ILLC Magazine

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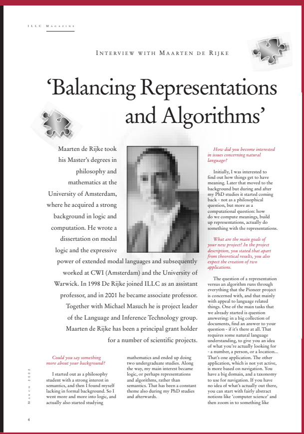
March 2002


INTERVIEW WITH MAARTEN DE RIJKE

'Balancing Representations and Algorithms'


Remembering

Guest Column by Renate Bartsch, professor Philosophy of Language


E-MAIL INTERVIEW WITH ALUMNA RENATA WASSERMANN

'ILLC's *cover girl* back in Brazil'

Renata Wassermann (Brazil) spent over four year as a student at the ILLC in Amsterdam. In January 2000 she defended her thesis 'Resource-Bounded Belief revision'.

In this issue amongst others:

'Balancing Representations and Algorithms', interview with Maarten de Rijke

'Remembering', guest column by Renate Bartsch

'ILLC's cover girl back in Brazil', interview with alumna Renata Wassermann

INSTITUTE FOR LOGIC, LANGUAGE AND COMPUTATION

Dear readers,

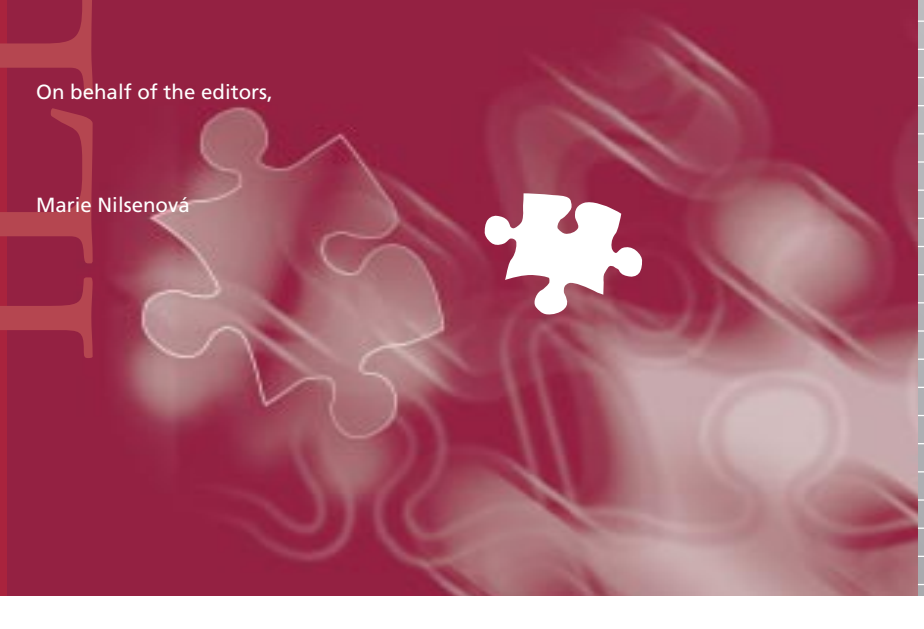
More or less one year after the last issue of the ILLC Magazine, we proudly present the fourth issue. As you will see, the year 2001 was a busy period at the Institute, which is why we couldn't stick to our original plan of preparing a new number every six months. As a Guayanese proverb says, *good gubby nah ah float ah tap* - 'good things do not come easily' - and although it's not a biconditional, we still hope that the content of the publication in your hand will prove that the wait was worthwhile.

We have kept some of our regular features, such as an interview with an alumnus, the logician Renata Wassermann who exchanged rainy Amsterdam for São Paulo, and a project description, this time investigating possible links between the research at the ILLC, the VU and the Utrecht University in the field of multi-agent systems. Giovanna Corsi kindly shared her ILLC experience as a guest visitor and Renate Bartsch replaces Johan van Benthem with a neurocognitive column on 'Remembering'. In an interview with Maarten de Rijke we find out more about his prestigious Pioneer project, 'Computing with Meaning', and in the personnel column, we can read about the interest of the new PhD students at the ILLC. As for personnel changes, we also say good-bye to Peter Blok who parts with the place he successfully managed for 4 years.

Our special thanks go to all the contributors to this issue; we hope you enjoy the collaboration as much as we did!

On behalf of the editors,

Marie Nilsenová



ILLC Magazine

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Preface

In this issue of ILLC magazine two of the institute's research projects are prominently present. One is the project 'Language and inference technology' (the former Spinoza project 'Computational logic') and the other is 'Logic and cognitive science'.

It is not a mere coincidence, nor is it due to cosmetic measures, that the names of neither of these two research projects discloses the faculty in which the researchers involved in it, work. As a matter of fact, both projects are staffed by people from two or even three different faculties. Evidently, the interfaculty status of ILLC is more actual than it ever was before.

The staff of the 'Logic and cognitive science' project was recently extended with an assistant professor, Reinhard Blutner, who is appointed in the Faculty of Science. The chair of the group is located at the Faculty of Humanities and is held by Frank Veltman and Michiel van Lambalgen. And Van Lambalgen also holds a part-time appointment in the Faculty of Science…! This makes this project truly interfacultary.

The project 'Language and inference technology' is staffed by people from the Faculty of Science and from the Faculty of Social Sciences. The research themes, however, incorporate topics which traditionally belong to the field of the humanities. And indeed, there is close collaboration with ILLC researchers from the Faculty of Humanities as well.

All this illustrates that ILLC operates in an area in which there is hardly any relation between the traditional division in faculties on the one hand and the distinction between separate scientific disciplines on the other hand.

This observation is not new, of course, but what is new is that the old boundaries between faculties less and less obstruct new collaborations between researchers.

To give an example, it is to be expected that the process of financial integration of ILLC's various financial budgets, will take a significant step forwards, when a convenant between the Faculty of Humanities and ILLC will be signed. Tighter financial integration allows allotment of resources that is primarily driven by content and needs, and not by the source of the budget.

Housing provides another example. Presently, ILLC is still spread over several locations. But due to several rearrangements that have taken place over the last year, groups of people working closely together are now housed on the same location. Still in the future is housing for all of ILLC at one location. In the university's development plans for the Watergraafsmeer, such a location for ILLC is foreseen, of course with suitable pieds à terre at the various locations in the city where teaching takes place. This is an example of a long term development, one not expected to be realized before the year 2006.

Nevertheless, what these examples show is that the needs of everyday practice more and more determine the organization, and not the other way round. This has been otherwise in the past, and hence is reason to be grateful and optimistic. Of course, what is ILLC's own responsibility is to show the same flexibility with regard to developments internal to the field. If such developments call for it, projects need to be redefined, even 'Language and inference technology' and 'Logic and cognitive science'. But all in due time.

Peter I. Blok
Managing director
(February 1, 1998 - February 1, 2002)

Interview with Maarten de Rijke

'Balancing Representations and Algorithms'

Maarten de Rijke took his Master's degrees in philosophy and mathematics at the University of Amsterdam, where he acquired a strong background in logic and computation. He wrote a dissertation on modal logic and the expressive power of extended modal languages and subsequently worked at CWI (Amsterdam) and the University of Warwick. In 1998 De Rijke joined ILLC as an assistant professor, and in 2001 he became associate professor. Together with Michael Masuch he is project leader of the Language and Inference Technology group. Maarten de Rijke has been a principal grant holder for a number of scientific projects.

Could you say something more about your background?

I started out as a philosophy student with a strong interest in semantics, and then I found myself lacking in formal background. So I went more and more into logic, and actually also started studying mathematics and ended up doing two undergraduate studies. Along the way, my main interest became logic, or perhaps representations and algorithms, rather than semantics. That has been a constant theme also during my PhD studies and afterwards.

How did you become interested in issues concerning natural language?

Initially, I was interested to find out how things get to have meaning. Later that moved to the background but during and after my PhD studies it started coming back - not as a philosophical question, but more as a computational question: how do we compute meanings, build up representations, actually do something with the representations.

What are the main goals of your new project? In the project description, you stated that apart from theoretical results, you also expect the creation of two applications.

The question of a representation versus an algorithm runs through everything that the Pioneer project is concerned with, and that mainly with appeal to language related things. One of the main tasks that we already started is question answering: in a big collection of documents, find an answer to your question - if it's there at all. That requires some natural language understanding, to give you an idea of what you're actually looking for - a number, a person, or a location... That's one application. The other application, which is not yet active, is more based on navigation. You have a big domain, and a taxonomy to use for navigation. If you have no idea of what's actually out there, you can start with fairly abstract notions like 'computer science' and then zoom in to something like

'computational complexity' and within that you zoom in to 'polynomial space', for example. There exist fairly logical approaches to build up the taxonomy, so called classifications - giving objects little descriptions, trying to see which

"One of the main tasks that we already started is question answering: in a big collection of documents, find an answer to your question - if it's there at all."

descriptions are more general than others, lots of implication testing. Once you built up your taxonomy, a new task arises, because you get new documents and your domain changes. Then you attempt to add new information to the taxonomy in a smart way, without having to rebuild the entire thing.

How closely do you observe and reflect upon what's happening in the IT industry?

Closely, in the sense that we work together with some companies. Elsevier Science Publishers funds one of our projects, other companies provide us with data sets, these are little startups around Amsterdam. There is another big company that we might be working with soon. Then of course there are companies interested in our students, for example for internships.

Have you noticed any changes, given the situation on the market?

Not yet. But most of the students have their own little companies or have a job on the side, so they actually have very little time and attention for their studies. On top of that, they are in Amsterdam, so that also distracts them a lot. So I hope that the first thing we'll see is that they will have more time for their studies.

Your new project is situated on the interface of computational logic and natural language processing. It should employ 3 PhD students and 2 postdocs. Is it difficult to find qualified people for this kind of interdisciplinary research?

Actually, it employs also a project manager, to make sure that I do some research. All the positions have been filled now, but only one of the people that will be employed is Dutch, the rest are foreigners (from Argentina, Switzerland, Belgium, Germany and Russia). It would have been hard if I had only restricted the recruiting, say, to de Volkskrant and the NRC.

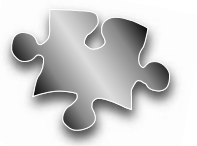
Do you see any dis- or advantages of hiring foreigners?

The disadvantage is that we build up expertise and to some extent that expertise vanishes because the people want to go home when they're done here. Another disadvantage is that you can't really use them for teaching (which is an advantage for (some of) them). But these are people that have very little social background here, so they have to get together and build up their infrastructure. Which often leads to that they really function as a group. It's not just a bunch of individuals that meets each other here a few hours a day. So that's a big advantage.

What is the relation between the 'Computing with Meaning' project and two of your other current projects? (e.g., STeFI (2000-2004) which concerns feature interaction for combinatorial complexity, or DERIVE (1999-2003) on finding information in natural language documents)

They all have to do with balancing representation and testing for feature interaction. In STeFI, we try to understand feature interaction in telecommunications. Nowadays, telephones connect multiple features. For example, you can have your telephone calls forwarded and you can also block certain people from phoning you. Now let's say you are coming here for the interview, so you have your calls forwarded to my phone, but imagine a person that I put on my black list phones you. It's not too hard to decide what to do – it's just that one is more important than the other, the problem is predicting that there will be these interactions. Technically, this can be tackled as a model checking task, but for it to be of any value, the model has to be fairly big and fairly realistic... so big and so realistic that it may take months, if not years to build it. Ok, so instead of model checking let's do inference, deduction. There we have little theories - a theory that describes one feature, and a theory that describes another feature and we have some axioms about the behavior of the whole system. If the system is not consistent, of course what you have to do then is really understand what actually caused it - just the fact that there is an inconsistency is in itself not too informative. But hopefully there are certain questions that you will be able to answer with this more abstract approach. We try to understand which kinds of questions we can tackle this way and which one's we cannot.

DERIVE started out as the predecessor of the Pioneer project. In information extraction, you generally have templates and go through texts to find decent pieces of information to put in the templates. The disadvantage is that for each task you have to build a new template and train the system from scratch. On the other hand, there's information retrieval, which is very flexible and domain independent and where all you do is assist search engines with keywords and get back a list of relevant documents. The DERIVE project is an attempt to have as much of the domain independence of normal retrieval as possible, but more of the depth and the linguistic analysis that you get out of extraction. We actually ended up doing question answering because that to some extent it is like template filling.



Could you say something about your participation in international competitions?

Well, I want to know whether it makes things better if I have richer representations or do more involved reasoning. But testing and evaluation is expensive and labor intensive. For question answering, you need someone to go through the answers that your system provides and see whether they are correct. And that's exactly one thing that these competitions provide - the human assessors that go through your proposed solutions. Other kinds of competitions are for automated reasoning and that's about who's the fastest. That of course you can do yourself already at home, but you take part in the competition for a different reason, namely to actually find out what works. Usually what you see is that if there is an idea that works in year n, in the year n+1, most people will use it. So the competitions really provide a focus to the field, both for automated reasoning and in the natural language processing based competitions.

"Competitions really provide a focus to the field, both for automated reasoning and in the natural language processing based competitions."

What major changes do you anticipate in the near future in the field of information retrieval?

Within that picture, where do you place your own research?

The task is to find an answer to the user's question, whether it's in an English or an Arabic document, on a video, or in a sound clipping. We're a long way from there but that's actually what you want - multilingual, deeper analysis and multiple media. And users want answers, not a lot of documents which they end up analyzing themselves. Of course, that's very ambitious and also very general to do in one goal. Rather, we work on related subtasks, such as multilingual retrieval, or complex answers. At the competition this year for the first time there was a complex task - you get a number of questions and in answering these questions you have to build up contexts which you will then have to use for answering later questions. Generally, you need world knowledge for question answering, but fairly statically. Here the big challenge for context tasks would be not just to get the world knowledge from some database, but also to identify in the information picked up the relevant bits for later. That's incredibly vague but that's exactly what you have to solve.

What do you consider the most attractive features of your professional career?

Two things: working with the people here and then the balance of theory and experimentation. You think you have nice ideas, well let's get them to work, evaluate them, often they don't work, so you go back, you rethink.

May I ask you what you do in your spare time, just to make it more credible to the readers that you actually have any?

I have a four-year old daughter. That consumes my spare time.

Marie Nilsenová

My visit

Giovanna Corsi (University of Bologna) visited ILLC during the fall of 2001

I first encountered both the city of Amsterdam and the new Master of Logic students during the Institute's annual boat trip: a splendid opportunity for newcomers to meet some of the ILLC folk and to get on friendly terms with them and with one another. Friendliness, indeed, alongside a serious working atmosphere was what I enjoyed most during my time at the Institute.

Seminars and workshops are regularly organized. At the seminar 'Computing with LLI' I had the opportunity to attend lectures on a broad spectrum of topics: the semantic web, tableaux, intermediate logics, theorem proving techniques. I was also confronted with hybrid logics: a most intriguing topic and a new challenge for a traditional modal logician. The 'Methods for Modalities-2' workshop was a stimulating occasion to get quickly up to date on the main streams of

to ILLC

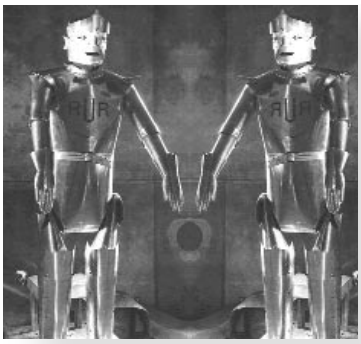
research into description logics, modal tableaux, dynamic logic, and applications of modal logics to the verification of programs.

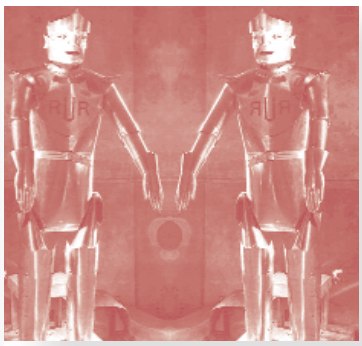
Most important is that all the activities in which the Institute is engaged are carried out in the spirit of promoting and developing a common cultural enterprise at the highest level.

At the OzsL Schoolweek in Nunspeet (which I attended both as a lecturer and as a participant) students, young researchers and tutors gathered together to exchange their contributions and to give a fresh impulse to their common enterprise.

As to be expected in Amsterdam, intuitionistic logic and mathematics is a vivid subject of discussion and study and I was glad to attend the 1st Arend Heyting Lecture in the context of an 'Afternoon on Constructivism'.

Last, but not least, I had the privilege of a tour in Amsterdam in the company and under the guidance of Dick de Jongh: I discovered and felt the soul of the city. The images I then collected of the city are still vivid in my memory.





Much Ado About Agents?

Recent ILLC publications may suggest that research at the institute is getting closer to the field of *intelligent agents*. Typical topics from agent research like game theory, mechanism design and the epistemology of actions receive increasing interest from ILLC researchers. The Vrije Universiteit and Utrecht University are well-known for their research on agents. In this article, experts from these universities give an impression of current research and trends, and try to lay bare interesting interrelations.

What are agents?

The study of autonomous agents and multi-agent systems is a new and fast growing research area within computer science, *artificial intelligence*, logic, cognitive science, and even social sciences. One can view agent systems from the perspective of artificial intelligence as intelligent entities that have analogies to human subjects. An autonomous agent is, then, a computer system that observes its environment and decides to act in order to achieve its objectives. Agent systems can also be viewed from the perspective of *software engineering*. Like other software engineering paradigms such as imperative and object-oriented methodologies, agent-based software methodology has various phases such as analysis, design, and implementation through which agent-based software can be developed.

What distinguishes agents from other computational systems is the fact that agents are self-interested in the sense that they set out to satisfy *preferences* on the states they can reach. The behavior of agents may involve complex reasoning

processes, but it can also be based on stimuli-response patterns. In the first case, the agent is called 'reasoning agent' and in the second case the agent is called 'reactive agent.' Probably the most popular agent is a so-called 'cognitive agent' endowed with mental attitudes such as beliefs, desires, intentions, and obligations. Its behavior is characterized by a rational balance between its mental attitudes. For example, a realistic cognitive agent may not intend to bring about a certain state unless it believes that the state is achievable. Various logical formalisms such as temporal, dynamic, epistemic, and default logics are used to specify and verify cognitive agents.

Of course, after all the efforts to make agent programming feasible one may not expect agents to operate in isolation. One then gets a so-called 'multi-agent system.' Multi-agent systems consist of a number of autonomous agents that interact with each other. Agents can interact in various ways: through communication or through manipulation of the environment in which agents are situated, etc.

"Probably the most popular agent is a so-called 'cognitive agent' endowed with mental attitudes such as beliefs, desires, intentions, and obligations.."

Agent communication is not limited to the exchange of data, but it involves many complex aspects such as agent dialogues and communication actions. Moreover, agents may co-operate with each other to solve a problem or they may compete to gain shares in resources. Auctions and negotiations are typical applications of multi-agent research. Agent institution and electronic markets are multi-agent applications where besides complex communication mechanisms, norm and social laws can determine the way agents can interact.

► Vrije Universiteit

Agent research at the Vrije Universiteit has been motivated and driven by applications, which are usually developed in cooperation with the industry. A typical example of such an application is a prototype for an information system for the Navy. Another example is a prototype for a bank application in which the individual banks are modeled as agents. In such applications, it is essential that the individual systems are autonomous, and therefore they are modelled as agents. For the design of these prototypes a software system called DESIRE has been developed and used over the past ten years.

Two main trends can be distinguished. First, several research initiatives are combined in 'dynamics of agents.' A typical example is the development of a formal language to describe

► Utrecht University

Generally, research in Utrecht can be brought under the heading of 'agent-based software engineering' where cognitive agents play a dominant role. The development of agent software is treated as analogous to object-orientation. An important project is the development of agent programming languages such as 3APL and GOAL and of agent logics such as KARO (Knowledge, Abilities, Results and Opportunities). More industry related research is agent-oriented e-commerce and virtual markets. The social aspects of agents are studied together with agent communication, especially generation of communication between agents. Finally, agent technology is applied in robots.

An important aspect in multi-agent systems research is, of course, the interaction between the agents, that is, the agent communication language and the interaction structure. The languages used for agent communication are different from those of traditional software systems. The latter stress the way information passes, and how to start up a procedure that is located in the remote system. The communication between agents

► And now... ILLC?

As we have seen, the formalization of social and intensional concepts is central to ILLC research as well as to *agent-oriented programming.* Yet, the approaches within the boundaries of the ILLC on the one hand and in the agent communities on the other are considerably different. Agents studied and developed at Utrecht University and the Vrije Universiteit have a more elaborate structure than the agents that figure in most ILLC publications.

As usual, one can argue that the difference should be sought merely in a difference of perspective. Most agent research is focussed on the development of agent systems and software. The term 'agent' is taken to be a metaphor for computational systems that can feasibly be described at an intensional level. The idea is that the more complex computational systems become, the more urgent the call for higher level description of that system. The petty details of what happens at a lower level only obstruct the view of the real issues when building complex systems. When describing computational systems at such a high level of abstraction, intensional, psychological, and social concepts play an increasingly important role. The basic idea is that we can hardly persist in trying to develop computational systems using the ones and zeros only. As such the rise of the agent paradigm is analogous to that of object-oriented programming.

But whatever they may be, agents remain computational systems that can be described in a