

ASSESSMENT OF RESEARCH QUALITY

Computer Science

2002 – 2008

Leiden University
Utrecht University
University of Groningen
University of Amsterdam
VU University Amsterdam
Radboud University Nijmegen
Delft University of Technology
Eindhoven University of Technology
University of Twente

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Table of Content

	page
Preface	5
Introduction	7
Composition of the Evaluation Committee	7
Proceedings of the Evaluation	8
Evaluations	8
Comments on the Process	9
Overall Conclusions	11
Overall Health of the Field	11
Structure of the Departments and Groups	12
Representation of Different Research Areas	14
Recruiting	15
Graduate Education and Postdoctoral Scholars	16
Evaluation Metrics	17
Assessment of Institutes and Programs	19
University of Groningen	20
Utrecht University	26
University of Twente	33
Delft University of Technology	38
University of Amsterdam	42
Leiden University	47
VU University Amsterdam	49
Radboud University Nijmegen	53
Eindhoven University of Technology	56
Appendices	61
1. Official Note of the Appointment of a Review Committee Member	62
2. Curricula vitae of the Review Committee Members	63
3. Assessed groups and their leaders	68
4. Assessment overview in grades	77
Epilogue	80



Preface

Computer science research in the Netherlands is of very high quality, with many instances of excellence in each department. I am very pleased to report that this is the Review Committee's main conclusion. Several professors and some of their papers are among the most highly cited in the field. The Dutch computer science departments belong to the international top, and this will remain the case in the future, as there are excellent young people ready to succeed the senior stars.

Over the past year, the Dutch computer science departments and the Review Committee, assisted by its Secretary, have worked hard to produce a quality assessment of computer science research in the Netherlands over the period 2002-2008. I want to thank everybody for their dedication to this difficult task, and I am proud to present the results of this work in this report.

In addition to many positive observations, the Committee has also found a number of issues that leave room for improvement. These matters are clearly formulated in our report, because it is the purpose of a quality assessment to do so. Our criticism may come as a disappointment to those concerned, and some may not agree. The Committee has done its utmost best to be objective and even-handed, without shying away from clear judgments. All remarks are intended to be constructive, and we hope that our recommendations will stimulate the continued pursuit of excellence in computer research in the Netherlands.

Willy Zwaenepoel
Chair



Introduction

All publicly funded research in the Netherlands is evaluated once every six years. The evaluation system aims at three objectives with regard to research and research management:

- Improvement of the quality of research through an assessment carried out according to international standards of quality and relevance;
- Improvement of research management and leadership;
- Accountability to higher levels of the research organizations and funding organizations, government and society at large.

This report reflects the evaluation of computer science in the Netherlands, carried out in accordance with the Standard Evaluation Protocol (SEP) 2003-2009.

Composition of the Evaluation Committee

The Informaticakamer of the VSNU ('Vereniging van Samenwerkende Nederlandse Universiteiten') recognized the following broad fields in which experts were needed:

1. Algorithms and theory
2. Software engineering
3. Networks, operating systems, distributed systems, and computational science
4. Information systems and databases
5. Graphics, visualization and image processing
6. Human-computer interaction, artificial intelligence, and knowledge representation.

One expert from each field was chosen to be a member of the committee, based on suggestions from the Informaticakamer. This led to the following composition of the committee:

1. Marta Kwiatkowska (Oxford University)
2. Carlo Ghezzi (Politecnico di Milano)
3. Frans Kaashoek (MIT)
4. John Mylopoulos (University of Toronto and University of Trento)
5. Thomas Ertl (University of Stuttgart)
6. Wiebe van der Hoek (University of Liverpool)
7. Willy Zwaenepoel (EPFL, chair).

Jan Heijn (BetaText, Bergen NH) served as secretary of the evaluation committee.

Proceedings of the Evaluation

All decisions were made by consensus by the entire committee, although the writing for individual groups and departments was done by individual members of the committee, assigned by the chair. The committee identified possible conflicts of interest from the beginning, and agreed upon ways to deal with them in the evaluation of departments and groups.

The committee received the self-evaluations in early September 2009, as well as hard-copies of the five key publications of each research group being evaluated. The only extra information requested by the committee was the CVs of the group leaders.

After some internal discussion and consultation with the departments, the committee decided that all meetings would be held at a single location, in Amersfoort. While most departments favored a visit to their site, the committee felt that it was more productive to have all meetings at a single neutral site. This approach avoided committee travel and gave the departments and groups more time to present their work, while at the same time giving the committee time to discuss and wrap up after a visit. The committee convened for a continuous 10-day period. Each department was given a single day, in no particular order.

The committee asked for an initial presentation by the department leadership, followed by presentations of the individual groups. Lunch was spent with graduate students and postdocs, and the day was concluded by an initial feedback session. Presentations were kept to a minimum, and much time was left for discussion. The committee is grateful that time limits on presentations were universally respected.

Evaluations

The evaluations were carried out along the guidelines of the SEP.

The SEP allows five ratings: excellent (5), very good (4), good (3), satisfactory (2), and unsatisfactory (1). The committee allowed itself an intermediate point between those ratings, e.g., 'between very good and excellent', represented as 4.5.

Each group was scored on the four characteristics defined by SEP, quality, productivity, relevance, and vitality and feasibility, and was also given a score reflecting the overall judgment. Each department was scored on two characteristics, overall rating and leadership rating. Overall rating entails coverage of the discipline and quality, productivity, relevance, and vitality and feasibility of the research in the department. Leadership rating entails the quality of the departmental management, including the existence and anticipated effectiveness of a strategic plan, the degree of cohesion within the department, and the ability to successfully deal with the upper university administration.

Comments on the Process

The procedure worked well, and, a few exceptions aside, the committee had the necessary information to make an informed evaluation. Seeing all departments in a single setting and in a single consecutive period of 10 days was a good idea, because it allowed the committee to get a good overview and establish clear comparisons between groups and departments.

In the hope of improving future evaluations the committee offers the following suggestions about the self-evaluation document:

1. Too much of the prose in the self-evaluation documents is about process and too little is about research content. Much of the prose about process is perfunctory and repetitive. The committee would have liked to see more about research, both past accomplishments and future directions.
2. Short CVs of all assistant, associate and full professors should be included in the self-evaluation document.
3. A brief explanation, collectively provided by all departments, of various Dutch peculiarities would be helpful. The committee was occasionally confused by the percentage of an FTE's time allocated to research, the difference between various streams of money, papers listed in publication lists of multiple groups for people with joint appointments, etc.

The committee also offers the following suggestions about the departmental visits:

1. All departmental visits should start by an overall presentation of the departmental strategy by the department's leadership, followed by an extensive discussion between the committee and the department's leadership. At least one hour should be allocated for this purpose, a substantial fraction of which should be left for discussion. Shorter or very high-level introductions, as provided by some deans and departments, are not particularly enlightening. Absence of any introductory departmental presentation represents a misunderstanding of the importance of overall departmental strategy.
2. In addition to meeting with full professors, Ph.D. students and postdocs, the committee should have the opportunity to meet with department members at intermediate ranks, such as assistant professors, associate professors, and staff researchers. Ideally, a separate time slot should be allocated for such a meeting.
3. At the end of the day, there should be an opportunity for the committee to talk separately with the dean of the faculty and the management of the department.



Overall Conclusions

Overall Health of the Field

In general, computer science in the Netherlands is a vibrant enterprise. In each department the committee saw strong evidence of excellence and in many departments a distinct improvement over the course of the evaluation period. As a country, the Netherlands remains among the top nations in computer science research, and in the absolute top in a number of sub-areas.

At the professorial level, besides the well-known senior stars, there are excellent young people ready to take over the torch. The Ph.D. students and postdocs the committee met from the various departments are diverse, motivated and well-prepared to take on a research career. Efforts to attract top talent, from home and abroad, are paying off. The research schools have come into their own, and have clearly had a salutatory effect on graduate education in the Netherlands.

Departmental leaders are actively positioning their departments to arrive or to stay at the forefront of international research. In particular, strict hierarchical structures are being reconsidered to make room for the professional development of young researchers.

The quality of publication venues is rising, as is the overall impact of the research. Several Dutch professors and some of their papers are among the most highly cited in the field. The amount of external funding is on the rise, in particular as a result of increased collaboration with industry. Although not part of this evaluation, much effort is invested in recruiting more (undergraduate) students to the discipline, and this effort should be commended.

On the downside, the committee was surprised to find out that the discipline of computer science in the Netherlands is under siege. University funding has been cut universally, as a result of a purely formulaic approach to university funding that shuns strategic decision making and that disfavors computer science because of the recent decline in student numbers. The committee had great difficulty reconciling the affirmations of deans that their institutions view computer science as an important discipline with the reality of retrenchment in almost all departments. Computer science funding is also declining in the core Dutch funding organization, the NWO, as a result in part of overall funding declines and in part of the rather absurd co-location with astronomy and mathematics in the exact sciences division of NWO.

Computer science is going to be a core discipline for the next several decades, both by itself and in connection with other disciplines. No university is going to be a good university if it does not have a good computer science department. Serious damage is being done to computer science departments by cutting funding based on what are probably short-term fluctuations in student numbers, rather than recognizing the long-term strategic importance of the field. All leading universities in the world have continued to grow their computer science departments through the downturn in enrollment,

albeit admittedly at a slower pace than before. None have shrunk their departments. The Dutch universities are putting themselves at a serious competitive disadvantage if they continue the current policy of retrenchment in computer science.

Similarly, the committee found the departments and their leadership on the defensive. Many seemed to have acquiesced to the status quo, or even to some degree of retrenchment. Revealingly, many computer science departments are reluctant to call themselves computer science departments, and instead try to hide under various awkward names, mainly with the goal of attracting more students or more funding. More worrisome, this terminology issue has trickled down into fashion-driven decisions about the long-term directions of the departments, walking away from the core of the field to more applied endeavors, which are believed to attract more students and funding.

A computer science department is a computer science department and should be called a computer science department. In several institutions the committee found a counter-productive dissipation of computer science over several, awkwardly named institutes. There should be a single place on campus or on the Web where one looks for computer science, and that place should be the computer science department. It may be necessary to create undergraduate programs with names that appeal more to students, and create research centers with names that appeal to current funding fads, but that should not undo the central position of the department as the place where computer science is done. Furthermore, each computer science department should have an adequate representation of the core of the field.

Specifically, the committee recommends that

1. University funding decisions take into account the strategic long-term importance of computer science and devalue near-term student enrollment numbers in the allocation of funding. New positions should be opened on a selective basis, especially in the departments that are doing well. Special attention should be given to strengthening the core of the field.
2. NWO funding for computer science be separated from funding for disciplines which have entirely different evaluation metrics than computer science.
3. Departmental leaders go on the offensive, and present their administrations with well-articulated proposals for new positions, especially in core computer science.
4. Under the leadership of highly recognized senior professors across the discipline, departments organize themselves to collectively advocate for computer science with the national funding agencies. The committee understands that an initiative of this sort has recently been undertaken, namely the ICT Platform Nederland, and applauds this development.

Structure of the Departments and Groups

All departments are in a transition from a strict hierarchical organization, with one full professor in charge of a research group, to a flatter structure, including the possibility of tenure-track appointments for junior professors. Progress in this transition varies from

department to department. In some it is merely cosmetic, simply replacing the titles of 'docent' by assistant professor and the title of 'hoofddocent' by associate professor, but leaving the gist of the strict hierarchical structure untouched. In others, the transition to a tenure-track system is far more advanced, with a clear up-or-out path for junior professors, potentially leading all the way to the rank of full professor, and with money committed upfront for a possible senior position. Overall, though, notwithstanding the changes underway, the strong hierarchical structure remains very present in the minds and in the facts. Quite revealingly, the committee heard several times references of group leaders to 'my associate professor' or 'my assistant professors'.

Dutch computer science has not fared badly under the hierarchical structure, due to the enlightened leadership of some senior professors. A large fraction of the group leaders are doing their utmost best to mentor and guide their younger colleagues, and to achieve maximum independence for them within the current structure. Nonetheless, the committee applauds the transition to a flatter structure, as it provides a clear career path for promising young scientists, and encourages the institutions and the departments to proceed more boldly in this direction. Such a transition cannot (and should not) happen overnight, but it is important that the transition moves forward swiftly to a clearly established end goal, so that the current ambiguity can be lifted. Differences across institutions are confusing, even more so for scientists from outside the Netherlands who contemplate moving there to establish an academic career. The differences are in part due to the transition underway, but there does not appear to be a clear consensus on the outlines of what the final situation should be like. It is not necessary that all departments arrive at the same final structure, but agreement on a few ground rules would make the system much more transparent and comprehensible to the outsider, thereby making the Netherlands a more attractive place for young scientists to establish their career.

The following are our recommendations for proceeding further.

1. Our strongest recommendation is to remove the restriction that only full professors can be thesis promotors. Assistant and associate professor should be able to act as thesis promotors. A change in the law is required for this to be possible, but this change is absolutely essential. Supervision of theses is inherent in the qualifications of professor. Without it, assistant and associate professors are not truly professors.
2. It should be possible to have multiple full professors per group, as is already the case in some institutions. There is no need for a one-to-one mapping between groups and full professors. Furthermore, the distinction among full professors between group leaders and personal chairs is counterproductive. It would be much simpler to have just one rank of full professor, allow multiple full professors per group, and perhaps rotate the group leadership over time between the full professors.
3. All assistant professors should be hired on probationary contracts, which after a limited time can be turned into tenured positions, with the decision of granting tenure based solely on performance. The current situation whereby some are tenure-track, some are not, and some are in permanent positions is confusing, and an abuse of the term 'assistant professor' as it is commonly understood in the international academic community.

4. Professors should be hired according to a department-wide strategy, rather than a group-specific strategy. The current practice is the opposite. Affirmations to the contrary notwithstanding, this has the unfortunate side effect that assistant professors are hired to fill out a gap in the group, rather than a gap in the overall department. In combination with a tenure-track system, where these assistant professors move up in the ranks, this leads to an ever stronger presence of full professors in a limited number of areas, and – given limited resources – gaps in the overall coverage of the field by a department.

Representation of Different Research Areas

Collectively, the Dutch computer science departments are considered world-class in a number of areas. However, the coverage of computer science in many departments is highly uneven. The same holds for the entire country. Depending on how one counts exactly, there are 10 ‘intelligent systems’ groups and 7 ‘formal methods’ groups. On the contrary, there is only minimal presence in computer systems, networking, database systems, algorithms, graphics, and other core computer science areas. Most of the departments are small, and therefore cannot cover the entire field. This argument is, however, no justification for the extreme skew in coverage. Furthermore, the argument certainly does not apply at the level of the entire country.

Part of the problem seems to be inbreeding. The Netherlands clearly has or has had a number of stars in certain areas, who have produced strong students. These students have carried on the work of their advisor at the same or at a different Dutch university. There is nothing per se wrong with this, but it has resulted in overcrowding in certain areas, and, by virtue of limited resources, under-representation in others.

Dutch universities have implemented various funding schemes for departments and groups. They differ from institution to institution, but they all include the number of first-year BSc students and the amount of external funding as parameters to calculate the amount of funding that a department receives. This policy has clear merits, but has had the unfortunate side effect of diminishing the presence of core computer science and augmenting applied fashion-driven research. Such areas attract more students and more funding, and some departments have moved very far in this direction to deal with financial shortfalls.

This evolution is extremely dangerous for the field of computer science in the Netherlands. Fundamental research in various aspects of core computer science is one of the country’s longstanding strengths, and its presence is essential in the long term, if only to nurture the more applied research. One cannot have a strong computer science department that is not strong in the core of the field. That does not exclude that one keeps a keen eye open for applications of one’s research, quite to the contrary.

What little external funding is available in the core of the field goes mainly to more theoretical work, in part as a result of the co-location of computer science with as-

tronomy and mathematics in the exact sciences division of the NWO. As a result of the strong connection between external funding and positions, the experimental core of the field, computer systems research, is grossly under-represented.

Specifically, the committee recommends that

1. Much more attention is given to a balanced representation of the entire field of computer science, both in the entire country and within each department.
2. The departments commit to maintaining and strengthening the core of computer science.
3. The departments commit to a better representation of experimental systems research.

Recruiting

The number of women at all levels but especially in senior positions in Dutch computer science departments is dismally low. This problem exists worldwide, but it seems worse in the Netherlands than in otherwise comparable countries. This problem is not amenable to short-term fixes, but more could be done. Institutions can provide targeted money for recruiting female candidates. The committee also saw a few examples of women, suitably qualified and ambitious to achieve senior rank, but stuck below the glass ceiling of full professor, because of the group structure and the one-full-professor-per-group model.

Better results would be obtained, in terms of recruiting women but also in terms of coverage and quality, if recruiting professors, at all ranks, was done differently. Current recruitments use a rather narrow profile as a target, and it is viewed as a failure if no suitable person is immediately found. This may reduce quality, because one only looks at a narrow set of candidates, and there is pressure for the search to 'succeed'. Many top departments, in contrast, recruit in all of computer science, with a preference for a number of broadly defined areas. Recruitments are viewed as multi-year efforts and look for a wide variety of profiles over a number of years. This augments the chance that one finds the best person in any given area, and furthermore would countermand inbreeding. Much progress has already been made in this regard, but further progress is required. Although many of the searches are 'open', all too often the result is that a local candidate is hired.

The committee recommends that

1. Departments put more effort in attracting and retaining female staff. The committee had the impression that, although in some cases there are several funds or incentive schemes available at the university or faculty level to support this, departments are not always using such possibilities in a well-planned and exhaustive manner.
2. Broader coverage of the field play a more important role in deciding the profiles of new recruitments. Recruitment at all levels on a departmental rather than a

group basis, as suggested above, would further counter the trend of deep but all too narrow departments.

3. Recruitment be viewed as a multi-year exercise, in which a department defines a number of profiles and recruits for those profiles over several years. This requires a mutual understanding between the administration and the department that a position is not lost if no suitable candidate is found in any given year.
4. A strong premium be placed on hiring candidates from outside the department and outside the intellectual sphere of the groups already present in the department.

Graduate Education and Postdoctoral Scholars

The research schools have clearly had a beneficial effect on the quality of graduate education in the Netherlands. All departments participate in one or more of these research schools. The Ph.D. students benefit from exposure to researchers from other institutions and from courses that would otherwise not be available in their own institution.

Some departments have started putting in place guidelines and milestones for progress towards the doctoral degree. Some also require a certain amount of coursework. Some coursework also involves skills such as technical writing and the like. The committee strongly supports these developments, although it warns against all-too-formulaic requirements, such as, e.g., a given number of journal articles before graduation.

Most research groups understand the need for excellence in the graduate student body, and are actively recruiting students, either from their own Master's programs or from elsewhere.

Funding requirements often mandate that a Ph.D. student is hired by a particular research group for a particular project or topic. Nonetheless, the committee recommends that departments consider creating a department-wide filter on admissions to the Ph.D. program.

To the great surprise of the committee, some groups and departments are reluctant to hire postdocs, and favor Ph.D. students instead, because there is a financial reward for graduating Ph.D. students and none for postdocs. This unfortunate situation should be corrected, as postdocs are crucial to the vitality of a research program.

Specifically, the committee recommends that

1. Departments continue along the path of putting in place department-wide policies for graduate education, and in particular consider more department-wide admission and recruiting.
2. Financial incentives are created for hiring and training postdocs, similar to the financial incentives in place for graduating Ph.D. students.

Evaluation Metrics

The committee was asked several times to comment on the use of bibliometry to assess various research efforts. Besides the obvious recommendation that any bibliometric analysis needs to be treated with great caution and in the context of other elements, the corpus used for analysis should be appropriate for computer science. This leads to the following two recommendations:

1. Conferences should be taken into account on the same level as journals. There are good conferences and not-so-good conferences, just as there are good and not-so-good journals, but in many branches of computer science conferences are at least as prestigious and selective as journals.
2. Google Scholar, albeit not without its flaws, is a much better corpus to use for computer science than the ISI Web of Science, because the ISI Web of Science does not adequately represent conferences, and because it labels certain publications as computer science that are not. Evaluations of computer scientists based on the ISI Web of Science in its current form are at best meaningless and at worst misleading.

Failure to abide by the above recommendations will have disastrous consequences for the field, as researchers will be encouraged to publish in journals or venues that have high impact according to ISI, but that none of their peers reads or takes seriously. Ironically, the attempt to measure impact will then result in people publishing in venues where impact is minimal.



Assessment of Institutes and Programs

University of Groningen

Institute of Mathematics and Computing Science

Overall Evaluation

Overall rating: 3.5

Leadership rating: 3.5

The institute has made considerable progress since the previous evaluation. There is evidence that the level of high quality basic research has improved. Not only has the institute recognized and utilized the strengths of existing staff, it also has made some strong appointments over the past years. The committee also praises the introduction of the tenure-track system in which these new appointments have been made. It encourages the faculty and the institute to now implement the tenure-track system to the full. Junior faculty should be evaluated on an 'up-or-out' basis, and promotions on the basis of quality should be implemented all the way to the level of professorship.

There are some areas where the institute is vulnerable, or could improve. The main issue is that core computer science research areas are either marginally or not represented. The institute would do well by investing in some of these areas. The committee does not wish to single out a specific area of research, but examples are theoretical computer science, algorithms, databases, operating systems and networks: core areas essential in the sustainability of a computer science department, both in terms of research and of teaching. In this light, it seems wise to make sure the staffing in the fundamental computer science group stays at appropriate levels, also after the retirement of one of its professors.

On a more general level, the institute as a whole is of a size that it may lose critical mass and momentum to fully compete with peer institutes in the Netherlands. As soon as funds for further investments become available, the institute should advertise broadly, and quality of the candidates should play a major role in the decision which direction to go.

The institute sees potential in further collaboration (locally, nationally and internationally) in the area of health and cognitive science, and it seems wise to pro-actively adjust its research agenda in this direction, in order to have more control over where such collaboration leads to, and to make sure it is driven from scientific questions in computer science, rather than becoming too much a problem solver for other disciplines.

Finally, the institute should be more open-minded in terms of possible venues of collaboration with ALICE. The institute should consider a plan for a single computer science department that takes the strengths and the opportunities of both IWI and ALICE as a starting point, and that sketches a strategy for gradually moving to a single strong unit. Of course, real collaboration needs to be anchored at the level of individuals, but the

two institutes should think of ways to actively encourage this, rather than just sending mutual invitations for each other's seminars.

Distributed Systems and Software Engineering (Aiello, Avgeriou)

Research program:	3.5
Quality:	3
Productivity:	4
Relevance:	3
Vitality and Feasibility:	4

The group does research in software architectures (specifically software patterns and architecture knowledge) and in distributed systems (service-oriented computing and embedded service-oriented middleware). The group is active in publishing and getting contract-funded staff. This should provide a basis for future expansion. At the moment of evaluation, the group has split into two subgroups: distributed systems and software engineering. It is important that both groups now collect some critical mass to guarantee sustainability. The software engineering group should focus on a single area within software engineering in which the group wishes to become known and provide a contribution, rather than spreading itself thinly on different topics. The distributed systems group is more focused, but has to mark its place in the international community in a clear way. The term 'distributed systems' does not provide an accurate definition of the group's mission. Indeed, the group focuses on 'services', i.e., on composition of distributed and dynamic applications.

Fundamental Computing Science (Lavalette, Hesselink)

Research program:	3.5
Quality:	4
Productivity:	3
Relevance:	3
Vitality and Feasibility:	2.5

This group is mainly pursuing fundamental research concerning the specification and verification of concurrent systems, logic and proof theory, and requirements engineering. Although very small in size, the group has produced high quality publications in leading journals. However, one of the two tenured professors is retiring in 2011, and the group needs a clear vision and strategy for the immediate future. This is one of the few core computing areas present in the institute, and replacing the retiring person by a senior leader in a field of fundamental computing is necessary. Some consideration has evidently been given to the issue of finding a replacement but no decision as to the research focus has been reached. This is now urgent, so as to enable the group to regain momentum, thus increasing the research and contract funding, and consequently the number of staff. The group would also benefit from having more staff between the level of Ph.D. student and professor.

Intelligent Systems (Petkov)

Research program:	4
Quality:	4.5
Productivity:	4
Relevance:	3.5
Vitality and Feasibility:	4

The group originated from a split of the previous computing and imaging group. The initial research focus on image processing and analysis was broadened into machine learning by hiring good junior faculty. The group focuses on publishing its best results in high-impact journals and the committee encourages the group to keep up this quality level, while also showing presence at the top conferences of the field. Health care and astronomy are so far the main application areas driving the research, and several contacts to the medical field and to industry have been established. There seem to be possibilities to grow in terms of research grants and Ph.D. students as well as into other relevant application areas, an opportunity the group should seriously pursue.

Visualization and Computer Graphics (Roerdink)

Research program:	4.5
Quality:	4.5
Productivity:	4.5
Relevance:	4
Vitality and Feasibility:	4.5

The group started in 2003 as a result of the split of the computing and imaging group. Since then, the group has grown significantly, attracting good associate and assistant professors from the outside. This has broadened the research spectrum from scientific visualization with a focus on life sciences to now also include information visualization with a focus on software visualization and user interaction with a focus on tabletop displays. By successfully publishing in the best venues of the field the group has gained international visibility. The committee acknowledges the vitality of the group and encourages the faculty members to take advantage of funding opportunities beyond NWO in order to increase the number of dissertations and international collaborations. The new research theme of visual analytics seems to provide potential for further growth.

Institute of Artificial Intelligence and Cognitive Engineering (ALICE)

Overall Evaluation

Overall rating: 4

Leadership rating: 3.5

ALICE is a relative young institute that recently moved from another faculty. The committee appreciates the efforts and struggles the institute has gone through, and is pleased with the enthusiasm, and the dynamic and outward-looking attitude of its members. The group might benefit from a strong and well-chosen theme that gives it national and international identity. The committee praises the introduction of a tenure-track system in which some recent appointments have been made. It encourages the faculty and the institute to now implement the tenure-track system to the full. Junior faculty should be evaluated on an 'up-or-out' basis, and promotions on the basis of quality should be implemented all the way to the level of professorship.

The counterpart of the enthusiasm of the group members is a threat of becoming too protective of the four existing groups and the current areas of research in which the groups are active. The committee also had some concerns about the omission of some key areas of AI (like knowledge representation and planning) in its research program. In the period of evaluation, the groups in ALICE have worked hard to position themselves in an international research community. The coming period should be one with a further focus on quality output, being in some cases a bit more selective in the venues of publication and kind of activities, building on the good things achieved and looking for possible fresh winds. If hiring new staff becomes a possibility, the institute should recruit as widely as possible. Especially the Languages, Sound and Cognition group might benefit from an external impulse that gives this group a more clearly recognizable identity in the artificial intelligence community.

Finally, the institute should be more open-minded in terms of possible venues of collaboration with IWI. The institute should consider a plan for a single computer science department that takes the strengths and the opportunities of both IWI and ALICE as a starting point, and that sketches a strategy for gradually moving to a single strong unit. Of course, real collaboration needs to be anchored at the level of individuals, but the two institutes should think of ways to actively encourage this, rather than just sending mutual invitations for each other's seminars.

Autonomous Perceptive Systems (Schomaker)

Research program:	4.5
Quality:	4.5
Productivity:	4
Relevance:	4
Vitality and Feasibility:	4

The main focus of this group is pattern recognition (with a specific interest in handwriting verification and identification). Despite heavy administrative duties by senior staff, the group manages to publish in high quality venues, and the relative amount of research funds is good. The group has collected expertise in a good combination of related areas (pattern recognition, machine learning and robotics) which makes it well equipped to engage in collaboration with other partners, both in the sciences and the humanities.

Multi-Agent Systems (Verbrugge)

Research program:	4
Quality:	4
Productivity:	4
Relevance:	3
Vitality and Feasibility:	4

The multi-agent systems group provides currently the main bridge with computing science. Its main research areas are logic for multi-agent systems, and interaction (in particular, argumentation, and collective decision making/action). Now that the group is slowly expanding, there are opportunities to further deepen the research agenda. There also seems to be scope for improving quality of output, for instance by moving the 30% output that is now at the bottom end (in terms of the standing of the venues of publication or their relation with MAS) with a little bit of extra effort into 10% in the top end. The main criterion for venues of publication should be the quality of those venues, and not just good citation results. At the same time the program now has a greater pool of people who can apply for funding. In sum, now that the group has established itself within the institute, it should use all its resources to further establish its international reputation in the core of its theme: that of AI in general (with venues like IJCAI, AAAI, the AI journal, JAIR) and in particular that of multi-agent systems (with venues like AAMAS and JAAMAS).

Cognitive Modeling (Van Rijn, Taatgen)

Research program:	4
Quality:	4
Productivity:	4
Relevance:	3
Vitality and Feasibility:	3.5

This group is interested in symbolic modeling of human cognition (in particular, learning, memory, multi-tasking and time perception) and its applications. The appointments in this group are relatively new and young, and although the output looks promising, the group now has to sustain and further build upon its promising reputation. The group should weapon itself against the threat of limited external funding in combination with a strong aspiration to expand. It should also be prepared to put additional effort in explaining its standing and achievements when evaluated in a computer science environment. Publication in some more AI and CS related venues (without compromising on quality) may be of help here.

Language, Sound and Cognition (Andringa)

Research program:	3.5
Quality:	3.5
Productivity:	3.5
Relevance:	4
Vitality and Feasibility:	4

This is not only a relatively young research group in ALICE, but its main focus (language cognition, and, in particular, auditory cognition) is also a relative novice in the international AI community. This makes it hard for the committee to fully assess the group's output, but time will tell whether the group is an asset for ALICE. It is also not easy for a computer science committee to fully assess the quality of the venues of publications this rather specialized program uses. This is an instance of a more general threat that the group needs to find a way to address: it needs to have a clear strategy where it wants to be in five years time, where it wants to publish and in which communities it wants to be visible. Part of this strategy should also prescribe how the group is going to explain these choices within its own institute and within the faculty. In terms of external funding, the group is strong and looks promising, and there seem possibilities with collaboration within and outside the university. Attracting senior staff that relates well with the current theme in the group but also makes a bridge to more general AI topics in the area of language and cognition, seems a wise thing to do.

Utrecht University

Utrecht Institute for ICT Research

Overall Evaluation

Overall rating: 4

Leadership rating: 3.5

The research institute exhibits excellence and strong expertise in important core computer science topics, for example, algorithmic complexity, agents and computational geometry. These areas of strength should be emphasized and expanded upon. At the same time, there are notable gaps in core computer science topics represented in the institute, for example, networking, operating systems and architecture. Further, there is a lack of breadth in research in databases, software engineering and graphics. The committee strongly recommends that the institute considers as a priority making future appointments in core areas to address these gaps, by looking for complementary strengths and expanding certain groups.

There are a number of excellent groups but also a few unsatisfactory ones, performing below expectation. To its credit, the institute has adopted a strategic approach to planning its future activities and its organizational structure, and is taking action to identify areas of weakness and to close down the corresponding groups. The committee hopes that the current efforts to address some of these problems are timely enough so that they will not affect the long-term sustainability of the institute.

There are excellent junior researchers. The associate and assistant professors should be given more independence, particularly concerning Ph.D. supervision. Their external visibility, through leading roles in EU projects, conference program committees and conference organization should be actively encouraged, supported and recognized.

The institute's ethos to "concentrate on high-quality foundational research, with a keen eye on applications" is laudable, but virtually all presentations of ongoing research were cloaked in applications. To give a concrete example, the research into agents was presented as addressing serious gaming – no doubt it has applications in games, as well as in other areas, but its strength is foundational, and inspired by applications, rather than the other way round. It appears that the institute reached this position due to the difficult funding and student enrollment climate, but care must be taken to distinguish marketing issues, say for the purposes of student admission, and the presentation of core research. The institute should present itself as being strong in foundational computer science, with applications, rather than giving the impression of being largely application-driven. In particular, the planned group closures should be used as an opportunity to strengthen its foundational research.

Structurally, the institute is subdivided into two research themes, each composed of several groups that are configured in the traditional mode, with one full professor leading the group. This appears to contribute to a sense of insularity in the institute: the groups tend to be narrow and incremental in their coverage of an area, with people with a similar background hired into one group. The institute should take steps to remove rigid barriers between groups and aim for a flatter, rather than hierarchical, structure. This can be achieved by evolving the groups into larger ones, with possibly several full professors in each. For example, the existing software technology group can be expanded with classical software engineering activities, and, likewise, algorithmic data analysis can serve as basis for broader research activities.

The tenure track system is in early phases of development. Although it offers the possibility of promotion to full 'profile' professor, there are no such positions in the institute at present, and the status of these professorships should be clarified in relation to established chairs. Regarding the hiring policy, in order to avoid further subdivision into smaller and narrower groups, the institute should advertise positions internationally and use broader descriptions of the research field in job specifications, as well as letters of recommendations from international experts.

It is clear that the financial position has affected the institute and remains a matter of concern. The proportion of direct funding has been declining, and is now at 50% of the total funding. The institute needs to urgently intensify its grant application activity, for example to EU, ERC and Veni/Vidi/Vici grants, to considerably increase the overall level of funding. The number of Ph.D. students is low. Furthermore, the recently adopted future target of 2 Ph.D. students per academic is not sufficient, and instead the institute should aim for a 3:1 ratio. The committee was also surprised to see resistance to applying for grants to support postdocs, in view of lack of credit being given for such positions by the university resource allocation model. The institute should create more such positions which play an important role in the development of academic careers.

Cognition and Communication (Van Oostendorp, Beun)

Research program:	3
Quality:	3
Productivity:	4
Relevance:	2
Vitality and Feasibility:	2

There is currently no full professor in the group. The research is organized around four broad topics, which are formulated more in terms of problems and current activities, rather than in terms of scientific research questions. Although the group is productive, it would benefit from a clearer focus on research questions, and also from defining specific fields (research communities, methods, results) and targeted publication venues for the coming period. The group should identify fields in which it wants to become a leading player, and pursue its activities accordingly. The committee was informed that there are plans to appoint a full professor in human-media interaction, thus refocusing the group in a new direction.

Content and Knowledge Engineering (Van den Berg)

Research program:	3
Quality:	3
Productivity:	3
Relevance:	2
Vitality and Feasibility:	2

The group was formed in 2002 by bringing together a number of academics with diverse backgrounds under the leadership of Prof. J. van den Berg (half-time since 2006). The group's focus has been on digital libraries and publishing. Although the group's research productivity has been adequate, there has been limited external funding (no external funding after 2003), too few Ph.D. students, insufficient guidance from senior staff, and significant staff departures. The institute has already decided not to continue this group, and the committee concurs with this decision. Remaining members of the group will join the new group on human-media interaction.

Games and Virtual Worlds (Overmars)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	4
Vitality and Feasibility:	5

This group is under strong leadership; it has changed focus from computational geometry and robotics towards games technology and virtual worlds, covering topics such as crowd simulation, path planning and animation, with ambitious aims in terms of research as well as influencing the community. A particular strength of the group is that it combines foundational research into computational models and algorithms, which includes rigorous proofs of properties, with applications and experimental research aimed at developing practical efficient techniques. There is scope for both high-quality research as well as commercial exploitation, by broadening the work to the use of virtual worlds in education and training. The group is highly visible through being the lead in the large FES-funded project GATE. The group is very strong in computational geometry, particularly judging by citations and community recognition, but it is not as well established in the games research. This is partly due to the activity being relatively new to the group, but also games being underdeveloped as a research field, with no recognized conferences and journals. The number of research FTEs of senior staff is low and a cause for concern, particularly as the group recently split away from multimedia and geometry. An appointment in graphics may be considered to broaden the activities.

Intelligent Systems (Meyer, Dastani)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	4
Vitality and Feasibility:	5

This group focuses on agent-oriented programming, multi-agent systems, and various agent applications, such as games, logistics and computational economics. While continuing its earlier more theoretical work, the group has recently also embraced more practical challenges, striking a healthy balance between theory and practice. The group is highly visible in the top publication venues in its field, both through papers and program committee memberships. The amount of external funding has increased considerably. The group also appears well integrated in the game-related research thrust at Utrecht. Overall, this group is excellent and moving in promising directions.

Multimedia and Geometry (Veltkamp, Van Kreveld, Hürst)

Research program:	4.5
Quality:	5
Productivity:	4.5
Relevance:	4
Vitality and Feasibility:	5

This group was formed in 2004, by splitting away from a larger unit concentrating on geometry, imaging and virtual environments. Since then it has been under the leadership of Veltkamp, who was promoted to the chair in multimedia in 2009. This is a young, growing group, with one associate and two assistant professors, a good track record of external funding and numbers of both postdocs and Ph.D. students. The research focus is on geometric algorithms and information retrieval for a variety of applications, from GIS and music, to 2D and 3D images and videos. The activities include both research into algorithms (van Kreveld) as well as applications (Veltkamp), where both types of activities complement each other well, though also giving the impression that a split into two may occur at some point. The group has a strong and convincing vision of their future direction. The group may be hampered in their activities by lack of database experts in the institute and the institute may want to consider making an appointment in this area.

Algorithmic Data Analysis (Siebes, Feelders)

Research program:	4
Quality:	4
Productivity:	4
Relevance:	4
Vitality and Feasibility:	4

The research focus of this group is data mining. This is a small group consisting of one full professor, assisted by an assistant professor. The group's research output is very good in quality and productivity, and it is being presented in top international venues (KDD, PKDD, ICDM, etc.). However, the group's resources are quite limited, especially so with the appointment of its senior member as the head of the research institute. The group should expand in terms of the number of tenure-track positions, but also in its research scope so that it accommodates some related research topics, such as machine learning in AI or data warehouses in databases

Algorithmic Systems (Van Leeuwen, Bodlaender)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

This is an internationally leading group in algorithmic complexity, addressing a range of problems across networks, graphs and planning, rigorously and in considerable depth. The committee applauds the emphasis on fundamental computer science, as opposed to being largely driven by applications. van Leeuwen is commended for the strong leadership, in research as well as education, in spite of heavy administrative duties. The publications are of very high quality, both in terms of venues and results, and several group's members, including those below the level of full professor, are internationally visible and recognized. The group has ambitious and well-thought out plans for future research directions, such as parameterized algorithms and complexity aspects of algorithmic game theory, and also for how the group will tackle these issues from an organizational point of view. Overall, this is an internationally leading high-quality group, with excellent prospects. However, the forthcoming retirement of van Leeuwen may result in severe weakening, and the institute must take appropriate steps to maintain the group's critical mass and the institute's strength in algorithms. This can be achieved by an appointment or a promotion at the rank of full professor, and additionally strengthening the group by making a junior tenure-track appointment.

Decision-Support Systems (Van der Gaag)

Research program:	4
Quality:	4
Productivity:	4
Relevance:	4.5
Vitality and Feasibility:	4

The group has produced high quality research during the assessment period, despite having to overcome difficult personal circumstances of its leader. Group members publish in leading venues of uncertainty in artificial intelligence. Since the group is cur-

rently considering including planning under uncertainty within its activities, it should broaden its visibility to the leading agents venues as well. Apart from publishing quality papers, the group is particularly commended for their work towards the development and implementation of the theoretical techniques, which led to a toolbox with high potential for impact, both in academic as well as commercial contexts. Now that the group is up to full strength again, the committee encourages it to steadily increase the number of publications and Ph.D. theses.

Organization and Information (Brinkkemper)

Research program:	3.5
Quality:	3.5
Productivity:	4
Relevance:	3.5
Vitality and Feasibility:	4

The group was established in 2004 with the appointment of a chair (Brinkkemper). The group's research focus is on software products, covering methodological studies of development processes in the software industry, instrumentation, and theory validation for implementation and adoption of software products. In addition to the chair, there are a number of junior tenure-track appointments. The group is responsible for popular BSc and MSc programs within the department of information and computing sciences. The group is also active in a number of ventures intended to help the Dutch software industry. The quality of the research of the group is good to very good. However, its resources are spread thin because of multiple activities. Moreover, the group includes several young researchers who were appointed recently, and needs to consolidate its research methodologies and improve quality control. The group should focus its research agenda towards mainstream software engineering venues, and also allocate more time and attention to research.

Software Technology (Swierstra, Jeuring)

Research program:	4
Quality:	3.5
Productivity:	4.5
Relevance:	4
Vitality and Feasibility:	3

The software technology group was established in the 1980s. It has evolved from a broader research group, covering many aspects of computer science, into a smaller, more specialized research group, focusing on programming languages and the development of programming support tools. The work covers both theoretical and experimental aspects of language and tool design. In particular, the group has been focusing on the higher-order, lazy, strongly-typed functional programming language Haskell. The group has been contributing to the development of the language, extensions of the

language, tool support, and applications in real-world projects. In this rather narrow field, the group became visible internationally and is recognized for its contribution to functional and generic programming.

The relatively narrow focus of the group may be detrimental to its sustainability in the long-term. The group should broaden its scope towards new directions, such as the implementation of functional programming languages and programming tools on emerging multi-core architectures.

University of Twente

Computer Science Department

Overall Department Evaluation

Overall rating: 4

Leadership rating: 5

The department generally consists of strong research groups that possess critical mass and enjoy international stature. The departmental structure for research – called Centre for Telematics and Information Technology (CTIT) – consists of research groups and application areas (strategic research orientations, or SROs), matched against each group in a 2D matrix. This structure encourages more focused and coherent departmental research, without binding the research of a group to a particular application area. In addition, the inter-disciplinary nature of CTIT (including members from mathematics, civil engineering, philosophy, etc.) leverages the department’s resources. The departmental administration exercises excellent leadership, by encouraging a healthy balance between research in core areas of computer science and applications. Moreover, there is ample and balanced funding for different groups, partly thanks to university policies that reward external funding. The department is playing a leading role in the tri-technical university initiative (3TU), named NIRICT, which may well contribute to international visibility and potential long-term funding sources, such as the European Institute of Innovation and Technology (EIT). As well, the committee was impressed by the Ph.D. students who joined for lunch, both for their maturity and focus.

At the same time, there are areas of administration and leadership where there is room for improvement. The department is still largely operating with a professor-chair model whereby research groups are identified with a (single) professor who leads the research and determines the directions and the hiring of junior colleagues and graduate students. The tenure track system in place is tentative and does not ensure that every assistant professor who meets quality and productivity guidelines will enjoy an orderly career of promotions through the ranks. Moreover, there is considerable in-breeding within some research groups, with insufficient safeguards for ensuring that there will be hiring in new areas, or that graduates will go away, at least for some time, to benefit from exposure to new ideas. On a related issue, there is total absence of women among the senior ranks of the department.

The committee also noted heavy emphasis on external research projects in group presentations, at the expense of research ideas and research agendas. Moreover, Ph.D. students seem to be hired for projects rather than admitted by the department, and there are no department-wide guidelines on breadth of computer science knowledge or other qualifying requirements for a doctorate degree. Along similar lines, some

groups seem to be suffering from high Ph.D. student turnover. This may be due to insufficient supervision, the lack of department-wide guidelines noted earlier, or the over-dependence of thesis work on external projects.

Human-Media Interaction (Nijholt, Heylen)

Research program:	4
Quality:	3.5
Productivity:	4.5
Relevance:	3.5
Vitality and Feasibility:	4

With some of its researchers coming from theoretical computer science and artificial intelligence, this group has now focused on human behavior, multimodal interaction, synthetic environments, and multimedia data management and presentation. The group has grown substantially over the last years to about 40 researchers including 20 Ph.D. students. Non-tenured staff and Ph.D. student FTEs more than doubled during the evaluation period due to the large amount of contractual funding, especially from participation in major EU projects. The group shows very high publication productivity (more than 100 publications per year) but is not strongly represented in top publications venues of HCI. While this somewhat limits the scientific impact, the socio-economic relevance of the research results of the group is obvious. A slightly more focused research agenda in some fields might improve the chances for getting NWO-type research funding with the potential for higher impact publications.

Design and Analysis of Communications Systems (Haverkort, Pras)

Research program:	4.5
Quality:	4.5
Productivity:	4.5
Relevance:	4.5
Vitality and Feasibility:	4.5

The group works in three different, but related, areas: (i) performance and dependability analysis, (ii) network management (mostly of wired networks), and (iii) wireless networks. The quality of the performance and dependability work is excellent, the network management work very good, and the wireless networks work good. The latter two groups should, in addition to their current publication venues, consider the top network or wireless conferences, such as Sigcomm, Infocom, Mobicom, etc. The partial move of the group's most visible member, Haverkort, to the Embedded Systems Institute is a major worry. A definitive solution should be considered in a shorter time frame than 2011. The redirection of the wireless networking research to vehicular networking technology is a good move, as is the increased focus on embedded systems in the group as a whole. On the negative side, the group suffers from inbreeding: all tenured people have their Ph.D. from Twente. It is necessary to inject fresh ideas in the group by bringing in people from other institutions.

Distributed and Embedded Security (Hartel, Nikova)

Research program:	3.5
Quality:	3.5
Productivity:	4
Relevance:	4
Vitality and Feasibility:	4

The group has been refocused on security for embedded and distributed systems following advice given by the previous research assessment. There have been major changes in staff, either due to retirement or moves to other groups, as well as new appointments. As of late 2007, the group is under the leadership of one full professor (Hartel). There is evidence that talented young academics have been appointed recently from outside Twente, and the committee understands that the hiring process is not yet completed. Strategically, the group seems to be well positioned, with research tackling aspects of system security and cryptography, as well as pertinent applications in e.g., healthcare. There are some publications in leading conferences and journals, but the quality for system security research could be improved. The group's track record of research funding is good and the number of Ph.D. students is healthy. Overall, the group appears to be on an upward trajectory, subject to its ability to retain talented staff below the level of full professor as well as appoint high quality researchers into tenure track positions.

Formal Methods & Tools (Van de Pol, Rensink)

Research program:	4.5
Quality:	5
Productivity:	4.5
Relevance:	4.5
Vitality and Feasibility:	4.5

The group was very strong in terms of reputation at the beginning of the assessment period. Since then, it has lost some prominent members who became full professors elsewhere, in addition to undergoing a change in leadership in 2007. Following that, a new strategy for the group has been formulated that features a combination of fundamental research, tool building and applications, largely aiming to address quantitative and compositional aspects of systems/software, with emphasis on the practical aspects of high-performance implementations to model checking. The quality and rate of publications throughout the assessment period is high, and some of the tools produced by the group are visible in the community. There are also talented young researchers in tenure track positions, judging from the prizes received, and the numbers of postdocs and Ph.D. students are growing. External funding is healthy, with a higher proportion of NWO grants compared to contracts. In summary, this group has been subjected to changes and movement of staff, but is now well positioned with respect to the emerging opportunities and, assuming it can retain its key staff, likely to be successful.

Databases (Apers, Hiemstra)

Research program:	5
Quality:	5
Productivity:	4.5
Relevance:	4
Vitality and Feasibility:	4

This is one of the strongest databases groups in Europe, with national and international awards, as well as clear international visibility. The group has done well in attracting promising junior researchers, also in diversifying along new directions of database research, such as semi-structured data, uncertainty in databases, as well as security and privacy. At the same time, the group's publication record has deteriorated in the past 3 years. Moreover, a key member of the group (Feng) left in 2006 for personal reasons. Given these facts, along with the demanding – and strategic – administrative role of the group leader within the department as well as within NIRICT, it is essential that the department allocates resources to strengthen or redefine the leadership situation for the group. The appointment of Djoerd Hiemstra is a positive step in this direction.

Information Systems (Wieringa, Van Sinderen)

Research program:	4
Quality:	4
Productivity:	4.5
Relevance:	4
Vitality and Feasibility:	4

This group has a long and strong history in requirements engineering. Its current research focus includes requirements engineering, as well as security, and information systems architectures with an emphasis on business process-oriented ones. The group is publishing in mainstream venues for its research foci, and enjoys high productivity. However, the quality of its research in security and information systems architectures could be improved by aiming more publications at journals and international conferences, rather than workshops. In addition, the group's output in terms of graduated Ph.D. students is low. This needs some attention and may require adjustments of its research processes.

Pervasive Systems (Havinga, Meratnia)

Research program:	3.5
Quality:	3.5
Productivity:	4
Relevance:	4
Vitality and Feasibility:	3.5

This group is new, and has made a strong start in a new but competitive research area, partially assisted by leveraging existing competence. Despite limited FTEs, the group already produced some strong results that have appeared in a strong journal, but might benefit from (a) more presence in top conferences, (b) a focus on specific problems within pervasive computing, allowing it to build an international identity and reputation in this competitive field of research. This may also help the group attract the necessary researchers and students to grow. As noted in the group's self-assessment, there is overlap with other groups within the department (notably with the distributed and embedded security group), in expertise and subject matter. Moreover, it is important for the group to emphasize research in its formative years, as opposed to R&D projects and commercial ventures. As the group expands, it is also important to avoid further in-breeding and hire researchers with different backgrounds and research foci. Last, but not least, pervasive systems is a fashionable topic today. It is important for the group to think and plan ahead for times when the topic is less in fashion.

Software Engineering (Aksit, Pires)

Research program:	3.5
Quality:	3
Productivity:	3.5
Relevance:	3.5
Vitality and Feasibility:	3

The group describes its mission as "... to model, implement and optimize software engineering processes for specifying, designing, implementing, verifying and optimizing software artifacts at various abstraction levels for the purpose of fulfilling the stakeholders' requirements of software systems ...". According to this very general description, one would expect the group to be active in core software engineering topics, to be visible in the international software engineering community, and to publish in software engineering venues, such as TSE/TOSEM or ICSE/FSE/ISSTA/ASE or the like. The group is instead known for its past work on object-oriented languages and methods, and for its subsequent focus on aspect-oriented concepts, i.e., on how cross-cutting concerns influence design and implementation of software systems. In these areas the group has gained international visibility and has done influential work. The group is less active in core software engineering topics and has limited extra-European visibility. The group should identify its own specific focus area and strengthen its presence and visibility within software engineering.

Delft University of Technology

Software Technology and Mediamatics

Overall Department Evaluation

Overall rating: 5

Leadership rating: 4

The computer science groups participating in this review are spread over two of the six departments of the faculty of electrical engineering, mathematics and computer science (software technology and mediamatics). These two departments are each composed of several sections, roughly corresponding to the research programs being evaluated below. A newly formed section on web information systems was not subject of this evaluation. Computer engineering and network architectures and services are in two other departments, which do not participate in this evaluation.

The committee was impressed by the overall research performance of computer science at the TU Delft. The groups work at an internationally competitive level on important problem areas and deliver strong results. The two departments seem quite sensibly managed and have made some crucial decisions to move into the right directions. Through hiring some strong new faculty Delft computer science is renewing itself well. The groups have acquired significant external research funding and they have attracted high-quality Ph.D. students.

In order for computer science at Delft to be better recognized as one of the leading research institutions, the faculty should consider a more uniform structure in the form of one department of computer science. The current spreading of computer science across the departments of software technology, mediamatics, and computer engineering prevents the research field from being perceived as one unit from the outside, and consequently a merger should be considered.

While the committee is aware of the shift of external funding towards multidisciplinary research, it is also convinced that good interdisciplinary research can be built only on a strong position in its own field and thus recommends not moving away from core areas of computer science when considering growth or renewals.

As already mentioned in the introduction the departments should further strengthen the autonomy of assistant and associate professors. In this respect the tenure track system as currently implemented in Delft should not stop at the associate professor level and the respective policies need to be clearly communicated. Furthermore, the distinction between full professors with chairs and personal full professorships should be eliminated. Concerning open competitions for full professorships, they should be announced with a broader profile in order to restrict potential inbreeding and to increase competition from the outside for all positions.

In relation to other fields in the university and the faculty, each field has to be judged by its own metrics which especially means that many areas of computer science cannot be adequately evaluated by journal-centric citation indices. The committee acknowledges the additional value which is provided by the Delft Institute for ICT Research and the NIRICT as part of the 3TU cooperation and the effort which has gone into new initiatives like ICT-KIC and FES-COMMIT but it also encourages a closer institutional cooperation of all Dutch computer science institutes beyond those boundaries.

Department 2 Software Technology

This department focuses on the design, construction and analysis of complex concurrent and cooperative software systems.

Parallel and Distributed Systems (Sips, Witteveen, Langendoen)

Research program:	5
Quality:	4.5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

The group covers high-performance computing (with focus on multicore programming and grids), distributed systems (with focus on peer-to-peer systems and wireless sensor networks), and distributed algorithms (with a focus on coordination and mechanism design). The group is dynamic: moving well into new areas, effectively developing junior faculty, raising ample funding, and publishing in strong venues. The group implements the science by experimentation approach with evaluation using real applications effectively. To maintain its strong reputation, the group should continue to publish in top venues.

Software Engineering (Van Deursen)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

The group works on aspects of software evolution (techniques for avoiding deterioration, program analysis tools for architecture reconstruction and aspect mining, and restructuring of overly complex software systems) as well as in embedded systems (model-based reasoning and component-based software development).

With the appointment of Van Deursen in 2003, the software engineering group has grown in a short period of time towards international recognition. The achievements in terms of quality of publications, participation in scientific commitments, impact and visibility have been remarkable. He has also been quite successful at putting together a first-class group of more junior professors. The group is now widely recognized for its leadership in software evolution and software testing.

Having consolidated its competence in core software engineering topics, the group is now undergoing a number of changes that seem to favor even further growth. Van Gemund will leave the group and join the new Embedded Software group headed by Langendoen. The Software Engineering programme has recently been extended by the appointment of Houben as new chair in Web Information Systems and will further be extended with a new part-time chair in global software engineering.

Department 5 Mediamatics

This department focuses on processing and interpretation of data with model- and knowledge-based algorithms to enable man and machine in close cooperation with their intelligent environment to deal with the increasing volume and complexity.

Intelligent Information Processing (Lagendijk, Biemond, Reinders)

Research program:	4.5
Quality:	4.5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

This research of the group covers signal processing (audio and speech, 3D video, watermarking) and pattern recognition (content-based retrieval, similarity-based classification, hyperspectral imaging and bioinformatics).

The group covers a wide spectrum of topics with an enormous scientific output. The results are impressive and many of them are published in high-impact journals and conferences of the field. The group is clearly successful, both with respect to research and contractual funding, in both its themes, signal processing and pattern recognition. The group has grown to 5 professors and 20 postdocs and Ph.D. students per theme, and will split into 2 separate groups.

Modeling and Visualization (Jansen)

Research program:	4.5
Quality:	4.5
Productivity:	4
Relevance:	4.5
Vitality and Feasibility:	4.5

The group works in modeling (feature modeling, multi-view modeling, and constraint techniques), game technology (generation of virtual worlds), and visualization (flow visualization, medical visualization, interactive virtual reality). The group has built up a strong reputation over the years, especially in the areas of visualization of flow and medical data with several publications in the top venues of the field. The external funding of the group has recently been rather limited but proposal activities of the junior faculty show the prospect for catching up. With most of the senior faculty coming closer to retirement, the group will undergo a transition and major renewal within the next few years. While the committee is supportive of moving the future focus in the direction of interactive visualization, it also encourages a broad interpretation of the theme which includes real-time rendering, modeling, and visual computing in general.

Man-Machine Interaction (Jonker)

Research program:	4
Quality:	4.5
Productivity:	4
Relevance:	3.5
Vitality and Feasibility:	4.5

The group's research themes are artificial intelligence (agent reasoning and programming, computational intelligence) and cognitive engineering (user-centered design and human perception). The man-machine interaction group is at a stage in its development where it is difficult to evaluate. The group is completing a transition between group leaders and from knowledge-based systems to man-machine interaction. This transition is somewhat complicated by the fact that the new group leader comes from the intelligent agent community, rather than from man-machine interaction.

The committee likes the attempt at formulating a new research paradigm at the boundary of artificial intelligence and cognitive systems. Trying to define a new paradigm is always risky, but the returns in the case of success are high. The committee encourages the group leader to move boldly in this new direction.

Now that the transition is well underway, the initial signs are positive. Publications and funding are very good and on the rise. Clearly, though, the transition has not yet been completed, and the risks remain considerable. The department could be more supportive in helping the new full professor completing the transition.

University of Amsterdam

Institute for Informatics

Overall Department Evaluation

Overall rating: 4
Leadership rating: 3.5

The institute has a research program that balances well fundamental research in computer science with applications. The institute is well positioned in the university, and overall the size and scope of the groups are appropriate. A number of the groups are world class, and the institute has been able to attract strong young talent. The leadership of the institute is thoughtful about how to stimulate strong research and maintain quality control.

The management of the institute suffers from frequent changes in leadership, and a small group appears to make the decisions. The leadership is shifting the research focus of the institute to more applied computer science (e.g., e-science), sometimes at the cost of core computer science, which the committee finds questionable. The committee also observed that the picture painted by the leadership is sometimes different from the one observed in the research trenches. Installing an advisory board for the director, as proposed by the director, might broaden the participation in decision making, increase awareness of the institute's challenges and directions, and provide better continuity.

The success of the institute is at risk because of the change in the funding model to which the university is transitioning. The change in model has resulted in financial deficit for the institute, resulting in a plan to close the human computer studies group (see below). In addition, the new model may lead to the undesirable situation where researchers are discouraged to raise external funding*, since it must be matched by first-stream funding. For instance, for EU grants the PIs would have to contribute 25% of the direct costs, which is unsustainable. This is counterproductive in an institute with research groups that are successful in attracting external funding. There is also uncertainty how the funding model is translated from the institute to the groups. The faculty and the university should, without delay, take measures to ensure that the institute stays a vibrant institute with a strong external funding pipeline.

* External and contract funding is desirable when it lines up with a long-term research program, since it brings in extra money for carrying out the research, allowing for, e.g., a more ambitious or broader program. Of course, care must be taken that the funding doesn't come with undesirable strings attached, such as pre-publication-approval, short-term deliverables, onerous tasks on researchers supported by the grant, or unclear procedures in the institute how the funding is passed on.

The committee also encourages the faculty to implement the tenure track model, and give equal resources to profile chairs and full chairs, providing attractive opportunities for new talent, and not limiting the existing junior faculty. The institute has done its best to recruit faculty from the outside, but female researchers are heavily under-represented in faculty, especially at the senior level.

Computer science at University of Amsterdam is fragmented. In particular, the institute for logic, language and computation (IILC) is separate from the institute for informatics, even though some of the IILC professors are clearly computer scientists. The two institutes should reach out to each other and work towards one institute for computer science. In addition, some staff members are moved between groups, but the match does not always make sense. Internal boundaries should be removed, and people should be able to flow between topics as their interests develop, instead of the current more hierarchical structure, where assistant and associate professors are assigned to a specific chair that goes along with a full professor.

The institute has a healthy and productive master and Ph.D. student body. Overall it has a thoughtful mentorship program. However, the stated goal for Ph.D. students (PhD thesis should be based on work published in 3-4 peer-reviewed international journals**) should be adjusted to match the verbal explanations given during the site visit, namely that conference publications are equally important as journal publications and that one top-quality publication in 4 years is better than 4 quality publications.

The committee was asked to comment on the possibilities of closer collaborations with the Department of Informatics at the Vrije Universiteit of Amsterdam. Bottom-up collaborations should be encouraged, both in research and education, where it makes sense to the people involved. There is not much merit in a top-down imposed wholesale merger. Both departments are of sufficient size to stand on their own, and they should continue to strive for being able to stand on their own. Since both departments are moving in a more applied direction, the argument of complementary strength is not convincing.

Computer Systems Architecture (Jesshope)

Research program:	3.5
Quality:	3.5
Productivity:	3
Relevance:	3
Vitality and Feasibility:	4

This group was created during the evaluation period. It is building on previous work on embedded systems-on-a-chip and is expanding into multi-core processors. The group

** Up to two of those papers can be replaced by papers published in peer-reviewed conference proceedings or chapters in edited books.

has an ambitious research program around a dataflow-concurrent execution model, and is exploring new processor designs, compilers, and programming languages to support this model, which may simplify the construction of programs that can exploit the many cores. This research program has led to some initial publications, and is aiming at publications in the top avenues in computer architecture, which the committee encourages. However, at the same time the committee worries that the group is taking on a large risk by betting on a single execution model and building a complete system around that model. The committee encourages the group to focus on technical nuggets, independent of particular model.

Human Computer Studies (Wielinga, Jones)

Research program:	4
Quality:	4
Productivity:	4
Relevance:	4
Vitality and Feasibility:	3

This group is well-known and its members have a good reputation in a field where social sciences meet computer science, a rather unique combination that closely relates to the identity of the group. Its research is organized along 5 themes, with a clear impact in terms of publications and for instance a widely used Prolog software infrastructure.

The committee understands the themes of the groups are being distributed over the other research groups at the retirement of the group's leader in 2010. The committee can only recommend to the institute to do these relocations carefully. One of the current associate professors is in the pipe line for a profile professorship, and the committee hopes that this will be a professorship with the same responsibilities and rights as those assigned to an ordinary full professorship.

Intelligent Autonomous Systems (Groen)

Research program:	4.5
Quality:	4.5
Productivity:	5
Relevance:	4.5
Vitality and Feasibility:	4.5

The Intelligent Autonomous Systems group is active in the areas of perception, modeling and decision making. Its research is reported on in high-impact conferences and journals, and the group is internationally competitive. A major strength of this group is that they do highly respected research, which is directly related to real world problems. The institute should secure the leadership of the group at the retirement of its leader, and put a plan in place to sustain this research effort in an area that is unique nationally, and of a proven quality internationally.

Information and Language Processing Systems (De Rijke)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

The group has established itself in a 4-year span period as a world-leader. It publishes in the best venues in its area (intelligent access to Internet information), and won a prestigious paper award. The group is very active and has attracted a healthy research income portfolio. There are numerous talented young staff members, and the group has a clear vision and strategy for the future.

Intelligent Sensory Information Systems (Smeulders)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

This group's research area is that of semantic computer vision (in particular, discovering concepts in an image), cognitive vision (comparing computer and human vision) and interactive visualization of large picture datasets. This research group has a very strong world-class reputation, with strong evidence of quality of all its individual members: they publish in high quality venues and are well present at an international level in their own research areas. The group attracts a consistent and healthy amount of research funding, and as a result has a good cohort of Ph.D. students and postdocs

Computational Science (Sloot)

Research program:	4
Quality:	3.5
Productivity:	4
Relevance:	4
Vitality and Feasibility:	4.5

This group has a strong program in developing and applying models to capture physical and biological processes at a wide range of time scales (micro to macro). The group has good collaborations with other sciences, which as resulted in many joint publications and contributions to publications in venues like Nature, which are highly acclaimed in the broad scientific community. The group also has a strong funding base, a good infrastructure to carry out the virtual laboratory work, and a well-thought-out development plan for Ph.D. students. The group should develop more the computer science aspects of the collaborative research in order to make stronger contributions to computer science.

System and Network Engineering (De Laat)

Research program:	3.5
Quality:	3.5
Productivity:	4
Relevance:	4
Vitality and Feasibility:	4

This group is a new one since the last evaluation, building on the computer networking expertise of the discontinued advanced computing systems engineering group. The group focuses on optical networking and how to expose photonics (e.g., lightpath reservation) to higher networking services, with the notable contribution of the Network Description Language. The group has strong connections with the operators of academic networks in the Netherlands, participates in formulating research directions with these stakeholders, and contributes internationally in standardization forums. The committee appreciates the impact of the group, but encourages it to shift focus from solving problems for other disciplines and stakeholders to putting an emphasis on formulating and solving interesting computer science research questions, and then demonstrate their value in those disciplines.

Software Engineering (Bergstra)

Research program:	4.5
Quality:	5
Productivity:	4
Relevance:	4
Vitality and Feasibility:	3.5

The group has been hosting two important, internationally visible, and well-established research lines, driven by Bergstra and Klint. Research has focused on the development of theory and tools in the field of algebraic specification (Bergstra) and on generating programming environments given a formal language definition (Klint). Klint ensures the group's strong connection with CWI.

Publications from the two research lines are first class, and appeared in top journals, including JACM, ACM TOPLAS, and Information and Computation. The two research leaders also found common research paths in new fields, such as software patents.

The future restructuring that will lead to a separate 'theory of computer Science' group and the merge of the software engineering focus with the systems and network engineering group raises some serious concerns. Making 'theory of computer science' an independent group can be beneficial. It acknowledges the relevance of Bergstra's potential contribution to many research areas within the institute. Moving the software engineering focus under systems and network engineering instead seems ill-advised. The MSc program in software engineering is a success story, and this suggests that the institute should consider creating a new group covering core software engineering, and allocating resources to it that would complement CWI's contribution via Klint.

Leiden University

Institute of Advanced Computer Science

Overall Department Evaluation

Overall rating: 4

Leadership rating: 4

Leiden has a strong and vibrant research program in computer science with a good balance of core computer science and applications. The two research programs in the institute are composed of strong groups which cover computer science aspects from theory to systems building and applications. Despite some diversity, the groups appear quite cohesive and result in a convincing fit. The institute has a well-organized Ph.D. program, with high-quality students and a good number of them per faculty member. The institute has done an excellent job of using external connections (e.g., with the CWI) to increase its scope, its Ph.D. body, and its faculty. This has allowed the institute to cover many basic topics in computer science with a small full-time staff.

The flip-side of using many external researchers is the large number of part-time faculty and students, which raises concerns about where their primary allegiance is. If the institute wants to aspire to improve beyond its current level, it needs to grow the number of full-time positions. The institute is trying to achieve this goal by putting much effort into teaching (which the committee applauds), which hopefully will attract more students to come to Leiden. More students mean more funding for positions but also less time to perform research. The management team should convince the faculty and the university to grow the institute more directly.

The institute attracts high-quality people, and develops them through a well-defined career path based on quality metrics. The institute is in a transitory phase with respect to the tenure track system. It should proceed and communicate the career paths more crisply. It should also increase the number of female faculty, at all ranks.

The focus on biosciences as one of the major application areas seems positive for the standing of the institute within the faculty but care should be taken that this remains a relationship which is beneficial for both sides leaving enough room for fundamental research in computer science. A university striving for excellence needs to have a computer science program that has good coverage of basic computer science topics before it spreads out into areas like technology management.

Algorithms and Foundations of Software Technology (Arbab, Bäck, Kok)

Research program:	4
Quality:	4
Productivity:	4
Relevance:	4
Vitality and Feasibility:	4

This group originally consisted of two clusters, respectively focused on algorithms and foundations of software engineering. A third cluster, on Technology and Innovation Management (TIM), was added earlier this year as a result of restructuring. The research spectrum covered by the group is quite broad, including also applications. In view of the small size of the institute, the policy is to focus research within each cluster; for example, the algorithms cluster is concerned with data mining and natural computing, rather than representing the full scope of algorithms research. This policy has enabled the institute to achieve high quality research outcomes, but there is a danger of narrowing down the scope too far. The emphasis on research contributions in core computer science and two-way integration between computer science research and applications, for example in biology, is commended and further encouraged. There is evidence of novel foundational research that has potential for further theoretical development as well as applications. While the first two clusters are cohesive, linked through concurrency, the third (TIM) is only tangentially connected. The institute should explore ways to strengthen the connection of this third cluster to the main body of the group's research. Ph.D. student numbers are healthy and external funding levels are good. The committee encourages the institute to increase the share of non-direct funding and position the department for growth.

Computer Systems and Imagery & Media (Deprettere, Haring, Lew, Verbeek, Wijshoff)

Research program:	4.5
Quality:	4.5
Productivity:	4.5
Relevance:	4.5
Vitality and Feasibility:	4.5

This program consists of two clusters, one focusing on high-performance computing systems, embedded systems (systems on chip), and compilers; the other one focusing on multimedia retrieval. The two groups benefit from each other: the multimedia retrieval provides a challenging application domain for the computer systems side, and the computer-system-side provides novel infrastructure for high-performance retrieval. The group has strong faculty (many recruited from outside of Leiden), is well funded, and develops its junior researchers well. It has a healthy and coherent collection of research projects and an appropriately-sized body of Ph.D. students. The group competes well internationally in terms of publications and placing its Ph.D. students.

VU University Amsterdam

Department of Informatics

Overall Department Evaluation

Overall rating: 4

Leadership rating: 4

The department has a clear strategy: it wants to grow through collaborations both within the department and with other departments. The intent is to make computer science societally more relevant, and to create a favorable situation for attracting students and funding. As already pointed out in the Introduction, the committee recognizes the need for students and funding, but wishes to point out the risk inherent in this strategy of lowering the VU's strong reputation in traditional core computer science areas. Some initial signs of such weakening are becoming visible, as, for instance, the theory group appears to have reduced impact while the group on business, web and media is rapidly growing. A careful balance will have to be maintained between societal relevance and collaborations on the one hand and strength in core computer science on the other hand.

The department has thoughtfully introduced new professorial structures. In particular, the removal of the one-to-one binding between groups and full professors and the permanent budget commitment for tenure-track assistant professors are major steps in the right direction. The department should go further in this direction. In particular, there appears little reason for continuing the distinction between chair and personal chairs (both should simply be full professors). Furthermore, the independence of assistant professors should be reflected in a non-hierarchical relationship to other professors. Finally, the use of the term assistant professor for both tenure-track and temporary positions is confusing.

In terms of hiring the department should conduct broader searches. Rather than at any given time only search for a single profile, the department could search for a number of profiles it wants to acquire over the course of a number of years. Since there is already a plan for what profiles are needed over the coming years, it should be relatively easy to implement this recommendation.

The committee was asked to comment on the possibilities of closer collaborations with the Institute for Informatics at the University of Amsterdam. Bottom-up collaborations should be encouraged, both in research and education, where it makes sense to the people involved. There is not much merit in a top-down imposed wholesale merger. Both departments are of sufficient size to stand on their own, and they should continue to strive for being able to stand on their own. Since both departments are moving in a more applied direction, the argument of complementary strength is not convincing.

The committee was favorably impressed by the graduate students. They seem talented, diverse, and well coached. The committee was equally favorably impressed by the financial situation and by the large amount of external funding brought in by all groups, allowing each group to fund enough graduate students to reach critical mass. The department graduates about 10 Ph.D. students per year, which seems a little on the low side, but it is more important to maintain quality than to raise the number of graduations.

The absence of women among the full professors in the department is disappointing, and more so the recent loss of two relatively senior women professors. The university and the faculty should make resources available to the department to address this problem, and the department should be more pro-active in seeking out good women candidates at all levels.

Administrative and technical support staff appears limited. The university and the faculty needs to understand that if the computer science department is to reach the next level of excellence, it should have adequate support services in IT, finances, communications, grant preparation, etc.

Artificial Intelligence (Treur, Eiben, Van Harmelen)

Research program:	4.5
Quality:	4
Productivity:	4.5
Relevance:	4
Vitality and Feasibility:	4.5

The artificial intelligence group is highly regarded in its field, and present and visible in the international community in the key venues of its three research groups. In their publications, there is definitely evidence of excellence. However, especially the agents group could improve its output quality by looking at the bottom 30% of their publications: a better strategy would be to turn this into work that is published in higher quality venues, even if it would be at the cost of decreasing its volume. At the moment, the group has no associate professor, a weakness that should be turned into an opportunity: when resources become available, the group should advertise broadly and let quality the main selection criterion. There seem also to be more opportunities of collaboration among the research groups, both within and outside the section.

Bio-informatics (Heringa, Teusink)

Research program:	3.5
Quality:	3.5
Productivity:	4
Relevance:	3.5
Vitality and Feasibility:	4

The bio-informatics group carries out a research program in systems biology with two full professors, one with a 0.8 appointment in computer science and a 0.2 appointment in biology, and another with a 0.8 appointment in biology and a 0.2 appointment in computer science. The group has a history of providing useful tools to the biology community. Most notable among its past work is Heringa's contribution to the widely used Toffee tool for multiple sequence analysis. Recent efforts have not yielded similar impact. There is also little evidence of contributions to computer science, which is problematic for a group that occupies the equivalent of a full professor position in computer science. The group should publish more in suitable computer science venues, in addition to their publications in journals like Bioinformatics.

Business, Web and Media (Akkermans, Gordijn, Schreiber)

Research program:	4
Quality:	3.5
Productivity:	4.5
Relevance:	4.5
Vitality and Feasibility:	4.5

This group focuses on inter-disciplinary research grounded in ontologies. The group is large in terms of senior staff, relative to the overall size of the department. The group's research results include the e3value framework for modeling value in business organizations, also a search engine for cultural objects that won the Semantic Web challenge in 2006. The research output of the group is very good in quality, and very good to excellent in productivity. The business and web component of the group could improve the quality of its research by targeting more top journal venues in information systems, such as the ACM Transactions on Information Systems.

Computer Systems (Bal, Brazier, Tanenbaum, Van Steen)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

The computer systems group is among the strongest computer science groups in the Netherlands. Senior and junior faculty are outstanding, including the only current ERC Senior Investigator award recipient in computer science in the Netherlands. The group works in a number of high-impact areas, including reliable systems, high-performance computing and large-scale distributed systems. They have a steady record of publications in the most selective venues for those areas. The department should carefully evaluate the impact of Tanenbaum's retirement and his departure in the next few years. While other people in the group have achieved considerable visibility, none equals Tanenbaum's. The number of full professors has recently gone up from 2 to 3, but is

now back down to 2. The department should also be careful not to lose top junior faculty who may receive attractive offers from other institutions.

Information Systems and Software Engineering (Van Vliet, Verhoef)

Research program:	4
Quality:	4
Productivity:	4
Relevance:	4
Vitality and Feasibility:	3.5

The information management and software engineering group aims at covering different stages of the complete lifecycle, driven by real-world problems. The group leaders focus on different perspectives. Van Vliet focuses on high-level design and software architecture, in particular recording rationale and design decisions that lead to an architecture. More recently, his group has been focusing on service-oriented systems, an area in which the group is planning to expand further in the future. Verhoef focuses on 'software as an asset', that is on supporting organizations in the governance of large application portfolios. This work has strong practical motivations and has a strong business-oriented connotation. Both sub-areas have been successful in the past, in terms of publications and collaborations with industry. The future developments, however, are unclear, also due to the expected retirement of Van Vliet, which may endanger research in core software engineering topics. This is an area in which high-quality, internationally visible research is needed, also to support the high demand coming from educational programs.

Theoretical Computer Science (Fokkink)

Research program:	4
Quality:	4.5
Productivity:	4
Relevance:	4
Vitality and Feasibility:	3.5

The theoretical computer science group, until 2001 led by de Bakker, has traditionally been strong and internationally visible in concurrency, process algebra and term rewriting, with co-algebras and formal verification added more recently. The retirement of the group's leader, Klop, in 2007 was anticipated, and the group is now under the leadership of Fokkink, appointed in 2005. Though the headcount shows four tenured staff in 2008, the committee understands that one of those will shortly leave. In the assessment period, the group has cemented its reputation in term rewriting through the production of a 2003 monograph on the topic, which proved to be a major effort. A further book is listed amongst the publications. In addition, members of the group collaborate with the bioinformatics and the computer systems group. More emphasis should be given to the computer science contribution in inter-disciplinary research. The number of postdocs and Ph.D. students is relatively low and has to increase, as well as the proportion of external funding, for the group to be able to compete internationally.

Radboud University Nijmegen

Institute for Computing and Information Sciences

Overall Department Evaluation

Overall rating: 5

Leadership rating: 5

The institute is organized in three sections (data security, intelligent systems, and model-based system development), which cluster the chairs. Formally, chairs are the basic organizational unit of the university: every staff member belongs to a chair. Sections, however, have a larger critical mass and wider focus, and provide a better visibility to research than individual chairs. Moreover, sections are themselves centered around principal investigators (PIs), the leading researchers who are responsible for steering the respective research areas. PIs do not need to be professors, but the role of PI is a key positive factor in the promotion system: one cannot become professor without PI potential. In addition, each section has a section leader, who has a coordination responsibility.

The institute has successfully adopted an organizational structure for research that complies with the existing rules, but at the same time tries to reduce fragmentation, and instead promote openness and cooperation. Indeed, sections cluster the existing research competence around significant macro areas in which the institute has critical mass. Moreover, a better distribution of workload may be achieved by providing more research time for PIs and less teaching.

The institute has rightfully kept its long-term focus on core computer science. Although the institute recognizes the importance of interdisciplinary work, and invests efforts in it, excellence in its core competences is a high priority.

The institute has defined explicit criteria to evaluate excellence in promotion cases and in acquisitions of researchers from outside, which is good. Establishing exclusive and automatic links between acquisition of certain grants (e.g., in the Veni/Vidi/Vici categories) and promotions, however, is too restrictive and dangerous in the long run. The outcome of a grant proposal often depends on current political winds, and is not one-to-one related to requirements to function at, for instance, the professorial level. In addition, an automatic link to achievements at the national funding level makes it difficult to compare promotion candidates to their peers outside the Netherlands.

There is high quality of research across all areas in which the institute is active. This puts the institute in an excellent position for growing further and achieving equal excellence in other areas. The institute has done all it can and all that could possibly be expected of it with its current size. The committee recommends that the university grows the

department by at least one chair. Given the past track record, such an investment is likely to result in rich returns in terms of visibility for the entire university.

Digital Security (Jacobs, Poll, Van der Weide)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

The digital security group was founded in 2002, using the Pioneer grant for Jacobs. The group performs top academic research but also participates in societal privacy policies. It addresses research topics spanning from Java security, smart-cards, RFID, and distributed security protocols, to applied cryptography. The cross-cutting themes across these topics are software correctness and identity security. The group has made substantial impact on the research community (e.g., papers in strong venues) and practice (e.g., tools for JML, OV chip card), building a strong international reputation. It has a good funding profile and an active Ph.D. student body. Through interactions with the press, it has also built itself a widely-recognized name, which has benefited computer science at Radboud in general.

Intelligent Systems (Barendregt, Geuvers, Heskes)

Research program:	4.5
Quality:	5
Productivity:	4.5
Relevance:	4.5
Vitality and Feasibility:	5

This rather new section is organized around three themes which each on their own are quite successful, both in terms of the quality of their output and the visibility in the international community of their areas. Collaboration and cohesion between the themes could be stronger (although this should not lead to compromising on quality), and knowledge representation seems to provide an angle that might help integrate the themes and give the area of intelligent systems a more comfortable coverage. There is a fruitful attitude of approaching fundamental scientific questions with an open eye for some carefully chosen and challenging applications.

Model-based System Development (Lucas, Plasmeijer, Vaandrager, Proper)

Research program:	4.5
Quality:	5
Productivity:	4.5
Relevance:	5
Vitality and Feasibility:	5

The group covers a broad spectrum of theory and applications in the area of model-based development, including formal verification, model-driven reasoning, and conceptual modeling. Though originating from quite disparate themes, it has fused into a cohesive thematic activity, with a clear strategy. The committee commends the group's commitment to applying computer science theories, tools and techniques to challenging applications, for example in the medical domain or in network protocols, and its emphasis on core computer science contributions in research. There are concrete and useful outcomes of applying the techniques in real-world situations, but there is also scientific depth and technical difficulty in published research. The group has a strong vision for the future, which includes ambitious novel directions that hold promise, such as the use of machine learning in verification. The newly established PI system is working well, and the working atmosphere is healthy, with a high number of postdocs and Ph.D. students contributing to the group's ethos. The publications are of very high quality, and the balance of external funding is good. Overall, this is a strong, coherent, and successful group.

Eindhoven University of Technology

Department of Mathematics and Computer Science

Overall Department Evaluation

Overall rating: 4.5

Leadership rating: 4.5

The committee was quite pleased by the strength and overall quality of the research done by the department and by its coherent focus on core computer science and on the study of deep problems of the discipline. Over the years, the department has been rightly reinforcing its position in its own strength areas. However, it also has made its research focus somewhat narrow and unbalanced. For instance, there seems to be an over-emphasis on formal methods (this is strongly present in the formal methods group, the system design and analysis group and the security group). Moreover, the focus within formal methods, and the hiring within this area, seems to strive at more of the same, rather than at a more widespread coverage within this theme. The department's focus on formal methods might in the future be counterbalanced by a stronger emphasis on experimental and engineering research.

The department's funding level is good. The management of the department appears to be effective, but a bit conservative in its handling of research groups, still dominated by the conventional full professor leadership model. There is also room for improvement along a number of other fronts. The department should strive to become more gender-balanced in the future. The department has probably not fully exploited the university's support to attract more talented female staff. The department should also resist a tendency to inbreeding, that strong departments sometimes exhibit. A stronger push in the direction of a tenure-track based system, truly open to external competition, would help going in this direction.

Architecture of Information Systems (Van der Aalst)

Research program: 5

Quality: 5

Productivity: 5

Relevance: 5

Vitality and Feasibility: 5

The group's research is focusing on business process management, and for that topic, this is probably the top research group world-wide. The research output of the group is excellent overall, especially so with respect to productivity and impact.

Databases and Hypermedia (De Bra)

Research program:	4
Quality:	4
Productivity:	4.5
Relevance:	4.5
Vitality and Feasibility:	4.5

The group is strong in the area of adaptive hypermedia and data mining, and is participating in a number of EU projects that apply database techniques to e-learning, e-culture, e-entertainment, etc. The research output of the group is very good in quality and quantity. The group can be strengthened by increasing its research activities in the area of database systems. The recent hiring of an assistant professor is a step in this direction. The committee also notes that several the current leading members of the group have shared academic background, at some expense to intellectual diversity.

Formal Methods (Baeten)

Research program:	4.5
Quality:	4.5
Productivity:	4
Relevance:	4
Vitality and Feasibility:	4

The group is concerned mainly with research into process algebras, including applications in systems biology, and also proof systems for object-oriented languages. The current research is focused on domain-specific languages for mechanical devices, including formal semantics, their extension with real-time, hybrid and stochastic features, as well as code generation. This theme is worthy and the committee encourages the development in this direction, perhaps even towards tool development which is currently not pursued. The process algebra research is highly visible internationally, as evidenced recently by a textbook on the subject, and the group is well represented in EU projects, with a good proportion of contract funding. The number of Ph.D. students is good, but the group should strive towards increasing the number of postdocs. Publications are in high quality venues. The committee is, however, concerned, about maintaining the quality of tenured staff below the level of professor, which it deems necessary to ensure the lasting impact of the formal methods research in the department.

System Design and Analysis (Groote)

Research program:	4
Quality:	4.5
Productivity:	4
Relevance:	3.5
Vitality and Feasibility:	4

The group does research in formal methods and its applications. The focus of the group is on mathematically sound modeling approaches and the development of tools to make modeling of complex systems using these approaches practical. The group has developed the expressive modeling language mCRL2 that extends the functionality of the mCRL language previously developed in the group. The group is productive, publishes in top-notch venues, and their tools are apparently used in Dutch industry. However, the work appears rather narrowly focused and somewhat insular. The group should broaden its approach and the venues in which it publishes.

Algorithms (De Berg)

Research program:	5
Quality:	5
Productivity:	5
Relevance:	5
Vitality and Feasibility:	5

The group pursues a high quality, coherent program of research focused on a subset of algorithms-related problems in computational geometry, with applications to cartography and GIS. This is an area rich in applications, and the group was enthusiastic and knowledgeable about the future directions, for example to capture motion data. The committee applauds the group's emphasis on foundational research, in the form of algorithm design, their formal proofs of correctness, and proof of concept implementation. The tenured staff, which includes female members, is highly talented, productive and internationally recognized for their work. They publish in venues of the highest quality. The group has an excellent track record of the competitive NWO funding, including a Veni, a Vidi, and a Vici grant, and some recent EU (contract) funding. The total number of Ph.D. students and postdocs is comparatively high. This is a group with a strong vision and on course for success, though this will depend on the department's ability to retain its tenured staff below the level of professor as their international reputation grows.

Visualization (Van Wijk)

Research program:	5
Quality:	5
Productivity:	4.5
Relevance:	5
Vitality and Feasibility:	5

The group does excellent research in visualization in a broad sense, and is especially strong in information visualization with applications in software development and bio-informatics. The group publishes in the high-impact venues of the field and the chair is clearly one of the most visible and influential researchers in visualization on a truly international level. Since its start, the group has increased outside research funding, and

the committee encourages the group to continue on this path and to further increase the number of Ph.D. students. The visual analytics theme provides good opportunities to do so. Other opportunities could arise from a stronger collaboration within the department, i.e. with the algorithms group, or by widening the scope of junior faculty into other areas of visual computing.

System Architecture and Networking (Lukkien)

Research program:	3.5
Quality:	3
Productivity:	3
Relevance:	4
Vitality and Feasibility:	3.5

This group started in 2002, and focuses on embedded and real-time systems. The main results are a system for content queries on surveillance video, a single-image programming system for developing distributed sensor applications, a quality-of-service system for distributing high-quality video in home networks, and a real-time scheduler (and analysis) for CAN bus scheduling. The group has a healthy amount of funding and Ph.D. students. The committee applauds that the group builds real systems, and appreciates the energy and time it takes to build such systems. The group could improve the quality of its research and visibility by better articulating its unique contributions and participating in the international top conferences in its field.

Software Engineering and Technology (Van den Brand)

Research program:	3.5
Quality:	3.5
Productivity:	3
Relevance:	3.5
Vitality and Feasibility:	3.5

The group was founded in 2006. Being relatively young, its international reputation and visibility are still rather limited. The research areas in which the group is active are reverse engineering (model extraction from code) and model-driven software development, especially maintainability of transformations. Both areas are relevant and several research groups are active in them internationally. The group should try to identify its own research agenda more clearly in the future and should set more ambitious goals in terms of publication venues for its research products. More focus and a more aggressive agenda should also help improve the somewhat weak funding situation of the group.

Security (Etalle)

Research program:	3.5
Quality:	3.5
Productivity:	4
Relevance:	3.5
Vitality and Feasibility:	4

This group is a new group, founded in 2007, at the tail of this evaluation period. The group is headed by Etalle (who previously was a member of the embedded security group at Twente) and was strengthened by the arrival of Skoric in 2008. The group focuses on two areas: policy specification and enforcement (e.g., trusted architectures for shared services), and physically unclonable functions (e.g., optical PUFs). The group has made a good start in articulating a research direction, raising funding, and building itself up, but the quality of the research could use improvement and would also benefit from more focus. The main challenge is to build an international reputation by publishing in the international conferences in the security community.

Appendices 1 and 2

Letter of assignment

Curricula Vitae of the Members of the Review Committee

Letter of assignment



UNIVERSITEIT VAN AMSTERDAM

College van Bestuur

To: Professor M. Kwiatkowska
Oxford University Computing Laboratory
Trinity College
Wolfson Building, Parks Road
OXFORD OX1 3QD
UNITED KINGDOM

*Postbus 19268
1000 GG Amsterdam
Spui 21
Tel: 020-525 9111
Fax: 020-525 2136*

Amsterdam, 29 July 2009

Your reference:
Our reference: 2009ci1381
Encl: Standard Evaluation Protocol 2003-2009 & Independence Form
Re: Invitation review committee Dutch Informatics Research
Cc: drs. J. Heijn, secretary committee

Division: Academic Affairs
Contact: H.L.Strating
Tel: +31 20 525 2666
Fax: +31 20 525 2406
E-mail: H.L.Strating@uva.nl

Dear Professor Kwiatkowska,

On behalf of the Boards of all participating Universities I would like to thank you for accepting the appointment as member of the Review Committee on Informatics Research of the Dutch Universities.

The evaluation of the institutes will take place according to the Standard Evaluation Protocol 2003-2009 for Public Research Organisations (SEP). This protocol has been defined by the three main Dutch organisations responsible for publicly funded research – the universities association (VSNU), the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Netherlands Organisation for Scientific Research (NWO) and is enclosed to this letter. For the preparation of the visit you will receive a self-evaluation report of all the participating institutes in the first week of September.

Evaluations of teaching and research follow the guidelines of the Dutch Universities on the independence of the panel members (see enclosure). We kindly request you to sign the enclosed Independence form and send it to the Deans Office of the faculty of Science of the University of Amsterdam, to the attention of J.M. Lips (P.O. Box 94216, 1090 GE Amsterdam, The Netherlands).

As you already know the visit to the Netherlands will take place in week 44 and 45. For all arrangements concerning your stay and travel to the Netherlands and other questions, please contact the secretary of the committee, drs. J. Heijn (jan.heijn@betatext.nl).

I thank you once again for your willingness to join the review committee and hope that this review will stimulate the participating informatics institutes to further develop their potentials.

Yours sincerely,

the Board,

b/a

Dr. K. van der Toorn,
President

Curricula vitae of the members of the review committee

Prof. Dr. Willy Zwaenepoel

Willy Zwaenepoel (1956, Belgian) is Professor and Dean of the School of Computer and Communication Sciences at EPFL in Lausanne, Switzerland. He received his BS/MS from the University of Gent, Belgium, in 1979, and his MS and PhD from Stanford in 1980 and 1984, respectively.

He has worked in a variety of aspects of operating systems and distributed systems, including microkernels, fault tolerance, parallel scientific computing on clusters of workstations, clusters for web services, mobile computing, and database replication. He is most well known for his work on the Treadmarks distributed shared memory system, which was licensed to Intel and became the basis for Intel's OpenMP cluster product. His work on high-performance software for network I/O led to the creation of iMimic Networking, Inc, which he led from 2000 to 2005. His current projects include I/O performance of virtual machines, symbolic execution, and software update mechanisms.

Before joining EPFL in 2002, Willy Zwaenepoel was on the faculty at Rice University, where he was the Karl F. Hasselmann Professor of Computer Science and Electrical and Computer Engineering. He was elected Fellow of the IEEE in 1998, and Fellow of the ACM in 2000. He won best paper awards at SigComm 1984, OSDI 1999, Usenix 2000, Usenix 2006 and Eurosys 2007. He was program chair of OSDI in 1996 and Eurosys in 2006, and general chair of Mobisys in 2004. He is the 2000 recipient of the Rice University Graduate Student Association Teaching and Mentoring Award, and the 2007 recipient of the IEEE Tsutomu Kanai Award for his work in distributed computing. He was elected to the Academia Europaea in 2008.

Prof. Dr. Thomas Ertl

Thomas Ertl received a masters degree in computer science from the University of Colorado at Boulder and a PhD in theoretical astrophysics from the University of Tuebingen. Currently, he is a full professor of computer science at the University of Stuttgart, Germany, and the head of the Visualization and Interactive Systems Institute (VIS) and the Visualization Research Center of the University of Stuttgart (VISUS). Prior to that he was a professor of computer graphics and visualization at the University of Erlangen where he lead the scientific visualization group. Besides that, he is a cofounder and a member of the board of science+computing ag, a Tuebingen based IT company.

His research interests include visualization, computer graphics and human computer interaction in general with a focus on volume rendering, flow visualization, multiresolution analysis, parallel and hardware accelerated graphics, large datasets and interactive steering, visual analytics of patent data, user interfaces and navigation systems for the blind. Thomas Ertl is co-author of more than 300 scientific publications and he served

as a reviewer for most of the conferences and journals in the field. He has been a member of many program committees (e.g. SIGGRAPH, Eurographics) and a papers co-chair for several conferences (e.g. IEEE Visualization, EG/IEEE EuroVIS, Volume Graphics). Since 2007 Ertl is Editor-in-Chief of the IEEE Transactions on Visualization and Graphics and Vice President of the Eurographics Association. He received the Outstanding Technical Contribution Award of the Eurographics Association and the Technical Achievement Award of the IEEE Visualization and Graphics Technical Committee in 2006 and he was elected as a Member of the Heidelberg Academy of Sciences and Humanities in 2007.

Prof. Dr. Carlo Ghezzi

Carlo Ghezzi (1946, Italian) is a Professor and Chair of Software Engineering in the Department of Electronics and Information of Politecnico di Milano. He is an ACM Fellow, an IEEE Fellow, and a member of the Italian Academy of Sciences. He was awarded the ACM SIGSOFT Distinguished Service Award (2006). He is a member of the ACM Council. He is a regular member of the program committee of important conferences in the software engineering field, such as the ICSE and ESEC/FSE, for which he also served as Program and General Chair. He was General Co-Chair of the International Conference on Service Oriented Computing.

Ghezzi has been the Editor in Chief of the ACM Trans. on Software Engineering and Methodology (from 2001 till 2006). He is currently an Associate Editor of the Communications of the ACM, IEEE Trans. on Software Engineering, Science of Computer Programming, Service Oriented Computing and Applications, and Software Process Improvement and Practice.

Ghezzi's research has been focusing on software engineering and programming languages. Currently, he is especially interested in methods and tools to improve dependability of adaptable and evolvable software systems, such as service-oriented architectures and ubiquitous/pervasive computer applications. He co-authored over 160 papers and 8 books. He coordinated several national and international (EU funded) research projects. He has recently been awarded an Advanced Grant from the European Research Council.

Prof. Dr. Frans Kaashoek

Frans Kaashoek is a Professor of Computer Science and Engineering in MIT's Department of Electric Engineering and Computer Science and a member of the MIT Computer Science and Artificial Intelligence Laboratory since January 1993. Before joining MIT, he was a student at the department of Computer Science (afdeling Informatica) at the Vrije Universiteit in Amsterdam, the Netherlands. He received a PhD degree ('92) from the Vrije Universiteit for his thesis Group communication in distributed computer systems, under the guidance of Andy Tanenbaum.

Kaashoek's research interest is computer systems: operating systems, networking, programming languages, compilers, and computer architecture for distributed, mobile, and parallel systems.

In 1998 Frans cofounded Sightpath Inc, which was acquired by Cisco Systems in 2000. He also serves on the board of Mazu Networks Inc.

Prof. Dr. Marta Kwiatkowska

Marta Kwiatkowska is Professor of Computing Systems and Fellow of Trinity College, University of Oxford. Prior to this she held appointments at the Universities of Birmingham, Leicester and the Jagiellonian University in Cracow, Poland. She obtained BSc&MSc in Computer Science in 1980 from the Jagiellonian University, PhD from the University of Leicester in 1989 and MA from Oxford in 2007.

Marta Kwiatkowska spearheaded the development of probabilistic and quantitative methods in verification on the international scene. Her work on the theory to practice transfer of probabilistic model checking was recognised by invitations to speak at the LICS 2003 and ESEC/FSE 2007 conferences. The PRISM model checker (www.prismmodelchecker.org) is the leading software tool in the area and is widely used for research and teaching. Applications of probabilistic model checking have spanned communication and security protocols, nanotechnology designs, power management and systems biology. Her research is currently supported by £3.7m of grant funding from EPSRC, EU and ERC, including the recently awarded ERC Advanced Grant VERIWARE ‘From software verification to everywhere verification’.

Marta Kwiatkowska is a Fellow of the BCS. She serves on editorial boards of several journals, including Logical Methods in Computer Science, Science of Computer Programming and Royal Society’s Philosophical Transactions A, and is a member of the Steering Committee of the International Conference on Quantitative Evaluation of Systems (QEST).

She was lead organiser of the Royal Society Discussion Meeting ‘From computers to ubiquitous computing, by 2020’ and guest co-editor of the associated Proceedings in Phil. Trans. R. Soc. A vol 366 no 1881.

Prof. Dr. John Mylopoulos

John Mylopoulos (1943, Greek and Canadian) is Distinguished Professor (chiara fama) in the Department of Information Engineering and Computer Science at the University of Trento (Italy), and professor emeritus at the University of Toronto (Canada). He received his BEng/MEng from Brown University (Providence, USA) in 1967 and PhD from Princeton University in 1970. Before joining the University of Trento in 2005, he was professor of Computer Science at the University of Toronto where he held a faculty appointment since 1970.

Mylopoulos has worked on a range of topics within the fields of Artificial Intelligence (AI), Databases and Software Engineering, including (software) requirements engineering, knowledge based systems, semantic data models and knowledge management. His most influential work proposed a semantic data model for information system design (Taxis project), modeling and analysis techniques for non-functional requirements, a meta-modeling language (named Telos) for information system design, and a methodology for developing agent-oriented software (the Tropos project). His current work fo-

cuses on design techniques for adaptive software, modeling and analysis techniques for business intelligence, and data quality.

He was elected Fellow of the Association for the Advancement of AI (AAAI) in 1994, Fellow of the Royal Society of Canada in 2007, and Fellow of the European Coordinating Committee for AI (ECCAI) in 2008. Mylopoulos was co-recipient of a most influential paper award at ICSE'94, a distinguished paper award at ASE'07, and a best paper award at RE'08. He has served as program co-chair for IJCAI'91, general chair for VLDB'04 and program chair for RE'97. He is currently co-editor of Springer's Lecture Notes in Business Information Processing (LNBIP), and served in the past as co-editor of the Requirements Engineering journal (also published by Springer).

Prof. Dr. Wiebe van der Hoek

Wiebe van der Hoek is Professor and Head of the Computer Science Department, University of Liverpool, UK. Between 1993 and 2002, he was an assistant Professor at the University of Utrecht, the Netherlands; he obtained his PhD at the Vrije Universiteit (Computer Science) in 1992 and his MSc at the Rijksuniversiteit Groningen (Mathematics) in 1986. He is a fellow of the British Computer Society and a College member of the Engineering and Physical Science Research Council (EPSRC).

He is internationally renowned for his research on knowledge representation formalisms, and in particular, has made contributions to the theory of modal and epistemic logic in AI and computer science. He also works on theory/belief revision and the logical foundations of game theory.

Van der Hoek is founder and editor-in-chief of Knowledge, Rationality and Action, and associate editor of *Studia Logica* and *Autonomous Agents and Multi-Agent Systems* and the book series *Texts in Logic and Games*. He figures in the main events on Multi-Agent systems: he was a keynote speaker and Program Chair at different editions of both EUMAS (2003 and 2005, respectively) and AAMAS (2005 and 2010), the European and the International conferences on Agents and Multi-Agent Systems. He won the best paper prize at AAMAS 2008 and 2009. As a member of the European network of excellence Agentlink, he was responsible for a series of European Agent Systems Summer Schools. He is a board member of LOFT (Logic and the Foundations of Game and Decision Theory). He (co-)authored two textbooks on epistemic logic, five chapters in handbooks, more than fifty papers in international journals and over hundred publications in proceedings of international conferences.

Appendices 3 and 4

Assessed research groups and their leaders

Assessment overview in grades

University of Groningen

Assessed research groups and their leaders

received by the Committee on
Monday 26 October 2009:

Faculty of Mathematics and Natural Sciences

prof.dr. T.T.M. Palstra, vice-dean and dean a.i.
dr. Y.E.F.M. Jeuken, policy officer research

prof.dr. Thomas Palstra
dr. Yvonne Jeuken

Instituut voor Wiskunde en Informatica (IWI), Johann Bernoulli Institute for Mathematics and Computer Science

prof.dr. J.B.T.M. Roerdink, chairman of the board
prof.dr. H.W. Broer, scientific director
prof.dr. N. Petkov, scientific director until 2008

since 01-2010 renamed:
prof.dr. Jos Roerdink
prof.dr. Henk Broer
prof.dr. Nicolai Petkov

Distributed Systems and Software Engineering

prof.dr.ir. M. Aiello
prof.dr.ir. P. Avgeriou
prof.dr.ir. J. Bosch, until 2005
prof.dr.ir. D. Hammer, 2005-2006

prof.dr.ir. Marco Aiello
prof.dr.ir. Paris Avgeriou

Fundamental Computing Science

prof.dr. G.R. Renardel de Lavalette

prof.dr. Gerard Renardel de Lavalette
prof.dr. Wim Hesselink

Intelligent Systems

prof.dr. N. Petkov

prof.dr. Nicolai Petkov
prof.dr. Michael Biehl
dr. Michael Wilkinson

Visualization and Computer Graphics

prof.dr. J.B.T.M. Roerdink

prof.dr. Jos Roerdink
prof.dr. Alex Telea

Artificial Intelligence and Cognitive Engineering (ALICE)

prof.dr.L.R.B. Schomaker, director

prof.dr. Lambert Schomaker

Autonomous Perceptive Systems

prof.dr. L.R.B. Schomaker

prof.dr. Lambert Schomaker

Multi-Agent Systems

prof.dr. L.C. Verbrugge

prof.dr. Rineke Verbrugge

Cognitive Modeling

prof.dr. N.A. Taatgen
dr. D.H. van Rijn

prof.dr. Niels Taatgen

Language, Sound, and Cognition

dr. T.C. Andringa

dr. Tjeerd Andringa

Indication of total research staff of these groups: 30-35 fte

Utrecht University

Assessed research groups and their leaders

received by the Committee on
Tuesday 27 October 2009:

Faculty of Science

prof.dr.ir. A. Bliet, dean
prof.dr. I. Moerdijk, vice-dean

prof.dr. Ieke Moerdijk

Department of Information and Computing Sciences

prof.dr. A.P.J.M. Siebes, head

prof.dr. Arno Siebes

Utrecht Institute for ICT Research

prof.dr. J-J.Ch. Meyer, scientific director
prof.dr. S.D. Swierstra
dr. M. Veldhorst, editor of self assessment

prof.dr. John-Jules Meyer
prof.dr. Doaitse Swierstra
dr. Marinus Veldhorst

Cognition and Communication

dr. H. van Oostendorp

dr. Herre van Oostendorp
dr.ir. Robbert-Jan Beun
prof.dr. John-Jules Meyer

Content and Knowledge Engineering

prof.dr. J. van den Berg

prof.dr. Jörgen van den Berg

Games and Virtual worlds

prof.dr. M.H. Overmars

prof.dr. Mark Overmars

Intelligent Systems

prof.dr. J-J. Ch. Meyer

prof.dr. John-Jules Meyer
dr. Mehdi Dastani

Multimedia and Geometry

prof.dr. R.C. Veltkamp

dr. Marc van Kreveld
dr. Wolfgang Hürst

Algorithmic Data Analysis

prof.dr. A.P.J.M. Siebes

prof.dr. Arno Siebes
dr. Ad Feelders

Algorithmic Systems

prof.dr. J. van Leeuwen

prof.dr. Jan van Leeuwen
dr. Hans Bodlaender

Decision-Support Systems

prof.dr.ir. L.C. van der Gaag

prof.dr.ir. Linda van der Gaag
dr. Silja Renooij

Organisation and Information

prof.dr. S. Brinkkemper

prof.dr. Sjaak Brinkkemper

Software Technology

prof.dr. S.D. Swierstra

prof.dr. Doaitse Swierstra
prof.dr. Johan Jeuring

Indication of total research staff of these groups: 60-65 fte

University of Twente

Assessed research groups and their leaders

received by the Committee on
Wednesday, 28 October 2009:

Faculty of Electrical Engineering, Mathematics and Computer Science

prof.dr.ir. A.J. Mouthaan, dean

prof.dr.ir. Ton Mouthaan

Computer Science Department

prof.dr. R.J. Wieringa, head

prof.dr. Roel Wieringa

Design and Analysis of Communication Systems

prof.dr.ir. B.R. Haverkort (until 03-2009)

prof.dr.ir. Boudewijn Haverkort

dr.ir. A. Pras (since 03-2009)

dr.ir. Aiko Pras

Databases (DB)

prof.dr. P.M.G. Apers

prof.dr. Peter Apers

dr.ir. Djoerd Hiemstra

Distributed and Embedded Security

prof.dr. P.H. Hartel

prof.dr. Pieter Hartel

dr. Svetla Nikova

Formal Methods and Tools

prof.dr. J.C. van de Pol (since 07-2007)

prof.dr. Jaco van de Pol

dr.ir. A. Rensink (06-2005 - 09-2007)

dr.ir. Arend Rensink

prof.dr. H. Brinksma (until 06-2005)

Human Media Interaction

prof.dr.ir. A. Nijholt

prof.dr.ir. Anton Nijholt

dr. Dirk Heylen

Information Systems

prof.dr. R.J. Wieringa

prof.dr. Roel Wieringa

dr.ir. Marten van Sinderen

Pervasive Systems

prof.dr.ing. P.J.M. Havinga

prof.dr.ing. Paul Havinga

dr.ir. Nirvana Meratnia

Software Engineering

prof.dr.ir. M. Aksit

prof.dr.ir. Mehmet Aksit

dr. Luís Ferreira Pires

Indication of total research staff of these groups: 105-110 fte

Delft University of Technology

Assessed research groups and their leaders

received by the Committee on
Thursday 29 October 2009:

Faculty of Electrical Engineering, Mathematics and Computer Science

prof.dr. D. Lenstra, dean

drs. G. Pessers-van Reeuwijk,

faculty executive secretary

prof.dr.ir. J. Biemond, chair dept. Mediametrics

prof.dr.ir. H.J. Sips, chair dept. Software Technol.

prof.dr. Daan Lenstra

drs. Geerlinge Pessers

prof.dr.ir. Jan Biemond

prof.dr.ir. Henk Sips

Parallel and Distributed Systems

prof.dr.ir. H.J. Sips

prof.dr. C. Witteveen

prof.dr. K.G. Langendoen

prof.dr.ir. Henk Sips

prof.dr. Cees Witteveen

prof.dr. Koen Langendoen

Software Engineering

prof.dr. A. van Deursen

demo/presentation

prof.dr. Arie van Deursen

prof.dr.ir. Arjan van Gemund

dr.ir. Ali Mesbah

Intelligent Information Processing

prof.dr. R.L. Lagendijk

prof.dr.ir. J. Biemond

prof.dr.ir. M.J.T. Reinders

prof.dr. Inald Lagendijk

dr.ir. Dick de Ridder

Modelling & Visualisation

prof.dr. F.W. Jansen

demo/presentation

prof.dr. Erik Jansen

dr. Charles Botha

ir. Jorik Blaas

Man-Machine Interaction

prof.dr. C.M. Jonker

prof.dr. Catholijn Jonker

dr.ir. Willem-Paul Brinkman

Indication of total research staff of these groups: 95-100 fte

University of Amsterdam

Assessed research groups and their leaders

received by the Committee on
Friday 30 October 2009:

Faculty of Sciences

prof.dr. L.D. Noordam, dean

prof.dr. Bart Noordam

Informatics Institute

prof.dr. P.M.A. Sloot, director
prof.dr. M. de Rijke, adjunct director
prof.dr. J.A. Bergstra, adjunct director

prof.dr. Peter Sloot
prof.dr. Maarten de Rijke
prof.dr. Jan Bergstra

Computer Systems Architecture

prof.dr. C.R. Jesshope

prof.dr. Chris Jesshope

Human Computer Studies

prof.dr. B.J. Wielinga (2004-2005)
prof.dr. H. Afsarmanesh (since 2009, a.i.)
prof.dr. S.R. Jones (2006-2008)

prof.dr. Bob Wielinga
prof.dr. Hamideh Afsarmanesh

Intelligent Autonomous Systems

prof.dr.ir. F.C.A. Groen

prof.dr.ir. Frans Groen

Information and Language Processing Systems

prof.dr. M. de Rijke

prof.dr. Maarten de Rijke

Intelligent Sensory Information Systems

prof.dr.ir. A.W.M. Smeulders

prof.dr.ir. Arnold Smeulders

Computational Science

prof.dr. P.M.A. Sloot

prof.dr. Peter Sloot

System and Network Engineering

prof.dr.ir. C.Th.A.M. de Laat

prof.dr.ir. Cees de Laat

Software Engineering

prof.dr. J.A. Bergstra

prof.dr. Jan Bergstra
prof.dr. Paul Klint

Indication of total research staff of these groups: 85-90 fte

Leiden University

Assessed research groups and their leaders

received by the Committee on
Saturday 31 October 2009:

Science Faculty

prof.dr. S.M. Verduyn Lunel, dean

Leiden Institute of Advanced Computer Science

prof.dr. J. Kok, scientific director

prof.dr. T.H.W. Bäck, education director

dr. I.M.A. Nooren, managing director

prof.dr. Joost Kok

prof.dr. Thomas Bäck

dr. Irene Nooren

Algorithms and Foundations of Software Technology

prof.dr. F. Arbab

prof.dr. T.H.W. Bäck

prof.dr. J.N. Kok

prof.dr. Farhad Arbab

prof.dr. Thomas Bäck

prof.dr. Joost Kok

dr. Jetty Kleijn

dr. Hendrik Blockeel

dr. Michel Chaudron

prof.dr. Bernhard Katzy

Computer Systems and Imagery & Media

prof.dr.ir. E.F.A. Deprettere

prof.dr. S. Haring

dr. M.S. Lew

dr.ir. F.J. Verbeek

prof.dr. H.A.G. Wijshoff

dr. Michael Lew

prof.dr. Harry Wijshoff

dr.ir. Bart Kienhuis

dr. Erwin Bakker

Indication of total research staff of these groups: 30-35 fte

VU University Amsterdam

Assessed research groups and their leaders

received by the Committee on
Monday 2 November 2009:

Faculty of Sciences

prof.dr. J. van Mill, dean

prof.dr. Jan van Mill

Department of Informatics

prof.dr. J.M. Akkermans, head of department

prof.dr. Hans Akkermans

prof.dr.ir. M. van Steen, director of education

prof.dr. Maarten van Steen

prof.dr. F. van Harmelen, MT research portfolio

prof.dr. W. Fokkink, Self-study coordinator,

prof.dr. Wan Fokkink

MT research portfolio as of 03-2010

prof.dr. A.Th. Schreiber, Chair INTERTAIN Lab team

prof.dr. Guus Schreiber

Artificial Intelligence

prof.dr. J. Treur

prof.dr. Jan Treur

prof.dr. A.E. Eiben

prof.dr. Guszti Eiben

prof.dr. F. van Harmelen

prof.dr. Frank van Harmelen

Bio-Informatics

prof.dr. J. Heringa

prof.dr. Jaap Heringa

prof.dr. B. Teusink

prof.dr. Bas Teusink

Business, Web & Multimedia

prof.dr. J.M. Akkermans

prof.dr. Hans Akkermans

prof.dr. A.Th. Schreiber

prof.dr. Guus Schreiber

Computer Systems

prof.dr.ir. H.E. Bal

prof.dr.ir. Henri Bal

prof.dr.ir. M. van Steen

prof.dr.ir. Maarten van Steen

prof.dr. F.M.T, Brazier

prof.dr. A.S. Tanenbaum

Information Management & Software Engineering

prof.dr. J.C. van Vliet

prof.dr. Hans van Vliet

prof.dr. C. Verhoef

prof.dr. Chris Verhoef

Theoretical Computer Science

prof.dr. Fokkink

prof.dr. Wan Fokkink

prof.dr. J.W. Klop (until 09-2004)

prof.dr. Jan-Willem Klop

Indication of total research staff of these groups: 80-85 fte

Radboud University Nijmegen

Assessed research groups and their leaders

received by the Committee on
Tuesday 3 November 2009:

Faculty of Science

prof.dr. J.M.E. Kuijpers, dean

prof.dr. Jan Kuijpers

Institute for Computing and Information Sciences

prof.dr. T.M. Heskes, director of research

prof.dr. Tom Heskes

prof.dr. B.P.F. Jacobs, deputy director

prof.dr. Bart Jacobs

dr. B. Smelik, managing director

dr. Bernadette Smelik

Digital Security

prof.dr. B.P.F. Jacobs

prof.dr. Bart Jacobs

dr.ir. E. Poll

dr.ir. Erik Poll

prof.dr. T. van der Weide

prof.dr. Marko van Eekelen

Intelligent Systems

prof.dr. H.P. Barendregt

prof.dr. Henk Barendregt

prof.dr. H. Geuvers

prof.dr. Herman Geuvers

prof.dr. T.M. Heskes

prof.dr. Tom Heskes

dr. Elena Marchiori

Model-based System Development

dr. P.J.F. Lucas

dr. Peter Lucas

prof.dr.ir. M.J. Plasmeijer

prof.dr.ir. Rinus Plasmeijer

prof.dr. F.W. Vaandrager

prof.dr. Frits Vaandrager

prof.dr. H.A. Proper

*Nijmegen Laboratory for Quality Software (LaQuSo)**

prof.dr. M.C.J.D. van Eekelen, research director

prof.dr. Marko van Eekelen

dr. P.W.M. Koopman, managing director

dr. Pieter Koopman

prof.dr. Tom Heskes

* joint activity of Radboud University and Eindhoven University of Technology

Indication of total research staff of these groups: 40-45 fte

Eindhoven University of Technology

Assessed research groups and their leaders

received by the Committee on
Wednesday 4 November 2009:

Department of Mathematics and Computer Science

prof.dr. A.M. Cohen, dean

prof.dr.ir. O.J. Boxma, vice-dean

prof.dr. J.C.M. Baeten, vice-dean

dr. D.M. de Haan, policy officer CS research

prof.dr.ir. Onno Boxma

prof.dr. Jos Baeten

dr. Dieuwke de Haan

Architecture of Information Systems

prof.dr.ir. W.M.P. van der Aalst

prof.dr. K.M. van Hee (until 09-2006)

prof.dr.ir. Wil van der Aalst

prof.dr. Kees van Hee

Databases and Hypermedia

prof.dr. P.M.E. De Bra

prof.dr. Paul De Bra

dr. Toon Calders

Formal Methods

prof.dr. J.C.M. Baeten

prof.dr. Jos Baeten

dr. Ruurd Kuiper

System Design and Analysis

prof.dr.ir. J.F. Groote

prof.dr.ir. Jan Friso Groote

prof.dr. Hans Zantema

Algorithms

prof.dr. M. de Berg

prof.dr. Mark de Berg

dr. Bettina Speckmann

Visualization

prof.dr.ir. J.J. van Wijk

prof.dr.ir. Jack van Wijk

dr. Michel Westenberg

System Architecture and Networking

prof.dr. J.J. Lukkien

prof.dr. Johan Lukkien

dr.ir. Reinder Bril

Software Engineering and Technology

prof.dr. M.G.J. van den Brand

prof.dr. Mark van den Brand

dr. Alexander Serebrenik

Security

prof.dr. S. Etalle

prof.dr. Sandro Etalle

dr. Boris Skoric

Indication of total research staff of these groups: 65-70 fte

Assessment overview in grades

5 = Excellent
 4 = Very good
 3 = Good
 2 = Satisfactory
 1 = Unsatisfactory

RP = Research Program (overall judgement)
 = overall department/institute evaluation
 Q = Quality
 P = Productivity
 R = Relevance
 V&F = Vitality & Feasibility
 = leadership rating department/institute

RP	Q	P	R	V&F
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Groningen					
Johann Bernoulli Institute	3.5				3.5
Distributed Systems and Software Engineering	3.5	3	4	3	4
Fundamental Computing Science	3.5	4	3	3	2.5
Intelligent Systems	4	4.5	4	3.5	4
Visualization and Computer Graphics	4.5	4.5	4.5	4	4.5
ALICE	4				3.5
Autonomous Perceptive Systems	4.5	4.5	4	4	4
Multi-Agent Systems	4	4	4	3	4
Cognitive Modeling	4	4	4	3	3.5
Language, Sound, and Cognition	3.5	3.5	3.5	4	4

Utrecht					
	4				3.5
Cognition and Communication	3	3	4	2	2
Content and Knowledge Engineering	3	3	3	2	2
Games and Virtual worlds	5	5	5	4	5
Intelligent Systems	5	5	5	4	5
Multimedia and Geometry	4.5	5	4.5	4	5
Algorithmic Data Analysis	4	4	4	4	4
Algorithmic Systems	5	5	5	5	5
Decision-Support Systems	4	4	4	4.5	4
Organisation and Information	3.5	3.5	4	3.5	4
Software Technology	4	3.5	4.5	4	3

RP	Q	P	R	V&F
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Twente	4				5
Design and Analysis of Communication Systems	4.5	4.5	4.5	4.5	4.5
Databases	5	5	4.5	4	4
Distributed and Embedded Security	3.5	3.5	4	4	4
Formal Methods and Tools	4.5	5	4.5	4.5	4.5
Human Media Interaction	4	3.5	4.5	3.5	4
Information Systems	4	4	4.5	4	4
Pervasive Systems	3.5	3.5	4	4	3.5
Software Engineering	3.5	3	3.5	3.5	3

Delft	5				4
Parallel and Distributed Systems	5	4.5	5	5	5
Software Engineering	5	5	5	5	5
Intelligent Information Processing	4.5	4.5	5	5	5
Modelling & Visualisation	4.5	4.5	4	4.5	4.5
Man-Machine Interaction	4	4.5	4	3.5	4.5

Amsterdam - UvA	4				3.5
Computer Systems Architecture	3.5	3.5	3	3	4
Human Computer Studies	4	4	4	4	3
Intelligent Autonomous Systems	4.5	4.5	5	4.5	4.5
Information and Language Processing Systems	5	5	5	5	5
Intelligent Sensory Information Systems	5	5	5	5	5
Computational Science	4	3.5	4	4	4.5
System and Network Engineering	3.5	3.5	4	4	4
Section Software Engineering	4.5	5	4	4	3.5

RP	Q	P	R	V&F
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Leiden	4				4
Algorithms and Foundations of Software Techn.	4	4	4	4	4
Computer Systems and Imagery & Media	4.5	4.5	4.5	4.5	4.5

Amsterdam - VU	4				4
Artificial Intelligence	4.5	4	4.5	4	4.5
Bio-Informatics	3.5	3.5	4	3.5	4
Business, Web & Multimedia	4	3.5	4.5	4.5	4.5
Computer Systems	5	5	5	5	5
Information Management & SE	4	4	4	4	3.5
Theoretical Computer Science	4	4.5	4	4	3.5

Nijmegen	5				5
Digital Security	5	5	5	5	5
Intelligent Systems	4.5	5	4.5	4.5	5
Model-based System Development	4.5	5	4.5	5	5

Eindhoven	4.5				4.5
Architecture of Information Systems	5	5	5	5	5
Databases and Hypermedia	4	4	4.5	4.5	4.5
Formal Methods	4.5	4.5	4	4	4
System Design and Analysis	4	4.5	4	3.5	4
Algorithms	5	5	5	5	5
Visualization	5	5	4.5	5	5
System Architecture and Networking	3.5	3	3	4	3.5
Software Engineering and Technology	3.5	3.5	3	3.5	3.5
Security	3.5	3.5	4	3.5	4

Epilogue

In 2008 the Dutch Universities agreed to coordinate the periodic research assessment in the fields of Natural Sciences, Mathematics and Informatics. Computer Science was scheduled first and the University of Amsterdam acted as coordinator. The national 'Informaticakamer' (academic representatives of Computer Science) was instrumental in establishing the assessment committee chaired by Prof. dr. Willy Zwaenepoel and consisting of: Prof. Dr. Marta Kwiatkowska, Prof. Dr. Thomas Ertl, Prof. Dr. Wiebe van der Hoek, Prof. Dr. Frans Kaashoek, Prof. Dr. Carlo Ghezzi and Prof. Dr. John Mylopoulos. Drs. Jan Heijn acted as Secretary to the panel.

This report is the result of the research assessment and provides an overview and insights in the quality of the research in Computer Science at the nine Dutch Universities that have publicly funded research in this area.

As representative of the coordinating University it is with great pleasure to note that the Review Committee obviously performed its task in an accurate, thorough and careful manner. It goes without saying that the Universities can be very satisfied with the overall conclusion of the Committee that Computer Science in the Netherlands is a vibrant enterprise and that the Netherlands remains among the top nations in Computer Science research, and in the absolute top in a number of sub-disciplines. In the coming period the Universities will respond to the constructive critical assessment as stated in this report and I am convinced that the results of this review will contribute to further improvements in the quality of research in Computer Science in the Netherlands.

I like to take this opportunity, also on behalf of my eight colleagues, to express my sincere appreciation to the Chairman and the Members of the assessment committee for their willingness to participate in this assessment and for the quality of their contribution. A special word of thanks is due to the Secretary of the committee, drs. Jan Heijn, who has applied his many organizational talents in this role.

Dymph C. van den Boom
Rector Magnificus
University of Amsterdam