Institute for Language, Logic and Information

ANNUAL REPORT **1990**
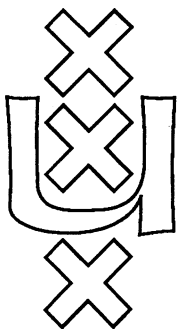
University of Amsterdam

The ITLI Prepublication Series

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Institute for Language, Logic and Information

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ANNUAL REPORT 1990

Contents

1   Institute for Language, Logic and Information

ITLI started in 1986 as an association of people from the permanent staff of the University of Amsterdam. In 1990 the following people took part:

Department of Mathematics and Computer Science (M&C)
- Johan van Benthem (chair of Mathematical Logic)
- Kees Doets
- Peter van Emde Boas (chair of Theoretical Computer Science)
- Theo Janssen
- Dick de Jongh
- Leen Torenvliet
- Anne Troelstra (chair of Foundations of Mathematics)
- Paul Vitányi (chair of Theoretical Computer Science)

Department of Philosophy (Ph)
- Renate Bartsch (chair of Philosophy of Language)
- Jeroen Groenendijk
- Martin Stokhof
- Frank Veltman
- Roel de Vrijer

Department of Computational Linguistics
- Remco Scha (chair of Computational Linguistics)
- Henk Zeevat

Centre for Mathematics and Computer Science
- Krzysztof Apt
- Jan van Eijck

In addition, about 15 research assistants are directly involved.

At present, ITLI has the following board:
- Renate Bartsch, Johan van Benthem, Peter van Emde Boas

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It is planned to make ITLI into an official research institute in the course of 1991, which will strengthen its computational component by incorporating the local programming research group, including professors Jan Bergstra and Paul Klint. This will lead to the introduction of further research lines and activities into current activities, which are still reported here in their former shape.

2   Research

2.1   General Areas

ITLI research takes place within the framework of the research program: *Logic, semantics and algorithmics*. This multidisciplinary research program is divided into four clusters:

- logic and foundations of mathematics
- logic and semantics
- computation and complexity
- theory of interpretation

Research in the first cluster elaborates on a long-standing Dutch tradition in constructive mathematics, especially intuitionism, but the platonistic and the formalistic approach to the foundations of mathematics are represented too: model theory/set theory and proof theory/lambda calculus (Troelstra, van Benthem, Doets, de Jongh).

Within the second cluster falls the research on topics that connect the study of formal, natural and programming languages. Main themes include intensional logic, categorial grammar, dynamic logic, epistemic semantics, compositionality and partiality (van Benthem, van Emde Boas, de Jongh, Janssen).

The third cluster comprises research in the areas of structural complexity theory, machine models, descriptive complexity, dynamic data structures, complexity aspects of logical systems and algorithmic aspects of databases (van Emde Boas, Vitányi, Torenvliet).

The final cluster centers around two themes: meaning and discourse, and philosophical foundations of a theory of interpretation. The purpose is to develop one comprehensive formal theory of interpretation, integrating a broadly conceived Montague grammar with competing developments like discourse representation theory and situation semantics. Key topics are the dynamics of interpretation, partiality of information and flexibility in syntax and semantics (Bartsch, Groenendijk, Stokhof, Veltman, de Vrijer, Swart).

Over the past decade, these research lines have often interacted, resulting in a collaboration of which ITLI 's foundation and the common research program is a natural outcome. For instance, there is joint work in progress on such topics as epistemic semantics and pragmatics, Montague grammar and type theory, dynamic reasoning and default logic, and semantics of programming languages. In this convergence, the research of the Amsterdam group is stimulated by various national and international contacts.

2.2 Specific Projects

This section gives a more detailed description of the above research lines as they are currently pursued.

Logic and foundations of mathematics   All standard fields of mathematical logic are represented. In foundational studies the constructive approach is dominant, witness several ongoing individual projects in the field of intuitionism and constructive mathematics generally. These are concerned with such topics as realizability and Martin-Löf type theories. Furthermore, there is a special interest in: (finite) model theory; model theory and proof theory for lambda calculus, type theory and linear logic; bounded arithmetic, provability and interpretability logic; applications of proof theory in the foundations of categorial grammar.

Logic and semantics   In this area, logical techniques are applied to modelling natural, formal and programming languages. Specific topics of current interest include: generalized quantifiers; connections between categorial grammar and lambda calculus; nonmonotonic reasoning, dynamic logic and relational algebra.

Almost every branch of intensional logic is being studied, both from a philosophical and a mathematical point of view. For instance, projects are under way in: enriched formalisms for modal logic, including epistemic logic; interval structures in tense logic; default reasoning in conditional logic.

One common tendency in all this research is to develop new modellings, both by employing partial models and by using dynamic interpretation rules.

Computation and complexity Theoretical computer science as currently practiced in Amsterdam has the following research lines: semantics of programming languages, including Montague semantics for 'intensional' phenomena, dynamic logic and minimal-model semantics of logic programming; mathematical complexitity theory, both theoretical and applied; theory of databases, including the development of query languages and knowledge representation; theoretical foundations of machine translation between natural languages.

Theory of interpretation This area is a mixture of descriptive and theoretical work: descriptive topics include quantifier phrases and determiners generally, modal and epistemic expressions, conditional sentences, comparatives and temporal expressions; in addition to indicative speech acts, questions and answers are being studied (both semantically and pragmatically); the scope of description is presently being widened from the sentence level to that of texts; another research line is the development of a general theory of 'semantic universals' in the spirit of linguistic universal grammar.

Special attention is given to Montague grammar and congenial syntactic theories such as categorial grammar and generalized phrase structure grammar. Specific topics are: syntactic power, especially in flexible versions with changing categories and shifting types; the mechanism of interpretation, especially questions of compositionality and semantic constraints on Montague grammar; application of Montague grammar in machine translation; extensions and refinements of the paradigm, e.g., the prospects of discourse representation, and the dynamic role of context; the integretation of lexical semantics into sentence and text semantics and pragmatics.

Finally, the historical and systematic foundations of philosophical and linguistic conceptions of meaning are being studied, with special attention for the cognitivism-debate.

2.3 Publications 1990

Benthem, J.F.A.K. van, R. Bartsch & P. van Emde Boas (eds.), *Semantics and contextual expression*, GRASS series vol. 11, Foris, Dordrecht

Benthem, J.F.A.K. van, "Categorial grammar and type theory", in: *Journal of Philosophical Logic* 19, pp. 115–168.

Benthem, J.F.A.K. van, "Kunstmatige intelligentie; een voortzetting van de filosofie met andere middelen", in: *Algemeen Nederlands Tijdschrift voor de Wijsbegeerte* 82, pp. 83–100

Benthem, J.F.A.K. van, "Computation versus play as paradigm for cognition", in: *Acta Philosophica Fennica* 49, pp. 236–251

Benthem, J.F.A.K. van, "What is extensionality?", in: J. Kelemen et al. (eds.): *Annales Universitatis Scientiarum Budapestinensis de R. Eötvös Nom.*, pp. 213–220

Benthem, J.F.A.K. van, "Review of Gabbay, Guenthner (eds.) *Handbook of Philosophical Logic vol IV*", in: *Language* 66, pp. 396–400

Berg, M. H. van den, "A dynamic predicate logic for plurals", in: M. Stokhof & L. Torenvliet (eds.): *Proceedings of the seventh Amsterdam Colloquium I*, ITLI, Amsterdam, pp. 29–52

Buhrman, H., M.H.M. Smid & E. Spaan, "Bounding the number of oracle queries for self-reducible sets", in: A.J. van Goor (ed.): *Proceedings CSN '90, Utrecht part 1*, SION, Amsterdam, pp. 79–94

Chierchia, G., "Anaphora and dynamic logic", DYANA report R2.2.A., Centre for Cognitive Science, University of Edinburgh, pp. 37-78

Dekker, P., "Dynamic interpretation, flexibility and monotonicity", in: M. Stokhof & L. Torenvliet (eds.): *Proceedings of the seventh Amsterdam Colloquium I*, ITLI, Amsterdam, pp. 95–118

Dekker, P., "The scope of negation in discourse", in: J. Groenendijk & D. Beaver (eds.): *Quantification and anaphora I*, DYANA report R2.2.A, Centre for Cognitive Science, University of Edinburgh, pp. 79–134

Denneheuvel, S. van, K.L. Kwast & G.R. Renardel, "A normal form for PCSJ-expressions", in: A.J. van Goor (ed.): *Proceedings CSN '90, Utrecht part 1*, SION, Amsterdam, pp. 109–120

Denneheuvel, S. van, K.L. Kwast & G.R. Renardel, "The rule language RL/1", in: A.M. Tjoa & R. Wagner (eds.): *Database and expert systems applications*, Springer Verlag, Wien, pp. 381–387

Denneheuvel, S. van, P. van Emde Boas, F. de Geus & E. Rotterdam, "RL/1, a language for constraint solving, logic programming and database processing", in: A.J. van Goor (ed.): *Proceedings CSN '90, Utrecht part 1*, SION, Amsterdam, pp. 121–134

Does, J. van der, "A generalized quantifier logic for naked infinitives", in: J. van Benthem (ed.): *Partial and Dynamic Semantics I*, DYANA report R2.1.A, Centre for Cognitive Science, University of Edinburgh, pp. 3–51

Does, J. van der, "Generalized quantifiers join naked infinitives", in: M. Stokhof & L. Torenvliet (eds.): *Proceedings of the seventh Amsterdam Colloquium I*, ITLI, Amsterdam, pp. 119–137

Eijck, J. van, "Quantifiers", CWI report CS-R9038. To appear in: *Encyclopaedia of Language and Linguistics*, Pergamon Press and Aberdeen University Press

Eijck, J. van, "Determiners", CWI report CS-R9039. To appear in: *Encyclopaedia of Language and Linguistics*, Pergamon Press and Aberdeen University Press

Eijck, J. van, "Formal semantics", CWI report CS-R9055. To appear in: *Encyclopaedia of Language and Linguistics*, Pergamon Press and Aberdeen University Press

Eijck, J. van, "Discourse representation theory", CWI report CS-R9067. To appear in: *Encyclopaedia of Language and Linguistics*, Pergamon Press and Aberdeen University Press

Emde Boas, P. van, "Machine models and simulations", in: J. van Leeuwen (ed.): *Handbook of Theoretical Computer Science vol. A: Algorithms and Complexity*, Elsevier Science Publishers, Amsterdam, pp. 1–66

Gavalda, G., L. Torenvliet, O.Watanabe & J.L. Balcazar, "Generalized Kolmogorov complexity in relativized separations", in: B. Rovan (ed.): *Proceedings mathematical foundations of computer science (MFCS '90)*, Springer Lecture Notes in Computer Science vol. 452, pp. 269–276

Groenendijk, J.A.G. & M.J.B. Stokhof, "Dynamic Montague grammar", in: L. Kálmán & L. Pólos (eds.): *Papers from the second symposium on logic and language*, Akadémiai Kiadó, Boedapest, pp. 3-48

Hendriks, H., "Flexible Montague grammar", in: H. Hendriks & M. Moortgat (eds.): *Theory of flexible interpretation: specification and grammar fragment*, DYANA report R1.2.A, Centre for Cognitive Science, University of Edinburgh, pp. 1–66

Hendriks, H. & M. Moortgat (eds.), *Theory of flexible interpretation: specification and grammar fragment*, DYANA report R1.2.A, Centre for Cognitive Science, University of Edinburgh

Janssen, T.M.V., "Models for discourse markers", in: M. Stokhof & L. Torenvliet (eds.): *Proceedings of the seventh Amsterdam Colloquium I*, ITLI, Amsterdam, pp. 213–226

Jongh, D.H.J. de & F. Veltman, "Provability logics for relative interpretability", in: P.P.Petkov (ed.): *Mathematical Logic*, Plenum Press, New York, pp. 31–42

Li, M. & P.M.B. Vitanyi, "Two applications of the universal distribution", in: *Proceedings AAAI spring symposium series: the theory and application of minimum length coding*

Li, M. & P.M.B. Vitanyi, "Kolmogorov complexity and its applications", in: J. van Leeuwen (ed.): *Handbook of Theoretical Computer Science*, Elsevier Science Publishers, Amsterdam, pp. 189–254

Li, M. & P.M.B.Vitanyi, "Applications of Kolmogorov complexity in the theory of computation", in: A.Selman (ed.): *Complexity theory retrospective*, Springer Verlag, pp. 147–203

Li, M. & P.M.B. Vitanyi, "Average case complexity under the Universal Distribution equals worst-case complexity", in: P.H. Styan (ed.): *Uppsala Abstracts of the second World congress of the Bernoulli Society for Mathematical Statistics and probability*, IMS/Bernoulli Society, pp. 194

Oosten, J. van, "Lifschitz' realizability", in: *Journal of Symbolic Logic* 55, pp. 805–821

Overmars, M.H., M.H.M. Smid, M.T. de Berg, M.J. van Kreveld, "Maintaining range trees in secondary memory, Part I: Partitions", in: *Acta Informatica* 27, pp. 423–452

Prüst, H. & R. Scha, "A discourse perspective on verb phrase anaphora", in: M. Stokhof & L. Torenvliet (eds.): *Proceedings of the seventh Amsterdam Colloquium II*, ITLI, Amsterdam, pp. 451–474

Prüst, H. & R. Scha, "A discourse approach to verb phrase anaphora", in: *Proceedings of the ECAI, Stockholm*, pp. 528–530

Prüst, H. & R. Scha, "VP-ellipsis induces clausal parallelism", in: AVVT (eds.): *LIN-bundel*, Foris, Dordrecht

Roorda, D., *Proofnets for Lambek calculus*, DYANA report R1.2.B, Centre for Cognitive Science, University of Edinburgh

Scha, R., "Taaltheorie en taaltechnologie; competence en performance", in: Q.A.M. de Kort & G.L.J. Leerdam (eds.): *Computertoepassingen in de Neerlandistiek*, LVVN jaarboek, pp. 7–24

Smid, M.H.M., M.H. Overmars, "Maintaining range trees in secondary memory, Part 2: Lower Bounds", in: *Acta informatica* 27, pp. 453–480

Smid, M.H.M., "A data structure for the union-find problem having good single-operation complexity", in: *Algorithm Review*, Newsletter of the ESPRIT II BRA program project 3075 (ALCOM), pp. 1–12

Spaan, E., "Nexttime is not necessary", in: R. Parikh (ed.): *Proceedings third conference theoretical aspects of reasoning about knowledge*, Morgan Kaufman, California, pp. 241–256

Stokhof, M. & L. Torenvliet (eds.), *Proceedings of the seventh Amsterdam Colloquium* (2 vols.), ITLI, Amsterdam

Troelstra, A.S., "Introductory note to 1958, 1972", in: S. Feferman et al. (ed.): *K. Gödel, Collected Works II*, Oxford University Press, New York, pp. 217–241

Troelstra, A.S., "On the early history of intuitionistic logic", in: Petkov (ed.): *Mathematical Logic*, Plenum Press, pp. 3–17

Veltman, F., E. Klein & M. Moens, "Default reasoning and dynamic interpretation of natural language", in: *Esprit '90. Proceedings of the annual ESPRIT conference, Brussels, November 12-15*, Kluwer Academic Publishers, Dordrecht, pp. 52-61

Veltman, F. & D. de Jongh, "Provability logics for relative interpretability", in: *Mathematical logic. Proceedings of the Heyting '88 summerschool*, Plenum Press, New York, pp. 31-43

Veltman, F., "Defaults in Update Semantics I", in: *Conditionals, Defaults and Belief Revision*, DYANA report R2.5.A., Centre for Cognitive Science, University of Edinburgh, pp. 28-64

Vrijer, R.C. de, "Unique normal forms for combinatory logic with parallel conditional, a case study in conditional rewriting", in: *Rapport Faculteit Wiskunde en Informatica*, IR-240, Vrije Universiteit, Amsterdam, 1990, 1-12

Yu Tai Ching, K. Mehlhorn & M.H.M. Smid, "Dynamic deferred data structuring", in: *Inf. Processing letters* 35, pp. 37–40

Zhisheng Huang "Epistemic logic and its problems (in chinese)", in: *Philosophical Research* 5, pp. 91–93

Zhisheng Huang, "Dependency of belief in distributed systems", in: Stokhof, Torenvliet (eds.): *Proceedings of the seventh Amsterdam Colloquium II*, ITLI, Amsterdam, pp. 637–661

2.4 Ph.D projects

The following Ph.D projects are executed under guidance of ITLI participants (computational Linguistics is abbreviated as CL, computer science as CS, mathematics as M, philosophy as Ph and the Netherlands Organization for the Advancement of Research as NWO).

- Pieter Adriaans (Software Intermediate/CS)
  Semantic driven parsing and modelling
- Martin van den Berg (CL)
  Dynamic logic and semantics of texts
- Harry Buhrman (CS)
  Developing tools in structural complexity theory
- Paul Dekker (NWO/Ph)
  Flexibility in syntax and semantics
- Sieger van Denneheuvel (CS)
  Constraint solving for databases
- Jaap van der Does (DYANA/Ph)
  Quantifiers, infinitives and intervals
- Willem Groeneveld (TLI/Ph)
  Logical investigations in dynamic semantics
- Herman Hendriks (DYANA/Ph)
  Flexible interpretation
- Marianne Kalsbeek (NWO/Ph-Utrecht)
  Interpretability and bounded arithmetic
- Karen Kwast (CS)
  Non-classical logic for database semantics
- Michiel Leezenberg (Ph)
  Formal semantics and pragmatics of metaphor
- Jeroen van Leeuwen (CL)
  Data oriented theory in first language acquisition
- Sjaak van Leeuwen (NWO/Ph)
  Individuals and sortal concepts
- Jaap Maat (NWO/Ph)
  Universalism and relativism in von Humboldt's philosophy of language
- Arthur Nieuwendijk (Ph)
  Philosophical foundations of logical theories
- Jaap van Oosten (M)
  Lifschitz-realizability and intuitionistic analysis
- Hub Prüst (CL)
  Pronoun resolution
- Maarten de Rijke (NWO/M&Ph)
  Enriched modal formalisms

- Dirk Roorda (DYANA/M)
  Proof theory of linear logic
- Ernest Rotterdam, Fred de Geus (RUG-Medes/CS)
  Anesthesia support system
- Harold Schellinx (M)
  Linear logic and type theory
- Edith Spaan (CS)
  Complexity theory
- Yde Venema (M)
  Tense logic and interval semantics
- Rineke Verbrugge (NWO/M)
  Interpretability and bounded arithmetic
- Henk Zeevat (CCS-Edinburgh/CL)
  Topics in dynamic semantics and unification grammar
- Huang Zhiseng (visitor Peoples Republic of China/CS)
  Non-classical logic for database semantics

Finally, there are some joint projects with other institutes, including:
- Yao-Hua Tan (NWO/Free University Amsterdam)
  Non-monotonic reasoning; its sources and logical structure
- Elias Thijsse (University of Tilburg)
  Knowledge representation and epistemic logic
- Michael Morreau (SNS, University of Tübingen)
  Non-monotonic reasoning
- Heinrich Wansing (Philosophical Institute, Free University Berlin)
  Categorial grammar and relevance logic

2.5 Dissertations 1990

The following Ph.D projects were completed in 1990:
- Wieb Bosma, Marc-Paul van der Hulst *Primality proving with cyclotomy*, UvA, promotores: prof. dr. H.W. Lenstra jr., dr. P. van Emde Boas, prof. dr. A.K. Lenstra
- Kees van Deemter *On the composition of meaning*, UvA, promotores: prof. dr. H. Bouma, prof. dr. J.F.A.K. van Benthem
- Sjaak de Mey *Determiner logic or the grammar of the NP*, RUG, promotores: prof. dr. J. Koster, prof. dr. J.F.A.K. van Benthem
- Victor Sanchez Valencia *Studies on natural logic and categorial grammar*, UvA, promotor: prof. dr. J.F.A.K. van Benthem

3 Teaching

3.1 Courses

The following list of courses gives an indication of the training which students at ITLI are supposed to acquire.

Philosophy
- philosophy of language, an introduction
- logic, language and meaning: historical and systematic
- recent developments in the semantics of natural language
- logic, an introduction
- metalogic
- philosophical logic, a survey
- intensional logic

Mathematics
- sets and models
- recursion theory
- lambda calculus and the theory of types
- intuitionism

Computer science
- formal languages and automata
- complexity theory
- semantics of programming
- logic and artificial intelligence

In addition, each year various advanced courses and colloquia are organized on selected topics. In 1990 these included:
- theory of automatic translation
- formal methods in AI
- partial logics
- intentionality
- formal arithmetic
- logical structures in natural language: quantifiers, modalities, general types
- linear logic

This ITLI curriculum lies in a wider environment of related courses in the Faculty of Humanities and the Department of Mathematics and Computer Science.

3.2 Post graduate training

ITLI participates in the national postgraduate Network for Logic, Language and Information TLI, which received a grant for the years 1989-1994 from the Dutch ministry of education. In this network the university of Amsterdam cooperates with the universities of Groningen, Utrecht, Nijmegen and Tilburg in the interdisciplinary field of mathematical logic, philosophical logic, linguistics, philosophy of language and computer science. The network coordinates postgraduate training in this field on a national scale, and finances nine four-year postgraduate scholarships ('AIO-plaatsen').

ITLI's partners in TLI are the following:

University of Groningen (RUG)
- Faculty of Humanities (Zwarts, Zonneveld, Vet, Molendijk, de Mey, de Vuyst, Hoeksema, Bouma)

University of Utrecht (RUU)
- Faculty of Humanities (Moortgat, Verkuyl)
- Department of Philosophy (Bergstra, van Dalen, Koymans, Renardel de Lavalette, Visser)
- Department of Mathematics (van Leeuwen, van Dalen, Moerdijk, Kok)

University of Nijmegen (KUN)
- Department of Philosophy (Seuren, van der Sandt)
- Department of Mathematics and Computer Science (Barendregt, Terlouw, Veldman)

University of Tilburg (KUB)
- Faculty of Humanities (Bunt, Thijsse, Kolb, Muskens)

TLI publishes a newsletter containing announcements, information about the activities of the network and other relevant information for participants in the network and for colleagues in the field at large.

3.3 European Summer School

ITLI has joined in an inter-universitary program of cooperation, the European doctoral network for the study of language, logic and information. This program was granted by the Commission of the European Communities within the framework of the Erasmus program. Universities from the following cities participate: Groningen, Leuven, Aarhus, Tübingen, Madrid, Toulouse, Dublin, Amsterdam, London and Edinburgh. The cooperation involves a mutual exchange program that enables students to continue and complete their studies at a host university.

ITLI was also involved in the organization of the second European Summer School in Language, Logic and Information, which was held in Leuven, July 30 to August 10, 1990. (The 1989 summer school was held at the university of Groningen.) The second summer school was organized by the universities of Groningen, Leuven, Tübingen, Toulouse, Amsterdam, Edinburgh and London (Imperial College), in collaboration with TLI.

The main focus of the summer school was the interface between linguistics, logic and computation, where this interface is the result of research into the logical, computational and cognitive foundations of natural language. In 1990 courses were divided into five areas:

- logic and mathematics
- semantics and philosophy of language
- linguistics
- computation
- language and cognition

They covered a variety of topics from fields of study such as theoretical and computational linguistics, logic and philosophy of language.

The school contained three closely related but distinct components. First, there was a fully integrated program of taught courses, at both introductory and advanced levels. Introductory courses were designed to familiarize students with new fields and did not presuppose any background knowledge, while advanced courses were designed to allow students, staff and researchers to acquire more specialized expertise in areas they were already familiar with. Second, there was a series of workshops which provided a forum for in-depth discussion of topics which are at the forefront of current research. And third, there were series of invited lectures by well-known experts in the field.

The summer school was visited by over six hundred people from all over Europe and from the United States and Canada. The third summer school will be held at the Universität des Saarlandes, Saarbrücken, August 12-23 1991. It will be organized by the European foundation for logic, language and information (see 4.4). ITLI and the Dutch AIO network TLI will participate.

4 Other Activities

4.1 Cooperation

ITLI is committed to broader scientific contacts outside of its 'inner circle'.

For a start, in Amsterdam itself, through various joint appointments, ITLI serves as a link between its sponsoring departments, while there are also official ties with the Faculty of Humanities (linguistics, computer science and the humanities) and the Centre for Mathematics and Computer Science (CWI). Recent appointments at the latter two sites (Zeevat in computational linguistics, van Eijck at the CWI) are expected to enhance this collaboration.

At a national level, the earlier-mentioned TLI-network is a common enterprise for training Ph.D. students. Currently, discussions are under way concerning the ad-

visability of turning this collaboration into a national graduate school or research institute. More concretely, the bi-weekly Montague Colloquium (succeeded by the present ITLI Colloquium) provides a forum for the Dutch semanticists, as well as visitors from abroad. Likewise, the Intercity Colloquium, which is held every two weeks in either Amsterdam or Utrecht, reflects national collaboration in the field of mathematical logic and the philosophy of mathematics.

In Europe, ITLI's international orientation was further institutionalized in 1989 by its participation in the Esprit Basic Research Action Dynamic Interpretation of Natural Language (DYANA, see 4.3). In this project, ITLI cooperates with the Centre for Cognitive Science of the University of Edinburgh, the Seminar für natürlichsprächliche Systeme of the University of Tübingen and the Institut für Maschinelle Sprachverarbeitung of the University of Stuttgart. Moreover, its bi-annual Amsterdam Colloquia, started in 1976, have become well-known gatherings of the international community (see 4.7).

Individually, ITLI-members maintain regular contacts with such further centers of semantic research as the Center for the Study of Language and Information (Stanford University), the Department of Linguistics at Amherst (University of Massachusetts), the Cognitive Science Center at Austin (University of Texas), the Department of Modern Language and Linguistics at Ithaca (Cornell University), the Department of Mathematics at Siena (University of Siena), the Steklov Institute (Moscow), the Department of Mathematics at Oslo (COSMOS, University of Oslo) and the already mentioned DYANA-partners.

At the end of 1989 an exchange agreement was reached between the Steklov Institute of Mathematics of Moscow and the Mathematics Departments at the University of Amsterdam, the Free University at Amsterdam and the Center for Mathematics and Computer Science. This exchange agreement includes visits of four mathematicians from Moscow visiting Amsterdam each year and four mathematicians from Amsterdam visiting the Steklov Institute, in principle for two week visits. The section Logic and Theoretical Computer Science of the ITLI receives and sends one such visitor each year (to and from the logic group at the Steklov Institute). In 1990 the agreement started with visits of D. de Jongh to Moscow in September and of S.N. Artemov to Amsterdam in October. Also ITLI supports the Steklov Institute by printing some prepublications for the logic group at the Steklov Institute.

4.2 Visitors

In 1990, the following people visited ITLI for a shorter or a longer period of time:
- J. Acero (Granada)
- S. N. Artemov (Moscow)
- A. Berarducci (L'Aquila)
- G. Cepparello (Pisa)
- G. Chierchia (Ithaca, N.Y.)
- P. C. Gilmore (Vancouver)
- V. Goranko (Sofia)
- G. Jäger (Bern)
- M. Kracht (Berlin)
- S. Lapierre (Montreal)
- L. Pólos (Budapest)
- A. Prijatelj (Ljubljana)
- P. Pudlàk (Prague)
- V. Shehtman (Moscow)

At the AIO level ITLI had the following visitors:
- M. Manucci (Siena)

- A. Carbone (New York)

4.3 Esprit Basic Research Action DYANA

From February 1989, ITLI is involved in an Esprit Basic Research Action, Dynamic Interpretation of Natural Language (DYANA). The project covers a period of two and a half years, with the possibility of continuation. The other participants are the Centre for Cognitive Science of the University of Edinburgh, the Seminar für natürlich-sprachliche Systeme of the University of Tübingen and the Institut für maschinelle Sprachverarbeitung of the University of Stuttgart.

This action in Esprit Basic Research is concerned with fundamental questions about the integration of logic, natural language and speech. The programme focusses on the themes of partial information and dynamic interpretation in natural language processing, with particular attention to the goal of developing a computational and cognitively motivated model of how spoken language is understood. The following are some of the key research questions:
- what declarative theory of grammar (extending from phonetics to discourse) would best support incremental interpretation and top-down information flow
- how can existing unification-based grammar formalisms be developed so as to increase their ability to express high-level generalizations, while retaining a clear semantics and a computational interpretation
- how is the informational content of an utterance dynamically integrated into the current discourse context
- what formal models can adequately capture the defeasibility and non-monotonic character of human reasoning
- to what extent is it possible to synthesize the formal methods used for modelling partial information in speech, grammar, semantics and reasoning

Participation in this project has brought ITLI four new jobs at post-doc level.

4.4 European Foundation FOLLI

In the person of Johan van Benthem ITLI is represented in the European Foundation for Logic, Language, and Information (FOLLI). FOLLI is a platform of scientists working at the borders of logic, linguistics, philosophy, mathematics, and computer science, which is founded in 1990 in order to propagate this field in Europe and to promote its interests in national and international organizations more effectively.

FOLLI is presently engaged in the following activities, in cooperation with several organizations of the European Community as well as industrial partners:
- coordination of the European congresses in this area, including the organization of a series of annual meetings on strategic themes of research that built on the tradition of the Amsterdam Colloquia
- permanent organization of the annual European summer school for doctoral students and scientific staff, by means of a system of standing and changing committees
- setting up an exchange programme for students and staff between Western-Europe and a network of Eastern-European sister institutes
- spreading general information about the area to persons interested and editing a future newsletter
- conducting a new scientific journal, the Journal of Logic, Language, and Information (JOLLI), which will start appearing end 1991
- conducting a new series of book and lecture notes, Studies in Logic, Language, and Information (SILLI), to be started in 1992

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The board of FOLLI consists of a steering committee whose members are J. van Benthem (Amsterdam, chairman), P. Gärdenfors (Lund), F. Guenthner (München), E. Klein (Edinburgh). The steering committee is assisted by a scientific council with members from the various subdisciplines, from many European countries.

4.5 NL and PL

In Summer 1990, the NFI (Nationale Faciliteit Informatica) gave a grant for an interdisciplinary research effort on Structural and Semantic Parallels in Natural Languages and Programming Languages to be conducted by ITLI, in collaboration with the University of Utrecht (OTS and Department of Philosophy). The grant will provide for two post-doc positions and two post-graduate positions. There is also a travel budget to invite short-term visitors.

The aim of the project is to stimulate and coordinate promising research on structural and semantic parallels in natural language and programming language analysis, in the following areas:

- Structure and Processing of Texts and Programs.
- New Directions in Semantic Representation.
- Non-standard Reasoning and Knowledge Representation.
- Language Analysis and Complexity Theory.

The project will build on exploratory research (at ITLI and in other places) which has shown that in these areas methods and techniques of Natural Language and Programming Language analysis are mutually applicable. The project, which is expected to start in Spring 1991, and which will run for at most four years, aims at the formation of a nucleus of young researchers competent in both NL and PL analysis, and at the stimulation of structured interdisciplinary action in the area.

4.6 JELIA 1990

From September 10th to September 14th, 1990, JELIA (Journées Européennes sur la Logique en Intelligence Artificielle, or the European Workshop on Logics in AI) was held at the Centre for Mathematics and Computer Science (CWI) in Amsterdam. The main conference themes were:

- logic programming and automated theorem proving
- computational semantics for natural language
- applications of non-classical logics
- partial and dynamic logics

The aim of the conference was to bring together researchers involved in developing logical tools for AI.

The conference was partially sponsored by the Esprit Basic Reseach Action 3175, DYANA. Thanks are also due to the Royal Dutch Academy of Sciences (KNAW) for a grant in the form of a financial guarantee.

The call for papers resulted in 76 submissions, of which 30 were accepted for presentation. All selected and presented papers are included in the Proceedings, to be issued by Springer-Verlag in their series *Lecture Notes in Artificial Intelligence*. The volume, number 478 in the series, will appear in Spring 1991.

The following invited papers were given:

- Nicholas Asher & Michael Morreau
  Commonsense entailment: a modal theory of non-monotonic reasoning
- J. Michael Dunn
  Gaggle theory: an abstraction of galois connections and residuation, with applications to negation, implication, and various logical operators
- Peter Gärdenfors
  Belief revision and non-monotonic logic: two sides of the same coin?

- Jeroen Groenendijk & Martin Stokhof
  Two theories of dynamic semantics
- Tore Langholm
  What is a Horn clause in partial logic?
- Fernando C.N. Pereira
  Semantic interpretation as higher–order deduction
- Vaughan Pratt
  Action logic and pure induction

4.7 Seventh Amsterdam Colloquium

The 1989 edition of the Amsterdam Colloquium was the seventh in a series which started in 1976. The series was originally an initiative of the Department of Philosophy, and the last two editions of the colloquium were organized by ITLI .

The colloquium took place December 19-22, 1989 with financial support from the Royal Dutch Academy of Sciences (KNAW). It was visited by more than one hundred visitors from Eastern and Western Europe, Japan, Israel, Canada and the United States. Within Europe, it is certainly the oldest continuous meeting place for colleagues in the area.

In the spring of 1990, ITLI published 32 of the 42 contributed talks in two volumes of proceedings, edited by M. Stokhof and L. Torenvliet (710 pp.) and entitled *Proceedings of the seventh Amsterdam Colloquium*. Copies can be ordered from Marjorie Pigge, Department of Philosophy, Nieuwe Doelenstraat 15, 1012 CP Amsterdam.

4.8 Colloquia

ITLI Colloquium   The ITLI Colloquium meets every forthnight. In 1990 the following talks were given:
- Daniel Vanderveken (Université de Quebec à Trois Rivières)
  A generally complete axiomatization of the laws of illocutionary logic
- Gosse Bouma (RIKS, Maastricht)
  Defaults in unification grammar
- Rob van der Sandt (KUN)
  Anaphora and accomodation
- Frans Zwarts (RUG)
  Wh-movement and polarity
- Jan van Eijck (CWI)
  Generalized quantifiers and partial information
- Aarne Ranta (Academy of Finland)
  Context semantics
- Peter Simons (Universität Salzburg)
  Extended categorial grammars for variable-binding languages
- Serge Lapierre (UvA)
  Hyperintensional semantics and reflexive domains
- Eva Hajičova (Charles University, Prague)
  Some thoughts on negation and presupposition
- Franciska de Jong Zwarts (Philips)
  The interpretation of partitive NPs
- Juan Acero (Universiteit van Granada)
  Towards a dynamic analysis of belief attibutions
- Michael Moortgat (RUU)
  Discontinuous type constructors
- Marcus Kracht (Freie Universität Berlin)
  Functional linguistics and the problem of compositionality

Intensional Logic Colloquium At the Intensional Logic Colloquium, talks were given by the following people outside ITLI: Jan Jaspars (ITK/KUB), Elias Thijsse (ITK/KUB), Ron Koymans (Philips Research Labs), Valentin Goranko (Sofia University), Gerard Vreeswijk (VU), Wiebe van der Hoek (VU), Patrice Enjalbert (Caen), Valentin Shehtman (Moscow), Marcus Kracht (Berlin)

Colloquium on Formal Arithmetic The following visitors from abroad contributed to the Colloquium on Formal Arithmetic:

- S. N. Artemov (Moscow)
  Provability logic, diagonizable algebras
- P. Pudlàk (Prague)
  Bounded arithmetic, complexity theory
- A. Berarducci (L'Aquila)
  Bounded arithmetic

Parallels in Natural Language and Programming Languages In spring 1990 a new colloquium series started on the topic Structural and Semantic Parallels in Natural Languages and Programming Languages. The following talks were given:

- Johan van Benthem
  Categorial grammars and polymorphism
- Theo Janssen
  Intensional contexts in programming languages and natural languages
- Jan van Eijck
  Feature algebras
- Dirk Roorda
  Polymorphism in ML
- Theo Janssen
  Machine translation
- Martin van den Berg
  Dynamic logic and natural language semantics
- Reinhard Muskens
  Montague semantics for programming languages
- Jan Rutten
  Non-wellfounded sets and programming language semantics
- Job Zwiers
  Compositionality and concurrency
- Kees Vermeulen
  Dynamic reasoning
- Peter van Emde Boas
  Variables, scope and binding in programming languages

Colloquium on Partial and Dynamic Semantics In december 1990 the first meeting was held of the Research Colloquium on Partial and Dynamic Semantics of natural language. The two-day meeting was devoted to the work of Irene Heim (MIT, Boston) and Angelika Kratzer (University of Massachusetts, Amherst). The meeting comprised lectures by both authors, and profound discussions with the participants about their work.

4.9 ITLI Prepublication Series 1990

Logic, Semantics and Philosophy of Language
LP-90-01 Jaap van der Does *A generalized quantifier logic for naked infinitives*
LP-90-02 Jeroen Groenendijk & Martin Stokhof *Dynamic Montague grammar*
LP-90-03 Renate Bartsch *Concept formation and concept composition*
LP-90-04 Aarne Ranta *Intuitionistic categorial grammar*
LP-90-05 Patrick Blackburn *Nominal tense logic*

LP-90-06 Gennaro Chierchia *The variablity of impersonal subjects*
LP-90-07 Gennaro Chierchia *Anaphora and dynamic logic*
LP-90-08 Herman Hendriks *Flexible Montague grammar*
LP-90-09 Paul Dekker *The scope of negation in discourse, towards a flexible dynamic Montague grammar*
LP-90-10 Theo M.V. Janssen *Models for discourse markers*
LP-90-11 Johan van Benthem *General dynamics*
LP-90-12 Serge Lapierre *A functional partial semantics for intensional logic*
LP-90-13 Zhisheng Huang *Logics for belief dependence*
LP-90-14 Jeroen Groenendijk & Martin Stokhof *Two theories of dynamic semantics*
LP-90-15 Maarten de Rijke *The modal logic of inequality*
LP-90-16 Zhisheng Huang & Karen Kwast *Awareness, negation and logical omniscience*
LP-90-17 Paul Dekker *Existential disclosure, implicit arguments in dynamic semantics*

Mathematical Logic and Foundations
ML-90-01 Harold Schellinx *Isomorphisms and non-isomorphisms of graph models*
ML-90-02 Jaap van Oosten *A semantical proof of de Jongh's theorem*
ML-90-03 Yde Venema *Relational games*
ML-90-04 Maarten de Rijke *Unary interpretability logic*
ML-90-05 Domenico Zambella *Sequences with simple initial segments*
ML-90-06 Jaap van Oosten *Extension of Lifschitz' realizability to higher order arithmetic, and a solution to a problem of F. Richman*
ML-90-07 Maarten de Rijke *A note on the interpretability logic of finitely axiomatized theories*
ML-90-08 Harold Schellinx *Some syntactical observations on linear logic*
ML-90-09 Dick de Jongh & Duccio Pianigiani *Solution of a problem of David Guaspari*
ML-90-10 Michiel van Lambalgen *Randomness in set theory*
ML-90-11 Paul C. Gilmore *The consistency of an extended NaDSet*

Computation and Complexity Theory
CT-90-01 John Tromp & Peter van Emde Boas *Associative storage modification machines*
CT-90-02 Sieger van Denneheuvel & Gerard R. Renardel de Lavalette *A normal form for PCSJ expressions*
CT-90-03 Ricard Gavaldà, Leen Torenvliet, Osamu Watanabe & José L. Balcázar *Generalized Kolmogorov complexity in relativized separations*
CT-90-04 Harry Buhrman, Edith Spaan & Leen Torenvliet *Bounded reductions*
CT-90-05 Sieger van Denneheuvel & Karen Kwast *Efficient normalization of database and constraint expressions*
CT-90-06 Michiel Smid & Peter van Emde Boas *Dynamic data structures on multiple storage media, a tutorial*
CT-90-07 Kees Doets *Greatest fixed points of logic programs*
CT-90-08 Fred de Geus, Ernest Rotterdam, Sieger van Denneheuvel & Peter van Emde Boas *Physiological modelling using RL*
CT-90-09 Roel de Vrijer *Unique normal forms for combinatory logic with parallel conditional, a case study in conditional rewriting*

Other Prepublications
X-90-01 A.S. Troelstra *Remarks on intuitionism and the philosophy of mathematics, revised version*
X-90-02 Maarten de Rijke *Some chapters on interpretability logic*
X-90-03 L.D. Beklemishev *On the complexity of Aarithmetical interpretations of modal formulae*

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X-90-04 *Annual report 1989*
X-90-05 Valentin Shehtman *Derived sets in Euclidean spaces and modal logic*
X-90-06 Valentin Goranko & Solomon Passy *Using the universal modality: gains and questions*
X-90-07 V.Yu. Shavrukov *The Lindenbaum fixed point algebra is undecidable*
X-90-08 L.D. Beklemishev *Provability logics for natural Turing progressions of arithmetical theories*
X-90-09 V.Yu. Shavrukov *On Rosser's provability predicate*
X-90-10 Sieger van Denneheuvel & Peter van Emde Boas *An overview of the rule Language RL/1*
X-90-11 Alessandra Carbone *Provable fixed points in ID0+W1, revised version*
X-90-12 Maarten de Rijke *Bi-unary interpretability logic*
X-90-13 K.N. Ignatiev *Dzhaparidze's polymodal logic: arithmetical completeness, fixed point property, Craig's property*
X-90-14 L.A. Chagrova *Undecidable problems in correspondence theory*
X-90-15 A.S. Troelstra *Lectures on linear logic*

4.10 GRASS Publication Series

ITLI is a partner in the GRASS publication series, published by Foris Publications (Dordrecht and Cinnaminson).

Managing Editors
- Alice ter Meulen (University of Indiana, Bloomington)
- Martin Stokhof (University of Amsterdam)

Editorial Board
- Renate Bartsch (Amsterdam)
- Johan van Benthem (Amsterdam)
- Henk Verkuyl (Utrecht)
- Co Vet (Groningen)

The following titles appeared in the past two years:

GRASS 9 Michael Moortgat, *Categorial investigations. Logical and linguistic aspects of the Lambek calculus*

GRASS 10 Irena Bellert, *Feature System for quantificational structures in natural language*

GRASS 11 Renate Bartsch, Peter van Emde Boas & Johan van Benthem (eds.), *Semantics and contextual expression*

The ITLI Prepublication Series

1990

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LP-90-01 Jaap van der Does	A Generalized Quantifier Logic for Naked Infinitives
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LP-90-03 Renate Bartsch	Concept Formation and Concept Composition
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LP-90-07 Gennaro Chierchia	Anaphora and Dynamic Logic
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LP-90-09 Paul Dekker	The Scope of Negation in Discourse, towards a flexible dynamic Montague grammar
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LP-90-11 Johan van Benthem	General Dynamics
LP-90-12 Serge Lapierre	A Functional Partial Semantics for Intensional Logic
LP-90-13 Zhisheng Huang	Logics for Belief Dependence
LP-90-14 Jeroen Groenendijk, Martin Stokhof	Two Theories of Dynamic Semantics
LP-90-15 Maarten de Rijke	The Modal Logic of Inequality
LP-90-16 Zhisheng Huang, Karen Kwast	Awareness, Negation and Logical Omniscience
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Computation and Complexity Theory

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CT-90-08 Fred de Geus, Ernest Rotterdam, Sieger van Denneheuvel, Peter van Emde Boas	Physiological Modelling using RL
CT-90-09 Roel de Vrijer	Unique Normal Forms for Combinatory Logic with Parallel Conditional, a case study in conditional rewriting

Other Prepublications

X-90-01 A.S. Troelstra	Remarks on Intuitionism and the Philosophy of Mathematics, Revised Version
X-90-02 Maarten de Rijke	Some Chapters on Interpretability Logic
X-90-03 L.D. Beklemishev	On the Complexity of Arithmetical Interpretations of Modal Formulae
X-90-04	Annual Report 1989
X-90-05 Valentin Shehtman	Derived Sets in Euclidean Spaces and Modal Logic
X-90-06 Valentin Goranko, Solomon Passy	Using the Universal Modality: Gains and Questions
X-90-07 V.Yu. Shavrukov	The Lindenbaum Fixed Point Algebra is Undecidable
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X-90-11 Alessandra Carbone	Provable Fixed points in $I\Delta_0 + \Omega_1$, revised version
X-90-12 Maarten de Rijke	Bi-Unary Interpretability Logic
X-90-13 K.N. Ignatiev	Dzhaparidze's Polymodal Logic: Arithmetical Completeness, Fixed Point Property, Craig's Property
X-90-14 L.A. Chagrova	Undecidable Problems in Correspondence Theory
X-90-15 A.S. Troelstra	Lectures on Linear Logic

1991

Mathematical Logic and Foundations

ML-91-01 Yde Venema	Cylindric Modal Logic
ML-91-02 Alessandro Berarducci Rineke Verbrugge	On the Metamathematics of Weak Theories
ML-91-03 Domenico Zambella	On the Proofs of Arithmetical Completeness for Interpretability Logic
ML-91-04 Raymond Hoofman, Harold Schellinx	Collapsing Graph Models by Preorders

Computation and Complexity Theory

CT-91-01 Ming Li, Paul M.B. Vitanyi	Kolmogorov Complexity Arguments in Combinatorics
CT-91-02 Ming Li, John Tromp, Paul M.B. Vitanyi	How to Share Concurrent Wait-Free Variables
CT-91-03 Ming Li, Paul M.B. Vitanyi	Average Case Complexity under the Universal Distribution Equals Worst Case Complexity
CT-91-04 Sieger van Denneheuvel, Karen Kwast	Weak Equivalence

Other Prepublications

X-91-01 Alexander Chagrov Michael Zakharyaschev	The Disjunction Property of Intermediate Propositional Logics
X-91-02 Alexander Chagrov Michael Zakharyaschev	On the Undecidability of the Disjunction Property of Intermediate Propositional Logics
X-91-03 V. Yu. Shavrukov	Subalgebras of Diagonizable Algebras of Theories containing Arithmetic
X-91-04 K.N. Ignatiev	Partial Conservativity and Modal Logics
X-91-05 Johan van Benthem	Temporal Logic
X-91-06	Annual Report 1990