On the occasion of
Johan van Benthem's
retirement from the
University of Amsterdam
26 september 2014

Logic

In the 1980s a group of researchers in mathematics (e.g. Van Benthem, De Jongh, Troelstra), philosophy (e.g. Bartsch, Groenen-dijk, Stokhof, Veltman), and computer science (e.g. Van Emde Boas, Janssen, Torenvliet) started cooperating on the shared theme of the logical analysis of natural language. This group created what is since 1991 known as the 'Institute for Logic, Language and Computation' (ILLC). Johan van Benthem was its first scientific director.

ILLC and its background

During this period computational linguistics (Scha) joined the institute as well. The aim of the ILLC is to study formal properties of information, to be viewed in its broadest sense, covering not only the mathematical and algorithmic properties of formal languages, but also the flow of information in communication and natural language processing, or human cognitive activities related to reasoning and music. In many of those studies, logic plays a prominent role.

ILLC's interdisciplinary view on information, making use of logic, is rooted in a strong tradition in the Netherlands, and especially at the University of Amsterdam.
This tradition already started in the beginning of the 20th century with two influential mathematicians with a great interest in philosophy – Brouwer and Mannoury – who were not only working on the foundations of mathematics, but also had a profound interest in language and information exchange.

Brouwer made important contributions to pure mathematics, but he is known especially for his development of intuitionism. Brouwer was a member of the 'Significs movement' ('Signifische Beweging'), the Dutch counter-part of the Vienna circle, with his colleague Mannoury as the influential leader. Their aim

was to study language and language use in the broadest possible sense: as a means by which people try to influence each other. In the 1930's, the significs group also initiated the interdisciplinary academic journal 'Synthese'.

The interdisciplinary logic-based view on information remained prominent in Amsterdam especially due to the efforts of Evert Beth in the 1950s and 1960s. Together with his colleague Heyting he managed to lure prominent logicians such as Curry, Henkin, Montague and Scott to Amsterdam for temporary professorships. They all helped to create the fertile ground on which the ILLC could be built and made to flourish.

At this moment, the ILLC is a still growing interdisciplinary research institute placed in two faculties (Humanities and Sciences), with a permanent staff of 49 researchers, 15 postdocs, and 57 PhD students. Research is divided over 3 programmes: Logic and Computation (LoCo), Logic and Language (LoLa), and Language and Computation (LaCo). The LoCo programme focusses on mathematical logic, theoretical computer science and logical principles in AI and information dynamics. LoLa investigates human reasoning and the interpretation of language, but also reaches out to other branches of formal philosophy. LaCo, finally, studies cognitive and computational models of human information processing, expecially of language and music.

Of crucial importance for the ILLC is its high profile Master program in Logic, which attracts gifted and highly motivated students from all over the world. Currently, the program has 106 master students, coming from 25 different countries. The ILLC recently revamped its graduate programme, supplying it with a state-of-the-art training programme.

Both the ILLC as a research institute and its Master Programme in Logic were assessed as 'excellent' during recent official international evaluation procedures.

ESSLLI and FoLLI

It is fair to say that the continuing, successful and stage-setting series of European Summer Schools in Logic, Language and Information, as well as the international Foundation of Logic, Language and Information, would not have been conceivable without the vision, efforts and trust of Johan van Benthem.

The series of Summer Schools started in 1989 in Groningen by Johan, in cooperation with Frans Zwarts, with a great confidence in logic as a constitutive, inspiring and combining factor in historically diverse academic branches such as linguistics, computer science, cognitive psychology, and related sciences, both in research and education. This turned out to be a successful enterprise, as the emerging interdisciplinary field has rapidly developed and grown. The Summer Schools have figured as one of the major platforms of this enterprise for training, research and dissemination; FoLLI (founded in 1991) constituted its supporting foundation, as well as the publishing organisation.

The Summer Schools emerged from a at that time unfamiliar and broad view of logic, and an equally broad and early European (and later global) perspective. The success, but also Johan himself, have inspired an American nephew, the North American Summer School (NASSLLI, since 2002), and recently an East Asian niece, the East Asian Summer School on Logic, Language and Computation (EASSLLC). The European school has grown into an international success story – this, again, by the continuous personal support, inspiration and steering of Johan. Each year, some 500 students and scholars from all over the world attend to the schools, and build and transmit an intellectual heritage, vital for the various disciplines.

Significantly, the participants each year praise the collegial even cordial, atmosphere, characteristic, also, of all of Johan van Benthem's work and activities.
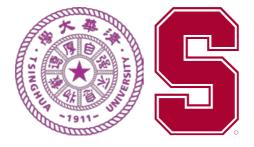
Logic
from East to West

During his long and distinguished career, Johan van Benthem has played a central role in forming and nourishing new logic communities. His interdisciplinary view of logic has been a focal point, influencing and connecting scientists and philosophers throughout the world. After founding the Institute for Logic, Language and Computation (ILLC) in the Netherlands, and helping to transform ILLC into the leading force in Logic today, Johan van Benthem went on to bring together researchers belonging to different institutes, disciplines and cultures, from the far East to the West. First as a honorary Weilun professor, then as a National Distinghuised Foreign Expert, and now as the National Changjiang Professor, Johan van Benthem has played an indispensable role in forming and fueling a new logic community in China. He is currently the co-director of the newly established Joint research Center for Logic (TALC) between Tsinghua University and the University of Amsterdam. After several years of successful cooperation between these two Universities, the joint center was established in 2013.

www.illc.uva.nl/Jointcenter/en/

TALC provides an active interface between ILLC, Tsinghua and logicians elsewhere, maintaining a broad interdisciplinary conception of logic, and acting as a bridge for scientific contacts between China and the international community. In the West, Johan van Benthem has played a key role in establishing and maintaining close connections between logic researchers in Europe and the US. In particular, he has been the core figure connecting the ILLC and the logicians in the Bay area, both via his professorships at Stanford University and Amsterdam University, and as an active member of Stanford's Center for the Study of Language and Information (CSLI).

Spinoza Prize 1996

In October 1996 Johan van Benthem was honoured with the Spinoza Prize, in the second year that the prize was awarded. The Spinoza Prize is the highest scientific award in the Netherlands. It is named after the philosopher Baruch de Spinoza, and it was instituted in 1995 by the Netherlands Organisation for Scientific Research (NWO) to stimulate and reward excellence in Dutch academia.
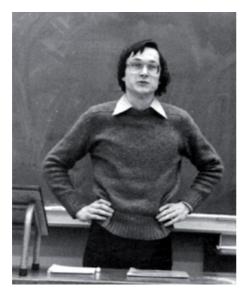
Van Benthem got this prize for positioning logic as a pre-eminently interdisciplinary enterprise, and a bridge between the humanities, the social sciences and the exact sciences. The Spinoza committee report lists the achievements of the laureate as a researcher, as an organizer, and as a source of inspiration for younger colleagues. It describes Johan as a stimulating and innovative researcher, attracting and inspiring many young researchers from the Netherlands and abroad.

The prize money of 2 million guilders was spent on a *Spinoza Logic in Action* project, aimed at the exact study of information flow and the promotion of logic as an interdisciplinary focus for the information sciences. This project ran from 1997 through 2000, and facilitated a substantial number of activities in Logic in Communication, Computational Logic and Logic Dissemination, in a team led by Paul Dekker, Jan van Eijck, Maarten de Rijke and Yde Venema. Although the Spinoza funding for these projects finished in 2000, activities in these areas continue inside and outside ILLC. The activities of the Spinoza Logic in Action project are summarized in a small book, *Logic in Action*, published by ILLC in 2001.

Johan's Contributions to Logic

Johan van Benthem is University Professor for Pure and Applied Logic at the University of Amsterdam, and he also holds professorships in the US (Stanford University) and China (Tsinghua University, Beijing). He is one of the founders of a new discipline where logic is viewed as the science of information processing in a broad sense, within a social context, with applications in mathematics, the information and social sciences and the humanities.

Van Benthem studied physics, mathematics and philosophy at the University of Amsterdam, where he earned his PhD with a thesis entitled *Modal Correspondence Theory*. This thesis deeply influenced the direction of research in modal logic. One of the results in the thesis is the characterisation

of modal logic as the bisimulation invariant fragment of first order logic, still a central theorem of modal logic. Also, the notion of bisimulation from Van Benthem's thesis turned out to be a key concept for the understanding of processes in theoretical computer science. Two processes perform essentially the same computation if they are related by a bisimulation.

But Van Benthem's work is not confined to modal logic and its direct application in computer science. Van Benthem also made important contributions in mathematics (logics of topology and space), in computer science (fixed point languages and computation), in philosophy of science (logical studies of science, logic of time), in linguistics (logical semantics, categories and type theory, generalized quantifiers), in economic theories of game playing (game logics, logic in games), and in cognitive science and philosophy (logic in philosophy, analysis of rational interaction).

The discipline of formal logic has seen considerable changes in the last few decades. In the 20th century, logic was mainly concerned with attempts to put mathematics on a proper foundation, and with analyzing the formal structure of language, in particular the use of language in reasoning.

Nowadays, logic is a much broader scientific discipline that is concerned with coding, passing on, processing, understanding of information in a broad sense. This trans-

formation and revitalisation has turned logic into a crucial discipline, highly relevant, not only in mathematics and philosophy, but also in computer science, linguistics, psychology and the social sciences. Such a transformation and rejuvenation of a scientific field cannot be attributed to a single person, of course, but it seems fair to say that Van Benthem has played a large and decisive part in it.

Central in Van Benthem's scientific work are deep and broad studies into three key information-related concepts: dynamics, action, and interaction. Dynamics: the essence of information is not the description of some kind of state of affairs, but the changes that occur in such descriptions. Action: the process of information flow can crucially influence how we act. Interaction: an important dimension of information is how it is exchanged between people or intelligent systems.

Van Benthem's work has helped to ensure that dynamics, action and interaction have become core concepts in logic. This constitutes a crucial contribution to the new area of Logic, Language and Computation (LLC), with information as its central concept.