaCo programme is focused on computational models of human information processing, especially in computational linguistics, music cognition and digital humanities. Our research is situated in the interdisciplinary territory between humanities, cognitive science and artificial intelligence. In most of our work in computational linguistics, this translates into a focus on models that incorporate many more insights from cognitive science and linguistics than is common in the Natural Language Processing field. In the past, this led to pioneering contributions to statistical parsing, syntax based machine translation and semantic role labelling. In our recent work, this focus is reflected in our work on graph convolution, recursive neural networks, interpretability and accomodation in dialogue. In our work on music cognition and digital humanities, LaCo's interdisciplinary profile translates into a much more sophisticated use of computational modelling and big data than is common in these fields. One important line of research has focused on the biological basis of music, which had its foundations in computational models of beat perception, but has over the years branched out to experimental work with infants, adults and other species on multiple aspects of music. A different line of research has explored how statistical and neural models can retrieve information from text that help answer questions in humanities disciplines ranging from history to philosophy.

Objectives Reached: The LaCo programme ensured that its growth was consolidated while keeping the programme's coherence. In part through its participation in the 'Language in Interaction' Gravitation programme, the relation between computational linguistics and cognitive (neuro-)science was further strengthened. The group significantly expanded its expertise in statistical methods in semantics and deep learning, facilitating collaboration both within ILLC (formal semantics) and with the informatics institute (machine learning). The group consolidated its position in digital humanities and information retrieval, and new collaborations emerged between digital humanities and computational linguistics. In its music research, the group explored the structural relations between language and music, and developed an internationally leading position in the comparative biology of music.

3.4 Past Targets on Funding and Organisation

The targets below refer back to the sections on strategy in ILLC's previous selfevalution reports (i.e. section 1.12 in ILLC-selfevaluation 2006-2011 and section 1.52 in ILLC-midterm-selfevaluation 2012-2014).

- To acquire the funding that is needed to pursue ILLC's research mission, the institute took several measures:

  The ILLC continued to collaborate with neighbouring faculties/institutes via UvA's Research Priority Areas (RPA). The 3 ILLC programmes participated in the RPA 'Amsterdam Brain and Cognition', an interdisciplinary centre in which five UvA-faculties collaborate. ILLC's researchers in Quantum Information and Complexity took up a leading role in the RPA 'Quantum Matter and Quantum Information', which is focused on the experimental and theoretical study of quantum matter and applications in quantum information. Furthermore, several LaCo and LoLa members played an important role in UvA's Centre for Digital Humanities, a collaboration between UvA, VU and the KNAW.

  The ILLC continued to stimulate and support its staff members to apply for personal research grants in national and European programmes. To implement this target, the ILLC collaborated closely with the university's grant support team (IXA).

  The institute increased its efforts to find partners and allies with whom to join forces in order to acquire, at the national and European level, research funding in programmes aiming at large-scale research conglomerates (Examples are listed on the ILLC consortia website).

- The institute secured a smooth transfer of its scientific leadership to a new generation of researchers. Due to the retirement of all members of the generation that founded the institute, the ILLC launched several vacancies. After the promotions in 2011–2012 of two full-time professors in LaCo (Rens Bod and Henkjan Honing), an application procedure for two chairs in LoLa resulted in the appointment of Robert van Rooij at the Faculty of Science and Arianna Betti at the Faculty of Humanities. In total 17 new members were appointed on permanent contracts in 2012–2017, including one full-time professor (Franz Berto), one 0.1fte-professor (Jos Baeten), and two members were promoted to full professorships (Khalil Sima'an and Sonja Smets). In addition, Fenrong Liu was appointed part-time in 2014 for five years on the new Amsterdam-China Logic Chair.

- The ILLC strengthened the internal coherence of the institute. When hiring new members, the ILLC continued to take care to attract researchers who are excellent in their own field and who can support ILLC's interdisciplinary research mission and strengthen its coherence.

- The ILLC further consolidated and strengthened its position as an interfaculty institute by increasing its collaboration with neighbouring institutes, in particular with the linguists, computer scientists, mathematicians and physicists.

- The ILLC continued to review its options to grow by focussing attention on acquiring individual research grants and securing more research income. Because researchers who acquire substantial individual grants receive a temporary reduction of their non-research duties, the ILLC assigns some teaching tasks to postdocs and hires temporary staff members.

- Besides the maximal effort which the ILLC continued to invest to consolidate the MSc Logic, the ILLC designed a strategic plan to install its own ILLC PhD Programme in 2013–2014. The new ILLC PhD programme, launched in 2014, is part of the Graduate Schools in Science and in the Humanities and is now coordinated and organised directly by the ILLC.

4 Results Achieved

4.1 Performance Indicators

ILLC-members publish in a wide range of different publication types ranging from papers in scientific journals, book-chapters, conference proceedings as well as PhD theses, monographs and edited collections (see Appendix Section 12.5). Taking into account the variety of research fields, each having its own publication culture, in which ILLC staff members publish, the most important performance indicators are peer-reviewed publications in academic outlets as well as PhD theses. Besides published scientific work, lectures and courses offered at (summer) schools form an important research product. When the context is well specified, citations are an important indicator in the Exact Sciences for the output published in scientific journals. The best indicators for marks of recognition and of the overall academic reputation of the ILLC rests on two pillars: the recognition of the individual qualities of its staff members and the international appreciation of the institute as a whole. With respect to the first, we refer to the personal grants obtained, editorships of journals and invited lectures at conferences and seminars. An important indicator for the second is the attention (in numbers of citations within Google Scholar) that a wide range of original trend-setting publications, written by ILLC members, still receives. Also the number of visiting research fellows and the number of organised workshops are good indicators of ILLC's activities for its international community.
With regard to ILLC's output indicators for 'relevance to society', we pay special attention to events (co)-organized for a wider interdisciplinary intellectual community as well as events targeted at high-school students, master students and PhD students. We refer to several outreach and dissemination activities, including publications aimed at a general audience in encyclopedias as well as popular science books. As indicator for the use of research products by societal groups, we point to several kinds of public-private collaborations including industrial-internships of ILLC PhD students as well as ILLC's research projects that involve collaborations with societal parties. Further examples of products that can be used by societal groups includes the software that has been developed within ILLC's research projects or within the consortia in which ILLC members participate. As indicators of the recognition by societal groups we list special honours and elected memberships of organisations and include an overview of valorisation funding.

4.2 Research Quality

Research Products for Peers
During the evaluation period, ILLC researchers produced a large number of refereed publications: 530 journal articles, 25 authored books, 48 edited books, 159 book chapters and 431 conference papers (see Appendix Table 12). In the evaluation period 41 PhD dissertations were completed. The total number of published output shows only minor fluctuations during the evaluation period and stays in general within the interval of 194 to 232 publications per year (these figures are based on all items in Appendix Table 12 except for the editorships). Overall, we notice an increase in conference paper publications from 52 in 2012 to 83 in 2017. The year 2016 stands out with double the standard number of PhD dissertations and a slight decrease in journal papers. The later can be explained due to the fact that of all 41 PhD candidates who graduated at the ILLC during the evaluation period, 10 graduated in 2016 while 28 new PhD candidates had just started in 2015–2016. Further information about the success rate of ILLC's PhD candidates is provided in Section 8. Besides the published output, we see that ILLC staff gives on average 10 lectures/courses at summer schools every year (see Appendix Table 13), many of which are organised by the Association for Logic, Language and Information.

Use of Research Products by Peers
To provide information about citations, we first highlight the results of Google Scholar indicating that two ILLC researchers have been cited more than 10,000 times, eight researchers between 5,000 and 10,000 times, six researchers between 3,000 and 5,000 times and eighteen researchers between 1,000 and 3,000 times (see Table 19 in the Appendix). UvA also conducted a bibliometric analysis, but as noted in ILLC's 2012–2014 midterm report, a bibliometric analysis that does justice to the full research spectrum of the ILLC or even to the research area of the institute's three individual programmes does not exist. A citation-analysis based on Web of Science (WoS) can be relevant, but only for a limited number of journal publications, excluding a wide range of publication types mainly used in the Humanities[2]. While the results of a bibliometric

[2]See the analysis of the QRiH, an national instrument designed especially to describe the quality and relevance of research in the Humanities in the Netherlands.

analysis, when based on traditional disciplinary boundaries, are very difficult to interpret in an interdisciplinary context, they can be useful to indicate how many different traditional research fields an institute covers. The analysis in Appendix 12.5, conducted on only 22 % of ILLC's total output (see Fig. 2), shows ILLC's multi-disciplinary character by listing the contributions to journals in not less than 12 different WoS research field-categories (see Table 17). Of these different WoS categories, most of ILLC's contributions belong to Computer Science (including AI), Mathematics and the general category 'Social Sciences, General' (including Philosophy and Linguistics) while a smaller part belongs to Psychiatry/Psychology, Neuroscience & Behavior and Physics. It is difficult to draw any further conclusions about the impact of ILLC's interdisciplinary research on this basis beyond the general observation that Table 16 in Appendix 12.5 shows an increasing trend in the last three years towards a higher total average impact within the wide and diverse range of 12 global WoS field-categories (including biology, clinical medicine, engineering, psychiatry, etc.). Of the analysed papers in Web of Science, 38 percent appeared in quartile one journals, while 66 percent appeared in the first two quartiles[3].

Marks of Recognition from Peers

ILLC's individual staff members were very successful during the evaluation period in obtaining external funding: Section 2.2 and the Tables in Appendix Section 12.3.5 show that in total 41 research grants were awarded to individuals. During the evaluation period, ILLC members have been frequent invited speakers at conferences and seminars, in total they gave 372 invited talks at conferences/workshops and 172 invited lectures at seminars. Moreover, in 2017, ILLC staff members were involved in 77 different editorships of journals (see Appendix Table 12). While ILLC members regularly receive best-paper awards[4] and prizes, one item of recognition by peers of which we are very proud is the honorary doctorate awarded to Dick de Jongh in 2015 by the Ivane Javakhishvili Tbilisi State University, in recognition for his great contribution to science in general, and for maintaining high standards of the Georgian linguistics and logic schools in particular. As an indicator for the appreciation of the institute as a whole, our previous mid-term report shows that 'ILLC' has become something of a brand name in our area. We didn't ask our international colleagues to provide us with new quotes about the ILLC this time, but to show that ILLC initiated groundbreaking research-lines and that we keep building further on this strong foundation of new trend-setting ideas, we highlight some citations in Google scholar that a range of original papers and books by our emeriti still receive (see Appendix Table 14). ILLC continues to be a thriving community in which staff members organised 51 workshops in Amsterdam between 2012–2017, a community which attracted in this period not less than 72 international research fellows coming from 20 different countries to our institute (see Appendix Figure 3).

4.3 Relevance to Society

Research Products for Societal Target Groups

While individual ILLC staff members are active in a variety of outreach and dissemination activities (see Appendix Table 12 and the items highlighted in Section 12.8), as an institute the ILLC takes specific measures to reach out to a larger population of students and actively promotes events that are targeted to a wider interdisciplinary intellectual community. With respect to the first, we mention a new series of annual master classes, initiated by the ILLC in 2017, specifically targeted towards high-school students. The first ILLC Master Class in Logic was a great success and gave rise to the organisation of the ILLC Master Class in Cognition in 2018, which will be continued with a new Master Class in Logic, Language or Computation in 2019. Another important annual event for high-school students and their teachers in Mathematics, co-organised by the Korteweg-de Vries Institute for Mathematics and the ILLC, is called Leve de Wiskunde!. The 16th edition of 'Leve de Wiskunde!' in 2018 attracted no less than 60 teachers and 50 high-school pupils to participate in the event. These contacts with high-school students and their teachers within the Netherlands are opening up new ways for ILLC researchers to reach out to a larger

[3]Note that the quartile analysis of WoS differs from the quartile analysis of Scimago which includes more journals in its ranking and adopts a different measure. Of all ILLC's journal papers published during this evaluation period, Scimago lists 71 percent quartile one journals, 92 percent in the first two quartiles and none in the fourth quartile.

[4]Best paper awards include e.g. papers by N. Gierasimczuk and her co-authors at the Logic & Cognition Workshop of ESSLLI'12, J. Schlöder at the Student session of ESSLLI'15, S. Hiller and R. Fernández at CoNLL'16, C. Geist and U. Endriss at IJCAI-JAIR'16, M. Dehghani, J. Kamps and their co-authors at ICTIR'16, B. van der Weij at CogMIR'16, D. Wiechmann and E. Kerz at ERUOPHRAS'17, E. Bruni and his co-authors at IJCAI-JAIR'17, M. Gattinger at the student session of ESSLLI'17.

population of students, triggered by the fact that logic components have recently been included in high-school mathematics-curricula and logic questions are now part of their exams, which points to a demand for the development of logic teaching-modules that can be integrated and used in Dutch high-schools.

The ILLC doesn't only reach out to the younger generation of high-school students, ILLC also helps its own graduates to establish contacts with other societal groups. Besides the events organised by UvA such as the Beta career event and the startup incubation programme of Ace Venturelab, the ILLC facilitates the contact between students and industry by participating in the Information Science MSc Thesis Fair. The Thesis Fair helps students in the information sciences and organisations (including companies, research institutes and governmental agencies) to find each other. Further, the ILLC also supports the annual Life after ILLC event (organised by the ILLC PhD Council) at which ILLC/Master of Logic alumni are invited to share their experiences on life after ILLC in or outside of academia.

With respect to events targeted towards a wider interdisciplinary intellectual community, we mention well-known conference series that have been supported and organized by the ILLC such as the 21 editions of the Amsterdam Colloquium, 12 editions of the International Tbilisi Symposium Series on Language, Logic and Computation as well as events such as the E.W. Beth lectures, the 2013-edition of the Heyting Lectures and the 2016-symposium on L.E.J. Brouwer, fifty years later.

Besides the outreach activities already mentioned, Table 12 in the Appendix indicates that 57 publications were written in the evaluation period for the general public or a wider academic audience. These publications include a range of articles in encyclopedias such as the online Stanford Encyclopedia of Philosophy as well as popular science books. In particular we mention Henkjan Honing's books for a general public, starting with his work entitled 'Iedereen is muzikaal' (Nieuw Amsterdam, 2009/2012). This book has been published in English as 'Musical Cognition: A Science of Listening' (Transaction Publishers, 2011/2013) and was reviewed in several journals and newspapers including Volkskrant, NRC Handelsblad and USA Today. Honing wrote two further volumes which are appearing in 2018–2019. The translation of his book 'Aap slaat maat. Op zoek naar de oorsprong van muzikaliteit bij mens en dier' (Nieuw Amsterdam, 2018) will appear as 'The Evolving Animal Orchestra: In Search of What Makes Us Musical' (2019, in press, The MIT Press) and his book on 'The Origins of Musicality' appeared earlier in 2018 with MIT Press. The later work builds further on Honing's TEDxAmsterdam-lecture in 2011. Henkjan Honing and his team are frequently featured in the Dutch media; for an overview we refer to the Music Cognition Group's website.

Use of Research products by Societal Groups

ILLC members have been increasing their effort to collaborate with industrial partners when their research gave them an opportunity to do so. In particular Appendix Table 12.3.4 shows that 6 contract research grants at the ILLC were funded directly by industry and the online list of research consortia mentions several industrial partners.

Because an important part of the mission of the ILLC concerns the education and training of Master and PhD students, ILLC researchers make sure that our graduates are well equipped to continue their career either within academia or in industry. To build up connections outside academia, industrial-internships are an excellent tool. Eight ILLC PhD candidates conducted an industrial-internship in divisions of companies such as Xerox in Grenoble, SONY in Paris, Microsoft Research, Unabel in Lisbon, Google in Switzerland, Google in London, Lattice Data/Apple in Menlo Park, Amazon in Zurich during 2012–2018 and we currently see this number of internships rising in 2018 with six new internship-contracts already established involving new company-divisions such as Google Brain in California and Facebook in New York. Moreover, several PhD alumni now hold positions at companies such as Pacmed, Funda, Adyen, Google, eBay, ING-bank, Deltares, and Apple.

As an example of research products for societal groups, we first mention the pioneering work on software and data within LaCo in the statistical language processing and learning lab and the work in the music cognition group on the use of web-based techniques. We highlight one of K. Sima'an's projects, DatAptor, that is funded by the NWO Domain of Applied and Engineering Sciences. DatAptor features a specific software package BEER version 2.0 which offers a trained machine translation evaluation metric with high correlation with human judgment both on sentence and corpus level. BEER 2.0 is an example of software used outside academia in the translation industry (e.g. by TILDE, the company in language technology). An important Data-Oriented Parsing demo was developed in the LaCo programme in the context of A. van Cranenburgh's PhD project, which builds on earlier work by R. Scha and R. Bod. This demo offers a syntactic analysis for a given sentence based on a model learned from a corpus of annotated sentences. Data-Oriented Parsing is a framework developed at the ILLC, based on the notion that language use relies on the recombination of exemplars and fragments from memory (the model has been applied to other forms

of cognition such as music and reasoning as well). The model in this demo supports multiple languages, grammatical function labels, and discontinuous constituents. Other important examples of products that can be used by societal groups are given by the demo's of the music Cognition Group, where we highlight in particular Hooked On Music. Hooked on Music is a popular citizen science game co-developed in 2014 by ILLC's music cognition group in collaboration with other researchers in the Netherlands, the Museum of Science and Industry in Manchester (UK) and several software companies. The game attracted massive worldwide attention with over 3M responses and over 100K participants.

Within the LoLa programme, we highlight GlamMap, a geo-spatial visualization tool that allows users to visualize geo-referenced metadata of cultural heritage artifacts on an interactive, two-dimensional geographic map. GlamMap was designed and further developed by the team of A. Betti and H. van den Berg in 2013–2014 in collaboration with researchers at TU Eindhoven. GlamMap's development was funded by the Young Academy of the KNAW and the European Research Council (ERC) via the Proof of Concept of Betti's ERC Starting Grant 'Tarski's Revolution: A New History' and was later continued via funding by NWO in partnership with the global library cooperative OCLC.

While not all ILLC research programmes have results that lead to products for societal groups, several ILLC researchers in all programmes have been part of different research consortia which have knowledge utilisation work packages. In particular we mention ILLC's participation in the Language in Interaction consortia which develops a range of apps based on research from the Consortium. The statistical language processing and learning lab took part in the H2020-project Cracking the language barrier, which lead the QT21-consortium to develop a range of software-packages. Similarly, our participation in the EXPERT-training-network on the development and use of hybrid language translation technologies led to a number of usable software resources. Several of the software components for the ESSENCE-training-network for research in computational communicating systems were developed by ILLC fellows and the consortium of the European Cost Action IC1205 on Computational Social Choice has assembled a collection of online resources in the area of collective decision making.

Marks of Recognition by Societal Groups
An important indicator is given by the special honors and elected memberships of ILLC members by societal groups and organisations. Four of our emeriti (R. Bartsch, J. van Benthem, A. Troelstra and M. Stokhof) are members of the Royal Dutch Academy of Arts and Sciences (KNAW); three of our emeriti (K. Apt, J. van Benthem and P. Vitanyi) are members of the Academia Europaea and one (J. van Benthem) is member of the American Academy of Arts and Sciences. J. Baeten, R. Bod and H. Honing are members of the Royal Holland Society of Sciences and Humanities (KHMW), the oldest learned society in the Netherlands. In 2014, J. van Benthem was awarded a Knighthood in the Order of the Lion of the Netherlands in recognition of his myriad research accomplishments and the leading role he has played in the academic community. When asked, ILLC members participate in societal advisory bodies offering e.g. expertise on quantum computing and cryptography to the General Intelligence and Security Service of the Netherlands or advice to the Ministry of Education on the development of new curricula for primary schools and high schools.

Another form of recognition by societal groups comes from valorisation funding. ILLC members have established several contacts which industry (SAP, Yandex, Google, Facebook, Intel, Symantec, elephant-candy etc.) and organisations including Rijksmuseum-Amsterdam, Koninklijke Bibliotheek, Stadsarchief Amsterdam. While we have been very successful in obtaining grants, many of the non-personal academic grants and research consortia involve companies and non-academic organisations who contribute in-kind, a relatively small contribution of the budget (803k€, for 2012–2017) comes from contract research with in-cash industrial funding (see Table 12.3.4 in the Appendix).

5 Research Positioning and SWOT Analysis

ILLC positions itself as a well known and widely respected leading player in the main areas of research it represents. While we cannot compare ILLC to another institute where exactly the same type of interdisciplinary research is being pursued, we can indicate three other institutes which together cover a large fraction of the research pursued at the ILLC and which can form a benchmark in matters regarding international orientation and scientific ambition. These institutes are the Stanford Center for the Study of Language and Information (CSLI), the Munich Center for Mathematical Philosophy (MCMP), and the Institute for Language, Cognition and Computation (ILCC) in Edinburgh. In Appendix 12.12 we indicate connecting research lines between the mentioned institutes and the ILLC. We have chosen these institutes as our benchmark because they support interdisciplinary work within the confines of their scientific mission

and have an excellent academic reputation. Similar like the ILLC, research at these institutes is pursued in close alignment with an excellent graduate programme and by attracting visiting international scholars. While the daily operations of these institutes differs, their international orientation and scientific ambition are strong parameters belonging to the key of their success. Both CSLI's research profile as well as the interdepartmental Symbolic Systems educational programme have been long-standing role models for the ILLC. Organisation wise, MCMP's international orientation and in particular their use of outreach methods via tools such as iTunes U, blogs, social media and courses on Coursera, addressing a young and dynamic audience, provide us with new ideas of how we can streamline some of our own outreach activities. Of special interest is ILCC's internal research organisation, which focuses on a division into various thematic groups, each of which includes a range of different research topics that form one coherent unit. ILCC's structure can provide us with an example of an alternative way of successfully organizing a broader interdisciplinary research line, which gives valuable input for ILLC's next internal reflection on its own organization structure.

Strengths

- Productive well-known researchers, many of whom are leaders in their field and have an excellent track record in obtaining personal research funding.
- A wide yet coherent and thriving interdisciplinary research programme, well embedded within the faculties FNWI and FGw.
- Fruitful local, national and international collaborations.
- High-quality PhD programme benefits from and contributes to an excellent research environment.
- Research interwoven with an internationally renowned Master of Logic programme.

Weaknesses

- Poor gender-balance among senior staff.
- Multi-location of the ILLC at Science Park and in the city center makes communication/collaboration harder.
- Limited success in instigating and/or leading large-scale collaborations and consortia.

Opportunities

- The future concentration of the information sciences at ASP942, opens opportunities for new collaborations between ILLC and IvI, and offers new innovation and valorisation opportunities.
- Well-positioned to participate in UvA's new RPA in AI and for continued participation in the RPAs 'Brain & Cognition' and 'Quantum Matter and Quantum Information'.
- ILLC's international research position is strengthened via collaborations in China while new opportunities appear in Germany, UK and the USA.

Threats

- The increasing preference of funding agencies for applied research creates opportunities for LaCo, but threatens ILLC's fundamental research lines in LoCo and LoLa. The current trend of funding a smaller number of larger projects also reduces the overall success-rate of grant applications.
- Given ILLC's imbedding as an interfaculty institute within UvA, if one of the faculties finds itself in a precarious financial situation, this will have a strong effect on the ILLC. We risk creating an imbalance within the institute when developments are possible in only one of the faculties.

Actions resulting from the SWOT analysis. Sections 6 and 7 together indicate how the ILLC will use its strengths, address its weaknesses, can benefit from opportunities and counter threats while taking into account that some issues in the SWOT are not under ILLC's direct control. These include the multi-location of the institute and the strategies and preferences of funding agencies.

6 Own assessment of Research Quality, Relevance to Society and Viability

6.1 Research Quality

Research at the ILLC is in general of very high quality, our strength lies in the fact that several of the research lines that shaped our area of investigation were first developed at the ILLC and that new ideas continue to lead the way. In this context we mention ILLC's leading strength in modal logics, our contributions to complexity theory, our pioneering work in dynamic semantics and our trendsetting line in probabilistic parsing. While building on this legacy of earlier pioneering work, ILLC creates the space where new ideas can constantly be tested and worked out in each of its programmes. ILLC members are encouraged to excel, which is witnessed by their publications, lectures and success in grant applications. We have hired new highly talented researchers in this evaluation period, many of whom already attracted new master students and PhD candidates to pursue new lines of research. Note that the ILLC runs a recognized and very ambitious graduate programme, working closely with master students to train them in cutting-edge research. By its open and encouraging atmosphere and by the intellectual support of an extensive international network of research collaborations, we believe we stand strong and are fully equipped to take on new scientific challenges and to pursue our academic mission.

6.2 Relevance to Society

ILLC appointed Peter van Ormondt for 0.4 FTE in 2016 as the institute's valorisation officer to help implement ILLC's valorisation and funding strategy. Where possible, ILLC members make their results accessible and available to a wider intellectual community as well as to society at large. Note however that not all ILLC research lines can be expected to deliver direct, short-term applications or products for societal use. Results in areas such as philosophy of language, mathematical and philosophical logic, theoretical computer science and linguistics can take long before spawning effects in society. Nevertheless, these effects may be profound as witnessed by the impact of work of logicians such as Church, Post and Turing in our digital era, not to forget the impact of theoretical linguistics on the development of programming languages. Similarly, one can already see that research in quantum computing is sparkling a new revolutionary impact in our society. An immediate effect is that the increasing interest in quantum technologies by companies creates new opportunities for ILLC researchers in quantum information to start collaborating with commercial partners in terms of consulting and research. Furthermore, as reflected in Section 4.3 (referring to ILLC's products for societal use and the industrial-internships for ILLC's PhD candidates), the work in natural language processing and music cognition within the LaCo programme belongs to the type of research that is closer to bear a direct, measurable societal impact. In areas where the impact is less direct, we focus on a variety of outreach and dissemination activities which includes activities specifically designed to reach a larger population of highschool students. As such, both the LoLa and LoCo programmes are involved in establishing new logic teaching-modules for Dutch high schools. Not only is this an excellent way to broadcast tools for computational thinking and sound reasoning within society, it advances our teaching methods and requires us to make our results as accessible and transparent as possible. The continuously growing academic network of ILLC staff and our efforts in extending our contacts with Dutch high school teachers as well as with industrial partners, opens the door to new valorisation opportunities. By joining larger consortia, ILLC also contributes to and benefits from the consortia's results on knowledge utilisation.

6.3 Viability

ILLC is one of the world's major centres in the interdisciplinary research area of logic, language and computation. The institute keeps thriving scientifically, continuously innovating its research agenda without compromising its identity. Internationally, the ILLC is highly visible in most if not all of its research areas, and in some fields it is world leading. It has made new successful appointments in the recent years and keeps attracting talented young researchers at PhD and postdoc level. As a result of this, the institute's community of researchers and students displays a culturally diverse group of excellent researchers in all age categories. However, ILLC is also aware that its strategy to combat the current gender imbalance is of crucial importance. ILLC displays an excellent track record when it comes to the acquisition of research funding. Given the institute's research profile, there are ample opportunities to continue this success, provided that the institute keeps an eye on the cohesion of its programmes, increasingly directs its

activities in line with national and international research agendas and also encourages its leading researchers to help redirect these (inter)national research agendas, stressing the importance of long-term fundamental research, whenever possible.

7 Future Strategy 2018–2023

7.1 ILLC's Overall Strategy

The ILLC is strongly motivated to pursue its scientific mission by creating an environment that enhances curiosity-driven research and can 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 core business of the ILLC is geared towards research-oriented teaching activities within ILLC's graduate programme. Furthermore, ILLC members will continue to take part in different outreach and knowledge dissemination activities, many of which also focus on the education and training of the younger generation (from high-school level onwards). In areas where it is possible (such as natural language processing in AI, Digital Humanities, Quantum Computing and in some parts of Logic), the institute will increase its efforts towards valorisation of its results, without infringing on research areas such as philosophy of language or mathematical logic, where applications are less close at hand.

7.2 Future Targets 2018–2023

ILLC Research: The pillars on which ILLC's research structure and scientific focus rests, is given by ILLC's three main programmes: LoLa, LoCo and LaCo. The general outline of each of these programmes, as described in Section 3, will remain a constant factor in the coming years while small variations in the programme's focus are expected to occur as science progresses and new researchers join/leave the institute. These programmes are not only our main scientific pillars of the ILLC, they also form the backbone of our organisational structure within the faculties FNWI and FGw. In addition to the three research programmes, ILLC also specifies a number of key themes which cross the different programmes and which can be subject to change in the light of new developments in science and science funding – both nationally, and internationally. One of those developments is the enormous growth in research on and use of artificial intelligence; although currently most attention goes to machine learning and big data, society increasingly also demands transparency, accountability and reliability, and the co-existence of very many AI systems necessitates thinking about cooperation, competition and communication between those systems. Another important development is given by the prospects that a future quantum internet may bring and the security methods that society requires in a post-quantum cryptography era. The ILLC is in an excellent position to make positive contributions to these developments, and can distinguish itself from other research groups, by focusing on the five themes below in which techniques used in the Humanities and in the Exact Sciences are brought together. These five themes give a new coherent focus to ILLC's current and on-going cross-programme collaborations and allow us to be prepared for immediate action when new calls for research funding appear in AI or in Quantum Computing.

1. *Explainable and Ethical AI:* Whereas machine learning methods excel in mimicking human behavior, logic and other model-based methods are much more amenable to normative use and to user intervention. The combination of logic, probabilistic methods for AI and machine learning, are expected to offer new insights that can help us build explanations for acts and decisions of artificial agents while taking into account their legal and ethical consequences. With its long and rich tradition in pure and applied logic and research on the relation between symbolic and subsymbolic frameworks, the ILLC is in a unique position to contribute to research that combines the tools used in the main paradigms (both in science and the humanities) that have shaped the field of AI till today;
2. *Interpretable Machine Learning for NLP:* ILLC's computational linguists have successfully participated in the paradigm shift towards deep learning methods that the field has gone through in recent years, while building up a strong, distinctive profile in *interpretable* machine learning methods in parsing, machine translation, semantics and dialogue modelling. Via collaborations with logicians, semanticists, and linguists, they are ideally placed to continue investigating the formal relations

between (classic and modern) modelling frameworks and to contribute significantly to make NLP more transparent, accountable and reliable;

3. *Cognitive Modelling:* Work that combines data-driven, learning methods and high-level symbolic descriptions, is also highly relevant for cognitive science and neuroscience. Strengthened by our expertise in designing computational tools and working out quantitative models to analyse different cognitive processes (from music cognition to the psychology of reasoning) as well as by our participation in the RPA 'Amsterdam Brain and Cognition', our participation in the Gravitation programme 'Language in Interaction' and themes (1) and (2) above, we will continue with increased intensity our research on *interpretable* models of higher-order cognition (reasoning, language, music).
4. *Logic, Games and Social agency:* In the study of information, both the concept, development and exchange of information are major topics. In this view, game theory and 'social' aspects of information naturally come into play and have been one of the unifying themes across the different ILLC programmes for many years. This theme now re-emerges with increased urgency in the light of the cooperative and competitive interactions between actors – whether computer systems or human users – in modern society. Our work on epistemics, rational behaviour in strategic games, the mechanisms for collective decision making in social choice theory, logics for social networks and game theoretic analyses of the evolution of stable communicative conventions, is directly relevant to current trends in AI, and to our collaborations with researchers in the social sciences, law and economics.
5. *Quantum Information and Computation:* The ILLC will continue to strengthen its research profile in quantum information theory via the participation in QuSoft (the Research Center for Quantum Software, launched by CWI, UvA and VU in 2015), the RPA 'Quantum Matter and Quantum Information' and the Gravitation project 'Quantum Software Consortium'.

ILLC Organisation:

- While having secured the transition of its leadership in the previous period, the ILLC now envisions a slower future growth in new permanent staff and will focus more attention on optimising its daily operations of facilitating staff members' research, teaching and valorisation activities.
- *Research Funding:* The ILLC will continue to implement the measures described in Section 3.4 to guarantee the institute's necessary funding acquisition. ILLC's focus on the five themes described above is expected to facilitate our efforts in starting or joining new research consortia (e.g. ERC Synergy, EU-ITN, etc).
- *ILLC Location:* By the end of 2021, the ILLC will move out of its temporary quarters to the new building, ASP942, that is currently being created to host the Information Sciences (ILLC and IvI) at Science Park. ASP942 has the ambition to become a hot spot for teaching, research and collaboration in the field of AI.
- *Enhance the synergy in ILLC's research programmes and setup new local collaborations:* Via cross-programme collaborations and activities, the ILLC will continue to increase the cohesion of the institute. In particular new synergy opportunities can appear at the cross-roads of ILLC's work in symbolic and sub-symbolic AI. Within the university, the ILLC plans to join the newly designed research priority areas in AI and more collaborations will be facilitated by our future move to ASP942. Together with the Faculty of Law, the ILLC has already started a new initiative for digital legal studies.
- *Implement ILLC's gender diversity targets:* as described in Section 10.
- *Publications and Open Access:* At both national and international levels, we witness the rise of new guidelines and requirements postulated by funding agencies to make publications available in Open Access format. In line with these developments, it is ILLC's strong ambition to substantially increase its open access output and to keep encouraging the green road to open access publishing. While taking into account the diversity of publication cultures and types (see Fig 2 and Table 17 in Appendix 12.5), the ILLC will increasingly stress the importance of always selecting the best possible publication outlets, following the international standard of each relevant sub-discipline. We expect these measures to result in a continued increase of the scientific impact of our research output within ILLC's research area and in a reduction of the number of non-cited publications.

ILLC Valorisation: In order to reinforce ILLC's research that is relevant for society, the institute will contact nearby partner institutes (e.g. CWI, IvI) to launch a 'Science meets Industry Day' in 2018–2019 to strengthen contacts with existing partners while also looking for new collaborations with industry and non-profit organisations. By paying attention to valorisation in the ILLC training programmes (including ILLC's participation in the *Information Science MSc Thesis Fair*), we can highlight non-academic career paths and continue to stimulate non-academic internships. ILLC's future move to ASP942 is also expected to open both new collaboration opportunities with members of the informatics institute as well as new innovation-opportunities. Ideally, these efforts will attract additional research funding and industry-funded student scholarships. Finally, the ILLC encourages its staff members to participate in science-outreach activities and has organised several successful masterclasses for Dutch high school students which activated the plan to design new logic teaching-modules for Dutch high schools that can reach a wider community.

ILLC Teaching: The ILLC will continue to invest in its excellent PhD Programme and to maintain the current status of excellence of the MSc Logic Programme. While the ILLC continues to contribute to a wide range of other educational tracks at UvA, it will join new educational initiatives that can strengthen its educational programme (an example is given by the recently installed BSc in Cognition, Language and Communication within the Faculty of Humanities). In 2018, the ILLC instigated a new minor in Logic and Computation for Bachelor students at UvA. If this new minor is successful, it can lead to the installment of a future ILLC Bachelor in Logic and Computation.

ILLC National and International Collaborations: Nationally the ILLC seeks to increase its visibility and to strengthen its network by building on existing collaborations, a.o. via ILLC's participation in the National Gravitation programmes 'Language in Interaction' and 'Quantum Software Consortium'. Internationally, the ILLC will renew its 5-year official collaboration agreement with Tsinghua University in Beijing for the *Joint Research Center in Logic* and continues to create new ties with institutes worldwide. In particular, we plan to intensify contacts with the *Center for the Study of Language and Information (CSLI)* at Stanford University, as well as to participate in a new institutional agreement between UvA and the *University of Edinburgh* to enhance research on topics of mutual interest.

8 ILLC's PhD Programme

8.1 Context, Supervision and Objectives

The ILLC PhD programme is designed to support and guide PhD candidates in their track to become highly qualified researchers in the areas described by the institute's research mission. Because of its interdisciplinary nature, the ILLC hosts candidates employed at the Faculty of Science and the Faculty of Humanities, as well as candidates with external funding.

All PhD trajectories at the ILLC are centred around a research alignment between PhD candidates and their supervisors. Candidates are assigned supervisors, who provide research supervision through regular meetings and guidance on practical aspects such as career development. The ILLC PhD programme has two main objectives. The first objective is to enhance the research alignment between candidates and their supervisors, and help guide candidates towards the successful completion of their project. The second objective is to help candidates develop the skills required to successfully find employment after obtaining their PhD. To help reach these objectives, the PhD programme performs a number of tasks, of which we now give a brief overview.

PhD Training Programme. The PhD training programme consists of a scientific programme and a transferable skills programme. The scientific programme includes: (1) advanced courses of the Master of Logic, many of which are taught at PhD level; (2) several seminar series and colloquia hosted by the ILLC and complemented by similar events at neighbouring institutions; (3) specialized disciplinary courses at various national Dutch research schools and relevant international summer schools (see Subsection 8.2 for details). The training skills programme consists of 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.

Quality and Quality control. The ILLC ensures the quality of its PhD programme in a number of ways. First, an assessment interview and annual evaluations are held. Second, the PhD training programme and the education and work environment of the PhD candidates are evaluated on an annual basis by the PhD Programme eValuation Committee (Dutch abbreviation 'PVC'). Third, the directors of the institute and of the PhD Programme hold regular meetings with ILLC's PhD council to discuss issues regarding the PhD programme and the welfare of PhD candidates.

8.2 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 UvA. New ILLC PhD candidates attend the introductory meetings organised by these Graduate Schools. The Graduate School of Humanities organises several additional skill courses, which are optional for ILLC PhD candidates. Similarly, the Graduate School of Sciences organises teaching skills training for ILLC PhD candidates.

ILLC PhD candidates are actively encouraged to participate in relevant international summer schools. Of special relevance is the summer school series organised by The Association for Logic, Language and Information (FoLLI). At the national level, ILLC PhD candidates can attend specialized disciplinary courses at various Dutch research schools, including LOT, SIKS, OZSW and ASCI.

8.3 Selection and Admission Procedures

All open positions funded via the ILLC are advertised on ILLC's web pages. A committee consisting of at least three qualified researchers (including one PhD candidate and one female) advises the institute director on the selection of the best candidate. Candidates with their own funding may apply for admission to the ILLC PhD programme by completing an online application form. The application forms are first evaluated by the director of the programme and if positive it can lead to a Skype interview with an ILLC staff member and/or the director of the PhD Programme, after which a final decision on admission is made.

8.4 Career Guidance

The PhD Programme offers 3rd year candidates a career development course which provides guidance on career tracks and writing of postdoctoral grant proposal. Candidates are encouraged to attend the 'Life after ILLC' event at which ILLC alumni speak about their current occupation and their job search experience. Recently we have initiated a series of Career Lunches where PhD candidates learn about career options by direct interaction with alumni working in various fields.

8.5 Placement

Table 23 in the Appendix gives an overview of the current occupation of the 41 ILLC graduates who defended their thesis during the evaluation period: 26 graduates are employed in academia, 12 in industry (ICT), 2 in non-profit organisations and 1 in a governmental organisation.
Table 24 in the Appendix indicates the places within academia where 22 PhD graduates are currently employed. The most common routes for finding a job have been to exploit personal network contacts (built up during their time at the ILLC) and applying for publicly advertised positions.

8.6 Duration and Success Rate

Information on the PhD duration and success rate is given in Appendix Table 20.

9 Research Integrity

The range of ethical and privacy issues that researchers and students can encounter in academia is very wide, it includes all types of fraud, misrepresentation, privacy-breaches, the stealing of ideas, plagiarism etc. ILLC's online code of conduct lists a number of *do's and don'ts* that should be ingrained in the work ethics, and hence the day to day practices, of everyone who is engaged in research in some way or other (as an active researcher, as a student, as a supervisor, or as an administrator). Ensuring the integrity of our research is also part of the research data management initiative launched by UvA in 2017. UvA's data stewards

are appointed to handle the requests for storage space, manage items and questions of researchers on data storage and take care of curation workflow. In addition UvA's research data management website provides its researchers with all information about required data management in line with the Netherlands Code of Conduct for Scientific Practice or the Code of Conduct Applied Research for Higher Professional Education, it provides access to storage-facilities and offers information on how to design of a data management plan. To train the new generation in issues of integrity, the ILLC PhD programme organises a Research Integrity Training for its PhD candidates with the aim of encouraging them to reflect on a number of dilemmas and problems that are directly related to their research situation. This training is based on the so-called 'Dilemma Game', designed by Erasmus University Rotterdam in which different dilemmas are discussed and participants are asked to debate the best course of action and to reflect upon the possible consequences.

10 Diversity

ILLC hosts a culturally diverse community with on average 67% non-Dutch nationals coming from over 30 different countries. The percentage of cultural diversity among staff in higher academic positions increased from 4% in 2012 to 29% in 2017 (Appendix 26).

Diversity in gender remains a concern for the ILLC, especially within the Faculty of Science (see Appendix 27). The strong gender imbalance in science was widely discussed in 2016, after which the ILLC set forward a number of specific targets to combat the gender-imbalance within the institute. First, the ILLC decided to appoint at least one new female assistent professor on a tenure track in FNWI by 2020 (given that the expected number of new tenured positions is low). Therefore, we opened up a tenure-track position linked to a MacGillavry fellowship[5] to attract top female talent in Logic and Computation in 2017. With respect to hirings at PhD and postdoc level, our long-term goal is to have a gender ratio which reflects the gender balance of the student population at Master's level. Second, the ILLC specified a list of measures and reserved 50k€ for new initiatives such as increasing the visibility of female academics in research-based teaching activities, increasing the list of invited female speakers at seminars, raising awareness of gender bias and enhancing female empowerment via coaching and mentoring for junior female researchers (see Appendix Section 12.10.3).

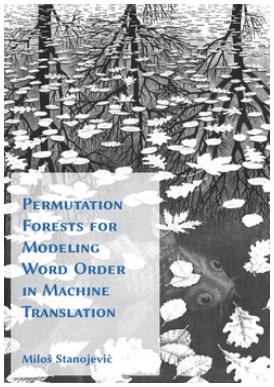
11 Relevant external developments

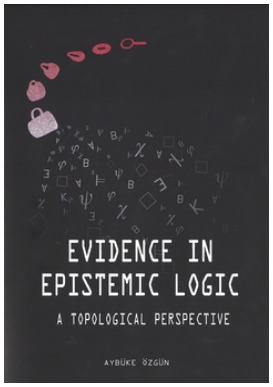
As described in ILLC's mid-term evaluation report, FGw introduced a new governance structure during this evaluation period and redesigned its research division, which in general had no major effect on the daily operations of the ILLC as an interfaculty institute. However in 2013–2014, FGw witnessed an increasing budget deficit, which affected the direct funding of PhD candidates in the Humanities and restricted all new hirings of FGw-staff.

In 2015, ILLC renewed its Convenant agreement between FGw and FNWI, which outlines the position of the ILLC as an interfaculty institute, and recorded the intention of the two deans to maintain the institute and the MSc Logic for another sexennial administrative cycle of the UvA.

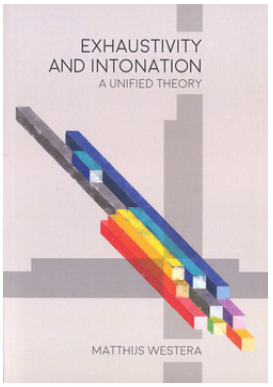
In April 2017, the Executive Boards of UvA and VU decided to discontinue the relocation plans which had been in preparation for some years and in which the aim was to plan joint accommodation for certain clusters in both universities' science faculties. After these plans were discontinued, room was created to focus on new initiatives such as the creation of a new hub for research and innovation in ASP942. ILLC signed up to participate in this new initiative as it will allow us to position our AI research more strongly, it can also open new collaborations with other information scientists at UvA and can connect our top researchers with new industrial partners.

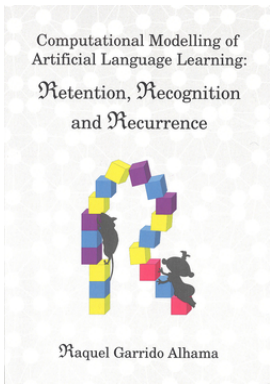
[5]The MacGillavry fellowship programme was installed in 2010 with the specific aim of doubling the percentage of women employed as permanent scientific staff members in FNWI from 8 percent to 16 percent (a first target which was reached in December 2016).

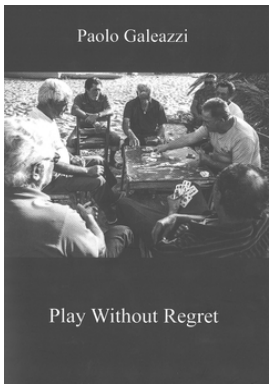

Permutation Forests for Modeling Word Order in Machine Translation
Miloš Stanojević


EVIDENCE IN EPISTEMIC LOGIC
A TOPOLOGICAL PERSPECTIVE
AYBÜKE ÖZGÜN

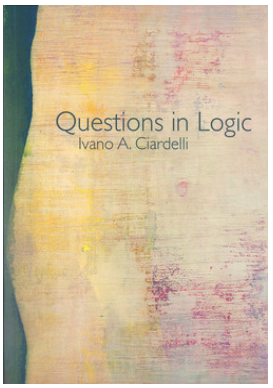

The Logic of Kant's Temporal Continuum
Riccardo Pinosio

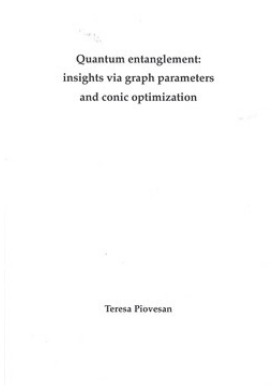

EXHAUSTIVITY AND INTONATION
A UNIFIED THEORY
MATTHIJS WESTERA

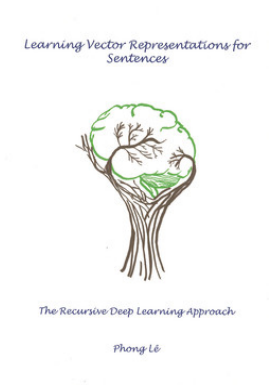

Computational Modelling of Artificial Language Learning:
Retention, Recognition and Recurrence
Raquel Garrido Alhama

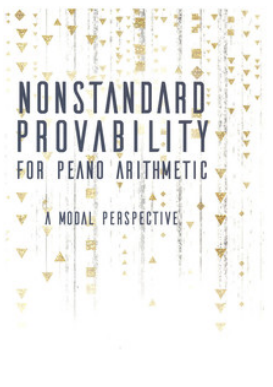

Paolo Galeazzi
Play Without Regret

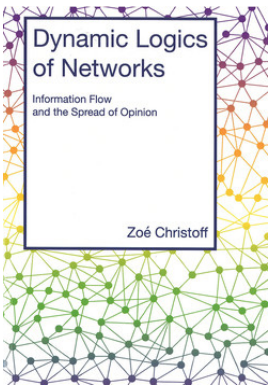

Latent Domain Models for Statistical Machine Translation
Hoang Cuong

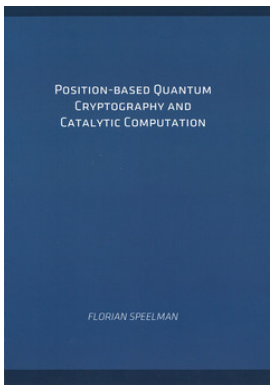

Questions in Logic
Ivano A. Ciardelli


Quantum entanglement: insights via graph parameters and conic optimization
Teresa Piovesan

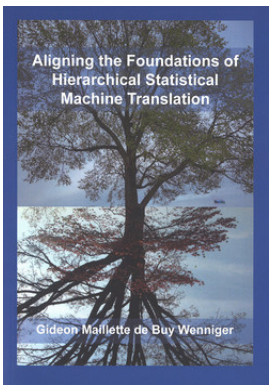

Learning Vector Representations for Sentences
The Recursive Deep Learning Approach
Phong Lê

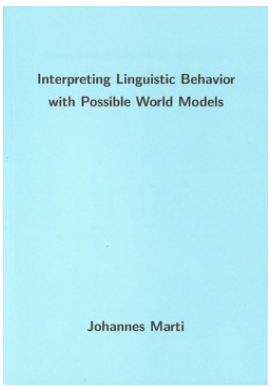

NONSTANDARD PROVABILITY FOR PEANO ARITHMETIC
A MODAL PERSPECTIVE

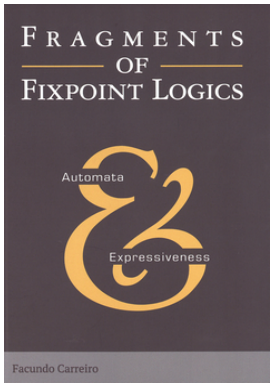

Dynamic Logics of Networks
Information Flow and the Spread of Opinion
Zoé Christoff

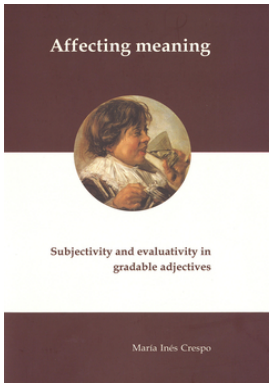

Position-based Quantum Cryptography and Catalytic Computation
FLORIAN SPEELMAN

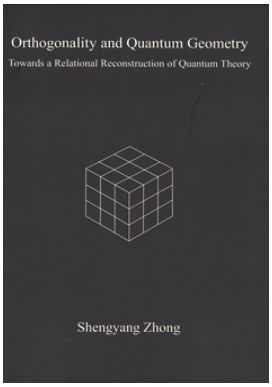

WHAT DO WE NEED TO HEAR A BEAT?
The influence of attention, musical abilities, and accents on the perception of metrical rhythm
FLEUR L. BOUWER-ODIJK

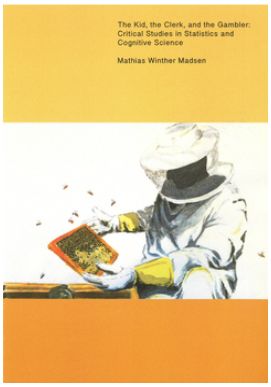

Aligning the Foundations of Hierarchical Statistical Machine Translation
Gideon Maillette de Buy Wenniger

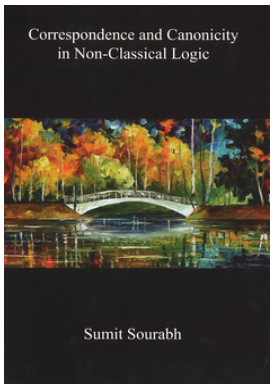

Interpreting Linguistic Behavior with Possible World Models
Johannes Marti

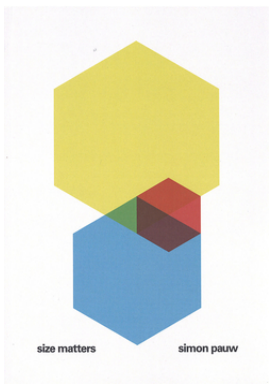

FRAGMENTS
OF
FIXPOINT LOGICS
Automata
&
Expressiveness
Facundo Carreiro

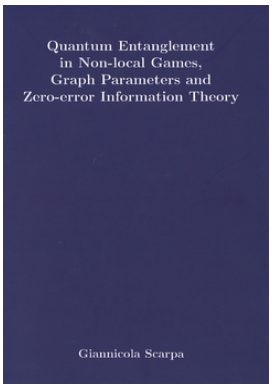

Affecting meaning
Subjectivity and evaluativity in gradable adjectives
María Inés Crespo

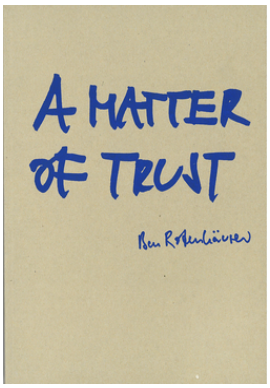

Orthogonality and Quantum Geometry
Towards a Relational Reconstruction of Quantum Theory
Shengyang Zhong

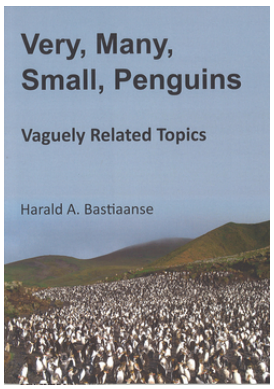

The Kid, the Clerk, and the Gambler:
Critical Studies in Statistics and Cognitive Science
Mathias Winther Madsen

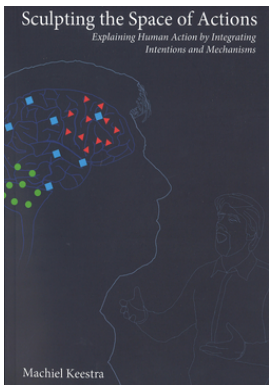

Correspondence and Canonicity
in Non-Classical Logic
Sumit Sourabh

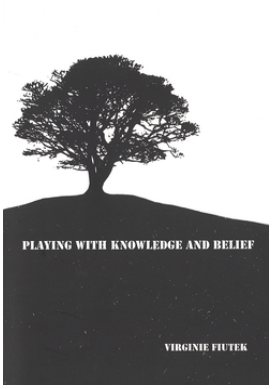

size matters
simon pauw

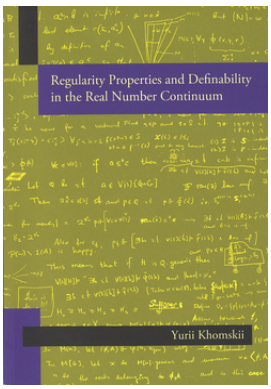

Quantum Entanglement
in Non-local Games,
Graph Parameters and
Zero-error Information Theory
Giannicola Scarpa

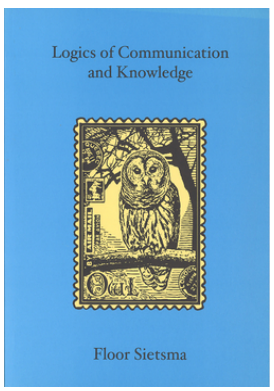

A MATTER OF TRUST

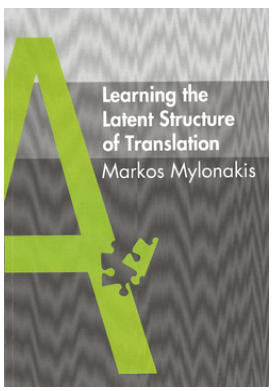

Very, Many,
Small, Penguins
Vaguely Related Topics
Harald A. Bastiaanse

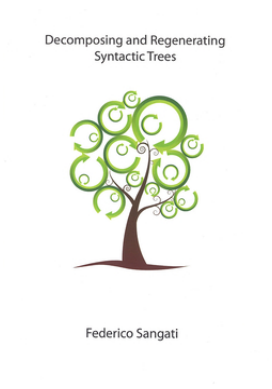

Sculpting the Space of Actions
Explaining Human Action by Integrating Intentions and Mechanisms
Machiel Keestra

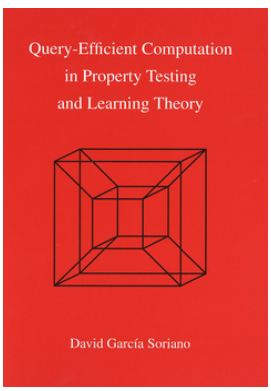

PLAYING WITH KNOWLEDGE AND BELIEF
VIRGINIE FIUTEK

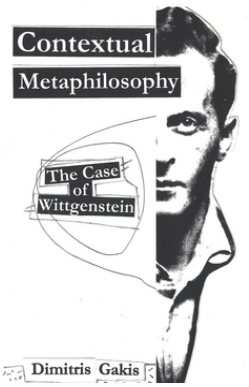

Regularity Properties and Definability
in the Real Number Continuum
Yurii Khomskii

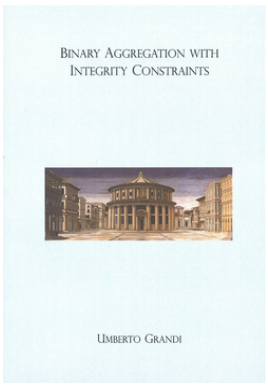

Logics of Communication
and Knowledge
Floor Sietsma

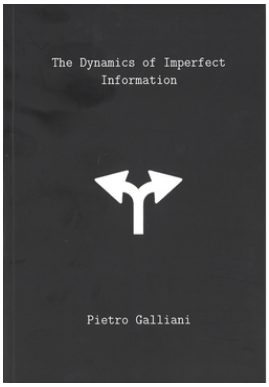

Learning the
Latent Structure
of Translation
Markos Mylonakis


Decomposing and Regenerating
Syntactic Trees
Federico Sangati

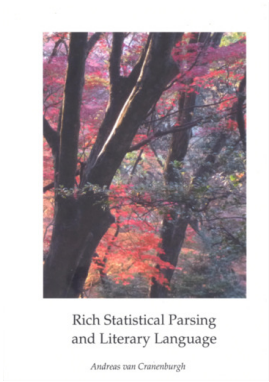

Query-Efficient Computation
in Property Testing
and Learning Theory
David García Soriano


Contextual
Metaphilosophy
The Case of Wittgenstein
Dimitris Gakis

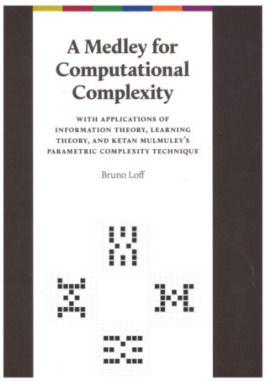

Binary Aggregation with Integrity Constraints
Umberto Grandi


The Dynamics of Imperfect Information
Pietro Galliani


Models of Language
Towards a practice-based account of information in natural language
Edgar J. Andrade-Lotero


Rich Statistical Parsing and Literary Language
Andreas van Cranenburgh


Categories for the working modal logician
Giovanni Cinà


A Medley for Computational Complexity
WITH APPLICATIONS OF INFORMATION THEORY, LEARNING THEORY, AND KETAN MULMULEY'S PARAMETRIC COMPLEXITY TECHNIQUE
Bruno Loff

12 Appendices

12.1 Composition of the ILLC: Organogram

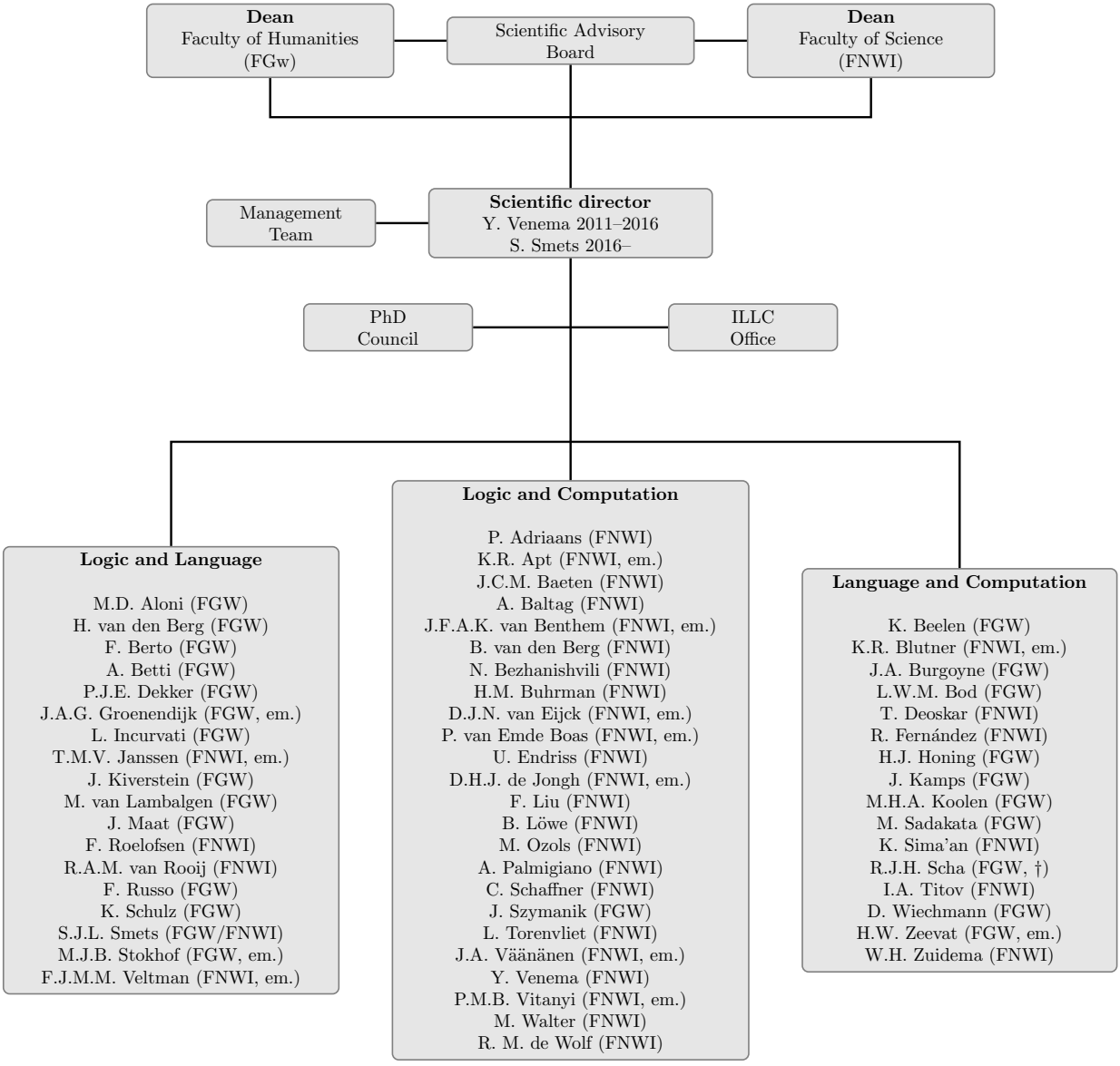


Figure 1: Organisation chart ILLC 2012–2017

12.2 Research Staff

12.2.1 Research Staff: Institute Level

Research staff at institute level		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Scientific staff	FGw	6.1	8.4	9.7	9.7	8.8	8.3
	FNWI	8.8	9.1	10.9	11.3	12.3	12.3
	ILLC	14.9	17.6	20.6	21.0	21.2	20.6
Postdocs	FGw	8.0	7.6	6.8	4.7	4.6	7.3
	FNWI	7.1	9.3	9.8	12.1	14.5	14.8
	ILLC	15.1	16.9	16.6	16.7	19.0	22.1
PhD Candidates	FGw	9.0	14.4	17.3	16.1	11.3	10.5
	FNWI	16.2	18.6	23.2	27.0	31.2	29.0
	ILLC	25.2	33.0	40.6	43.0	42.4	39.5
Technical support	FGw	0.0	0.2	0.9	0.5	0.5	2.1
	FNWI	0.0	0.0	0.1	0.4	0.0	0.0
	ILLC	0.0	0.2	0.9	0.9	0.5	2.1
Total research staff		55.2	67.7	78.6	81.7	83.1	84.2
Visiting fellows	FGw	0.3	0.3	1.0	3.3	0.6	0.5
	FNWI	5.4	3.7	2.5	3.1	5.5	6.9
	ILLC	5.7	3.9	3.5	6.4	6.1	7.4
Support staff	ILLC	3.3	3.9	4.5	4.5	5.1	5.8
Total staff		64.2	75.5	86.6	92.6	95.3	100.4

Table 2: Research staff overview

12.2.2 Research Staff: Per Programme

Programme		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Logic and Language	Scientific Staff	6.3	7.1	8.6	8.8	8.6	7.3
	Postdocs	6.6	5.4	4.4	3.1	4.9	8.9
	PhD candidates	12.8	14.4	13.5	12.8	12.1	13.3
	Technical Support	0.0	0.2	0.9	0.5	0.5	1.8
	Total LoLa	25.7	27.1	27.4	25.1	26.0	31.3
Logic and Computation	Scientific Staff	4.8	6.1	7.2	7.2	7.2	7.3
	Postdocs	3.7	4.7	4.4	4.5	3.9	3.1
	PhD candidates	7.3	8.1	11.1	12.0	11.4	12.7
	Total LoCo	15.7	18.8	22.8	23.6	22.5	23.2
Language and Computation	Scientific Staff	3.8	4.4	4.8	5.1	5.4	6.0
	Postdocs	4.9	6.8	7.7	9.2	10.3	10.0
	PhD candidates	5.2	10.5	16.0	18.3	19.0	13.5
	Technical Support	0.0	0.0	0.1	0.4	0.0	0.3
	Total LaCo	13.8	21.8	28.5	33.0	34.6	29.8
ILLC Total Research		55.2	67.7	78.6	81.7	83.1	84.2

Table 3: Research staff per programme

12.2.3 Main Changes in the Composition of the Programmes 2012–2017

Composition of LoLa. In 2012, LoLa was still strongly represented by ILLC founders, but during subsequent years the group witnessed a significant change of personnel and leadership. Theo Janssen retired in 2013, and Jeroen Groenendijk and Frank Veltman in 2014. Martin Stokhof keeps a position as emeritus professor as of 2016. The chairs of Philosophy of Language (held by Groenendijk and Stokhof at the FGW) and Logic and Cognition (held by Veltman, at the FNWI) were taken over in 2013 by Arianna Betti and Robert van Rooij, respectively. These new chairs, together with the appointments of Floris Roelofsen first as UD in 2014 and later as UHD (at the FNWI) and of Hein van den Berg as UD in 2016 (at FGw), assured continuation of the strong position of the LoLa group in the areas of philosophy of language and semantics and pragmatics. But during this evaluation period, the LoLa group also broadened its scope of research considerably. In 2012, Sonja Smets joined the group first as an Associate Professor (UHD) and later as full professor. She strengthened the group's profile in the area of formal epistemology and intensified the connection with the LoCo group by her work on dynamic epistemic logic and quantum logic. In 2014 the LoLa group was also extended by three new staff-members in different directions: Francesco Berto was appointed as full professor in metaphysics (at FGW). His research is in the areas of paraconsistent and hyperintensional logic. Luca Incurvati joined LoLa in 2014 (at FGW), as assistant professor (UD) in philosophical logic. Due to these two appointments, the LoLa research in philosophical logic has been strengthened considerably. Federica Russo was appointed as assistant professor (UD) in philosophy of science, specialised in causality. Finally, Jaap Maat was appointed as assistant professor in 2017 in history of the humanities and linguistic ideas.
15 PhD candidates graduated in the group between 2012 and 2017.
Composition of LoCo. There have been a number of important changes to the make-up of the LoCo programme since 2012: Johan van Benthem and Krzysztof Apt both retired in 2014[6], Alessandra Palmigiano left the ILLC in 2013 and 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) at FGw. The other three appointments all concern regular Assistant Professorships (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 previous 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 to the Amsterdam-China Logic Chair at the Faculty of Science, a new chair established by the Amsterdam University Fund Foundation. In January 2015, we 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. In 2015 Jouko Väänänen retired and in 2017 Jan van Eijck retired. In 2017 two new tenure track appointments were made in the area of quantum software for Maris Ozols and Michael Walter, holding joint appointments in the ILLC, the mathematics institute (KdVI) and the physics institute (IoP) at UvA.
15 PhD candidates graduated in the group between 2012 and 2017.
Composition of LaCo. There have been a number of significant changes of personnel in the Language and Computation programme in the period 2012–2017. Immediately after Rens Bod's professorial appointment in computational and digital humanities, in 2012 also Henkjan Honing's professorial position in music cognition became permanent and that year also Jaap Kamps was promoted to associated professor in FGw. Reinhard Blutner retired in 2013. In that same year, Ivan Titov was hired as full-time assistant professor on a structural position at the FNWI. Ivan Titov reduced his appointment to 0.2 FTE in 2017 to take up a senior lecturer position in Edinburgh. Titov significantly strengthened computational linguistics, especially

[6] Johan van Benthem remains professor at both Stanford University and Tsinghua University, and as such he maintains close ties with the ILLC.

in the field of learning semantics and deep learning. Also in 2013, Marijn Koolen (ditigal humanities) joined the LaCo group as an assistant professor on a temporary position at the FGw (until 2016) while Makiko Sadakata joined the LaCo group as part-time assistant professor in the FGw on a structural position in the field of music cognition. In 2017 Ashley Burgoyne was appointed as part-time assistant professor in the music cognition group. Furthermore, in 2014, Khalil Sima'an was promoted from associate to full professor in computational linguistics. Also in 2014, Daniel Wiechmann joined LaCo holding expertise in experience- or usage-based models of language. In August 2015, Jelle Zuidema's position as Assistant Professor became structural. In 2015, Henk Zeevat reduced his appointment to 10%, to take up a senior research position in Düsseldorf. In September 2015, emeritus professor Remko Scha, who had remained an active researcher in the group after retirement, passed away, which was a great loss for the programme. In 2016, Tejaswini Deoskar joined the programme on a temporary position as assistant professor in natural language processing. In 2017, Kaspar Beelen joined LaCo as assistant professor in digital humanities at FGw and Tom Lentz joined us on a 4-year temporary contract as assistant professor in the area of speech processing. Raquel Fernández, who was promoted to associate professor, moved in 2017 within the ILLC from the LoLa to the LaCo programme as her ongoing research has closer ties to LaCo.
11 PhD candidates graduated during 2012–2017.

12.3 Financing

12.3.1 Funding and Expenditure: Institute Level

	2012		**2013**		**2014**		**2015**		**2016**		**2017**	
Funding	***fte***	%	***fte***	%	***fte***	%	***fte***	%	***fte***	%	***fte***	%
Direct funding	23.7	39%	28.5	40%	30.5	37%	31.7	36%	29.7	33%	32.1	35%
Research grants	23.7	39%	27.9	39%	31.4	38%	30.9	35%	31.6	35%	31.3	34%
Contract Research	2.6	4%	5.5	8%	10.2	12%	12.2	14%	14.6	16%	13.0	14%
Other	10.9	18%	9.7	14%	10.0	12%	13.2	15%	13.4	15%	15.3	17%
Total	**60.9**		**71.6**		**82.1**		**88.1**		**89.2**		**91.6**	
Expenditure	**k€**	%	**k€**	%	**k€**	%	**k€**	%	**k€**	%	**k€**	%
Personnel costs	5,409	93%	5,938	91%	7,198	89%	7,481	92%	7,475	90%	7,780	93%
Other	397	7%	620	9%	915	11%	694	8%	862	10%	544	7%
Total	**5,806**		**6,558**		**8,113**		**8,175**		**8,337**		**8,324**	

Table 4: Funding ILLC

12.3.2 Funding and Expenditure: Per Faculty

		2012		2013		2014		2015		2016		2017	
Funding institute level		***fte***	**%**	***fte***	**%**	***fte***	**%**	***fte***	**%**	***fte***	**%**	***fte***	**%**
Direct Funding	FGw	12.9	54%	17.4	61%	18.3	60%	17.8	56%	14.1	48%	10.6	33%
	FNWI	10.8	46%	11.1	39%	12.3	40%	14.0	44%	15.6	52%	21.5	67%
	ILLC	**23.7**	**39%**	**28.5**	**40%**	**30.5**	**37%**	**31.7**	**36%**	**29.7**	**33%**	**32.1**	**35%**
Research grants	FGw	9.9	42%	11.8	42%	14.2	45%	11.3	36%	8.1	26%	10.3	33%
	FNWI	13.8	58%	16.1	58%	17.2	55%	19.6	64%	23.5	74%	21.0	67%
	ILLC	**23.7**	**39%**	**27.9**	**39%**	**31.4**	**38%**	**30.9**	**35%**	**31.6**	**35%**	**31.3**	**34%**
Contract research	FGw	0.0	0%	0.5	10%	1.1	11%	0.3	3%	1.2	8%	5.0	38%
	FNWI	2.6	100%	4.9	90%	9.2	89%	11.9	97%	13.4	92%	8.0	62%
	ILLC	**2.6**	**4%**	**5.5**	**8%**	**10.2**	**12%**	**12.2**	**14%**	**14.6**	**16%**	**13.0**	**14%**
Other	FGw	0.7	7%	1.2	12%	2.1	21%	4.8	36%	2.3	17%	2.9	19%
	FNWI	10.2	93%	8.5	88%	7.9	79%	8.4	64%	11.1	83%	12.5	81%
	ILLC	**10.9**	**18%**	**9.7**	**14%**	**10.0%**	**12%**	**13.2**	**15%**	**13.4**	**15%**	**15.3**	**17%**
Total	FGw	23.5	39%	30.9	43%	35.7	43%	34.2	39%	25.7	29%	28.7	31%
	FNWI	37.4	61%	40.7	57%	46.5	57%	53.9	61%	63.5	71%	63.5	69%
	ILLC	**60.9**		**71.6**		**82.4**		**88.1**		**89.2**		**91.6**	
Expenditure		k€	%	k€	%	k€	%	k€	%	k€	%	k€	%
Personnel costs	FGw	2,438	45%	2,752	46%	3,532	49%	3,054	41%	2,433	33%	2,855	37%
	FNWI	2,971	55%	3,186	54%	3,666	51%	4,427	59%	5,042	67%	4,925	63%
	ILLC	**5,409**		**5,938**		**7,198**		**7,481**		**7,475**		**7,780**	
Other	FGw	96	24%	89	14%	163	18%	103	15%	137	16%	104	19%
	FNWI	301	76%	531	86%	752	82%	591	85%	725	84%	440	81%
	ILLC	**397**		**620**		**915**		**694**		**862**		**544**	
Total	FGw	2,534	44%	2,841	43%	3,695	46%	3,157	39%	2,570	31%	2,959	36%
	FNWI	3,272	56%	3,717	57%	4,418	54%	5,018	61%	5,767	69%	5,365	64%
	ILLC	**5,806**		**6,558**		**8,113**		**8,175**		**8,337**		**8,324**	

Table 5: Sources of research funding per faculty

12.3.3 Funding: Per Programme

Programme	**Funding**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Logic and Language	Direct funding	10.2	10.8	9.3	9.7	7.8	8.0
	Research grants	11.6	10.9	11.0	7.2	8.1	10.4
	Contract research	2.6	4.5	6.0	6.3	7.7	9.1
	Other	3.4	2.2	2.3	6.5	5.1	6.2
	Total LoLa	**27.8**	**28.5**	**28.6**	**29.7**	**28.7**	**33.7**
Logic and Computation	Direct funding	6.0	7.6	11.7	13.5	13.3	14.1
	Research grants	5.9	6.0	4.7	3.7	4.1	3.7
	Contract research	0.0	0.4	1.0	1.6	1.4	1.6
	Other	7.1	7.1	6.4	6.4	6.6	8.3
	Total LoCo	**19.0**	**21.1**	**23.7**	**25.2**	**25.4**	**27.7**
Language and Computation	Direct funding	7.4	10.2	9.5	8.6	8.6	10.0
	Research grants	6.2	11.0	15.7	20.0	19.4	17.1
	Contract research	0.0	0.5	3.2	4.3	5.4	2.2
	Other	0.5	0.4	1.4	0.3	1.6	0.8
	Total LaCo	**14.1**	**22.0**	**29.8**	**33.2**	**35.0**	**30.2**
ILLC	Total ILLC	**60.9**	**71.6**	**82.1**	**88.1**	**89.2**	**91.6**

Table 6: Sources of research funding: programme level

12.3.4 Funding: Earning Capacity

	2012		2013		2014		2015		2016		2017		Total	
	k€	#	k€	#	k€	#	k€	#	k€	#	k€	#	k€	#
Grants awarded to individuals	2,089	6	1,821	4	588	5	6,626	8	6,049	10	3,617	8	20,791	41
Contract with industry	109	1			274	2	400	2			20	1	803	6
Non-personal academic grants	3,003	8	1,614	4	534	3	460	2	8,77	3	732	3	7,221	23
Total	5,201	15	3,435	8	1,396	10	7,486	12	6,926	13	4,369	12	28,814	70

Table 7: Earning Capacity: Grants ILLC

		2012		2013		2014		2015		2016		2017		Total	
		k€	#	k€	#	k€	#	k€	#	k€	#	k€	#	k€	#
FGw	Non-personal academic grants	996	3	874	3	260	2			726	5	262	5	3,112	10
	Grants awarded to individuals	934	3	96	2	90	1	178	1	4,909	1	3,510	1	9,717	17
	Total	1,930	6	970	5	350	3	178	1	5,635	6	3,773	6	12,836	27
FNWI	Contract with Industry	109	1			274	2	400	2			20	1	803	6
	Non-personal academic grants	2,007	5	740	1	274	1	460	2	151	2	470	2	4,102	13
	Grants awarded to individuals	1,155	3	1,725	2	498	4	6,448	7	1,140	5	107	3	11,073	24
	Total	3,271	9	2,465	3	1,046	7	7,308	11	1,291	7	597	6	15,978	43

Table 8: Earning capacity per faculty

12.3.5 Funding: Overview of awarded grants

Concerning awarded grants, what stands out is that during this evaluation period no fewer than 41 grants were awarded to individuals, of which 27 prestigious personal grants and scholarships such as: 7x EU Marie Curie, 4 ERC Starting, 1 ERC Consolidator, 4 VENI, 4 VIDI, 1 Aspasia, 2 VICI, 1 NWO Top-module1, 1 NWO TOP-module2, 1 SNF fellowship and 1 Schrödinger fellowship. The remaining 14 individual grants funded research projects with postdocs and PhD candidates (9) and visiting fellowships or workshops (5). The ILLC was also successful in participating in non-personal academic grants during this period (7.1M€, 23 grants), comprising participation in consortia such as NWO Language in Interaction, CLARIAH, Creative Industries' Golden Agents on a national level, as well as two EU MC International Training Networks ESSENCE and EXPERT, and H2020 QT21-project and the COST Action IC2015 on Computational Social Choice on an international level. The ILLC also scored higher in collaborating with industry during this period, with a total of 800k€, granted.

Logic and Language				
2012	FGw	Dilek Yamali	NWO Mozäiek	184,000
2013	FGw	Arianna Betti	ERC Proof of Concept	80,000
2013	FGw	Arianna Betti	KNAW Conference Grant	16,000
2013	FNWI	Nina Gieracimszuk	NWO VENI	246,000
2013	FNWI	Robert van Rooij	EU MC ITN ESSENCE	740,000
2014	FNWI	Robert van Rooij	NWO Free Competition	245,000
2015	FNWI	Floris Roelofsen	ERC Starting Grant	1,500,000
2015	FNWI	Raquel Fernández	NWO VIDI	800,000
2015	FNWI	Floris Roelofsen	NWO VIDI	800,000
2015	FNWI	Robert van Rooij	NWO Free Competition	250,000
2015	FGw	Tamara Dobler	EU MC IF	178,000
2016	FGw	Franz Berto	ERC Consolidator Grant	2,000,000
2016	FNWI	Jakub Dotlacil	NWO VENI	120,000
2016	FGw	Martin Lipman	NWO VENI	250,000
2016	FGw	Arianna Betti	NWO VICI	1,800,000
2016	FGw	Arianna Betti	NWO Large (Golden Agents)	726,000
2016	FNWI	Raquel Fernández	NWO Aspasia	100,000
2016	FNWI	Floris Roelofsen	KNAW Visiting Professor Programme	28,000
2016	FGw	Manuel Gustavo Isaac	SNF fellowship	100,000
2017	FGw	Margot Strohminger	EU MC fellow	170,000
2017	FGw	Thomas Schindler	EU MC fellow	170,000
2017	FGw	Carlo Proietti	EU MC fellow	170,000
2017	FNWI	Sonja Smets	KNAW Conference Grant	23,000
2017	FGw	Luca Incurvati	ERC Starting Grant	1,500,000
				12,196,000

Table 9: Overview grants awarded LoLa

Logic and Computation				
2012	FNWI	Luca Spada	EU MC IF	184,000
	FNWI	Paul van Ulsen	NWO Free Competition	201,000
	FNWI	Ulle Endriss	EU COST	719,000
	FNWI	Yde Venema	NWO Free Competition	211,000
	FGw	Jakub Szymanik	NWO VENI	250,000
2014	FNWI	Benedikt Löwe	ICSU	30,000
	FNWI	Alexandru Baltag	KNAW CEP	47,000
	FNWI	Roberto Ciuni	EU MC IF	176,000
2015	FNWI	Sam van Gool	EU MC Global	248,000
	FNWI	Jakub Szymanik	NCN Opus Grant	210,000
	FNWI	Christian Schaffner	NWO VIDI	800,000
2016	FNWI	Benno van den Berg	NWO TOP2	226,000
	FNWI	Ulle Endriss	NWO TOP1	666,000
	FNWI	Nick Bezhanishvili	EU Horizon	27,000
	FNWI	Ulle Endriss	EU COST	124,000
2017	FNWI	Benedikt Löwe	KNAW Conference Grant	17,000
	FGw	Jakub Szymanik	ERC Starting Grant	1,500,000
	FNWI	Ronald de Haan	Schrödinger Grant	67,100
				5,703,100

Table 10: Overview grants awarded LoCo

Language and Computation				
2012	FGW	Rens Bod	UvA Priority Area: Digital Humanities	398,000
	FGW	Henkjan Honing	UvA Priority Area: Brain & Cognition	398,000
	FNWI	Khalil Sima'an	STW	760,000
	FNWI	Khalil Sima'an	EU MC ITN	461,000
	FGW	Henkjan Honing	NWO Open Competition	500,000
	FGw	Rens Bod	NWO: Language in Interaction	200,000
	FNWI	Rens Bod and Johan van Benthem	NWO: Language in Interaction	416,000
	FNWI	Rens Bod and Johan van Benthem	NWO: Language in Interaction	210,000
	FNWI	Ivan Titov	Google	109,000
2013	FNWI	Khalil Sima'an	NWO VICI	1,479,000
	FGW	Aline Honingh	UvA	35,500
	FGW	Ashley Burgoyne	UvA	35,500
	FGW	Jaap Kamps	NWO: ExPoSe	803,000
2014	FNWI	Khalil Sima'an	EU H2020	274,000
	FGw	Ashley Burgoyne	ABC Talent Grant	90,000
	FGw	Marijn Koolen	NL eScence	50,000
	FGW	Rens Bod	AAA	210,000
	FNWI	Ivan Titov	Google	64,000
	FNWI	Ivan Titov	Yandex, 1 PhD (in kind)	210,000
2015	FNWI	Ivan Titov	Amazon, web-access grant	0
	FNWI	Ivan Titov	NWO VIDI	800,000
	FNWI	Ivan Titov	ERC Starting	1,500,000
	FNWI	Ivan Titov	SAP	400,000
2016	FGW	Rens Bod	NWO Open Competition	759,000
2017	FNWI	Jelle Zuidema	NWO: Language in Interaction	320,000
	FNWI	Jelle Zuidema	NWO: Language in Interaction	150,000
	FNWI	Raquel Fernández	Facebook	20,000 (USD)
	FGw	Jaap Kamps	NWO CREATE	262,500
				10,914,500

Table 11: Overview grants awarded LaCo

12.4 Output Indicators

12.4.1 Publications and Editorships

Institute for Logic, Language and Computation	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	$\sum$
Refereed journal articles	85	97	90	85	66	107	530
Books/monographs	4	4	6	5	4	2	25
Edited books	10	12	8	6	6	6	48
Book chapters	28	28	39	21	24	19	159
PhD theses	10	3	5	5	10	8	41
Conference papers	52	77	67	74	78	83	431
Publications aimed at general public	5	10	11	16	8	7	57
Editorships	66	68	67	67	70	77	415
Research Programme Logic and Language							
Refereed journal articles	26	21	30	23	19	34	153
Books/monographs	1	1	1	4	2	1	10
Edited books	5	3	3	1	1	2	15
Book chapters	12	11	18	8	13	12	74
PhD theses	2	2	4	2	1	4	15
Conference papers	18	21	12	14	22	25	112
Publications aimed at general public	0	1	1	2	1	1	6
Editorships	16	18	16	15	17	19	101
Research Programme Logic and Computation							
Refereed journal articles	36	44	38	37	31	59	245
Books/monographs	0	1	2	0	1	0	4
Edited books	4	6	5	3	4	1	23
Book chapters	10	7	16	9	9	3	54
PhD theses	5	1	1	3	3	1	14
Conference papers	17	28	19	29	21	26	140
Publications aimed at general public	3	4	8	10	1	4	30
Editorships	38	39	40	41	41	43	242
Research Programme Language and Computation							
Refereed journal articles	25	34	24	28	19	15	145
Books/monographs	3	2	3	1	1	1	11
Edited books	3	3	2	2	1	3	14
Book chapters	6	12	8	5	3	4	38
PhD theses	3	0	0	0	4	3	10
Conference papers	25	32	38	33	39	36	203
Publications aimed at general public	2	5	2	4	6	2	21
Editorships	12	11	11	11	12	15	72

Table 12: Main categories of research output[7]

12.4.2 Lectures and Outreach

Activity	2012	2013	2014	2015	2016	2017	$\sum$
Invited talks at seminars	27	25	27	34	33	30	176
Invited talks at conferences	53	50	55	75	71	74	378
Lectures aimed at the general public	16	16	11	13	22	23	101
Inaugural lectures	2	0	1	0	1	0	4
Media appearances	15	6	11	18	8	5	63
Lectures and courses at summer schools	12	10	12	8	11	9	62
Conferences/workshops organised by ILLC	4	8	7	12	8	12	51

Table 13: Lectures, media appearances, organisational activities

Author	Title	# citations	# citations 2010–2018
M. Li, P. Vitanyi	*An Introduction to Kolmogorov Complexity* and Its Applications, Springer-Verlag NY, 1993.	6024	2764
J Groenendijk, M Stokhof	*Dynamic predicate logic*, Linguistics and Philosophy, 14(1), 1991.	1896	628
K. Apt	*Principles of Constraint Programming*, Cambridge UP, 2003.	1069	634
A. Troelstra and D. van Dalen	*Constructivism in Mathematics*, Elsevier, 1988.	1490	540
J. van Benthem	*The Logic of Time*, Springer, 1983.	1047	250
F. Veltman	*Defaults in update semantics*, Journal of Philosophical Logic 25(3), 1996.	877	469

Table 14: Google Scholar Citations: Selection of earlier pioneering work

12.5 Bibliometric Analysis

This section provides the tables with bibliometric indicators per relevant analyzed unit, resulting from the bibliometric analysis, as conducted by the University of Amsterdam in 2018. The tables below, make use of the following parameters:

N	the number of peer reviewed publications retrieved from the Science Citation Index (SCI), the Social Science Citation Index (SSCI) and the Arts & Humanities Index (AHCI)
C	total number of citations to these publications
Wavg	the world average amount of citations for articles with the same age and research field
CPP	average number of citations per publication
RI	relative impact[8]
T10	absolute number of publications from this group in the world's top 10% most cited publications of the same age and from the same research area
T10perc	percentage publications from this group in the world's top 10% most cited publications of the same age and from the same research area (absolute number between brackets)
NC	absolute number of not cited publications
NCperc	percentage not cited publications

[7]Publications by authors from two or more programmes are only counted once on the institute level.

[8]The relative impact is the common measure that is used as a proxy for the impact of a publication. The number of citations provides a measure for the impact of the publication to which these citations refer. However, the number of citations to a publication varies considerably across different research fields. For this reason the impact of a publication is normalized by dividing the number of citations to a publication by the world average number of citations for the research field to which the publication belongs. The relative impact in Table 16 is measured within the respective global field belonging to one of the categories in Table 17). For a series of papers, the RI is calculated by taking the average. Note that the information about the average relative impact with respect to the restricted interdisciplinary area represented only by WoS-journals in logic, language and computation, could be relevant for the ILLC but cannot be derived on the basis of the provided analysis in this section.

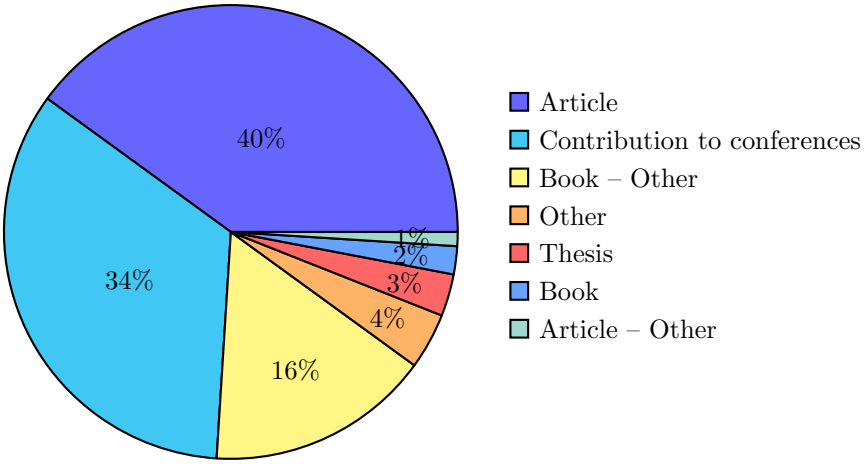


Figure 2: Simplified ILLC Publication types for the period 2012–2017 as found in Pure, UvA's research output database

Year	N	C	Wavg	CPP	RI	T10	T10perc	NC	NCperc
2012	45	478	375	8.3	1.18	8	18%	5	11%
2013	59	418	449	7.6	1.02	5	8%	9	15%
2014	54	319	327	6.0	0.85	4	7%	13	24%
2015	56	294	225	4.0	1.27	10	18%	14	25%
2016	40	98	85	2.1	1.31	6	15%	19	48%
2017	69	52	37	0.5	1.40	8	12%	41	59%

Table 16: Bibliometric indicators per year for ILLC's output in WoS over the period 2012–2017

Category	N	C	Wavg	CPP	RI	T10	T10perc	NC	NCperc
Biology & Biochemistry	3	60	28	9	2.49	1	33%	0	0%
Clinical medicine	11	116	83	8	1.13	1	9%	1	9%
Computer science	86	273	319	4	1.00	8	9%	39	45%
Economics & Business	1	8	7	7	1.12	0	0%	0	0%
Engineering	8	31	45	6	0.54	0	0%	4	50%
Mathematics	65	194	157	2	1.28	7	11%	24	37%
Molecular bio. & Genetics	1	6	23	23	0.26	0	0%	0	0%
Neuroscience & Behavior	14	217	158	11	1.44	5	36%	0	0%
Physics	14	97	107	8	0.85	2	14%	4	29%
Plant & Animal science	3	43	16	5	2.29	1	33%	0	0%
Psychiatry/Psychology	27	216	162	6	1.56	3	11%	4	15%
Social sciences, general	90	398	394	4	1.14	13	14%	25	28%

Table 17: Bibliometric indicators per research field for ILLC's output in WoS for the period 2012–2017

Quartile	N	C	Wavg	CPP	RI	T10	T10perc	NC	NCperc
Q1	104	768	578	7	1.43	18	17%	21	20%
Q2	76	386	345	5	1.43	12	16%	20	26%
Q3	58	160	269	3	0.71	3	5%	21	36%
Q4	33	157	116	5	1.05	3	9%	15	45%

Table 18: Bibliometric indicators per journal quartile for ILLC's output in WoS for the period 2012–2017

12.5.1 Citations in Google scholar

Number of citations	Names staff members
$> 10,000$	Johan van Benthem, Paul Vitanyi
$> 5,000$	Jos Baeten, Harry Buhrman, Jeroen Groenendijk, Jaap Kamps, Martin Stokhof, Anne Troelstra, Yde Venema, Ronald de Wolf
$> 3,000$	Alexandru Baltag, Rens Bod, Jan van Eijck, Ulle Endriss, Henkjan Honing, Robert van Rooij
$> 1,000$	Pieter Adriaans, Maria Aloni, Franz Berto, Peter van Emde Boas, Raquel Fernández, Theo Janssen, Michiel van Lambalgen, Fenrong Liu, Floris Roelofsen, Federica Russo, Christian Schaffner, Khalil Sima'an, Sonja Smets, Ivan Titov, Jouko Väänänen, Frank Veltman, Henk Zeevat, Jelle Zuidema

Table 19: Number of Google scholar citations of current ILLC staff members in November 2018

12.6 Success Rate of the PhD Programme

Start	**F**	**M**	**total**	**Graduated after**								**Not yet**		**Discontinued**	
				≤ 4 y		≤ 5 y		≤ 6 y		≤ 7 y					
2008	2	9	11	5	45%			2	64%			1	9 %	3	27%
2009		2	2	1	50%			1	100%				0%		
2010	2	5	7	3	43%			1	57%	1	71%	1	14%	1	14
2011	3	9	12	3	25%	3	50%	2	67%			1	8%	3	25%
2012	9	10	19	6	32%	3	47%	3	63%	1	68%	4	21%	2	11%
2013	1	9	10	4	40%	2	60%					4	40%		
2014	1	12	13	4	31%	4	62%					3	23%	2	15%
Total	18	56	**74**	26	35%	12	51%	9	64%	2	66%	14	19%	11	15%

Table 20: PhD Candidates 2008–2014

# PhD defenses/Programme	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Logic and Language	2	2	4	2	1	4
Logic and Computation	5	1	1	3	4	1
Language and Computation	3	0	0	0	5	3
	10	3	5	5	10	8

Table 21: PhD Defenses per programme

# PhD defenses/Faculty	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Faculty of Humanities (FGw)	4	0	2	2	4	2
Faculty of Science (FNWI)	6	3	3	3	6	6
	10	3	5	5	10	8

Table 22: PhD Defenses per faculty

Current occupation	#	%
Research	26	63
Industry	12	29
Non profit	2	5
Government	1	2

Table 23: Occupation of PhD alumni 2012–2017 at time of writing

Country	**Institution**
Belgium	KU Leuven
China	Peking University
Colombia	Universidad del Rosario
Denmark	University of Copenhagen
France	Global NYU
	Institut Jean Nicod
	Toulouse Capitole University
Germany	Munich Center for Mathematical Philosophy
	University of Bayreuth
	University of Bremen
	University of Hamburg
Ireland	Dublin City University
Italy	Free University of Bozen-Bolzano
	ISI Foundation
The Netherlands	Centrum Wiskunde & Informatica
	University of Amsterdam
	University of Groningen
Portugal	University of Porto
Spain	Basque Center on Cognition, Brain and Language
	Universidad Complutense de Madrid
	Universitat Pompeu Fabra
United Kingdom	University of Edinburgh

Table 24: Academic positions of PhD alumni 2012–2017 at time of writing

12.7 List of Five Most Important Scientific Publications in last 6 years

When selecting the items for the list below, we included some samples of scientific papers in journals and conferences which contain important new results, handbooks that are of high value for our community as well as work that reaches a wider scientific audience.

LoLa Programme:

- P. Cobreros, P. Égré, D. Ripley and **R. van Rooij**. Tolerant, Classical, Strict. Journal of Philosophical Logic, 41(2), 347–385, 2012.
- **I. Ciardelli**, **J. Groenendijk** and **F. Roelofsen**. Inquisitive semantics: a new notion of meaning. Language and Linguistics Compass, 7(9), 459–476, 2013.
- **A. Baltag**, **N. Gierasimczuk** and **S. Smets**. On the Solvability of Inductive Problems: A Study in Epistemic Topology. In R. Ramanujam, (ed.), Proceedings of the 15th Conference on Theoretical Aspects of Rationality and Knowledge , TARK 2015, Electronic Proceedings in Theoretical Computer Science, 215, 81–98, 2016.
- **M. Aloni** and **P. Dekker**, The Cambridge Handbook of Formal Semantics, Cambridge University Press, 2016.
- **F. Berto**. Impossible Worlds and the Logic of Imagination, Erkenntnis, 82(6), 1277–1297, 2017.

LoCo Programme:

- **J. van Benthem**. Logic in Games. The MiT Press, 2014.
- **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.
- C. Kupke, A. Kurz, and **Y. Venema**. Completeness for the Coalgebraic Cover Modality. Logical Methods in Computer Science 8(3), 2012.
- F. Brandt, V. Conitzer, **U. Endriss**, J. Lang, A.D. Procaccia (eds.), Handbook of Computational Social Choice, Cambridge University Press, 2016.
- **A. Baltag**, **N. Bezhanishvili**, **A. Özgün** and **S. Smets**, Justified Belief and the Topology of Evidence. Proceedings of the International Workshop on Logic, Language, Information, and Computation. Lecture Notes in Computer Science book series, volume 9803, pp 83–103, 2016.

LaCo Programme:

- **R. Bod**, A New History of the Humanities: The Search for Principles and Patterns from Antiquity to the Present. Oxford University Press, 2013.
- **P. Le** and **W. Zuidema**, The Inside-Outside Recursive Neural Network model for Dependency Parsing. Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP), 729–739, 2014.
- **H. Honing**, C. ten Cate, I. Peretz, S.E. Trehub, Without it no music: cognition, biology and evolution of musicality, Philosophical Transactions of the Royal Society B 370,20140088, 2015.
- **J. Bastings, I. Titov, W. Aziz, D. Marcheggiani** and **K. Sima'an**, Graph Convolutional Encoders for Syntax-aware Neural Machine Translation. Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP), 2017.
- **M. Dehghani**, H. Zamani, A. Severyn, **J. Kamps** and W.B. Croft. Neural ranking models with weak supervision. Proceedings of the 40th International ACM SIGIR Conference on Research and Development in Information Retrieval. ACM 65–74, 2017.

12.8 List of Five Most Important Societal Outputs in last 6 years

- The Hooked on Music game, co-developed by Henkjan Honing and Ashley Burgoyne in 2014 to investigate the catchiness of songs, has been used more than 3M times by more than 100.000 participants from 199 countries.
- GlamMap is a geo-spatial visualization tool that allows users to visualize geo-referenced metadata of cultural heritage artifacts on an interactive, two-dimensional geographic map. GlamMap was designed and further developed by the team of A. Betti and H. van den Berg in 2013–2014 in collaboration with researchers at TU Eindhoven.
- The first ILLC Master Class in Logic in 2017 for high-school students was a great success and gave rise to the organisation of the ILLC Master Class in Cognition in 2018. This series will be continued with a new Master Class in 2019.
- The symposium turing100.nl, co-organised by Benedikt Löwe, in the context of the Alan Turing Centenary in 2012, featured several keynote speakers and a public performance of the play 'Breaking the Code' about Alan Turing's life and work at the Public Library of Amsterdam.
- Henkjan Honing's participation in the miracles of music-project, is featuring several performances, meetings, a film and lecturers to raise awareness of the importance of music in education, development and health (while prepared in 2017, the premiere performance took place in January 2018).

12.9 Conclusions and Recommendations of the Previous Assessment and the Most Recent Mid-Term Assessment

12.9.1 Evaluation 2006–2011

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), the chair of the committee Prof. Ewan Klein (University of Edinburgh, UK) and 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 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."

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 11, the university board abandoned the plan to establish a new Amsterdam Faculty of Science and hence this issue is no longer of concern to the ILLC.

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 reviewed its internal structure during the last midterm evaluation and this did not give rise to any changes. With regard to the second point, the institute actively fosters internal cooperation along various themes. In particular, a group of researchers, from all three ILLC programmes, joins the 'cognition@illc' meetings to coordinate its efforts around topics that relate to cognitive science in relation to the Amsterdam Brain and Cognition initiatives. Similarly, the researchers involved in the Language in Interaction project have joint meetings and the same holds for the researchers involved in QuSoft. Recently the ILLC management also organised brainstorm sessions for its members of staff with the aim to point to specific topics that generate new synergy, which helped us articulate the themes in Section 7.2. 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 was installed at the Faculty of Science, and filled by promoting an excellent internal candidate, Khalil Sima'an.

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 appointments 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. Note that a new assistant professor in logic and computation (Bahareh Afshari) will join the LoCo programme in January 2019.

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 two UHD's (associate professors) with a full-time appointment, Leen Torenvliet and Christian Schaffner. We have three full professors with a part-time position working in theoretical computer science as well as 2 new assistant professors (tenure-track), Maris Ozols and Michael Walter, who are in part affiliated to the ILLC. 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. 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. The institute would like to respond explicitly to two of these.

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

   As of January 2012, Sonja Smets joined the ILLC first as UHD (associate professor) and later as full professor. 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 2014 on the Amsterdam-China Logic Chair at the University of Amsterdam's Faculty of Science. Makiko Sadakata was appointed as part-time assistant professor in 2013 and Federica Russo joined the ILLC in the department of philosophy in 2014. Finally, one new assistant professor, Katia Shutova joined the LaCo programme in 2018 and Bahareh Afshari will join the LoCo programme in January 2019. Regrettably however, the majority of junior staff that joined ILLC in this assessment period are male, with the consequence that we did not manage to increase the ratio of female staff members in the period 2012–2017. In light of these concerns, ILLC has specified specific gender targets (see Section 10) and has already taken specific actions (e.g. opening a MacGillavry position) to implement its strategy on diversity.

(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 Section 8 of this document.

12.9.2 Mid-Term Evaluation 2012–2014

In May 2015, the ILLC was visited by its Scientific Advisory Panel consisting of Prof. Angelika Kratzer, Prof. Mark Steedman (chair) and Prof. Wolfgang Thomas. The panel wrote down their findings in a short report. In the paragraphs below we summarize the main conclusions and recommendations:

The panel 'congratulates the institute on a very striking progression since the last midterm review and the subsequent external review'. In particular the panel stresses the 'admirable management' of the transition to a new situation after several senior retirements, the 'excellent recruitment at junior and senior levels' and the 'increasing success in obtaining external funding'. The report indicates that 'the new PhD program is of world class calibre', providing the PhD students with 'just the right amount of guidance, challenges, independence, and opportunities to shape their own education'. About ILLC's research programme, the report mentions that the institute 'has continued to grow in response to contemporary developments in Science and the Humanities, while maintaining the previous strengths'. The panel also highlights that 'this overall success of ILLC is seen in excellent publications, including several books, in high levels of research funding, [...], and in the PhD program, as well as the extensive outreach program.'

Recommendations:

- *We saw a lot of collaboration across the three programs sustained by the joint focus of formal methods. (This strong and rather unique spirit of collaboration and innovation within ILLC as a whole beyond the confines of the three programs could in fact have been emphasised more in the Self Evaluation.) This common ground was also warmly endorsed by the PhD students.*

  We hope the spirit of collaboration and innovation within ILLC as a whole is emphasised more in the present report, in particular ILLC listed five themes in our future strategy which will be the focal points for collaborations across the different programmes.

- *We were asked whether the original tripartite division of programs was hindering innovation and development, as suggested by the external reviewers. The current structure does not seem to us to be holding back innovation of itself. In spite of a diversity of topics, we see a rarely-found coherence in shared methods and views of their interaction. However, the groups could do more to articulating to themselves and the outside worlds what exactly their source of coherence is. It may be helpful to change the names to something more intelligible to the outside worlds, or to give some of the research themes like cognitive modeling the same status, to create more visible links between the ILLC and national and international initiatives.*

  We agree with the panel that the current structure does not hold back or hinder innovation and development. The groups have been working in the meantime on articulating their coherence, this is reflected in the description of each research programme which is available online at the ILLC website. Concerning the names of the research programmes (which are in line with a similar division adopted by the main ESSLLI international summer schools), the staff members did reflect about the names but in lack of a suitable alternative, we have kept the names operational till now. At the same time we note that this discussion will continue and hence it may well be possible that the names will change in the future.

- *Within the existing tripartite structure, we already noted the considerable strength of new appointments including senior appointments. We noticed however that while the Logic and Computation group appears to have large numbers of full professorial members, only one of these is full-time in ILLC. While the large number of 10% and 20% appointments in this group is a sign of intellectual breadth, we suggest that ensuring continuing leadership and direction this group should call for bringing it up to the strength of the other two groups in terms of full-time professorial members.*

  We agree that the LoCo programme is not up to full strength when comparing the number of full-time professors with the other research programmes. The institute has taken action in this matter and while three of the junior members who were hired during this evaluation period have been promoted to a higher academic position (UD1 or UHD) in 2018, a full professorship-track for one the LoCo members has been discussed.

- *The major threat that we see to the continued development and well being of this internationally renowned jewel in Amsterdam's crown lies in the instability of the institutional framework, which is interfering with the research and teaching mission, both in terms of the excessive amount of time spent on issues of administrative structure and regarding uncertainties in the long-term scientific perspective of ILLC. [. . .] We suggest that every support should be given to maintaining this world class Institute as a unity, preserving its current high productivity and intellectual integrity. This institute deserves a better solution than a forced marriage with one or other departmental partner.*

  Since April 2017, the stability of the institutional framework was secured after the merger between UvA and VU had been called off by the executive boards of both universities. While ILLC had indeed spent an excessive amount of time on issues of administrative structure and future perspectives in the last years, after April 2017 we found ourselves in a more stable situation. This decision to call off the merger has given us back the time and space needed to focus on optimizing our daily research and teaching operations. The institute currently appreciates the strong supported that it receives from both the Faculty of Science and the Faculty of Humanities in order to pursue its scientific mission.

12.10 Diversity

12.10.1 Cultural Diversity

Year	Non-Dutch fraction of staff (based on FTE)	Number of nationalities
2012	67%	30
2013	67%	31
2014	65%	33
2015	68%	34
2016	67%	36
2017	68%	35
Avg	67%	

Table 25: Non Dutch fraction of staff based on FTE, including PhD, postdoc, assistant, associate and full professors

x\y	All scientific staff	Professor	Assoc.prof (UHD)	Assis.prof (UD)	Postdoc	PhD
2012	67%	4%	62%	59%	74%	67%
2013	67%	8%	64%	62%	83%	68%
2014	65%	22%	67%	65%	72%	71%
2015	68%	25%	68%	67%	75%	71%
2016	67%	27%	68%	64%	76%	70%
2017	68%	29%	63%	62%	80%	68%

Table 26: Development of the percentage of non-Dutch scientists at ILLC

12.10.2 Gender Diversity

x\y	Professor		Assoc Prof		Assis Prof		Postdoc		PhD*	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2012	13	0	10	1	7	4	19	6	31	14
2013	14	1	10	1	10	5	17	4	31	12
2014	16	2	9	1	11	5	20	5	36	12
2015	14	2	10	1	11	5	19	6	33	14
2016	13	3	10	2	10	6	25	7	34	19
2017	12	3	10	1	15	5	26	8	30	15

Table 27: Gender diversity ILLC Staff (*PhD employed by the UvA/ILLC)

12.10.3 ILLC Gender Targets Plan 2016

Measures Taken in 2015–2016:
Gender Diversity among PhD Candidates: During the writing of our self-evaluation mid-term report, we realized that in 2013 and 2014 only 1 out of 23 new PhD candidates who joined the ILLC PhD Programme was female. Since then, the institute has paid special attention to gender diversity in its PhD hiring procedures and the balance is slowly being restored.

In June 2015, Dr. Raquel Fernández, at that time an assistant professor at the ILLC in the Faculty of Science was awarded an NWO Vidi grant for her project on Asymmetry in Conversation. Dr. Fernandez was promoted to associate professor in May 2016. Consequently, she was eligible for an additional NWO Aspasia grant of 100 k€. In accordance with the NWO regulations on the Aspasia programme, the subsidy was equally divided into two parts, and used, respectively, as an additional research budget of the Vidi-laureate, and as a start-up budget for a (gender) diversity programme of the institute.

Gender-Diversity Target as Specified in 2016: In order to increase the number of permanent female staff appointed at the ILLC and in particularly within FNWI, we set the goal to hire at least one new female assistant professor by 2020. Note that within the coming few years we expected to see only one (perhaps two) new vacancies for permanent staff at FNWI. As with respect to hirings for temporary staff (PhD and postdoc level), our long-term goal is to have a gender ratio which reflects the gender balance of the Master-student population.

To reach this target, ILLC proposed the following measures:

- Career perspective for female staff: Within the ILLC at FNWI, a career plan is to be designed for all permanent-employed female staff including feasible targets for career promotion. Within the Faculty of Humanities, the institute will raise the issue about the need for career opportunities and a better career perspective for female staff and discuss it with the department chairs.

- Professors by special appointments: The institute actively scouts female candidates who can be proposed for a special appointment via e.g. the Beta-plus programme.

- Gender bias: The management team of the institute contacts the chairs of selection committees and draws their attention to issues concerning gender bias at the start of application procedures.

- Scouting of female candidates: The ILLC staff and the ILLC management team put together a list of potential female candidates and actively encourages them to apply when a new vacancy is posted for a permanent position.

- Female representation in selection committees: The ILLC requires at least one female member to take part in every selection committee.

- Shortlist of female candidates: The institute states that in standard job selection processes (from PhD-level onwards) it is reasonable to expect that at least one female candidate is among the shortlisted candidates and is invited to an interview.

- Implement a Gender Diversity Programme: The main objective of this programme is to increase the visibility of female academics and to raise the awareness of gender issues in the ILLC community, with specific measures targeted towards female members. In the framework of the Aspasia grant of Dr. Fernández (2016), a budget of 50K has been assigned to implement the following list of measures:

1. female visibility in research-based teaching: The ILLC takes responsibility for an interdisciplinary (and also interfaculty) research-directed MSc programme, the Master of Logic. The female/male ratio among teaching staff in this programme is significantly lower than that among students. To increase the visibility of female researchers in the programme, and to expose the student community to female role models, we plan to invite internationally leading female researchers to engage in so-called 'coordinated' research projects with students.

2. female speakers: The ILLC hosts a wealth of seminars and colloquia. The experience shows that female researchers are ill-represented as speakers. In order to encourage our seminar organisers to invite more female speakers we have opened a special fund to cover travel and accommodation costs.

3. awareness raising: The institute will invite members to staff to attend special workshops designed to increase the awareness of gender bias.

4. female empowerment: The institute will organise training sessions and facilitate coaching and mentoring for junior female researchers (PhD candidates and postdocs) in our institute, with the general aim of strengthening their personal position and the concrete aim of furthering their career perspective.

While several of these measures are currently being implemented, the ILLC management team will evaluate the progress we made in 2019, with the intention to keep the necessary measures in place also after the expiration of the Aspasia funding.

12.10.4 Diversity Action Plan of the University of Amsterdam

In 2016, UvA's Diversity Commission provided a list of concrete recommendations on issues concerning the improvement of diversity. Consequently the faculties designed a plan and appointed a diversity officer. Within the Faculty of Science, the efforts were concentrated on restoring the gender imbalance. Where women hold 20 percent professorships nationally and 19 percent UvA-wide, this figure was only 6 percent in 2017 at the faculty of science while in contrast it was 34 percent at the faculty of humanities. The strong gender imbalance in science was widely discussed in 2016, after which the ILLC specified its Gender-Diversity Targets which are part of the FNWI faculty's overall Diversity Action plan.

12.11 International Origin ILLC Guests and PhD Candidates

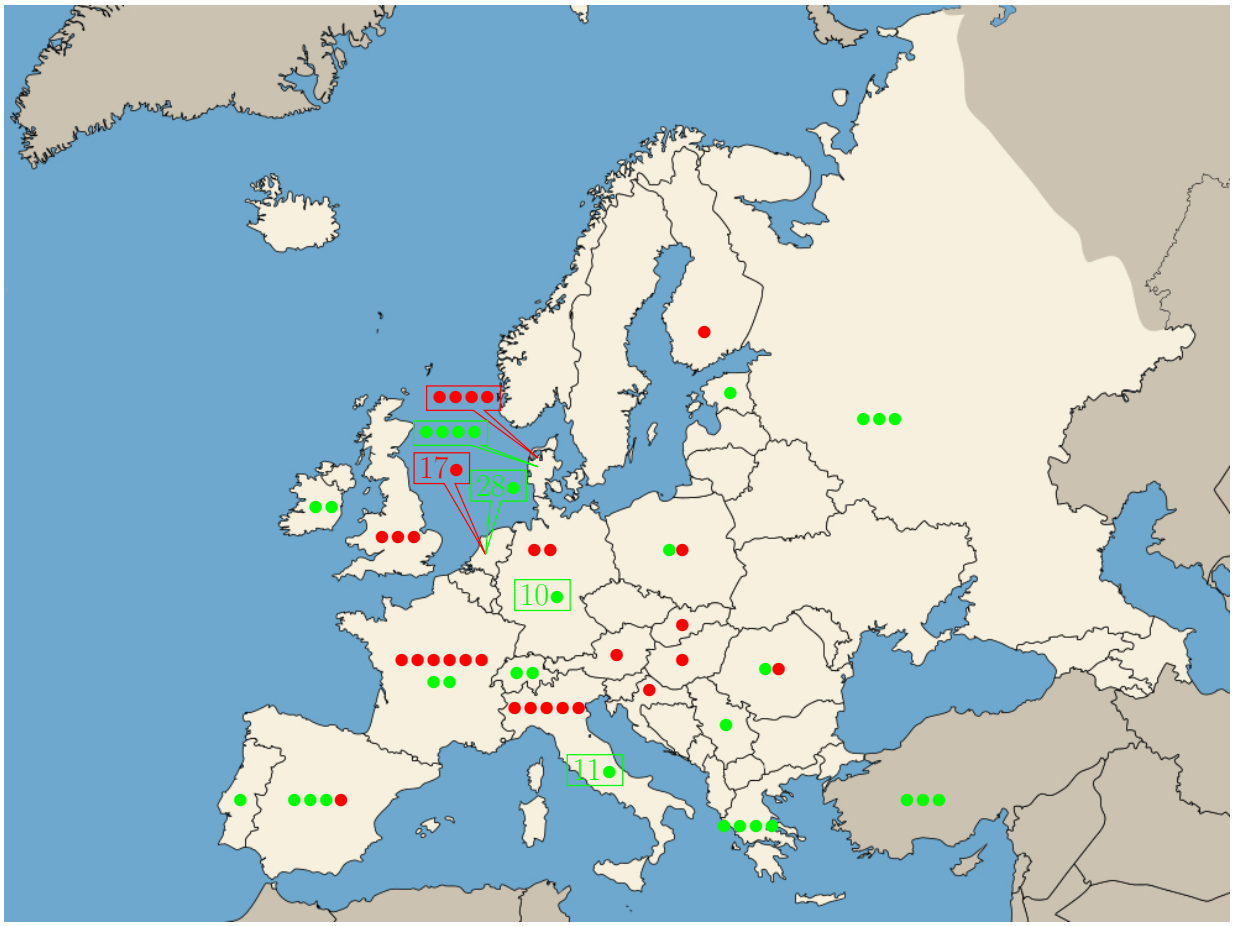


Figure 3: Guests and PhD candidates from Europe

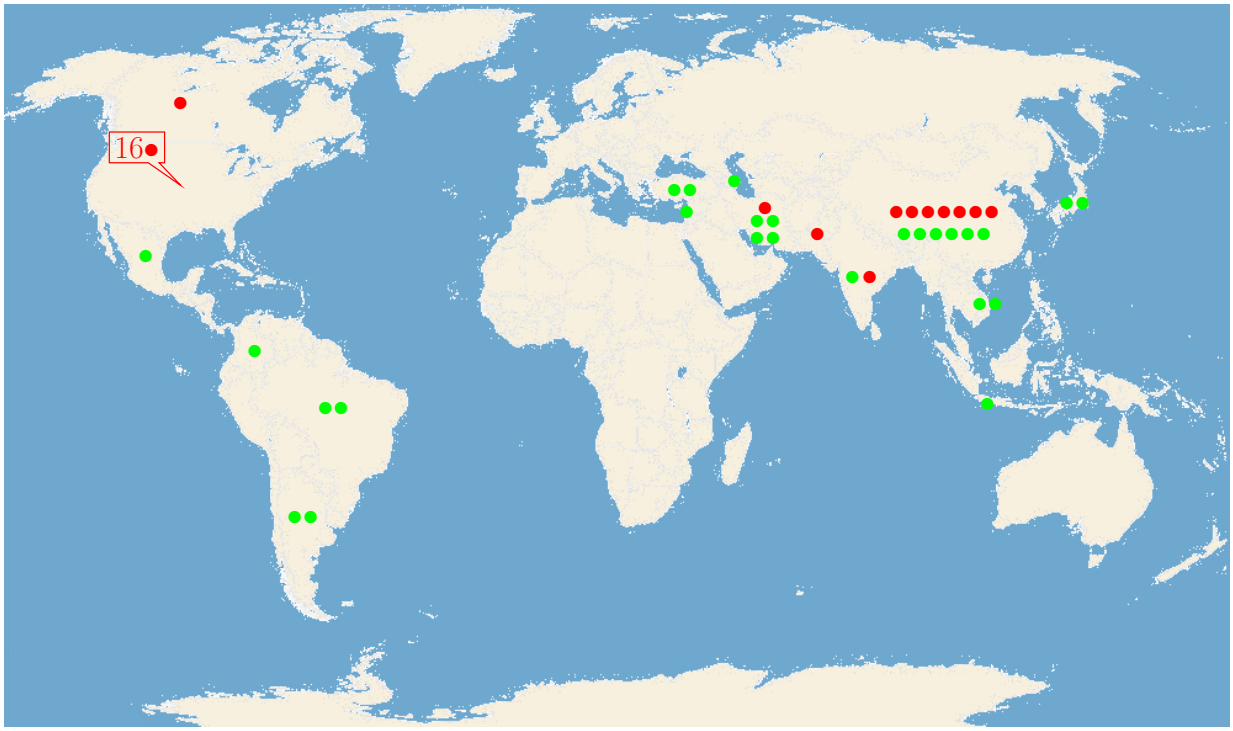


Figure 4: Guests and PhD candidates from outside Europe

12.12 Benchmark

ILLC's research profile can be compared to the Center for the Study of Language and Information at Stanford University (CSLI), the Munich Center for Mathematical Philosophy at the Ludwig Maximilians-Universität München (MCMP) and the Institute for Language, Cognition and Computation at the University of Edinburgh (ILCC). We highlight connecting research lines below:

- CSLI's interdisciplinary profile, covering the research of psychologists, linguists, philosophers and computer scientists who are involved in computational, logical and the stochastic modelling of functional processes, partly mirrors ILLC's profile in LoLa and LoCo. CSLI has also been a long-standing research partner with the ILLC, partly due to the fact that Johan van Benthem has held research positions there since 1992.

- Researchers at MCMP use mathematical methods in various areas of philosophy, and the various formal methods they use include logic and probability theory, which are essential research tools at the ILLC. Key areas that overlap in interest with the ILLC include epistemology, logic and philosophy of language, philosophy of science and philosophy of mathematics, as well as metaphysics. While MCMP is a relatively young institute, which was in full operation in May 2011, some students that were trained by them got research positions at the ILLC, and ILLC students and postdocs have received positions there. We are intensifying our collaboration with the MCMP, both in research and in education.

- The ILCC is a leading research institute dedicated to the pursuit of basic and applied research on computational approaches to language, communication and cognition. ILCC's research is interdisciplinary in nature, and there are strong connections to other departments in Edinburgh. Within the area of natural language processing, computational linguistics, semantics and pragmatics as well as in computational music we see overlapping interests with LaCo at the ILLC. The School of Informatics at the University of Edinburgh hosts leading researchers in the area of logic and computation, in both pure and applied logic (including in quantum information theory and quantum logic) which connects well to the research that is being pursued in LoCo. ILCC hosts researchers trained at the ILLC while former ILCC members have obtained research positions at ILLC.

13 Acronyms

AAA	Amsterdam Academic Alliance
ABC	Amsterdam Brain and Cognition (Research Priority Area)
ACLC	Amsterdam Center for Language and Communication
AIHR	Amsterdam Institute for Humanities Research
ASP	Amsterdam Science Park
AUC	Amsterdam University College
CSLI	Center for the Study of Language and Information at Standord University
CWI	Centrum voor Wiskunde en Informatica (Centre for Mathematics and Computer Science)
ERC	European Research Council
ESSLLI	European Summer Schools in Logic, Language and Information
FGw	Faculteit der Geesteswetenschappen (Faculty of Humanities)
FNWI	Faculteit der Natuurwetenschappen, Wiskunde en Informatica (Faculty of Science)
FoLLI	The Association for Logic, Language and Information
FTE	full time equivalent (1.0 fte = 38 work hours/week)
Gravitation project	A prestigious NWO funding programme for large consortia (Zwaartekracht project)
H2020	Horizon 2020 funding programme created by the EU/EC
ILCC	Institute for Language, Cognition and Computation University of Edinburgh
ILLC	Institute for Logic, Language and Computation
IoP	Institute of Physics of the UvA
ITN	Marie Skłodowska-Curie Innovative Training Networks
IvI	Institute of Informatics of the UvA
IXA	Innovation Exchange Amsterdam
JRC	Joint Research Center in Logic
KdVI	Korteweg-de Vries Institute for Mathematics of the UvA
KHMW	Koninklijke Hollandsche Maatschappij der Wetenschappen (Royal Holland Society of Sciences and Humanities)
KNAW	Koninklijke Nederlandse Academie van Wetenschappen (Royal Netherlands Academy of Arts and Sciences)
LaCo	Language and Computation Research Programme
LoCo	Logic and Computation Research Programme
LoLa	Logic and Language Research Programme
MCMP	Munich Center for Mathematical Philosophy (More Women Researchers as University Lecturers)
NLP	Natural Language Processing
NVAO	Nederlands-Vlaamse Accreditatie Organisatie (Dutch-Flemish Accreditation Organiszation)
NWO	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Netherlands Organisation for Scientific Research)
Pure	Database management system in which researchers register their research output
PVC	PhD Programme eValuation Committee
QMQI	Quantum Matter and Quantum Information (Research Priority Area)
Research FTE	part of FTE officially dedicated to research
RPA	Research Priority Area
SEP	Standard Evaluation Protocol
STW	Stichting voor de Technische Wetenschappen Technology Foundation
UD	Universitair Docent (Assistent Professor)
UHD	Universitair Hoofddocent

	(Associate Professor)
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
WoS	Web of Science