I/O magazine

ICT RESEARCH PLATFORM NEDERLAND

SPECIAL

CELEBRATING
20 YEARS OF IPN

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**ICT-ONDERZOEK
PLATFORM
NEDERLAND**

Column

PAUL KLINT

OK, Boomer
What are the vital attributes
of a scientist?

Nowadays, we'd say that at the very least scientists must be smart, creative and thorough. But do those attributes change over the years? In the past, you had to be a dab hand at using the index cards in the systematic catalogue of the university library. Nowadays, Google skills are more desirable and being able to give excellent presentations is an absolute must.

In the distant past, I read the books from Carlos Castaneda about his experiences as a mushroom-eating pupil of the mythical teacher Don Juan Matus. One of the lessons that I can best remember is the meditation in which Carlos had to stare at a stone for an hour every day. And every day at the same stone! At least until the moment he discovered that his teacher let him see a different stone each day and he started to appreciate the differences between the stones. Attention and patience lead to insight. A few days ago, a colleague let me see his research into ancient Chinese ivory puzzle balls. They are sculpted by hand from a solid piece of ivory but ultimately consist of 25 beautifully decorated orbs that nest inside each other but move independently. Attention and patience lead to a fantastic work of art.

With attention and patience, legions of monks copied manuscripts throughout the centuries.

With attention and patience, science is practised.

However, attention and patience appear to be increasingly rare qualities. Or is this a case of "OK, Boomer!", and do young researchers have other qualities that also lead to good results? Young researchers are often incredibly fast, very enthusiastic and afraid of nothing, but they sometimes do miss a historical awareness (as a result of which they can once again impartially wander down paths that are "known" to lead nowhere; or do they?).

It could well be the case that the requirements of research as well as the attributes of researchers change over the years. In a nutshell, that is another argument for making teams as diverse as possible and not only in terms of age.
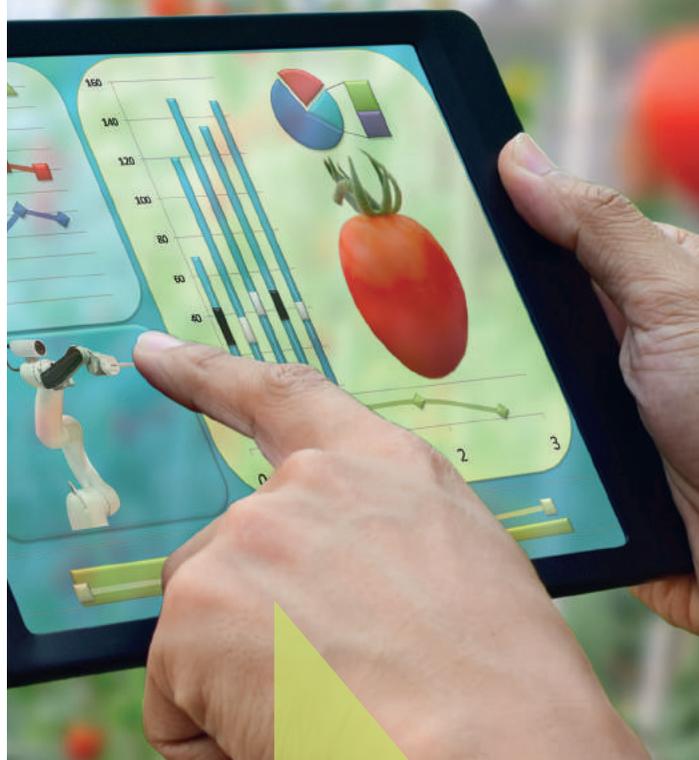
HARVEST TIME HAS COME

Text Sonja Knols Images Shutterstock, Ivar Pel

This year, the ICT Research Platform Nederland (IPN) celebrates its twentieth birthday. Recently appointed board members Catholijn Jonker and Han La Poutré reflect on the current state of the organisation, the importance of community building, and the added value of speaking with one voice.

Catholijn Jonker, professor of Interactive Intelligence at TU Delft, and professor of Explainable AI at LIACS (Leiden University), and Han La Poutré, MT member and senior researcher on Intelligent and Autonomous Systems at CWI, and professor of Intelligent Energy Systems at TU Delft, are clear and united in their opinion: 'Over the past twenty years, IPN has been crucial in organising the ICT research community in the Netherlands, and in representing the interests of this community on a national level. We have gained a better understanding of ourselves, and of what everyone is working on and how their work contributes to the field.'

That is why both of them did not hesitate when new positions in the IPN board opened up. 'I want to help develop the future strategy of the Dutch ICT research field and advocate the importance of ICT science as a separate discipline,' says La Poutré summarising his ambitions. 'Next, it is important to me to further improve an inclusive and open culture,' he says. 'In recent years, I have seen the struggles to get the field to unite and join forces,' newly elected IPN chairperson Jonker adds. 'Now I want to strengthen the bonds even further. Over the past few years, Maarten van Steen and his team have done a wonderful job. Universities have become more involved in IPN decisions and activities, the Special Interest Groups (SIGs) have come closer and, all in all, more people feel represented by IPN. We want to build on that and start harvesting what we've been planting over the years.'

Inclusivity

In the IPN organisation, the SIGs have an important role to play, La Poutré emphasises. 'Their presence at the table ensures inclusivity of topics. One of the things we are currently working on is a vision document. The involvement of the SIGs ensures that we do not over-look any significant areas or topics.' The aim of the vision document is to provide NWO, the government and other funding bodies with an outline of what the community itself identifies to be important topics for the future, he explains. 'Take artificial intelligence, for example. How do we come to a responsible AI that is trustworthy and reliable, can be held accountable and is transparent, and does not lead to socially unacceptable outcomes? Or energy: How do we reduce the energy usage of computer science solu-tions? And also: how can we use ICT to organise the energy grid?'

'We want to look beyond the hypes of today,' Jonker adds. 'And we want to stress the importance of ICT research for adjacent fields. When you look at the recently granted Gravitation programmes, ICT research is at the core of the majority of them. We need to advocate the importance of involving us in proposals initiated by other fields, since nowadays things like visualisation techniques, pattern recognition, data

science, machine learning, or software engineering are often at the heart of innovative scientific projects.'

Getting the entire field to agree upon a joint vision will be challenging, Jonker observes. 'One of my personal frustrations is that we seem to find it hard to stand up for our own community. ICT researchers are very content-driven, and are trained to be critical thinkers. We often suffer from too much self-criticism, and sometimes should look more beyond the details and sketch the bigger picture, especially toward the outside world.'

La Poutré thinks it is crucial the ICT community keeps showing what it is capable of, and how relevant research is, especially now the environment is becom-ing ever more hectic. 'Not a day goes by without news stories about artificial intelligence, data science or cyber security. All of these topics are increasingly becoming part and parcel of our daily lives. We should present society and industry with new views on the future possibilities offered by ICT. What people need to realise, is that everything with the adjective smart means there is ICT running it. And that to keep it smart, research is crucial.'

Catholijn Jonker:

'Let's stick together and make it simple for policymakers to say yes to us'

Perhaps ICT researchers should start taking the lead in discussions about ICT developments, Jonker contem-plates. 'More than ever, others try to go and run with our work. They take some algorithms of ours and start doing ill-advised things with them. We are the only ones who can interpret ICT developments in the correct way, put these into context, and curb the associated risks and dangers. And we can sketch a clear picture of how ICT developments will shape our future society, and comment on expectations that are simply unrealistic.'

Both agree that slowly but surely, all of the efforts put into building a national ICT research community are starting to pay off. La Poutré: 'An excellent example of the added value of cooperation is the process we recently went through in formulating the sector plans. The fact that we could speak with one voice, and were able to present a clear and joint view of the topics that

Han La Poutré:

'We should present society and industry with new views on the future possibilities offered by ICT'

urgently needed investments, certainly helped in acquiring the funds to appoint new people.'

During their first board meeting, the new IPN board has identified several apparent challenges to tackle. La Poutré: 'First, there is an acute shortage of people who can provide education. Universities that used to welcome 200 first year students recently had almost 900. And even with a numerus fixus in place, the teaching load is still more than double what it used to be.
Second, we need to think of ways to acquire funding for focus areas represented by IPN's Special Interest Groups. The urgency of these topics is clear, but how can we acquire the necessary funds? The same goes for seed money to foster new fields that will emerge in ten years' time. The countries around us are investing way more, so how do we keep pace?' Another topic of concern remains the lack of diversity. 'Unfortunately, computer science is still a predominantly white male territory,' Jonker says. 'We need role models to improve the participation of women and people from different ethnic backgrounds in ICT research.'

Gear up

La Poutré concludes: 'A lot of good has been achieved over the past twenty years. Now it's time to gear up. As a young field, we had to grow and develop. But now we've entered adulthood, we should take a joint responsibility in advancing the field as a whole.' Jonker summarises her mission for IPN in an even shorter phrase: 'Let's stick together and make it simple for policymakers to say yes to us.'

IPN VISION

IPN is drafting a document containing the vision of the Dutch ICT research community on the questions that will be dominating ICT research ten years from now. ICT scientists play a key role in the digital transformation of society we are currently going through. For new questions, which often come from what we are learning today, new solutions need to be sought. What are these questions of tomorrow? The document will outline some of the subjects that the Dutch ICT scientists foresee to be dominating research in ten years from now.

THE CALIMERO-EFFECT

Since the start of I/O Magazine 16 years ago, Paul Klint has been writing columns expressing his views on recent developments in ICT science and ICT science policy. To celebrate IPN's anniversary, a broad selection of these columns has been bundled in a booklet called "The Calimero-effect". This booklet is now available through the website of IPN: ict-research.nl.

IMPRESSED BY THE UNANIMITY OF COMPUTER SCIENTISTS

Bert Meijer, professor of Organic Chemistry at Eindhoven University of Technology, acquired a unique glimpse into how the natural sciences are organised in the Netherlands during his role as torchbearer of sector outlook Science and Technology. I/O Magazine therefore wondered how he, as an outsider, views the computer science research community. Meijer: 'It is admirable how this community has organised itself within a discipline that is developing so quickly.'

Text Reineke Maschhaupt

'The pleasant and decisive role of ICT Research Platform Nederland (IPN), and especially of Peter Apers and IPN chairman Maarten van Steen, were vital for my role as quartermaster for the sector plans within computer science. There was considerable unanimity about the strongest research areas within computer science and about the allocation of the funding which they had in view. I received a quick answer to each question, and I had the feeling that they genuinely spoke on behalf of the community. Thanks to this unanimity and the good organisation we could award computer science the highest number of positions within the boundaries set by the Ministry of Education, Culture and Science.

At all the universities I visited, I saw that good consultation occurred within the computer science community. Everybody knew how the different specialisms were spread across the Dutch universities. The Netherlands is a small country and does not have a lot of money for extra research. It is therefore important that each university develops its own expertise within the discipline. That requires clear agreements. This is particularly important for computer science because fundamental and applied research are so closely related to each other. Therefore, within each university, these two strands need to find a synergy and on top of that each needs to develop its own expertise.

All computer scientists agree that fundamental knowledge is an absolute condition for ensuring that the digitisation of society proceeds in the correct manner. As an outsider, it is very easy to think everything computers do belongs to the computer science domain as a result of which the differences between applied and fundamental research become diluted, especially because a growing number of collaborations with companies are taking place. What made the sector plans of the computer scientists so strong was an open-minded view about the many applications of computer science without losing the focus on fundamental research.

CATCHING UP

It is interesting to observe that physics and chemistry are now suffering from the rule of the restrictive head start. These disciplines have always been well organised but more recently, they have been lagging behind. In terms of good organisation, both computer science and mathematics have caught up with them. Physics and chemistry are now looking to computer science and mathematics for inspiration and are moving swiftly with new consultative bodies on new pieces of advice. As a chemistry community, we quickly hope to link up with IPN again and to take joint actions.

'THANKS TO THE GOOD ORGANISATION WE COULD AWARD COMPUTER SCIENCE THE HIGHEST NUMBER OF POSITIONS'

A suggestion from the chemistry community would be that computer science can best focus on everything which is directly or indirectly related to computer science and not just defend its own causes. That is what chemistry has always done: stating possible solutions for problems outside of our own field and emphasising the role of chemistry in these. In particular, demanding attention for research that concerns all disciplines would give IPN a strong position.'
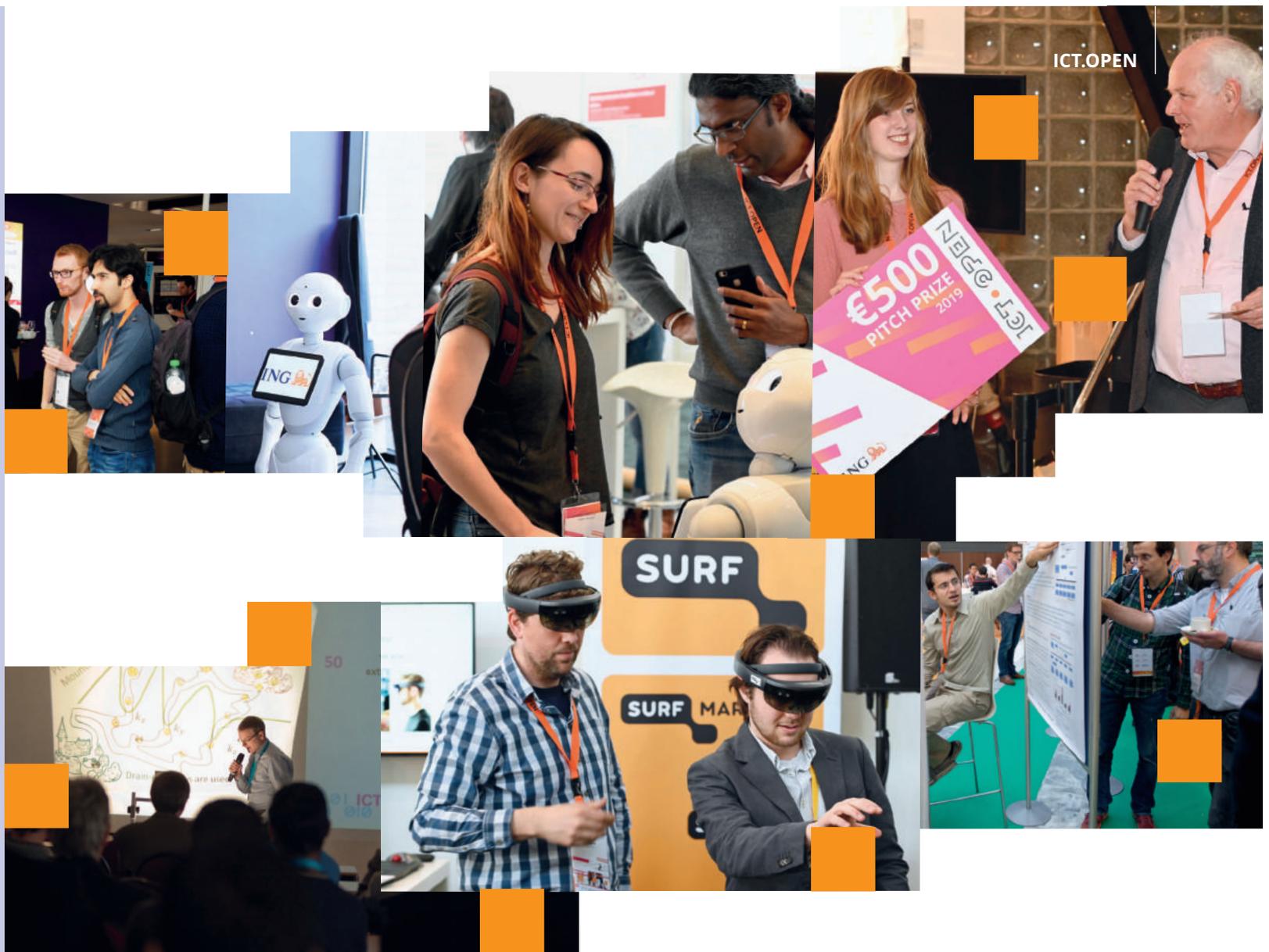
ICT.OPEN
AT A GLANCE

Since 2011, the annual conference ICT.OPEN has brought together the ICT world from fundamental research through to novel and innovative applications. The conference started as a combination of IPN's meeting SIREN, the annual meetings of the research schools ASCI, IPA and SIKS, and the STW.ICT meetings of ProRISC, SAFE, Sentinels and later on PROGRESS. Since 2018, ProRISC and SAFE have withdrawn from ICT.OPEN and have organised their own meetings again.

Each year, about 500 participants from academia, knowledge institutions, companies and civil society organisa-tions attend the two-day event to share information and meet new people. The 9th edition of ICT.OPEN will be held at MartiniPlaza in Groningen on Tuesday 17 and Wednesday 18 March 2020. Past editions of the event have been held in Veldhoven (2011), Rotterdam (2012), Eindhoven (2013), and Amersfoort (2015-2019). Due to a programming switch from the autumn to the spring, ICT.OPEN was not held in 2014.

www.ictopen.nl

POWERING THE
INVISIBLE ENGINE

''Vital software shapes society''. That is the catch phrase the Dutch National Association for Software Engineering VERSEN has chosen to launch its recently finished manifesto. VERSEN board members Marieke Huisman, Patricia Lago and Alexander Serebrenik share their thoughts on the future of Dutch software research. 'Software is the engine that powers all computer science developments like AI and cyber security. Although for many people this engine is invisible, it is so fundamental that we need to understand how to do it right.'

Text Sonja Knols
Image Shutterstock

'The Dutch software community is well organised,' Patricia Lago says. 'That enables us to come up with a broad-based manifesto that showcases the importance of software research, the challenges we identified, and the areas we excel in.' 'And what's perhaps even more important: that we have the right people to address these challenges,' Alexander Serebrenik adds.

Need for software research

The time was ripe to draw up a joint vision document about the future of Dutch software research, the three say. 'In most of the recent science policy documents, software is conspicuously overlooked, although it is a fundamental part of computer science research. No matter how nice a new machine learning application might be, if the software is bad, the entire thing fails to work,' Lago illustrates. 'Like never before we need software research on how to create reliable, sustainable software in an efficient way.' In the manifesto, the software research and education community describes a number of challenges imposed by the demands of the

'Implementing software will affect society - willingly or not'
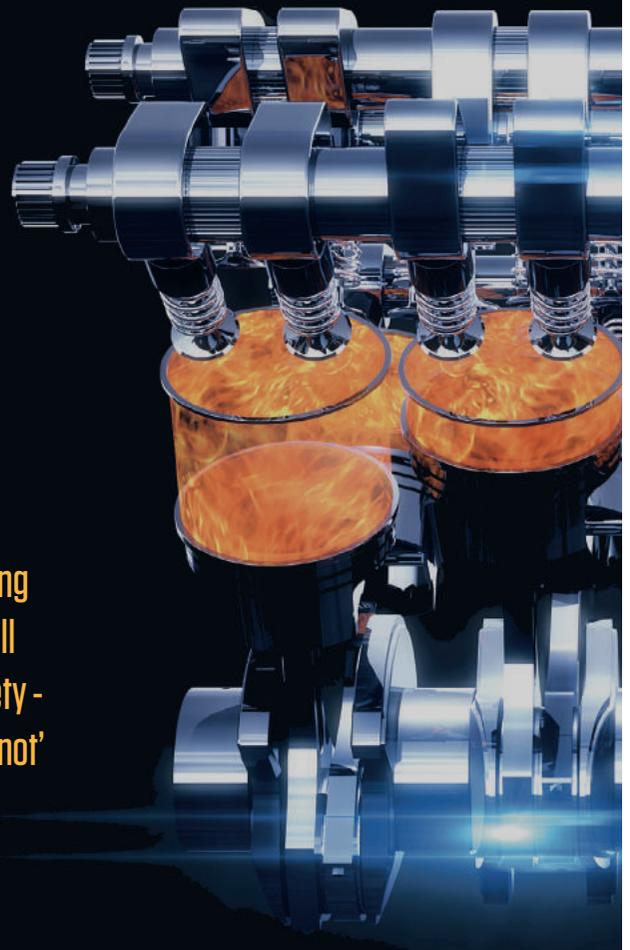
digitising society. Modern software used in cars, aeroplanes, operation robots, banks, healthcare systems or the public sector, comprises millions of lines of code. To produce such software, many challenges have to be overcome. How do we develop this software and simultaneously master its complexity? How do we ensure the correctness and security of this software, as human well-being, economic prosperity and the environment depend on it? How can we guarantee that software is maintainable and usable for decades to come?

Currently, Dutch software research is under siege, due to a steep increase in the number of students enrolling in computer science programmes. 'Of course, it's a great development that we are able to attract a growing number of people towards our field,' Marieke Huisman hurries to say. 'Especially since the job market is craving for qualified personnel. But since education has clear deadlines, too often research has to pay the price of the growing pains.'

Community building

The process of drafting the manifesto has acted as a fertile exercise in community building, Huisman says. 'From the start, we have involved all of the group leaders in setting up the manifesto and in agreeing on the main research

themes for the imminent future. We think it is important that everybody knows what others are working on, even if their area of expertise is a little further away from their own.' 'It is energising to see how the community is evolving,' Serebrenik adds. 'Over the last few years, a number of people has been appointed. This manifesto helps them in sketching the landscape and determining how their work fits in.'

The next step is getting the message across to policymakers. IPN plays an instrumental role in that process, Huisman thinks. 'Being one of IPN's Special Interest Groups, we benefit from their contacts with policymakers on a national scale.' 'IPN is instrumental in organising the computer science field, and representing it with one voice towards, for example, the Ministry of Education, Culture and Science,' Lago adds. 'As a software community, we are also benefitting from IPN in other ways,' Serebrenik says. 'For example, we gratefully make use of their activities and insights to increase diversity in the world of ICT.'

Eventually, the VERSEN board members hope that their manifesto will create awareness among policymakers with regard to the importance of software research and innovation. 'Implementing software will affect society – willingly or not. Take developments like smart cities, self-driving cars or even things like dating apps, which have altered the way we communicate with each other. These things don't happen by magic. In the end, it is all about software.'

VERSEN SOFTWARE MANIFESTO

In its manifesto, the Dutch software research and education community explicitly lists four groups of challenges it is in a perfect position to address:

1. Software reliability. How do we ensure that complex software behaves as expected, does what society needs, and is robust against unexpected uses?

2. Efficient engineering. Software engineering is exceeding human scale in terms of velocity, volume and variety. How do we keep pace?

3. Software maintainability and evolution. How do we create software with a long operational life that can be evolved and migrated to new technologies in a cost-effective way? And how can the software engineering team be organised in such a way that it embraces change and facilitates sustainable maintenance and evolution?

4. Software education. How can we supply the job market with well-equipped and highly qualified personnel from a diverse background?
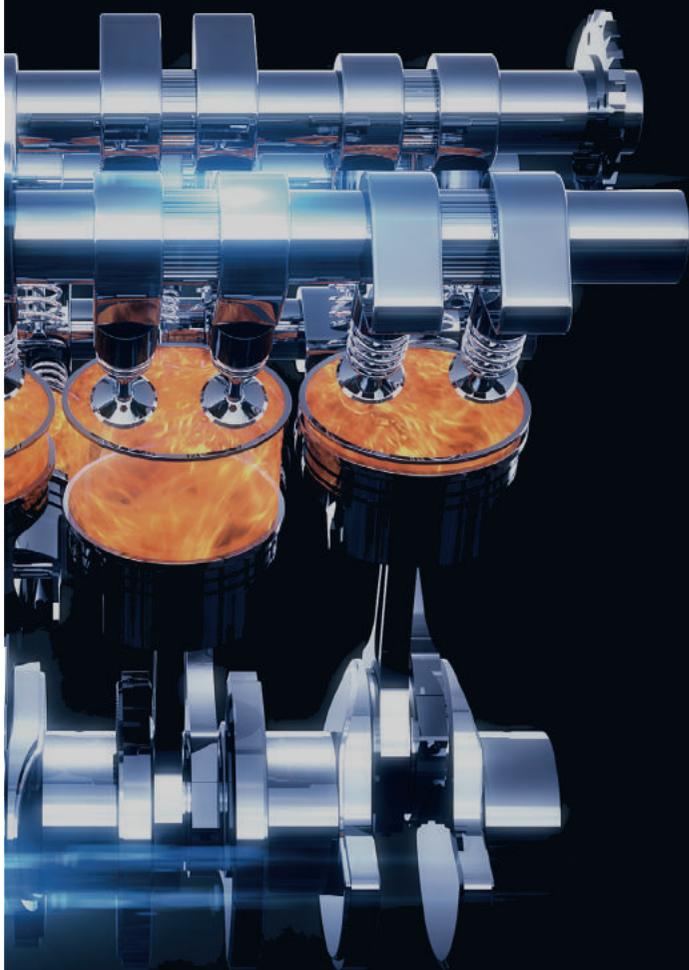
Twenty years of ICT Research Platform Nederland (IPN)

Mark Overmars

2000
USB Flash drives
are introduced

2001
BitTorrent, a peer-
to-peer file sharing
service, is launched

2003
MySpace founded

(IPN CHAIRMAN 2003-2007)

Why was IPN founded in 2000?

'Before IPN there was a foundation called Stichting Informatica Onderzoek Nederland (SION). SION had two functions: distributing research money and providing a platform where the computer science community could get together to decide about its future research directions, for example. At a certain moment, SION stopped being an independent foundation and became an advisory committee embedded in NWO. The platform function fell away, and IPN was founded to fill the gap left. Peter Apers had done a lot of preparatory work, and he asked me to become the first chairman. The computer science community needed a new platform to discuss the future of the field.'

What was IPN's most important contribution during your term as chairman?

'That was the Nationale Onderzoeksagenda Informatica, published in 2001. In this so-called NOAG-i, we formulated three ambitions for the 2001-2005 period. First, increasing the number of top researchers through talent development. Second, improving the interaction with researchers in related sciences in which IT methods and techniques are applied and investigated. And third, improving the transfer of knowledge between IT researchers and potential users of the research results. Furthermore, we formulated seven research themes, like software engineering, intelligent systems and parallel and distributed computing. The themes were inspired by the computer science community. The present IPN research themes are better suited to applications society needs.

So a clear shift has taken place: IPN now has more of an eye for societal applications.'

You left academia in 2013 to work in business, and you are currently managing director at Quarterfall. Looking at IPN from your present perspective, what should its focus be?

'I would say quality and vision. Society needs people who can do very good research. As a managing director, my most important goal is finding highly qualified people. The specific area of expertise is less important. When people are good, they can easily adjust their expertise while working within a company.

With respect to vision, it's important to look beyond the current hypes, develop a robust long-term vision and stick to it. IPN has now chosen "blockchain" as one of its themes. In my opinion, this is far too narrow and the result of a temporary hype. Let me give a concrete example from my own academic career. Twenty-five years ago, I was working on some fundamental problems that underly the software for self-driving vehicles. After a number of years, the results were not yet practically relevant and the grant providers dropped the robotics area. More recently, self-driving vehicles have become a very important research area. Making the step from fundamental research to applications just takes a lot of time, and we should dare to invest in long-term programmes. To keep everybody happy, the Netherlands tends to fund first one group for a number of years and then another. But that does not lead to excellent research.'

Four former chairmen reflect on the development of ICT Research Platform Nederland (IPN) over the last two decades since it was founded in 2000. What has been achieved? Where does IPN stand now? And how do they see IPN's future?

Text Bennie Mols

Paul Klint

2004
Web 2.0: enabling user generated content

2006
Cloud gains popularity

2007
iPhone launched

(IPN CHAIRMAN 2003-2007)

What were IPN's most important contributions during your term as chairman?

'The big transition I worked on was to broaden the organisation from Informatica Platform Nederland to ICT Research Platform Nederland. That was a complex strategic operation, which involved different communities and brought together many more research groups under the umbrella of IPN. But that also made it harder to stay on course. ICT is such a diverse field, ranging from theoretical foundations of algorithms and programming languages to very applied fields, such as robotics or chip manufacturing. There is a staggering amount of applications. ICT is connected to so many other domains that everybody wants to get involved. Sometimes that's a minefield. I tried to bring all the different domains closer together, but I still don't know whether my efforts were successful enough.

A second important contribution was the launch of the I/O Magazine. I have always considered it very important to improve the communication about ICT. Actually, I still think there's a lot of room for improvement. As a community, we should tell better stories about our field. Take my own subfield of software engineering. Most stories in the media focus on software bugs. That is not a good angle for communicating our research. We should communicate about the constructive and positive effects of software engineering and about the fundamental questions that underly our research. That's important for interesting young people in the profession. With respect to communication, we can learn a lot from the fields of physics and astronomy. They are very good in their public relations.'

What proved to be much harder than you had hoped or what was a disappointment?

'Because ICT is such a diverse field, speaking to the outside world with one voice has always been difficult. We haven't learned enough to operate as one front, to put our group interest above individual interests. That's another thing that we can learn from physics and astronomy.

A disappointment is the huge gap that seems to exist between policymakers in The Hague and researchers in the field. All too often I have seen how policymakers think that they can improve the field in a top-down way with all kinds of administrative fabrications, like ICTRegie, the Software Engineering Research Centre or in the context of science in general, the Top Sectors policy. These initiatives consume vast amounts of researchers' time only to disappear after some years without any remaining positive effect. And to my great annoyance, not even a proper evaluation is done.'

How would you analyse the evolution of twenty years IPN?

'The first column I wrote for the I/O Magazine was about the underdog effect of our field: the feeling that we were small and fields like physics or astronomy were big. Although the number of students and researchers has grown significantly since then, managers in our field sometimes still exhibit such an underdog feeling. I don't think there's a reason for that feeling anymore. We are now a mature field. Funding for ICT has grown, although I think it is still way out of balance compared to ICT's societal impact.'

Arnold Smeulders

2008
Bitcoin introduced
as a concept

2010
Stuxnet virus

2011
Siri announced

What were IPN's most important contributions during your term as chairman?

'The most important result is that ICT became a force in national science policy. Working together with vice-chairman Peter Apers, ICT became a separate sector in the Top Sectors policy instead of a subsector as it had been before. Although the status of ICT in society was already growing, ICT's status as a science was low. We started at the very bottom and slowly climbed the ladder. The system of science policy is very conservative, and we have the disadvantage that we are a young field. It took us an enormous amount of effort to show that ICT is not just about applications but a fundamental science as well. The fact that there are so many ICT applications doesn't mean that computer science is an applied science.

We also organised the first ICT.OPEN conference. We wanted to open our field up and show the outside world, what we can do and how we might cooperate. ICT.OPEN has become very successful in this. During my period as chairman, we also arranged the public-private research programme COMMIT in collaboration with many other parties. Although this was not an initiative of IPN, it has been important for the Netherlands at large, and it took two years of my life to set it up.'

(IPN CHAIRMAN 2007-2014)

Did an important change in the content of ICT research occur during your term?

'In my period, both the quality and the quantity of data exploded and we started to talk about big data. This impacted many problem formulations within ICT. Before the data explosion, people said about ICT research: if it's not hardware, then it's software. The field has become much more diversified, with methodology as a third strand in subfields like data analysis, sensory data, security and human-machine interaction.'

What should IPN focus on now?

'ICT researchers should become more interested in science policy and not nag about it or turn their back on it. They should understand how it works, accept it and be willing to contribute. That's a duty that comes with a higher status. We should ask the question why science funding is the way it is. Why does 140 million euro of public funding go to physics, 80 million to astronomy and only 30 million to ICT? I don't know of a public debate about this division. Considering the impact on society, I don't think this division of money holds up in a public discussion. It is the result of a conservative science policy that needs to be changed.'

Maarten van Steen

2014
HTML 5
announced

2016
First reprogrammable
quantum computer
realised

2020
20th anniversary
of IPN

What were IPN's most important contributions during your term as chairman?

'I have tried to create a stronger community feeling by changing the organisational structure of IPN. IPN used to have representatives from the technical universities, the general universities and some special members like CWI. But the computer scientists at the general universities were not so well organised and felt underrepresented. In the new organisational structure, every university which has a computer science department sends two representatives to IPN. Consequently, the heads of all the computer science departments came to sit directly together at the table, which improved the communication. In turn, that has led to computer science now being able to speak with the outside world with one voice. If policy-makers want to talk with the academic computer science community, they can now talk directly with IPN. Speaking with one voice has been my most important aim for IPN. During the discussions about the most recent sector plans, computer scientists came with one plan. I heard compliments from the outside world that we had done a good job. Some other sectors even started to see our organisation as an inspiring example.'

What are some of the worries you still have?

'My predecessor Arnold Smeulders has always fought very hard to make it clear to the outside world that we need not only innovation with ICT, but also in ICT. This is an ongoing battle. We are making progress but very slowly. It also has to do with what others in the field of science policy grant you. As computer scientists, we should not wait to be placed in the driver's seat; we should go out and claim the seat. Instead of complaining, we need to act. And because we are not the only players in the field of science policy, we need to look for partnerships too.

Another worry is the enormous pressure on the balance between teaching and research at universities. The number of computer science students has grown enormously without a significant growth in academic staff. That leads to academics sometimes spending 70% of their time on teaching and so having only a limited amount of time for research.

What about IPN's future?

'In both developing our research directions and communicating about the field, we should focus on what is important in the long run and not lose our way in hypes. At the moment, artificial intelligence is a driving force, but the bigger picture is digitisation in general. Too few people realise what an enormous impact the digitisation of all kinds of systems will have. What should we do to ensure that digitisation runs smoothly? That should be on our agenda. How do we build software for an electricity plant that can safely and reliably function and evolve over a period of forty years? Finally, I would like to see computer scientists take a leading role in public discussions. All too often I hear people in the media talking about fashionable ICT topics like AI, data science and blockchain, but they don't have a clue what they are talking about. As computer scientists, we should stand up, cut through the hype, say what is really happening and take the lead.'

(IPN CHAIRMAN 2014-2020)

TNO ICT Innovations
TNO's Information & Communication Technology unit works for clients in fields such as telecoms, banks, defence and security, industry, energy, construction, healthcare, mobility and logistics. Its ambition is to help its clients to achieve complex digital transformations, using its knowledge of technology, policy and business models.

CONNECTING TO COMPUTER
SCIENCE COMMUNITY

Henk-Jan Vink, Managing Director Unit ICT Innovations at TNO, participates in the IPN general
meetings on behalf of his organisation. He values the platform due to its internal network
and the external visibility it provides to the ICT research community.

Text Leendert van der Ent
Image Sjoerd van der Hucht

Could you summarise TNO's activities in the ICT field?

'Our ICT unit operates to enable key technologies for our external customers: generic ICT methods, technologies and tools. We believe that the convergence of ICT technologies creates innovation. Fast, open infrastructures, combined with data sharing and AI-driven analytics, developed and applied in a secure and responsible manner, all require a system engineering approach that can deal with this complexity. These are the technologies we work on. Our unit has about 300 people, including a dozen professors, sixteen PhD students and loads of interns. We closely cooperate with external partners from academia, business and government, and we enable the work of many other TNO colleagues who apply ICT in their respective domains.'

What is your unit's most important challenge in this regard?

'I think our most important challenge is also our most important strength: systems integration in a multidisciplinary setting. ICT plays an important role as an enabler and accelerator in the innovation challenges the Netherlands is facing. From a societal and economic perspective, our task is to further our knowledge: integrating new technologies in practice. An example is adding artificial intelligence to the networks of telecom operators. This demands an in-depth knowledge of deep learning, as well as a thorough insight into the network layouts. This bridging function requires multidisciplinary thinking and acting. It's challenging, but it's also what we're good at.'

What are the benefits of IPN membership for TNO?

'The partners within IPN are close, and people are willing to share what is happening. This is vital in a small country like the Netherlands. The network and activities, such as ICT.OPEN, function well. There is a great atmosphere to meet and talk. IPN therefore has a clear added value for us because it gives us the setting to assess how we could translate fundamental knowledge into practical applications and valorisation.'

In your opinion, what is IPN's most important task?

'I see several important tasks, but will mention one. It provides a platform to jointly underline the importance of fundamental and applied ICT research for our society as part of the global economy. ICT deserves a prominent place on the political-societal agenda. The investments from the Ministry of Education and Science and the Ministry of Economic Affairs and Climate Policy have remained more or less stable for decades, whereas the relative importance of ICT has clearly increased in this period. This growing gap between importance and resources is giving rise to increased friction. IPN can put this mismatch on the agenda and give the ICT research community the mouthpiece it needs. And when you have to be heard, you also have to be seen. IPN can provide that visibility.'

MORE HARMONY
IN THE INFORMATICS WORLD

This year, the three research schools ASCI, IPA and SIKS are celebrating their 25th anniversary. A lot has changed in that time and not all ambitions have been realised. Will they still be around for the next 25 years? The three scientific directors look back and ahead.

Text Amanda Verdonk
Image Shutterstock

When the research schools were set up 25 years ago, the aim was to offer joint education for all PhD students at Dutch universities. Creating one research school per discipline, in which all PhD students follow more or less the same courses, would be more efficient than having a separate school for each department. 'The informatics world was then split into three,' says Henri Bal of ASCI. 'That was a fairly logical division at the time. Theory was housed in IPA, the AI researchers and software engineers found each other in SIKS and computing and imaging together formed ASCI.'

FOCUS ON EDUCATION

Over the years, the role of the research schools has changed considerably and some ambitions have fallen by the wayside. Initially, for example, research would also be conducted within the schools, but the focus is now entirely on education. ASCI did however create the

so-called DAS infrastructure, a distributed supercomputer with which PhD students can quickly conduct experiments with, for example, cloud computing. 'That is unique in the world', says Bal. 'At the moment the sixth generation is being rolled out.' Initially, there was also the idea of only admitting top researchers to the schools. 'But now almost everyone is member of a school,' says Bal. 'And that's a good thing. The courses and conferences provide the PhD students with a large network, which was different in my time. They notice that they are not the only ones who sometimes get stuck. And for grant applications it also helps if you know a lot of people.'

In addition, the researchers are given a sneak peek of another field, says Arno Siebes of SIKS. 'You cannot obtain all your study credits by just following courses from your own discipline. This will secretly force you to listen to other, related topics. Perhaps you will then come across an issue that you could contribute to.'

Research schools

The research schools certainly have added value, say all three directors. The international visitation committee, which assessed the quality of Dutch universities in 2016, was also very pleased with the role of research schools in the Netherlands, says Mark van den Brand of IPA. 'A number of foreign committee members were even jealous that they didn't have this system in their own country.'

EMERGENCE OF AI

The division of the entire Dutch informatics world into three different research schools is, however, less logical than it was in the past, all three directors say. This is due, for example, to the rise of artificial intelligence (AI). Bal: 'AI is now primarily housed at SIKS, but is at the crossroads with other disciplines. That is why more cooperation between the schools is needed.' Siebes also emphasises that the range of courses is constantly changing. 'Explainable and Responsible AI is popular right now, and deals with the ethical and social

aspects of AI. Data are not neutral, and sometimes include discrimination, as the hiring database from Amazon has shown. It showed that women were not recommended by the system for a job, because they were not hired in the past. How do we deal with that historical data and how do we make systems that do not suffer from bias? These questions connect us all.'

'The courses and conferences
provide the PhD students
with a large network'

Van den Brand dares to go one step further and wonders: does it actually make sense to have three different research schools? 'Personally, I think it would be better to have one single informatics research school, with dedicated special interest groups. For example, software engineering is not only in IPA, but also in ASCI. And every research school now

pays attention to machine learning and AI – we could organise this more efficiently if we were one research school.'

PARTY

The establishment of IPN, five years after the start of the research schools, has brought more harmony into the fragmented IT landscape, says Van den Brand: 'In the past I did not know which organisations were involved in ICT. IPN has brought people together, and acts as a mouthpiece for governments and NWO.' In his view, the research schools can also work together more harmoniously. To emphasise that, and to celebrate their 25th anniversary, the three schools are organising a joint symposium

> **'We should look ahead: what is the future of the research schools?'**

this autumn. Van den Brand: 'We should look ahead: what is the future of the research schools?' Siebes is not necessarily against a merger either. 'If there is a guarantee that everything will continue in a similar way, such as the flexibility to choose new themes and organise programmes, then we will support that. I am not in the slightest bit attached to the name.' For Siebes, however, the symposium must primarily be a celebration. 'For a bunch of nerds like us, inviting six celebrities from the field to tell a wonderful scientific story would make a great party.'

About the research schools

Advanced School for Computing and Imaging (ASCI)

Size: 95 PhDs, 84 staff members
Scientific director: Henri Bal, Professor of Computer Science at VU Amsterdam
Participating institutes: TU Delft (administrator), VU Amsterdam, University of Amsterdam, Eindhoven University of Technology, TU Delft, Leiden University, Utrecht University, University of Twente, University of Groningen, Erasmus University Rotterdam, Radboud University

Institute for Programming research and Algorithmics (IPA)

Size: 100 PhDs, 110 staff members
Scientific director: Mark van den Brand, Professor of Software Engineering and Technology at Eindhoven University of Technology
Participating institutes: Eindhoven University of Technology (administrator), Centrum Wiskunde & Informatica, Radboud University, University of Groningen, TU Delft, Leiden University, Utrecht University, University of Twente, University of Amsterdam, VU Amsterdam.

School for Information and Knowledge Systems (SIKS)

Size: 250 PhDs, 500 staff members
Scientific director: Arno Siebes, Professor of Algorithmic Data Analysis at Utrecht University
Participating institutes: VU Amsterdam (administrator), Utrecht University, University of Twente, University of Amsterdam, TU Delft, Eindhoven University of Technology, Radboud University, Maastricht University, Tilburg University, Open University, Leiden University, Centrum Wiskunde & Informatica

BUILDING A
BREEDING GROUND

The only non-university regular member of IPN is CWI, the Dutch national research institute for mathematics and computer science. Director Jos Baeten looks back on the twenty years of computer science development in which IPN has served as a network organisation. 'Now we are making sharper choices and we are a breeding ground for computer science.'

Text Rianne Lindhout
Image CWI/Foto Gillisen

Centrum Wiskunde & Informatica (CWI) has been the national research institute for mathematics and computer science in the Netherlands since 1946. The institute was the birthplace of the European internet in 1988. It built the first Dutch computer in 1952 and kick-started the development of the popular programming language Python in the 1990s. So far, CWI has founded 26 spin-off companies.

Where were you 20 years ago when IPN was founded?
'I signed the founding document myself on behalf of the research school IPA. At the time, I was a professor of computer science in Eindhoven. IPN was established because we wanted to unite ourselves as a young field, determine the direction of ICT and represent it externally. No such community existed back then and computer science certainly had to fight for a place in science. And to be honest, the field still has a backlog.'

A backlog? But computer science is everywhere!
'Indeed it is, but if the network goes down, you're left twiddling your thumbs. And ICT is still lagging behind modern physics. This is now a century-old academic field that attracts a lot of extra funding. Many leading figures have a background in physics, but very rarely in computer science. Did you know that the KNAW has only had a separate section on computer science since last year? Also, like many others, I feel that IPN should no longer be the ICT research Platform, but the Computer Science Platform, encompassing more areas than ICT, and also covering education.'

Yet computer science has grown rapidly. What does that mean for CWI?
'CWI used to have the largest computer science department in the Netherlands but now, universities sometimes have larger departments. Because of that growth, we continuously focus and balance our scientific pursuits. Unlike universities, we don't offer higher education. Therefore, we do not have to practice all fields of computer science to be able to fill a curriculum. We do, however, have the specific task to serve as a breeding ground for mathematics and computer science. We explore new directions, and eventually transfer these to a university or society.'

Can you give an example of a new research direction?
'Digital humanities. Researchers in digital humanities aim to analyse large data files, like newspaper archives, in such a way that it delivers the exact information that a user is actually looking for. Another example is making all works of art from the Rijksmuseum accessible, for which we closely cooperate with the museum and other research partners.'

Has IPN succeeded in establishing the community feeling it aimed for?
'That is a matter of trial and error. We extensively discuss which niches we do and do not address, and IPN represents the profession well among policy makers. However, I found the exercise of the computer science sector plan for research and university education in 2018 much less of a success. Universities without a separate computer science department and CWI were not allowed to participate. That was definitely to the detriment of expertise and the group feeling.'

HALL OF FAME OF
DUTCH ICT RESEARCH

Since 2011, nine young ICT researchers have been awarded the prestigious Netherlands Prize for ICT Research. This Hall of Fame honours these talents, and at the same time illustrates the wide scope of the Dutch ICT research community.

Bettina Speckmann
Eindhoven University of Technology (2011)

Bettina Speckmann heads the Applied Geometric Algorithms (AGA) group that works on the design and analysis of efficient algorithms and data structures for problems involving geometric objects in space. The focus of AGA lies on geometric algorithms for spatial data and their applications in the areas of GIScience and Smart Mobility, geo-visualisation, mobile agents, and eHumanities.

Marieke Huisman
University of Twente (2013)

As the leader of the Formal Methods and Tools Group, Marieke Huisman carries out research on reliability and correctness of concurrent and distributed software. The techniques and tools she develops can help software developers make their software more reliable, and enables them to discover errors upfront before the software is launched.

Cees Snoek
University of Amsterdam (2012)

Cees Snoek heads the Intelligent Sensory Information Systems Lab and is also a director of the QUVA Lab, the joint research lab of Qualcomm and the University of Amsterdam on deep learning and computer vision. His research is about semantic video and image retrieval: how to automatically recognise objects, concepts and actions in (moving) images.

Birna van Riemsdijk
TU Delft / University of Twente (2015)

Birna van Riemsdijk is associate professor Intimate Computing in the Human-Media Interaction group at the University of Twente. Combining theoretical computer science, artificial intelligence and human-machine interaction, she develops theory and software for creating intimate technologies that take into account human vulnerability, norms and values in supporting us in our daily lives.

Alexandru Iosup
TU Delft / VU Amsterdam (2016)

With his group Massivizing Computer Systems, Alexandru Iosup is making distributed computer systems scalable, reliable, and performant, yet forming efficient, engineered ecosystems available to everyone. Iosup's research is relevant for the operation of clouds, grids, and datacentres, and has many applications in e-Science, business workloads, massive multiplayer online games, and education.

Elmar Eisemann
TU Delft (2019)

With this Computer Graphics and Visualisation group, Elmar Eisemann researches the accurate, detailed depiction of visualisations. He focusses on four interrelated aspects of computer graphics: rendering, visualisation, perception and content generation. His research is applied in a wide variety of domains, ranging from cell biology and architecture to gaming and artificial intelligence.

Peter Schwabe
Radboud University (2017)

Peter Schwabe is an expert in Digital Security. He designs highly efficient cryptographic algorithms and optimised, speed record-setting, cryptographic software. He also codevelops the Networking and Cryptography Library, which contains highly efficient implementations of algorithms for network communication, authentication, encryption, decryption and digital signatures.

Pablo Cesar
CWI / TU Delft (2020)

Pablo Cesar is group leader of the Distributive and Interactive Systems group at CWI and associate professor at TU Delft. His research is about modelling and controlling complex collections of media objects that are distributed in time and space, with a particular focus on understanding and modelling the interaction between people and technology.

Joost Batenburg
CWI / Leiden University (2018)

Joost Batenburg heads the CWI group Computational Imaging and is also a professor at Leiden University. His research is about tomographic image processing and reconstruction. He is responsible for the FleX-Ray lab, where a custom-designed, CT system is linked to advanced data processing and recon-struction algorithms to quickly produce accurate images from very little data.

NETHERLANDS PRIZE FOR ICT RESEARCH

The Netherlands Prize for ICT Research is awarded annually by the ICT Research Platform Netherlands (IPN), in collaboration with the Dutch Research Council (NWO), to recognise outstanding research in computer science. Anyone active in this field can nominate candidates for the award, which consists of 50,000 euros to spend freely on ICT research plus a certificate and a sculpture.

Images Angeline Swinkels, Gijs van Ouwerkerk, University of Amsterdam, Annelies van 't Hul, Ivar Pel, Elodie Burrillon

FIGHTING FOR
THE PUBLIC GOOD

Text Amanda Verdonk Image Elodie Burrillon

Cynthia Liem is musician, computer scientist and chair f ICT Next Generation, a network of the Next Generation of ICT researchers in the Netherlands. Liem is committed to the public cause, but also to creating a healthy and attractive working environment for young, mostly international researchers.

'When I started my position as a tenure track, assistant professor, I encountered an academic culture I wasn't very happy with. To show I merited a tenured contract, I knew I had to have a strong publication record and the capacity to obtain grants, but I found myself running into obstacles. I started my scientific career working on music data and the retrievability of music resources. While the technologies for this are the same as for other information sources, I felt taken less seriously: people said music was cute, but not important. That made it challenging to get funding. I've always had a multidisciplinary approach; I also talk to academics in humanities and psychology. This takes more time, because you need to learn to speak each other's languages, convince each other that collaboration is useful, and convince your external reviewers. People often say we shouldn't stay in our own super-specialised bubble, and that we should create multidisciplinary cross-overs, but in reality it doesn't happen much.'

'The current generation of young researchers is very international. In my department, I am even one of the few native Dutch speakers of my generation. With ICT Next Generation, we want to build a network among the young generation, so they can find each other and have a joint voice when they enter a policy-making position. We are happy that we are involved with IPN and are part of the vision-making process. How do we deal with internationalisation and how do we keep the academic world healthy and attractive enough, while the commercial sector is becoming an ever more attractive employer?'

'Many of us are concerned about improper technology leading to inequality in society. This is what made me want to work for the public good. I was recently asked by multiple parties to come up with an algorithmic "fix" to prevent bias in automated job candidate screening, but I eventually refused it. As a result, I was not able to generate any publications on novel technology. Fortunately, I still managed to get a tenured position. However, I can see colleagues without a permanent contract running into similar moral dilemmas. Can you turn away from the improper use of your technology, knowing this will leave you empty-handed in terms of your output, or possible partnerships for grants? I am happy to see the recent discussions on alternative and less quantitative science assessment, and hope these will strengthen us in considering our societal role as academics.'

'ICT Next Generation is still in its pioneering phase, but I hope we will become a broad network with a broad discussion. It will be hard work, but we hope we can really do something for the young generation and make their voices heard.'

Cynthia Liem is an assistant professor at the Multimedia Computing Group at TU Delft and chair of ICT Next Generation. She also studied classical piano performance at the Royal Conservatoire The Hague and is still an active performer, most notably with the Magma Duo.