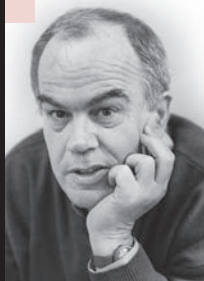


ILLC Magazine

February 2001

INTERVIEW WITH HERMAN VAN DER WUSTEN,
DEAN OF SOCIAL AND BEHAVIOURAL SCIENCES

Logic should *link up* more with the social sciences



Logic should *link up* more with the social sciences

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Interview with Herman van der Wusten; Dean Social and Behavioural Sciences

In this issue amongst others:

NWO 'Vernieuwingsimpuls' awarded to Rens Bod and Paul Dekker
Free-lance logic: interview with ILLC alumnus Jan Jaspars

NWO 'Vernieuwingsimpuls' awarded to Rens Bod and Paul Dekker

The Netherlands Organization for Scientific Research (NWO) has recently awarded a 'Vernieuwingsimpuls' grant to two ILLC researchers with challenging and provocative ideas. During the next five years, both Rens Bod and Paul Dekker will be provided with the means to develop and test these ideas. In this interview, they comment on their plans.

Rens Bod recently received an NWO 'Vernieuwingsimpuls' grant to investigate the relationship between logic and cognitive science.



Rens Bod recently received an NWO 'Vernieuwingsimpuls' grant to investigate the relationship between logic and cognitive science.

What are you going to do with this grant?

I'm going to investigate the relationship between logic and cognitive science.

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How do you see the relationship between logic and cognitive science?

Logic is a very important part of cognitive science.

Logic is a very important part of cognitive science.

Can you give an example of how logic is used in cognitive science?

Logic is used in cognitive science to model human reasoning.

Logic is used in cognitive science to model human reasoning.

INTERVIEW WITH JAN JASPARS

Free-lance logic

Having obtained his Ph.D. at the University of Tilburg in 1994, Jan Jaspars spent two years as a postdoc at CWI in Amsterdam. After that, he became the Netherlands' first freelance logician. His work activities can be found at www.science.uva.nl/~jaspars/activities/.



How did you become a freelance logician?

I became a freelance logician because I was interested in logic and wanted to work on my own.

I became a freelance logician because I was interested in logic and wanted to work on my own.

What kind of work do you do as a freelance logician?

I do a variety of work, including teaching and consulting.

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Dear reader,

With already the third issue of ILLC Magazine we hope to have reached the point of no return. Where the first issue was a try-out, and the second one still an insecure undertaking, the third issue may be called a solidification of this series, and a firm basis from which to continue.

As regular features in this Magazine you will recognize 1) the column of Johan van Benthem on The Challenge of Neurocognition; 2) an ILLC project description, this time on Quantum Computing; and 3) an interview with an alumnus, Jan Jaspars.

Our main interview is with professor van der Wusten, dean of the Faculty of Social and Behavioural Sciences. After the Deans of the Faculties of Science (ILLC Magazine No 1) and Humanities (No 2), he is the third Dean to give his opinion on the interfaculty institute ILLC. What's more, this issue contains a double interview with Paul Dekker and Rens Bod, who have both been awarded the prestigious 'Vernieuwingsimpuls' by NWO. Finally, Elena Lissaniouk from St.-Petersburg State University enthusiastically describes her visit to ILLC.

Our special thanks go to Marc Pauly who volunteered to interview Jan Jaspars, and to Balder ten Cate who was responsible for the interviews with Rens Bod and Paul Dekker.

We hope you enjoy reading the issue.

On behalf of the editors,

Ingrid van Loon



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COLOPHON

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PREFACE BY THE DIRECTOR

A change for plans for plans, change

Some people consider a research institute such as ILLC as an oasis in the midst of the desert of 'real life', one of the few places where people can pursue their interests in tranquillity, without having to respond to a constantly changing environment. This is the picture of the theoretical scientist as a monk in monastery, undisturbed by the turmoil of every day life, quietly investigating solid and permanent truths. Well, that may be what it looks like from the outside, but those who are on the inside know better, of course.



First of all, the university has its cycles of planning and change. Some of these are determined by developments on a political level, others by its own internal administrative logic. Not all of these changes and planning cycles are equally transparent, at least not from the perspective of the working scientist. There seems to be at least some truth in the saying that politicians want to be remembered for what they've changed, not for what they've kept in place. But inasmuch as these changes in administrative structure, financial planning cycles, and so on, are motivated by a concern to meet the challenges of a changing society, they are for the better. At least they should be and it is up to us to see to it that they are. ILLC, as any university institution, is subjected to these changes and in the last issue of the ILLC Magazine, Peter Blok has given an overview of what that involves.

But there is a second, far more important source of change: the scientific environment in which we do our research. This environment is not fixed and stable, but rather is in a state of permanent flux. It changes constantly and it sometimes does so in unpredictable ways. Here we are both agent and patient. Some of these changes happen because we play an active part in initiating them, Others occur elsewhere, but we need to react and adapt to those as well. One of the major challenges that a research community such as ILLC faces, is to plan for these changes as much as possible. Of course, it is difficult to predict scientific developments over a longer period of time, yet one has to try to anticipate and prepare for them.

One instrument is that of the 'long term research program'. Research institutes are required to have research programs, covering a four year period, in which they plan for future developments. Last year ILLC has gone through this process of planning its research when it drew up its Research Program 2001 - 2004. We have identified two areas in which we expect major new developments and in which we want to invest more resources. One area is that of computational logic, which is rapidly developing and which promises not only connections with applied research, but also new theoretical insights, for example in relations between complexity and expressive power. The other area is that of relations between logic and semantics, and cognitive science.

Psychologists and biologists study cognitive abilities experimentally which logicians and semanticist approach from a theoretical angle. A common interest exists, the challenge is to turn that into a common endeavor. Furthermore, the new Research Program 2001 - 2004 also rearranges some of the existing projects so as to optimize the possibilities of new connections and collaborations. (For those readers who are interested in the details: the program is available from the ILLC office.)

But, one might ask, what is the actual value of such an exercise, if scientific developments are so hard to predict? A final answer must wait until we reach the end of the planning period, of course. But there is another reason why drawing up a long term research program is a worthwhile undertaking. It forces us to take a step away from the actual projects we are engaged in on a daily basis and to think in a more disinterested fashion about how our field is developing, how we want it to develop and what part we can play in that. Such instances of collective reflection are very valuable by themselves, and their importance does not depend on what the actual outcome of future developments turns out to be.

Unplanned for, the contents of this issue of the ILLC Magazine turns out to be more or less related to the theme of planning and change.

In his column Johan van Benthem sketches one of the most profound scientific challenges which logic and semantics face today, which was already hinted at above, viz., the rapid development of research in neurocognition. For the first time we are able to study cognitive processes such as reasoning, vision, speech, in real time and at the most basic physical level. We can see, almost literally, what is going on and that will change how we think about our own, higher level enterprise in fundamental ways.

The ILLC project description is on one of the most exciting developments in the field of computer science, that of quantum computing. This is definitely a development that, if it turns out to be practically realizable, will drastically change, if not the way we think, the way we work.

Rens Bod and Paul Dekker represent another aspect of planning and change. They both have received a 'Vernieuwingsimpuls' grant from NWO. The Vernieuwingsimpuls program is explicitly dedicated to foster 'high risk' research, i.e., the 'I can't really explain, but I have a hunch' kind of exploring of new directions that may change the field but also may turn out to be a dead end. But, of course, you only allow very talented people to engage in such an enterprise, so as to make sure that even if the new direction turns out to be a dead end, it will be an interesting one, one that is worthwhile to explore.

Finally, the interview with Jan Jaspers touches on planning and change in yet another way. He presents ILLC's alumni-to-be with an almost Stoic outlook on the idea of a career: planning is not that important and a change of environment is a joy forever.

Martin Stokhof
Scientific Director ILLC

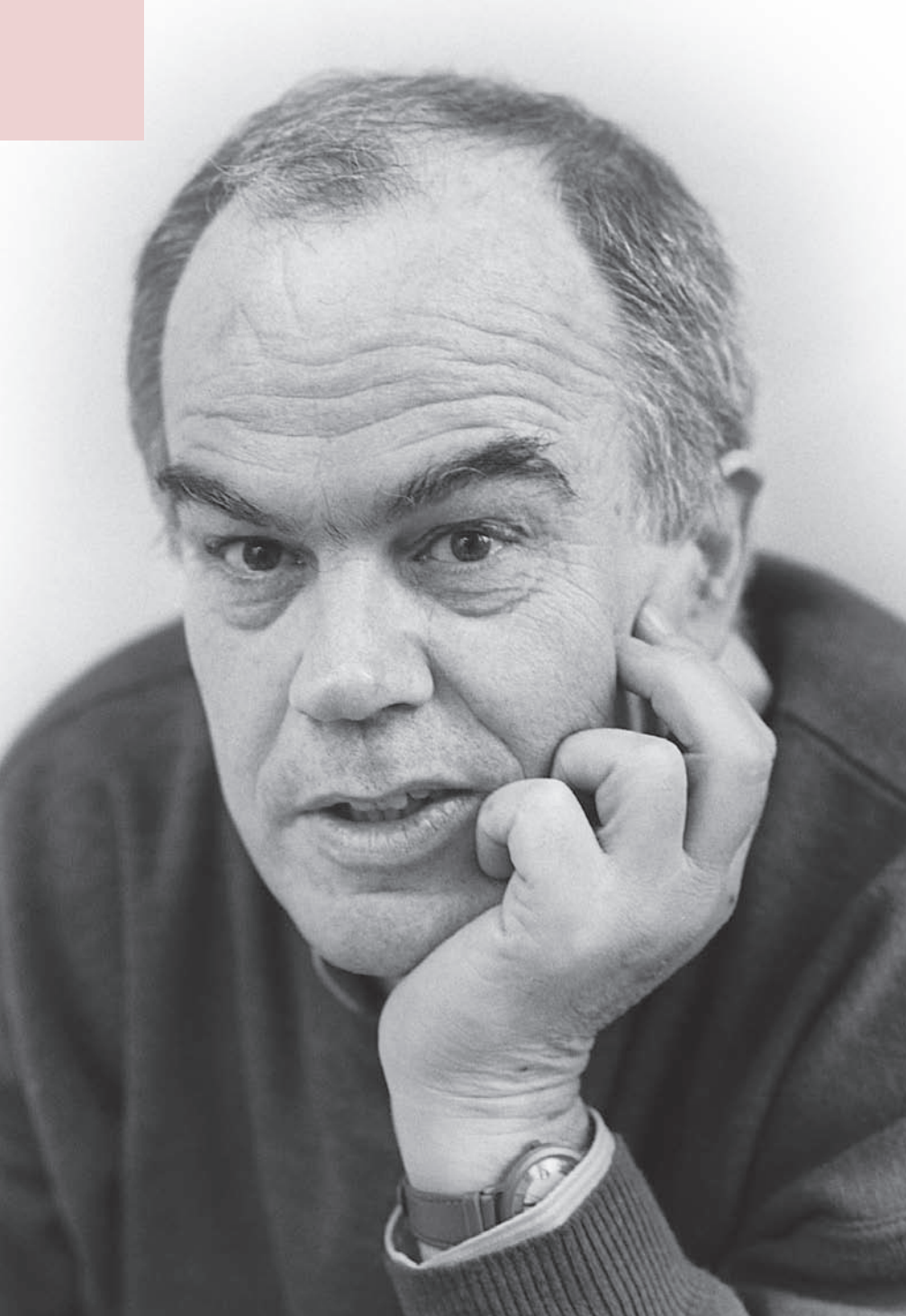


Professor Herman van der Wusten, Dean of the Faculty of Social and Behavioural Sciences, contributes only a 'smidgin' to the ILLC. Yet he believes it is an important institute. 'Logic is concerned with the rationality of scientific practice.'

For almost all his life Van der Wusten has been connected with the Universiteit van Amsterdam (UvA). First as a student of social geography, then as a staff member. He took his doctoral degree in this subject and is now Professor of Political Geography, a subdivision of social geography. 'I wouldn't advise such a monomaniacal career to anybody. But that's the way it went, there's nothing I can do about it.' A few years ago Van der Wusten was called by the then chairman of the board, Jankarel Gevers. 'Gevers was introducing at the UvA the act designed to modernise the administrative structure of universities, the so-called MUB.' In Van der Wusten Gevers found one of the first new 'professional' deans. The introduction of the MUB at the UvA involved a considerable expansion of the faculties. Van der Wusten became the 'group dean' of

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a new faculty combining the Faculties of Educational Sciences, Social and Political Sciences, Psychology and Environmental Sciences. The new faculty was called the Faculty of Social and Behavioural Sciences (FMG). At the same time the institutes were given free scope and more independence. 'This was also an important development for the Institute for Logic, Language and Computation.'

Van der Wusten is stopping in May after being dean at the FMG for almost four years. 'From the start I said that I would do this until I was sixty.' The new faculty is well on its way in terms of its organisation, Van der Wusten believes. 'The units are working. There's a lot more room for improved co-operation and managing the business is still a hell of a job. Take the ILLC, which depends on three faculties.'

A present focus of attention is how the ILLC should function in the coming years. Each faculty has its own preferences, so it is always difficult to arrange affairs across faculty borders. Roughly speaking, two things should be quite clear. Van der Wusten: 'How much money are we going to put in during the next four years, and how much freedom to operate will the institute have?'

The ILLC is a research institute. For Van der Wusten it is interesting how the institute deals with teaching. This, too, is differently organised in each faculty. 'In the science faculty the entire organisation is part of the *research institute*, because much more research goes on than teaching. In the humanities and the social

sciences the *departments*, where you find the staff, have their own important function.' The departments and the teaching institutes in the FMG have to negotiate seriously on staff. And the research institutes take part in these negotiations. 'It's a complicated, continual triangular negotiation.' There are two forms into which 'an interfaculty

'When I read the ILLC research programme, I see increasing links between psychology, biology and medicine, especially in the field of information processing. I think this is an interesting development.'

adventure', as Van der Wusten calls it, can be moulded. In one form the staff continues to work at a research institute of the faculty, but is then seconded to a new construction. This applies to e.g. the Amsterdam Institute for Labour Studies. 'The co-operation is more a kind of network construction between the faculties.' Things are different at the ILLC, because they are an institute by regulation. 'With the ILLC you can really do business. We say: you get this amount of fte (full time equivalent), after that it's up to you. Of course, it's easy for me to talk, because the FMG's contribution to the ILLC is very modest.'

This contribution - 'a smidgin of FMG' - has its origin in the 'Pionier' project which the Netherlands Organization for Scientific Research (NWO) awarded to Michael Masuch some time ago. The research, which Masuch carried out with Professor Mokken, was aimed at formalising the development of theory in the social sciences. 'If you look at the logical structure of a theory in a series of hypotheses, you often find internal inconsistencies.'

Van der Wusten observes that in recent years the ILLC has become more interested in the so-called neurosciences. 'When I read the

ILLC research programme, I see increasing links between psychology, biology and medicine, especially in the field of information processing. I think this is an interesting development.' Van der Wusten knows from experience that psychologists are inclined to react cautiously at first, but he would not be surprised if more and more psychologists started to engage with the ILLC the coming years.

The Dean of the FMG regrets the lack of interaction between logicians and the rest of the scientific field. 'You see that small groups get smaller, that people discover wonderful things, but in general the effect on scientific practice is a bit disappointing.'

Logic is concerned with the rationality of scientific practice, so it makes sense to present the results as clearly as possible. 'It's not a direct reproach to the ILLC, but more a general problem that people don't always think about the broader implications. And on the other hand the receiving party is easily inclined to think that it's all too complicated for them.' So Van der Wusten would be happy if logic linked up more with the disciplines in the FMG. 'You see a cyclical development in logic. The field which people regard as logic grows and shrinks again in the course of time.'

'You see that small groups get smaller, that people discover wonderful things, but in general the effect on scientific practice is a bit disappointing.'

Van der Wusten himself has had two major experiences in interfaculty work. He knows that it is not always easy. 'For years I carried out studies in socio-political compartmentalisation with Hans Blom from the Humanities. He really has a different point of view. Our Ph.D. students had a consultation group, and we worked together intensively, but if you ask us what socio-political

compartmentalisation is, we both have different stories.'

Van der Wusten has an idea why: 'Historians tend to see each fact in itself as unique, whereas social scientists look at generalities. It's typical that we didn't succeed in producing a final product together.'

Another of Van der Wusten's experiences involved research in the home regions of foreign workers. 'Physical geographers, economists and social workers were working together there. Sometimes I was annoyed by the economist who was always talking about money, but when we drew up a report at the end I discovered that it made for a broader line of approach.' It is more complicated than working in your own disciplinary group, Van der Wusten believes. 'It really takes getting used to. If you are working in a really multi- or interdisciplinary way, you come up against your own presuppositions. Everybody has his or her own tacit assumptions.' But Van der Wusten also emphasises that it is not at all wrong to have blinkers. 'You've got to think: this is my angle, but what's the drawback? If you look at it this way, you can make advances, and even restructure scientific fields.'

It is not to be expected that the FMG will greatly increase the relatively small contribution to the ILLC in the coming years. 'If you want to transfer extra manpower to the ILLC, you're talking about shifting people and money around. There is no free money. (...) At the moment a sum of money is always being tugged at by people. I can shift people around but at the moment this isn't an obvious thing to do. There is no group in the FMG which is more suited to the ILLC than the existing institutes in the FMG. But we need to take note of what is happening in psychology. In the next contract in four years' time we will have to see whether perhaps some things can be shifted around there.'

All in all Van der Wusten is very satisfied with the ILLC. 'Serious work is done there and it projects a fairly strong image to the outside world. Hallelujah, I would say.'

Ward Wijndelts

Quantum Computing

Remember that a cat is said to have nine lives? A Quantum Cat does even better: it can be dead and alive at the same time. This wizardry is at the heart of quantum computing, a novel way of computing based on certain characteristics of quantum mechanics.

It emerged in the 1980s as a theoretical alternative to traditional computing, which is being faced with its physical limitations before long. The possibilities are very promising, but the field is still in its infancy, and realization of a working quantum computer is still an enormous challenge. CWI (National Research Institute for Mathematics and Computer Science) started the first quantum computing research group in The Netherlands (and one of the first in Europe) in 1995, and has contributed significant discoveries in the field. The European Union has recognized the importance of this research and has given the group substantial support.

Experience over the last half-century shows that computing power doubles every 18 months (Moore's law). This is primarily due to the ongoing miniaturization of computing elements, made possible by reducing at the same time the heat dissipation of the computing process, so that this is kept within acceptable limits. However, miniaturization will soon reach the size of individual atoms. There it is faced with a fundamental lower



limit of energy dissipation, unless we drastically change our computing methods. At the atomic level the laws of mechanics ruling our daily life break down and should be replaced by those of quantum mechanics. This complication gives us, however, also an added bonus: quantum mechanics offers a novel way of computing, enabling computations out of reach for traditional computers, even if these could be miniaturized to the same level. An example is the factoring of large numbers, of crucial importance for, e.g., internet security.

Quantum mechanics was developed in the 1920s to describe phenomena at the atomic level, which could not be explained by ordinary classical mechanics. Despite its enormous success it has always remained a 'difficult' subject, because several of its features contradict everyday intuition. A crucial notion is 'superposition': entities like

electrons seem to behave on the one hand as a small localized particle, on the other hand they seem to be a wave. An electron, fired towards a screen with two slits in front of it, however seems to be neither a particle nor a wave. According to quantum mechanics it is in a superposition of going through the first as well as through the second slit.

Erwin Schrödinger, who won a Nobel Prize for the invention of wave (quantum) mechanics, designed in the 1930s a thought experiment to illustrate a seemingly absurd consequence of the new mechanics. A cat sits in a closed box together with one radio-active atom. This atom will decay with a certain probability, according to the laws of quantum mechanics. Upon decaying, the emitted nuclear particle crushes a thin glass tube filled with cyanide and the cat dies instantly. Being outside the box, we don't know whether the radio-active particle has decayed and thus



whether the cat is dead or alive. Quantum mechanically the animal is in a superposition of both states with a certain probability. If we look inside the box, however, we see only one of the two states: the cat is either dead or alive. An observation of the 'superposition' of states makes it collapse to one of the cases with a certain probability.

Quantum mechanics describes matter as a superposition of all of its possible states, each with a certain amplitude – a complex number whose modulus squared is interpreted as a probability. These amplitudes thus have addition properties different from ordinary probabilities – a feature that becomes apparent in 'interference'. Precisely this feature together with the superposition principle gives quantum computing its power. The evolution of a system is described by a unitary operation on the superposition which preserves the probability interpretation of the amplitudes.

In traditional computing the smallest unit is a 'bit' which can only take the values 0 or 1. Quantum computing is based on 'qubits' which consist of a superposition of the two classical states 0 and 1 each with its own amplitude. Several physical realizations of qubits have been proposed, including an atom in the ground state (0) or excited state (1), the spin of an atomic nucleus (up or down), horizontal or vertical polarization of a photon, a current in a superconducting ring (left or right turning) and a more complicated silicon based proposal. A computation starts with a number of qubits in a well-determined state, on which a series of unitary operations is performed

(the algorithm). Because of interference certain superpositions are intensified, whereas others cancel each other out. After a number of steps the final state (the result) is observed. During the intermediate evolution all possible computational paths are followed



simultaneously (quantum parallelism), but they remain hidden in a box. In certain cases this form of computation may lead to a tremendous speed-up compared to traditional methods, but at the same time it poses equally tremendous problems. "Do not disturb during computation", runs the slogan: the smallest disturbance from the environment may ruin the delicate superposition and may render the computation meaningless.

An important notion in quantum mechanics and quantum computing is 'entanglement': two (or more) qubits can be prepared in such a way that, although they are separated in space – one could be on Mars and the other here on earth – they have correlations that can not be explained by classical probability theory, for example two atomic nuclei having unknown but opposite spins. As soon as one qubit is measured, the content of the other is also known, no matter how far they are apart. This property can be used for error correction during the computation, as well as for more efficient transmission of information and for certain forms of distributed computations. (Interestingly enough, entanglement was introduced in the 1930s by Einstein, Podolsky and Rosen as a paradox, in order to show the incompleteness of quantum

mechanics, because it seems to violate the principle that information can not travel faster than the speed of light.)

The field of quantum computing started in the 1980s and gained momentum after P.W. Shor showed in 1994 how to construct an efficient algorithm for factoring large numbers, by a clever use of superpositions, interference, Fourier analysis and some number theory. Most public-key cryptosystems, extensively used on the Internet and in the financial world, are based on the difficulty of factoring large numbers with traditional computing methods. Quantum computing may break those systems, but offers in return other, secure ways of coding information. Another quantum algorithm by L.K. Grover (1996) to search a database is quadratically faster than any classical algorithm.

CWI has applied quantum computing notions to communication complexity, which addresses the question how many bits have to be communicated between two parties who jointly want to compute some function, each having only part of the input information. In some cases the amount of communication can be significantly reduced. A number of strong and general limitations of quantum computers was found, as well as some new speed-ups. The extreme vulnerability of quantum superpositions has led to quantum versions of error-correcting codes. To make these work in practice more knowledge of quantum information theory is needed. CWI studies this field, alongside related notions as quantum Kolmogorov complexity. Finally, CWI's research into 'quantum entanglement' also contributes to quantum theory itself.

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'The Challenge of Neurocognition'

interface of what is nowadays often called 'informatics': the study of information structures and processes in their broadest manifestations. This study involves logic, linguistics, computer science, philosophy, mathematics, and crosses into further fields like economics or sociology. Central themes include information, languages, algorithmic complexity, expressive power, reasoning, and communication, and learning. But how does one judge the merits of a logical theory produced in our usual fashion about some 'informatics' phenomenon? One well-known way goes like this: take a breath, look important, and solemnly say the words "this theory reflects my intuitions". It was Saul Kripke who once wrote that, ultimately, an appeal to intuition is the deepest justification one can have in our field. But times change, and such appeals, even when coming from professional geniuses, no longer sound as convincing as they once did. Nowadays, many people would like to see some additional validation of their logical systems, at least in the form of computational experiments establishing their average behavior when really used. Of course, there is not one way of justifying a theory. One can use a logic system to create a virtual reality that 'works', regardless of whether it correctly described anything that existed before. And one can also judge a system on esthetic merits. It might be totally wrong, utterly useless, but hauntingly beautiful.

In the course of a century, logicians have developed sophisticated 'protective barriers' between our theories and reality. Thus, with the linguists, we can say that our business is describing 'competence': what rational language users or cognitive agents can do in principle. Or we can justify our job as being normative: describing what people should do - and if they do not 'behave', threatening them to design a machine which does better. The result is a safe cushion between theory and practice, just as in other academic disciplines - and, let's face it, even in industrial research labs, once one takes the trouble to really look inside. But even through all this insulation, a little voice keeps asking this little question to logicians like me:

How do people really do it?

And the worry is that they do pretty well in language and reasoning tasks, but not in our framework at all. This point has been made by many authors through the last century - and indeed, the Ancien Regime has had its difficult moments, when Thermidor seemed around the corner, and many crowned heads would finally roll. One forceful onslaught was that of cognitive psychology in



Column by
Johan van
Benthem

the 1970s, when Johnson-Laird claimed significant reasoning was not form- but content-based. Another close call was the advent of neural nets in the 1980s, which promised a realistic account of cognitive tasks close to brain action - without any of the representation or rule systems that logic deals with. Logic has survived both, for reasons too complicated to explain in this column - and what's more, it has left the battlefield, perhaps mauled, but with battle honors intact. But lo and behold, in the 1990s, the next challenge arrived with modern neuro-imaging of brain activities. So, has our profession finally been superseded by those scans and those nice (false) color images of brain areas firing up as we read, think, or plan?

What is certainly true is this.

Neurocognition provides online real-time measurement of brain activities that some time ago were considered irrevocably 'behind the veil of ignorance', and therefore the exclusive domain of 'intuitions'. The repercussions of this experimental fact have not yet been grasped, by and large, by the logical community. But think of this: we no longer have to speculate what happens when people reason about a particular task. We can tell them to do it, and literally see what their brain is doing. Of course, you can read a genius like L.E.J. Brouwer as usual about the foundations of "two-ness" and more intuitionist fables, if you so prefer. But you can also observe what numerical thinking really does in the brains of this particular biological species which happens to have invented these number systems. Linguists and psychologists have been faster these years in adjusting to this new horizon for their research. But eventually it will also open up for researchers interested in the actual workings of logical reasoning, or mathematical proof.

Indeed, logic and neural structure are not total strangers. Already in the 1950s, perhaps the first significant, and still basic result about the computing power of the neural networks of the time was proved by Stephen Kleene. Understanding the more sophisticated neural structures known to-day and their expressive and algorithmic properties is one kind of contact. But a different direction of approach is also possible. We can try to give our usual concerns an extension into the empirically measurable. For instance, much of ILLC's work on concept formation, vision, non-classical reasoning styles, or efficiency of logic architectures can be seen as a form of cognitive theorizing which could benefit from empirical testing. Now, obviously, it is not clear what exactly can be tested in terms of activation patterns - and what, say, brain scans of people engaged in classical versus nonmonotonic reasoning would actually

tell us. But instead of thinking up obvious skeptical arguments here, might it not be more exciting to find out what can be done with the new apparatus?

As has often been said, predicting the future is difficult, while predicting the past is much easier. I have aimed here for a middle ground, predicting the present. For, as it happens, the kind of contact I am advocating here can be found in the recent work of Renate Bartsch - while it is also very much on the mind of our newly appointed professors of 'Logic and Cognition', Michiel van Lambalgen and Frank Veltman. Moreover, bridge themes like the above are being explored right now in

informal contacts between ILLC and the Amsterdam Neurocognition group, with a view toward establishing collaborations between the 'logicians' and the psychologists-cum-neurobiologists. This local initiative reflects an upcoming national initiative by NWO for stimulating the cognitive sciences in their full width, from the sciences to the humanities. ILLC is certainly not the front-runner in this movement - the BCN in Groningen and the NICI in Nijmegen are leading the pack. But at least it seems that ILLC is getting up and running, with some of us becoming eager to see what people actually do when they engage in the activities that we profess to study.

My Logical Window

Elena Lissaniouk is lecturer at the Department of Philosophy of St.-Petersburg State University. She visited ILLC from December 6 - 12, 2000.

Everyone knows that 300 years ago Russian czar Peter had breached a window to Europe and the first route he himself used it for was St-Petersburg-Amsterdam. Nowadays most logicians know that Amsterdam is one of the best places for doing logic. First, the tradition, for much of the 20th century logical classics was done either at the University of Amsterdam, or by the researchers that were somehow related to it. Second, the leading position in modern logic and logical semantics, which undoubtedly belongs to the worldwide famous Dutch school in logic. That is why I chose the ILLC for a short academic stay and was never

dissatisfied. Talks with the ILLC researchers...the use of the library...ILLC's publications: the two weeks I spent at ILLC were as fruitful as I could have only dreamed of. During my stay the 5th Sinn and Bedeutung Conference was held in Amsterdam, where it became obvious to me that our Russian tradition in logic is mostly continentally oriented, though nowadays it can also be called quasi-analytical. Russian logicians and semanticists are working on logical problems, which to a large extent do not deviate much from the ones in the analytical tradition, but they use 'continental spectacles'. In their research, normally they try to start from and/or to find out a metaphysical background, underlying paradigm (or possible paradigms), which they suppose to be their basic area of concern, and to inscribe the provided solution to a question into that background.

The majority of their analytical colleagues normally aim at posing



a question through numerous problematic instances of its occurrence, and then they suggest a solution to that rather separate question, which still lie in the basic problematic area under concern. Such approach has been lively presented during the Sinn and Bedeutung Conference. The whole framework of the conference reminded me of a puzzle with participants' papers as different fragments of it and with the questioners in the sections and invited speakers as trying to assemble the whole picture. Such considerations led me to a suggestion that a joint discussion among scholars who are exhibiting apparently distinct approaches to similar problems can be fruitful for both sides and hopefully to an elegant solution of a problem in question. Perhaps, it's time to have a door instead of the window, isn't it?

Elena N. Lissaniouk

A DOUBLE INTERVIEW

NWO ‘Vernieuwingsimpuls’ awarded to *Rens Bod* and *Paul Dekker*

The Netherlands Organization for Scientific Research NWO has recently awarded a ‘Vernieuwingsimpuls’ grant to two ILLC researchers with challenging and provocative ideas. During the next five years, both Rens Bod and Paul Dekker will be provided with the means to develop and test these ideas. In this interview, they comment on their plans.

Rens Bod is presently working as a KNAW fellow at the department of computational linguistics. He has done research on combining linguistic and statistical information in speech recognition.



“It is very frustrating to see that most people who have tried to do speech recognition on the basis of real, linguistically motivated grammars, end up with systems that perform even worse than simple Markov models that have no linguistic knowledge at all, except for the chances that one word follows another.”

Bod has worked on the combination of these successful statistical methods of Markov models with grammatical, linguistic models. After he finishes his current project in June or July, he

will start with his new research project, which is called ‘Towards a Unifying Model for Linguistic, Musical and Visual Processing’.

Bod explains that his project contains two innovative elements. The first is an attempt to give a uniform account of visual, musical and linguistic perception.

“That people perceive structures is not controversial. For visual, musical and linguistic perception, it has become normal science to talk in terms of hierarchical structures. What is controversial and innovative however, is to look for one universal model that for any new input, be it visual, musical or linguistic, can predict the observed tree-structure. In the Chomskyeian tradition, it is commonly assumed that there is a separate language-device. For musical and visual perception, similar assumptions have been made. I do not want to argue against this. However, I want to see whether an underlying generalization exists for all these cognitive faculties.”

The other innovative element in Bod’s proposal is his attempt to combine two principles of perception.

“For structural perception, two seemingly incompatible principles have been proposed. On the one hand, there is the principle of simplicity, which was introduced by Wertheimer and the other

Gestalt psychologists and philosophers. On the other hand, the 19th century genius psychologist and physicist Helmholtz argued that in case of ambiguity people prefer the most likely interpretation.”

“These two principles, simplicity and likelihood, independently show up in different fields of research, such as computer vision and natural language processing. My idea is to combine the two principles. I have strong intuitions that independently of each other, simplicity and likelihood play a role in human perception. On the one hand, people prefer the simplest tree-structure. This is related to the minimum effort principle. But in this search for the simplest structure, they are continuously biased by the frequencies of previously observed structures.”

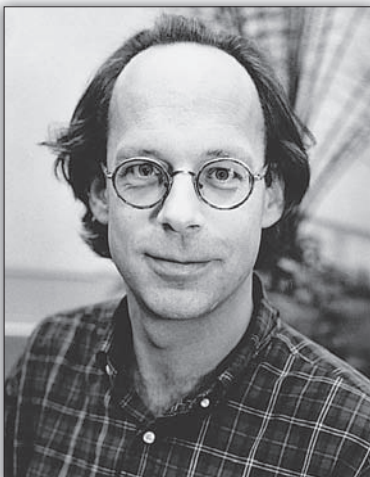
Bod illustrates this with an example. “If I pronounce a word like *Alblasserdam* very quickly, you can easily think I said *Amsterdam*.”

The ‘Minimum Description Length Principle’ that also figures prominently in the work of Paul Vitanyi and others on Kolmogorov Complexity represents one way of combining simplicity and likelihood. Part of Bod’s plan is to see how this can be applied to visual, musical and linguistic perception. Another starting point is the memory-based model which is known as ‘data-oriented parsing’.

It works with corpora - large databases of sentences - that have been manually annotated. For linguistic purposes, many such corpora exist. In Amsterdam, the OVIS corpus has been developed, which is also annotated semantically. Likewise, several musical corpora exist, such as the Anthem corpus, containing 105 national anthems, and the Essen folksong database.

For visual perception however, it is harder to find suitable corpora. Here, Bod's background also shows itself. Having graduated in history of art before he became interested in computational linguistics, Bod would like to apply his system to architectonic maps from architects such as Palladio, which, as he explains, also have a very hierarchical structure.

Paul Dekker is currently finishing his KNAW project 'Formal models of information exchange', which is to result in a final paper 'Meaning and use of indefinite expressions'. He expects to be finished with this in April. Then, he will start with his new project, 'Formal language games'.



In this project, he tries to "generalize and systematize the game-theoretical outlook upon the meaning and use of language".

"Games have been used before in logic, linguistics and dialogue theories, but they haven't so much been taken as a starting point. The innovative element is that now the

game-theoretical perspective is really taken as a basis and we try to systematically analyze the relations between games and language within the framework. This is a challenging idea in the sense that success is not guaranteed. Which was also one of the selection criteria used by NWO."

On the question why games have recently gained so much interest in the ILLC, Paul answers: "One of the reasons is that Johan van Benthem has become interested in games. He always has a pull on many people. In addition, I think that games quite readily suggest themselves to us. It is not a coincidence that they have been used in logic, linguistics and dialogue theory before. This is especially clear when you leave the static perspective and start looking at the actions people actually perform. Language-use is a rational form of cooperative behavior. Even in situations of conflict, a minimal degree of cooperativity is necessary. Rationality and cooperativity are also basic aspects of games, so that provides a clear link between the two topics.

"Furthermore, like games, language-use is a rule-based form of behavior. People always talk about the 'rules of the game'. Logic can also be seen as the study of certain rules of reasoning. Broadly speaking, such rules of conversation, reasoning, information exchange, question answering, etcetera can all be traced back to the general idea of language-use as a game."

One feature of Dekker's game-theoretical approach is that it can provide a more qualitative perspective on interpretation. This might suggest there is a link with Bod's project. However, Bod notes that "Paul's topic is more concerned with semantics and pragmatics, whereas I restrict myself mainly to structural perception: recognition of complex, hierarchical structures. The step to semantics is only taken in the second phase. It is already a big challenge to see how linguistic, musical and visual input are assigned a structure, even when it is

still the question whether we are concerned with actual communication."

Currently, Dekker is looking around for research staff. He notes that suitable people are hard to find, especially outside of Amsterdam. Bod also explains that it is hard to compete with industry. "I saw a number of brilliant students leave. Unfortunately we can't offer them the same salaries."

A positive aspect of programs such as the Vernieuwingsimpuls program, Bod states, is that they offer structural possibilities, unlike postdoc positions which only last two or three years. "In that sense, the existence of projects like the Vernieuwingsimpuls, which basically requires that afterwards, the university offers the candidate a position, is a very good development."

Dekker is also very positive. "During and just after my Ph.D. work, there was a period in which it was very hard for new people to get through the thick layer of permanent staff. I'm one of the few people who finally managed. This situation has changed, partly because of projects such as these. Not only does the system become somewhat more flexible, but also new opportunities are created in this way."

About the selection procedure, Dekker notes: "At first, I was surprised by the little amount of information on which the decision is based. Compare it to for instance Pionier-projects for which 80 page-reports are written before the final decision is made. On the other hand, I was pointed out that one should compare it also to applications for permanent appointments. These are much more expensive on the long run, while the decision is usually based on just a job-application and an interview."

Balder ten Cate

INTERVIEW WITH JAN JASPARS



Free-lance logic



Having obtained his Ph.D. at the University of Tilburg in 1994, Jan Jaspars spent two years as a postdoc at CWI in Amsterdam. After that, he became the Netherlands' first free-lance logician. His web animations can be found at www.science.uva.nl/~jaspars/animations/.

I am just realizing, you obtained your PhD in Tilburg, so why do we interview you as an alumnus of the ILLC? It seems that everyone considers you an ILLC alumnus. I guess it's because your thesis appeared in the ILLC dissertation series?

I don't actually know about the precise selection criteria of ILLC alumni. But, yes, nothing to be hush-hush about, I got 'aluminated' in Brabant, at the Catholic University. It was not so much a matter of religious background, but more a good alternative to escape from the aio-oio regime at the time. I had a normally paid research job there and could work at my PhD at the same time.

I studied maths and logic in Amsterdam, most of my dissertation is about modal and dynamic logics, much, if not all, of the supervision was taken care of by Johan van Benthem, and then, post-doctoral life I spent in Amsterdam again ... that probably makes me look less gringo and more ILLC-ish.

What does a free-lance logician actually do?

A: Mainly my work consists of teaching courses on logic and computer science at different universities in the Netherlands. But I am also developing course material. In particular, I develop applets and scripts for visualizing logical and computational concepts.

What is the job market like for free-lance logicians? Are you "fully booked?"

I started in 1997 and I know that business will continue at least until 2003.

Do you give yourself any vacation?

The strange thing is that it seems there is more free time and more work, a natural consequence of giving up the classical mechanics of fixed working hours at a fixed office. Is that time dilatation as a result of the higher speed of life? Not really, there is just more overlap and that suits me better.



I spend more and more time on programming and writing, and if internet connections work properly, this can be combined with escaping from Dutch winters.

Do you do any work in the nonacademic world? Has there ever been a private person or a company calling you up because they were in need of a logician?

Not really. I once gave a course 'foundations of computer science' for IT-trainees at the PTT, but it was organized by Leiden university who asked me. At the moment I cannot think of 'commercial' applications which I would like better than the work I am doing now, and I haven't start looking for such possibilities. But who knows what the future may bring. As a free-lancer I do not have to change jobs to change my work.

What was your PhD thesis entitled “Calculi for Constructive Communication” about?

I developed a logic for reasoning about changing epistemic states in a multiple agents setting aiming at a logical analysis of communicative actions and their associated pre- and postconditions such as Gricean maxims. The first step was representing epistemic states on the basis of partial possible worlds, inspired by Barwise and Perry’s situation semantics and the more classical approach to partiality of my former Tilburg colleagues Reinhard Muskens and Elias Thijssse. The nice thing of partial modal logic for modeling epistemic reasoning is that it is possible to distinguish ignorance and doubt.

The next step was to implement the dynamics of such states for which I chose the line of Johan van Benthem and Maarten de Rijke’s dynamic modal logic. In this way it was possible to model growth of knowledge as a combination of enriching and elimination of possibilities: a constructive destructive logic. The final result was a decorated unorthodox version of intuitionistic modal logic in which epistemic possibility (doubt) behaves nonmonotonic ... diamonds are not forever!

Do you still have time to do research?

Not much. My original idea was to still have time for about one more substantial article per year, and I certainly have spent some time doing research with some colleagues in Germany and Holland over the past few years. But since my work is getting more irregular it is getting harder, if not impossible, to maintain collaborations. I got some private investigations going on, but it is just harder to stick to the normal procedures of publication.

Besides teaching, you also develop interactive web applications to accompany courses.

A: Yes, it all started with the interdisciplinary Betagamma course on programming and reasoning in 1998. This was a course for first-year students to learn the basics of structured programming and program correctness proofs on the one hand, and logical modeling on the other hand. The idea was to make some interactive applications to let the students experiment with e.g. how a Turing machine works, how logical formulas can be evaluated in a model, proof checkers, etc.



I got inspired when I tried Barwise and Etchemendy’s ‘Turing’s World’ in a course on formal languages and computation. The problem was that the book was too expensive to use next to the textbook we used for the course. I learned about JavaScript and programmed a few Turing machines so that students could play with this machinery over the net. I found out that difficult subjects can become highly teachable through such visualization. When you start proving a difficult theorem after this kind of introduction you just have more referential possibilities to let the students follow the essential steps.

Besides that I gained credibility as a teacher since I managed to master the formal languages that students use themselves nowadays.

The last two years I also tried this method for more advanced logic courses in Utrecht: nonmonotonic reasoning and modal logic. With some simple machinery you can easily explain difficult things like the difference between circumscription and default logic or frame correspondences for modal formulas. I believe very much in learning mathematics in a functional way. This does not mean that I insist on real life applications.

Just simple pictures with some buttons can do a great job for understanding by practice in addition to the standard pen and paper work. What I do not believe in is that computers may replace classical teaching, blackboard instructions and textbooks. A problem of many software education programs is that the teaching material tends to depend too heavily on the software. The inevitable danger is that students mix up the knowledge of the theory and the ability to master the software.

Any advice to current PhD students?

Don’t think too much about what will happen after your promotion. It disturbs this happy period of pure research, and given the current job situation in both academic and nonacademic areas, there is no need to worry.

Does a free-lancer have plans for the future?

Not really. I am currently involved in a project with Amsterdam University Press (AUP) which aims at producing a book with additional software for high school students on machines and logic. This line towards the more elementary issues on a basic level for a pre-academic audience I want to pursue further in the future. One of the advantages of my position is that I can make gradual shifts of emphasis easily in order to get into new areas.

Marc Pauly



**Personnel
July 2000 -
January 2001**

Left:

- Jon Ragetli, September 1, 2000
- Paul van Ulsen, PhD defense September 26, 2000
- Maria Aloni, PhD defense January 25, 2001

New:

- Rosja Mastop, PhD student "Exchanging Information", January 1, 2001
- Boudewijn de Bruin, PhD student "Logic, Game Theory and Philosophy", September 1, 2000
- Sebastian Brand, PhD student Coordination-based Parallel Constraint Solving, September 1, 2000
- Balder ten Cate, PhD student "Rational Communication and Dynamic Semantics", October 1, 2000
- Willem Jan van Hoeve, PhD student "Integration of Constraint (Logic) Programming and Mathematical Programming", October 1, 2000
- Maarten Stol, PhD student "Simulation and Testing for Feature Interaction", January 1, 2001
- Caterina Caracciolo, PhD student "Logic Language Links project", March 1, 2001

New professors:

- Harry Buhrman: full professor Algorithmics and Complexity Theory, in particular of physical systems, January 1, 2001
- Michiel van Lambalgen and Frank Veltman: full professors, together occupying the chair in Philosophical Logic and Cognitive Science, probably as from March 1, 2001
- Dick de Jongh: full professor in Pure Mathematics, in particular foundations of Mathematics, probably as from March 1, 2001

Change of Position:

- Marco Vervoort, PhD defense September 19, 2000; now ILLC webmaster
- Carlos Areces, PhD defense October 12, 2000, now postdoc "Simulation and Testing for Feature Interaction", January 1, 2001

Prizes and Awards

NWO Sciences:

- **Krzysztof Apt** "ALMA-0 and New Foundations for Declarative Programming"
- **Krzysztof Apt, Farhad Arbab (CWI), E.B.G. Monfroy (CWI)** "Coordination-based Parallel Constraint Solving"
- **Maarten de Rijke, Krzysztof Apt** "Simulation and Testing for Feature Interaction"
- **Paul Vitanyi** "Universal Learning"
- **Yde Venema, Bart Jacobs (KUN), Jan Rutten (CWI)** "Coalgebraic Modal Logic: Theory and Applications"

NWO Humanities:

- **Johan van Benthem** "De kennis en rationaliteitsaannamen van speltheoretische oplossingsconcepten"
- **Maarten de Rijke**: 'Pionier' Project "Computing with meaning"

KNAW fellowship:

- **Robert van Rooy** "Games, Relevance, and Meaning"

NWO postdoc position:

- **Jaap Maat** "Leibniz' opvattingen over formele en natuurlijke talen"

NWO "Vernieuwingsimpuls"

(1 senior researcher, 1 postdoc and 1 PhD student or 2 PhD-students; plus extra computer support):

Paul Dekker "Formal Language Games"

Rens Bod "Towards a Unifying Model for Linguistic, Musical and Visual Processing"

FoLLI Outstanding Dissertation Award:

Jelle Gerbrandy, Bisimulation on Planet Kripke

Khalil Sima'an, Learning Efficient Disambiguation

**ILLC Publications
July 2000 -
January 2001**

- DS-2000-06: Hans van Ditmarsch, Knowledge Games
- DS-2000-07: Egbert L.J. Fortuin, Polysemy or monosemy: Interpretation of the imperative and the dative-infinitive construction in Russian.
- DS-2001-01: Maria Aloni, Quantification under Conceptual Covers
- DS-2001-02: Alexander van den Bosch, Rationality in Discovery - a study of Logic, Cognition, Computation and Neuropharmacology

- MoL-2000-01: Sophia Velissaratou, Conditional Questions and Which-Interrogatives.
- MoL-2000-02: Mariana Haim, Duality for Lattices with Operators: A Modal Logic Approach.
- MoL-2000-03: Sjaak Verbeek, An Information Theoretic Approach to Finding Word Groups for Text Classification.
- MoL-2000-04: Catarina Dutilh Novaes, A Study of William of Ockham's Logic - from Suppositio to Truth Conditions.
- MoL-2000-05: Patrick Yancey, Indeterminacy and Translatability.
- MoL-2000-06: Shai Berger, Studies on the Uses and Usefulness of Diagrams.
- MoL-2001-01: Levan Khavtasi, Extending Focus Theories: Particles in Focus.

• MoL-2001-02: Iouri Netchitailov, An Extension of Game Logic with Parallel Operators.

• PP-2000-06: Rosalie Iemhoff, A(nother) characterization of Intuitionistic Propositional Logic.

• PP-2000-07: Carlos Areces, Patrick Blackburn and Maarten Marx, The Computational Complexity of Hybrid Temporal Logics.

• PP-2000-08: Annette Bleeker and Jan van Eijck, The Epistemics of Encryption.

• PP-2000-09: Maarten Marx and Yde Venema, Local Variations on a Loose Theme: Modal Logic and Decidability.

• PP-2000-10: Nick Bezhanishvili, Varieties of Two-Dimensional Diagonal-Free Cylindric Algebras. Part I..

• PP-2000-11: Eva Hoogland and Maarten Marx, Interpolation in Guarded Fragments.

• PP-2000-12: Valentin Gorankov, The Basic Algebra of Game Equivalences.

• PP-2000-13: Maarten Marx and Szabolcs Mikulás, Products, or How to Create Modal Logics of High Complexity.

• PP-2000-14: Maarten Marx and Nick Bezhanishvili, All proper normal extensions of S5-square have the polynomial size model property.

• PP-2000-15: Alessandro Agostini, Dick de Jongh and Franco Montagna, Coordination of 01-agents vs. coordination of worlds-based agents.

• X-2000-03: Johan van Benthem, Logic and Games: the third encounter.

• X-2000-04: Anne Troelstra, Ware en Gevoelige Verhalen.





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