A Portrait of a Scientist: Logic, AI and Politics

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1 Bückeburg

Mitnehmen kann man das Vaterland
An den Sohlen und an den Füßen
Das halbe Fürstentum Bückeburg
Blieb mir an den Stiefeln kleben.
So lehmichte Wege habe ich wohl
Noch nie gesehen im Leben.

Heinrich Heine: Ein Wintermärchen, 1844

At the time Alan Turing was engaged in deciphering the code of the Enigma in Bletchley Park and Konrad Zuse applied his patent for the first electronic computer called "Rechenvorrichtung" in Berlin, Jörg was born into the rural capital of the smallest Fürstentum of Germany, called Schaumburg-Lippe, a name even well educated Germans have probably never heard of. Jörg grew up as the oldest son of a family whose male providers had been joiners and curlers for centuries. There has never been a question that one day he would inherit the small family owned curler and joiners workshop.

But things turned out otherwise: Schaumburg-Lippe never became an independent Land again and the once respectable Siekmann family of joiners, curlers and church leaders was on the decline: mass furniture production became a highly capital intensive, fully automated business, where a certain Swedish company set the pace. In that process, almost all of the family-owned small and medium sized woodworking companies vanished and the once proud Schaumburg Lippesche Handwerkskammer dating back far into medieval times became obsolete.

But Jörg did not quite fit particularly well anyway: when he could not decide whether he wanted to be an artist or a scientist – an idea so inconceivable that his father threatened to cut off all his family ties – he took his juvenile poems and drawings to a family friend who looked at his paintings and poems with a stern expression and suggested: "Son, you better learn the trade of your fathers!"

So, Jörg became a joiner's apprentice in the nearby village of two hundred souls called Scheie, and after three and a half years he passed the traditional examinations and practical tests with some distinction: being now a well recognized member of the German chamber of handicraft entitled to call himself a Tischlergeselle.

Two years in the army, a further apprenticeship as a metalworker and welder finally qualified him to enter the Technikum Rosenheim, an engineering school

* We like to thank Jörg for freely using his "Autobiographic Notes" from which some material and most of the personal information is drawn and quoted without explicit indication.

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for woodwork and furniture production, which bestowed the title of grad.Ing. Rosenheim on him. A small research and technology company hired him right away and they invented the "R-value", a ventilation measure, apparently still in use today, which classifies the ventilation capacity of (wooden) windows.

Being bored with the "science" of window manufacturing, still unwilling to accept the position as the head of his father's company, which did not flourish all too well anyway, he decided it was time for a fundamental change and a new start.

University life was walled up in those days by the Abitur, the German equivalent of the anglo-saxon A-levels, a watershed in the conservative Germany of Adenauer's days that divided those who have from those who have not. His first marriage (of which there were several more to come) broke up and he started again as a schoolboy in evening classes and eventually he was admitted as a student at the Braunschweig Kolleg, a prestigious German adult education centre. Three years later at the age of almost thirty all doors were finally open: he had his Abitur!

But life never seemed to evolve in a straight line with Jörg; politics dominated his life: this was the late sixties, the peak of the student revolt in Paris and Germany. Benno Ohnesorg, his fellow student from the Braunschweig Kolleg, was shot by a policeman during a student demonstration, Greece was controlled by the military dictatorship of Papadopoulos and his colonels. This is a period in Jörg's life he wisely concealed in his curriculum vitae and application letters to the university in a country that not only exported terms like Kindergarten and Eigenwert into the English language, but also the word Berufsverbote.

2 Göttingen and Essex

Zu Göttingen blüht die Wissenschaft,
Doch bringt sie keine Früchte.
Ich kam dort durch in stockfinstrer Nacht,
Sah nirgendwo ein Lichte.

Heinrich Heine: Der Tannhäuser, 1836

In nineteen seventy the dream of the "little joiner's boy" became true: he enrolled as a student in mathematics and physics at Göttingen University and he was accepted as a member and soon elected a senior tutor of the Akademische Burse.

The introduction to mathematics by Grauert and Brieskorn, Scheibe's lectures on time and relativity and the intellectual and political debates of the Akademische Burse were formative years. But it was logic and its introductory courses by Patzig and others that captured his imagination: apparently there are deeper and more eternal truths behind the appearance of everyday academic life.

The Vordiplom in mathematics and physics, evening classes in the English Language Lab, a few months at the Sound and Vibration research institute in Southhampton (where they implemented one of the fastest Fourier-Transformations of its time), and finally a one-year grant from the DAAD prepared for a master course in computer science in England at Essex University. Science and politics again: the final M.Sc. degree with distinction and the admittance

to Oxford as a PhD student of Dana Scott but also a course he taught at the student union on Rosa Luxemburg and Mandel's economic theory.

In the end the public lectures on artificial intelligence by Terry Winograd, Carl Hewitt, Roger Schank and Yorick Wilks at Essex sparked a new flame that should now last for a lifetime: if machines can think and we can talk to them – these were the years of Terry Winograd's SHRDLU and Nils Nilsson's SHAKEY – then surely this was a much greater scientific challenge than all of mathematics and physics taken together, and certainly on par with some of the grand problems in logic related to the fundamental barriers of human and machine thinking.

So when Pat Hayes joined the staff of Essex University and accepted him as his PhD student, all future plans with Oxford and Germany were abandoned. The excitement with the new subject was fuelled by the staff at Essex: Richard Bornat, Mike Brady, Jim Doran, Pat Hayes, Bernard Sufrin, Yorick Wilks and a constant stream of visiting scientists from Edinburgh, Sussex and also from America provided much of the early excitement for this new subject.

His thesis "Unification and Matching Problems" on unification theory for combinations of associativity, commutativity and idempotency introduced the notion of a unification hierarchy based on the cardinality of the set of most general unifiers. With his collaboraters Mike Livesey and Peter Szabo, Jörg elaborated a classification of this hierarchy, which now carries his name. The early work of Gordon Plotkin, the thesis of Gerard Huet, and his work with Peter Szabo and others finally established unification theory as a subject of its own, with annual workshops and subsections at AI, automated reasoning and mathematics conferences.

3 Karlsruhe

Eines Nachmittags ging Markgraf Karl Wilhelm im Hardtwald auf die Jagd, um seinen Aerger zu vergessen. Er traf einen Hirsch, verfolgte das Tier und ließ dabei sein Gefolge weit hinter sich. Vom langen Ritt ermüdet, setzte er sich schließlich auf einen Eichenstumpf mitten im Wald. Bald war er eingeschlafen. Erst nach Stunden fanden seine Jagdgenossen ihren schlafenden Herrn. Man weckte ihn, und als er sich umschaute, gefiel ihm der Ort so gut, dass er sagte: "In meinem Leben habe ich noch niemals besser geschlafen als hier. An diesem Platz möchte ich immer wohnen. 'Karls Ruhe' soll er künftig heißen. Und über diesem Baumstumpf will ich eine Kirche errichten, in der ich einstens zur ewigen Ruhe gebettet werde."

Historical saga of the foundation of Karlsruhe

In 1976 Jörg moved to Karlsruhe when AI slowly started to gain ground in Germany. The year before, the first informal German meeting on artificial intelligence was organised and a year later it was accepted formally as a working group of the GI, the German computer science society. Jörg was now an assistant and soon an associate (Hochschulassistent) in the institute of Peter Deussen at the computer science department in Karlsruhe.

His research area continued to be unification theory working in close collaboration with his friend Peter Szabo, but also and more importantly – at least in Jörg's values – the beginning of the automated theorem proving system with

the tongue-twister name Markgraph Karl Refutation Procedure (MKRP). He convinced Germany's funding agencies that he could build a theorem proving system that would not only outperform the strongest American systems by far, but establish a new paradigm of less search and more (mathematical) knowledge for theorem proving. He claimed that Deussen's book "Halbgruppen und Automaten" would be the first text book completely generated in natural language by a machine – a promise that turned out to keep him busy not only for the anticipated decade but obviously till the end of his active life.

We had the days of Carl Hewitt's PLANNER, the declarative versus procedural debate and Pat Hayes paper "An arraignment of theorem proving or a logician's folly". But the field of automated theorem proving was not particularly influenced by these debates and still dominated by Alan Robinson's resolution calculus. Its few and simple inference rules entrapped many researchers to believe that developing a successful general purpose strategy for theorem proving would be only a matter of time. Under the influence of the Essex debates and Pat Hayes' way of thinking, the new MKRP-system was supposed to be the first knowledge based theorem proving system to lead out of the trap of the merely search based approaches of the day. Bob Kowalski's connection graph seemed to be a good starting point for the new MKRP-system because of its immediate access to available resolution steps, and soon innumerable papers about connection-graph based theorem proving in general and all sorts of refinements in particular poured out of Jörg's group. The system developed well at first and soon it exhausted the computational resources of the computing faculty. Every Wednesday evening the faculties' single computer (occupying more than half of the basement of the faculties' building) was rebooted in a single-user mode for the sole reason of accommodating Germany's best theorem proving system within its four megabyte of virtual memory; and every Wednesday evening, Jörg's group reassembled in front of a VT100 terminal observing and soothsaying MKRP's behaviour on the latest examples of the deduction community.

The race was stiff with two major horses at that time: his friend Larry Wos with his much smaller team and their parsimonious but extremely well-engineered system OTTER versus the big elephant MKRP. Larry would call – usually very early in the morning – mocking a German accent: "Hey can you do zis, ve have just solved it" and then the group had a few days at most to prove a new challenge theorem from a given set of axioms. The sooner the answer "We have just done it as well, Sir" the better – so the day had twenty four hours after such a phone call to analyse the new proof and adjust the settings of the various refinement strategies such that MKRP would also find the proof[1]. The next challenge's twist was then to spot weaknesses in the opponents system, design a hard problem whose solution relied on a special technique within the weak spot of the competitor, solve it at leisure – and send it in reverse right over the Atlantic waiting for their phone call.

[1] You can always solve a difficult mathematical problem when another system has already succeeded given enough time: just analyse, set the parameters right, analyse again, add a new procedure, analyse again, etc.

While this went on for many years, the pendulum for the first prize sometimes swung to this side of the Atlantic and then back to the other. Both systems improved considerably – but none of the promised breakthroughs was forthcoming. Deussen's book was still waiting to be automatically generated.

The MKRP-effort showed that indeed you can build a knowledge based theorem proving system which prunes the search space by several orders of magnitude – but the traditional search based systems performed all in all just as well. As Larry Wos pointed out in a seminal debate at one of the CADE conferences: "We now have the ultimate system Ψ that proves a theorem without any search: it uses its efficient and knowledgeable supervisor OTTER to find a proof and then proceeds by using this knowledge to guide Ψ right through the search space". "MKRP was unfortunately still wrapped too much in the intellectual time warp of the sixties" as Jörg would comment on these developments later.

At that time, research in AI and on deduction in particular was not a mainstream business in Germany. There were yearly informal meetings on AI, until in 1981 Jörg initiated the annual German workshops on Artificial Intelligence (GWAI) with proper proceedings published by Springer. These annual meetings at the Hölterhoff Stiftung in Bad Honnef near Bonn stimulated the early excitement about AI in Germany and much of the proud and more often than not the over-important sense of self, called WIR-GEFÜHL in German, emanated from these – sometimes hilarious – meetings. In March 1982, Jörg and Wolfgang Bibel started the first German summer school on AI in Teisendorf. With more than 100 participants, it was a big success not only because Jörg became acquainted with his later wife, but also because the lecturers succeeded in transmitting their enthusiasm about AI to the convened young researchers always looking for a PhD thesis.

Politically the late 70's saw the growth of the German peace movement from a small circle of concerned scientists and peace activists into a mass movement: the planned deployment of Pershing missiles close to the eastern boarder and iron curtain reduced the effective early warning time from several hours down to a few minutes and the Soviet Union responded with the threat of an automatic launching policy – which fortunately was never fully implemented by either side. Several false alarms – some up to the highest threat level – were computed by the huge American early warning system and when these facts became public, several professors of jurisdiction and computer science, including Jörg, opened a law case against the German government at the Federal Court in Karlsruhe: some courageous American senators provided classified material for the German computer society of concerned scientists FIFF, of which Jörg was one of the founders. He made the material public, wrote several papers and a journal article with Karl Bläsius. He must have given a few hundred public talks, television interviews and speeches to the peace movement all over Germany and experienced for the first time the difference between giving a seminar talk and being a speaker in front of ten thousand people.

Politics would meet AI again when Peter Raulefs, Jörg and Graham Wrightson organized the International Joint Conference on AI (IJCAI) in 1983 at Karl-

sruhe: with more than two thousand participants it was the first major event of this size in Germany and widely covered by the media – not least because the accompanying industrial exhibition proudly displayed an empty Martin Marietta (Pershing) booth.

4 Kaiserslautern

P.T. aus Arizona
von dem Stamme der Apachen
lebte ziemlich gut in K-town, Germany.
War GI und bei der Army,
na, und Sehnsucht nach den Staaten
hatte P.T., der Apache, eigentlich nie.
Nur im Herbst, wenn Vögel schrien,
über K-town südwärts zogen,
sagte P.T. manchmal leise zu sich "Uff".
Und dann trank er sehr viel Bourbon,
stieg in seinen alten Chrysler
und fuhr rüber nach Karlsruhe in den Puff.
P.T. P.T. Das hat dem P.T. gutgetan ...

Franz-Josef Degenhardt: P.T. Arizona, 1968

In 1980 the department of computer science of the University in Kaiserslautern advertised the first professorship for AI in Germany and after the usual tiresome medival "rituals", Jörg was offered the job and in 1983 he moved from Karlsruhe to Kaiserslautern with his newly wedded wife and his coltish dog called Minsky.

To us, the next generation of scientists, who found AI already an established subject when we were students, it is probably Jörg's lecture series 'Introduction to Artificial Intelligence' that is most vivid in memory. By the mid eighties the field was thriving and banging at the doors of the scientific establishment, but it was still provocative in its general claims regarding the nature of human versus machine thinking.

The lecture at its peak drew sometimes more than five hundred students from all over Germany and many other European countries to Kaiserslautern, with students occupying the floor, the windows – wherever there was additional space – completely electrified by the subject and the atmosphere generated by this strange and witty missionary of a futuristic technology[2] with his hand-crafted slides decorated with flowers in the style of the sixties.

Jörg appeared on television, newspapers and radio shows: the AI hype had finally infected Germany as well and the bearded messiah with his dog Minsky became a familiar sight[3]. The 1984 paper on the subject of AI and its future invited by the OECD, has been printed and reprinted many times and was

[2] The lecture of the 80's was actually filmed and made publicly available as videotapes. His AI-lecture today, more mature and sober now (and available on the web), uses Stuart Russell's textbook on AI as its base.

[3] There is the funny event, when Jörg was invited for one of his well-paid AI-intros to German industrialists, in this case called "Schock der Moderne", and he hesitated to go as he had to care for his dog that day. So they sent two chauffeur driven big black Mercedes cars headed by a motorbike leading the convey to little Kaiserslautern University: one with the back seat removed for his dog and the other one for himself.

"probably the only paper I ever wrote that was really read by others and had some influence", as Jörg used to say. It was certainly read by the officials of the GI who threatened to expel him from the German computer science society, if he would continue to announce publicly that there was no difference in principle between human and machine thinking[4].

However, in practice Jörg was now able to observe the disturbing and most obvious difference between human and machine thinking: In 1985 daughter Helen was born and all along the years Jörg intensely studied and proudly reported the progress and evolution of this young brain built on protoplasm rather than silicon, whereas his primal scientific child, MKRP, would not at all live up to his expectations.

On an initiative of Jörg together with Peter Deussen, Peter Raulefs, and Wolfgang Wahlster, a new collaborative research centre of the DFG (the German national science foundation), called Sonderforschungsbereich 314, had started in 1985. Not only was its title "Künstliche Intelligenz" (AI) still provocative, it also violated all the rules since it was not only one of the largest SFB's ever, but it also spread over three universities (Karlsruhe, Kaiserslautern and Saarbrücken) who were soon to become major centres of AI-research in Germany besides the strong groups in Hamburg. Peter Deussen became its first chairman: KI – the German acronym for AI – had finally entered the territory of the scientific establishment and many of the later institutions (like the DFKI and others) can be traced back to this research initiative.

This SFB formed the basic framework for the development of MKRP. Much effort was spent in order to resolve the weaknesses in dealing with equational theories. Starting already in Karlsruhe, a difference reduction approach was developed and integrated in MKRP. However, since it could not compete with the upcoming term rewriting systems, horses were changed again and some sort of term rewriting was integrated into MKRP. The exploration of the theoretical properties of the connection-graph calculus attracted many researchers not only in Jörg's group and also caused some heated arguments about the first origins of (sometimes incorrect) proofs. Although theorem provers based on connection-graphs don't exactly flourish any more, we now know that connection-graphs are confluent and weakly complete. The cumbersome progress in developing strategies for MKRP promoted the upturn (and revival) of more basic research topics like unification theory or sorted logics in his group. By 1990 they had coded and proved, as promised, much of Deussen's textbook on automata theory and transformed and finally translated these proofs automatically into natural language as well – but, to anyone involved, the shortcomings were all too apparent: this was not a mathematical assistant system by anybody's standard and more seriously, the research paradigm of the seventies and eighties – search based or partially knowledge guided as in MKRP – seemingly did not permit the construction of one either. A new paradigm had to be found!

[4] He continued to do so, the motion was nonetheless cancelled – and now 20 years later, Jörg was honoured as a fellow of the GI in honour of his contributions to the field of AI and his work for the GI.

And there is a spot in Jörg's heart that makes it different: When the MKRP-effort did not live up to expectations he did something unusual: he announced publicly that they had failed[5] and asked the funding agency if they were allowed to use the rest of the money to look for alternatives[6]. Strangely this was granted.

Meanwhile AI had finally established itself in the German scientific community. In the mid eighties Jörg persuaded Springer to have a new series of lecture notes on AI in order to increase the international recognition of AI (Germany being late by at least twenty years in comparison to England and the US with its legendary Dartmouth Conference in 1956). It was the wise decision of Hans Wössner of the Springer Company to integrate LNAI as a part of the larger LNCS series. With Jörg being the general editor – now jointly with Jaime Carbonell – LNAI became the most widely distributed series on AI worldwide.

Within the German computer science association (Gesellschaft für Informatik) AI had developed from a small working group into a well recognized Fachbereich until – under Jörg's chairmanship – it had more than 4000 members. Time had come to push for more. In one of the most dramatic and impassioned presidential management committee meetings of the GI, Jörg negotiated a new structure for the GI: the good old society was now to rest forever upon four pillars instead of the previous three divisions of Computer Science[7]: 1. Theory, 2. Software and 3. Hardware. But who was to be the number one? When the meeting was on the brink of collapse and Jörg threatened to form an independent AI society , the chairman of the theory division, Wilfried Brauer, suggested in a brilliant and hilarious motion that THEORY would be willing to become number ZERO – so AI could become number one and software and hardware would follow suit as section three and four. The menacing threat of an independent AI society[8] was off the table and later on, section number ONE became one of the best organised and largest AI-societies worldwide.

In an unusually farsighted move the German government had commissioned an expert advisory review in the seventies on the state of German industry (and universities) with results that became apparent to everyone only ten or fifteen years later. The report stipulated that while Germany's manufacturing was still healthy in its traditional areas such as car building, chemistry or mechanical engineering, it was in danger of losing its competence in fields based on more recent research such as computer science, genetic engineering, new materials to

[5] "Look, Mr. President, Sir, we can get a man on the moon, but to do so, we need n-billion dollars. And if after m years the man is not on the moon, you have to say so: Sorry Sir, there was a certain amount of risk involved, and we have failed" – this is his favourite story line.

[6] It sounds easy, but MKRP had a certain amount of visibility, even in the German media where "A computer-generated mathematical textbook" played the role of the "man on the moon". Older subjects like physics and chemistry have an established record of honourable failure, but in computer science and AI it still appears to be rare.

[7] Actually called under the much broader name Informatics in Germany right from its start.

[8] Actually as in almost all of the other industrial nations at the time.

replace the end of the iron age, molecular biology or the life sciences. Likewise, the report stated, German universities – still captured within their Humboldian values and traditions, – may still be better than their reputation, but too slow to adapt and to open up to new subjects.

The result of these findings was the decision to found about two dozen so-called an- Institutes, i.e. research institutions on the campus of a university but legally separated, which could act much faster than over-bureaucratised German universities. These should be able to build a bridge between industrial research labs and production on the one hand and basic university research on the other.

This was a big chance for AI as well and Jörg negotiated with the German ministry to include AI in the list of "new" subjects. Michael Richter, Jörg and other colleagues from Kaiserslautern filed a bid for such an institute and when they joined forces with Wolfgang Wahlster from the nearby university in Saarbrücken, they finally won the national competition. The German Research Centre for Artificial Intelligence, the DFKI GmbH, was born as a research company (Ltd) with almost all big firms from Germany as actual shareholders and with funds for an initial period of ten years equivalent to about 100 million US$. Within the next fifteen years the institute grew into one of the largest, most innovative and in some areas internationally leading AI research labs still situated both at Kaiserslautern and Saarbrücken with more than two hundred researchers today.

5 A New Start: Saarbrücken

"Louis, I think this is the beginning of a wonderful friendship."

Michael Curtiz: Casablanca, 1942

Offended by the fact that the smallest and poorest Länder of the federal republic, Saarland and Rheinland-Pfalz, had won the AI-race, some other states of Germany opened AI- institutions of their own, and Berlin offered Jörg a chair and the founding directorship for another AI institute. Fortunately a chair and the accompanying AI research department within the DFKI at Saarbrücken were vacant as well and finally Jörg moved to Saarbrücken to become one of the local DFKI directors joining Wolfgang Wahlster, Hans Uszkoreit and Gert Smolka. He received a joint position for the chair of AI in the computer science department of the university and his research department at the DFKI.

The challenges of a large research institute depending on external funding accelerated the diversification of research topics in Jörg's groups. Starting already in Kaiserslautern, knowledge representation and description logics became favourite research topics in one of his groups. The research had a strong theoretical touch and has been internationally recognized for its classification of description logics with respect to their complexity classes. It also resulted in one of the fastest (at that time) classifier systems called Kris. Another part of Jörg's group started research in multiagent systems. Its first achievement[9] was

[9] The system won a gold medal in the system competition at one of the MAS conferences.

the development of a general purpose layered architecture called INTERRAP that combines deliberative and reactive reasoning with multiagent (i.e. social) planning. The system is still used inside many industrial applications including the seminal transportation domain which sparked off the work on holonic multiagent systems. Software verification has always been a prominent application area for automated deduction. So, when the German security agency BSI advertised funding for the construction of a "national" tool for formal software development, Jörg enticed us to move from Karlsruhe to Saarbrücken in order to merge and amend the already existing theorem provers KIV and INKA to form the kernel of an integrated Verification Support Environment (VSE). During the following years safety and security problems became more and more a real issue in industry and the industrial applications of VSE with its engineering problems of verification in the large became a major part of daily business. The practical challenges of evolutionary formal software development spawned the work on "management of change" that turned out to be of much wider applicability.

Recently a new research lab on e-learning opened its doors for the development of a datamining tool called DAMIT and an internationally recognized learning environment for mathematics called ActiveMath, which was recently honoured as the best system of its kind by the funding EU-authorities.

It is to Jörg's credit that all these groups are now established and flourish in his department and most importantly: they interact and plenty of interdisciplinary papers have come out of it. Besides the dramatic increase of research issues under Jörg's responsibility it is perhaps his continuous effort to reconcile diverging, conflicting, and more often than not inconsistent aims and values that best characterizes his time in Saarbrücken. In particular this is true with respect to his scientific, social, and political enthusiasm of the past. Early socio critical reflections more than ever were confronted with the needs of the DFKI as an institution that became a global player demanding an annual budget of up to four or five million Euros he had to raise for his department. The struggle for peace and disarmament becomes more difficult in a situation where relevant parts of the research budgets all over the world stem from the various departments of defence, and, inevitably, the German armed forces suddenly can be found among the customers of the DFKI.

The ideal self-determined life of a scientist, which Jörg possibly had in mind when entering the academic stage, differs much from the extremely disciplined time management necessary to fulfil DFKI's management duties, international obligations, and the usual professorial duties of university life. Scientific discovery as an end in itself leads not necessarily to well engineered solutions for problems and furthermore scientific solutions have to be transformed into products for the actual market of technological innovations. Leading a large department at an application driven research institution gives rise to the question of how well do we ride on the technology wave: being too late there is the usual punishment that someone else has received the research grant or industrial contract – but being too early will not win any industrial contract either.

As so often before, Jörg did not choose the straight and narrow way of resolving all these conflicts by ultimately adjusting his conception of life in this or that direction. May be it's his way to live with the tension of antagonistic forces that made him view it all from a certain distance[10] and is one source of his well-known behaviour in every day discussions and private conversations[11], as well as in serious confrontations. They often get straight to the heart of the problem thereby opening the way for unconventional solutions but sometimes run the risk of damaging a personal relationship that has grown over many years. But knowing what academic life is like[12], it is astonishing: even now, after more than fifteen years of very close collaboration and competition, they still work together effectively and, in particular, the friendship between Jörg, Hans Uszkoreit and Wolfgang Wahlster saved the DFKI more than once in a moment of existential crisis.

At the university in his basic research group, the aftermath of MKRP's failure dominated the discussions of the early nineties. Why did the MKRP-effort fail? Well, it was certainly not a complete failure, but then: why did it not live up to its expectations? After all, it was based on mainstream research assumptions of artificial intelligence, i.e. transporting the water of knowledge based techniques into the intellectual desert of search based automated theorem proving. In Jörg's opinion it is not knowledge-based AI that failed, but their own apparent lack of radicalism. While on the bottom of MKRP there was a graph based, first order theorem proving mechanism that was optimized for a non-informed search, there was the plan of a superviser module incorporating the necessary domain knowledge in mathematics and controlling effectively the logic engine. But the distance between this general mathematical knowledge to be represented in the supervisor and the low level of abstraction of the logic engine was just too much and the supervisor module never went into existence. Jörg's favourite variation on McCarthy's quote "Nothing can be explained to a stone" was "Nothing can be explained to a first order theorem prover".

A paradigm shift, as Jörg used to phrase it, was again on the agenda: instead of investigating calculi and their search spaces, the representation of mathematical knowledge itself became the favourite research topic. Ideas were tossed around to raise the abstraction level of the representation and to encapsulate chunks of mathematical knowledge such that they could be chained into an abstract proof. The idea of proof planning, developed by Alan Bundy to combine tactic-based theorem proving with AI planning techniques, now fell on fertile soil: "knowledge based proof planning" became the new battle cry of this research group.

When Saarbrücken applied for an interdisciplinary collaborative research centre on "Ressource-adaptive cognitive processes" (SFB-378), Jörg saw his second chance: a new project called ΩMEGA was approved and for a funding period

[10] "...seven professors and directors competing with their publication record and their respective annual research budgets is a sight not totally unfamiliar from the baboon's hill in the local Kaiserslautern Zoo, where the silver back may change over night" is his favourite quotation.

[11] His so-called "Waldspaziergänge" with those who are supposed to deviate.

[12] If you are unfamiliar with these mechanisms, David Lodge's books (e.g. THINKS, Penguin Books Ltd, 2002) provide a good source of background reading.

of twelve years he had the chance to start all over again to realise his dream. The ΩMEGA project, by now with additional funding from other sources again one of the largest all-out efforts to build a proof assistant and mathematical support system, is carried out at the University (and not at the DFKI with its application driven pressure) as an independent research group. It is here where Jörg's heart can be found – and they still have another four years to go.

Apart from his role in building and establishing artificial intelligence in Germany, Jörg has been very active in recent years in another academic / political / institutional endeavour: Logic and AI. The community divided the field into dozens of societies, conferences and workshops. While this specialization and these factions are not necessarily a disadvantage, there is a lack of unity. So upon Jörg's initiative the International Federation for Computational Logic (IFCoLog) was set up with Dana Scott as the founding president. The European Network of Excellence on Computational Logic (CoLog) provided most of the support for this far reaching international effort to unite and establish computational logic as a subject of its own, on a par with maths, physics, chemistry and the other academic disciplines. With Moshe Vardi now as the acting president of IFCOLOG and FLOC as its mayor unifying event, things are now – after many years of travelling, convincing people, getting the finances right – in good shape.

In a similar vein he joined forces recently with Dov Gabbay and his mission to establish logic as a unifying foundational subject not just for mathematics as in the past, but for the much grander agenda of computer science, AI, the cognitive sciences and practical as well as jurisdictional reasoning. As chairmen of CoLoG-Net, they started a new journal for applied logic (JAL) that encompasses and unites for the first time the different logic factions, and they established together with John Woods and Johan van Benthem the new red series as a mirror to the seminal yellow series on mathematical logic by Elsevier: a new landscape of computational logic is opening up and this may well be the new continent that is to survive the tides of today.

But time has come for Jörg now to take stock and harvest and, with about seventy successful PhD's supervised, about hundred and fifty papers and books and innumerable publications in collaboration with his research assistants, there is plenty to chose from[13].

At Jörg's 60th birthday party at the University and DFKI – customarily a stiff academic event with plenty of mental incense around – his former PhD students formed a mixed choir for their self-composed song, which we do not want to deny to the well intended reader of an intellectually demanding volume such as this. It may be worth mentioning, that Jörg's favourite anecdote about his friend and greatly admired colleague Alan Bundy records an incident at the 7th CADE at Kaiserslautern, when Alan struggled with a non-operating microphone in his invited talk. Having received a replacement (which did not work either), he finally grasped the microphone, switched it off and in true Frank-Sinatra-esque style sang spontaneously: "I'll do it my way..." – and made history. So finally here is our version of the song to the well-known tune:

[13] http://www-ags.dfki.uni-sb.de

JÖRG'S WAY

And now, the end is near;
And so you face the final lecture.
My friend, we'll say it clear,
We'll state our case, it's no conjecture.

You've lived a life that's full.
Aimed at awards and ev'ry female,
But more, much more than this,
You did it your way.

Regrets you have had none;
Attacked colleagues and other 'primates'.
Your faith, it has been born
In the sixties anarchic climate.

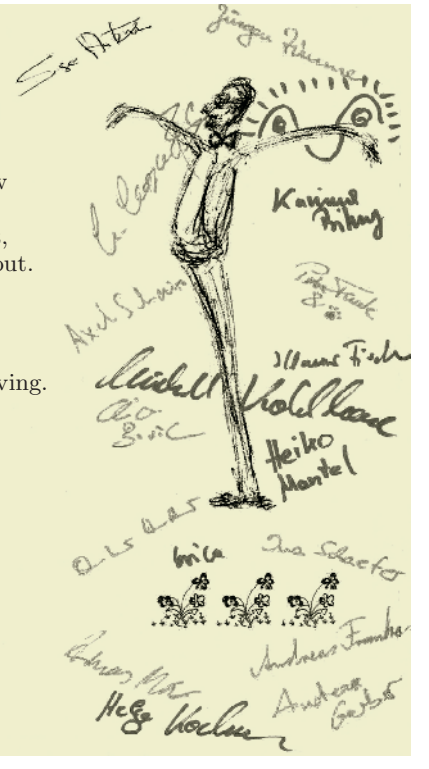
You planned all flow'ry slides
To put AI on every highway
But more much more than this
You did it your way.

Yes, there were proofs, I'm sure you knew
That you just took out of the blue.
But through it all, when there was doubt,
You planned them all and worked them out.
We faced it all, and we stood tall
And did it your way.

You've moaned, shouted and cried,
You've had your thrill, to show good proving.
Your trip, your magic fight,
We found it all so amusing.

To think you did all that;
And may we say – not in a shy way,
Oh No, oh no not you,
You did it your way.

For what is Jörg, what is his pride?
Funding, first talk, and his first night.
To present things, you did not know
You had your team, to run the show
Your record shows how well it goes
On your AI way.



6 Epilogue

Hopefully his energy will not fade too soon, so his plans and actual collaborations will come to fruition in the new book series "Principia Mathematica Mechanico". It encompasses logic but also AI's contribution to this age-old dream of the possibility for an exact science, which came into life with Euclid's Elements, explicitely formulated in Leibnitz vision and Frege's realization of the Begriffsschrift and finally culminated in Whitehead and Russel's Principia Mathematica. This series will tell the story of *our* century's contribution – logic, computer science, and AI – to this quest for a science which is built upon exact and formal logical foundations.