university of groningen

Developing knowledge and innovations together:

digital society



university of groningen

Developing knowledge and innovations together:

digital society

‘Digitalisation has a huge potential to help us make responses much more effective, much more efficient and much more geared to the needs of the beneficiaries.’

Androulla Kaminara, director DG ECHO (Directorate-General for European Civil Protection and Humanitarian Aid Operations) Europese Commissie
Bron: Twitter, 23 augustus 2018

‘What is good for the world is naturally good for Groningen. Both economically and socially. By firmly embracing the digital transformation, Groningen creates even more opportunity to continue working on a brighter future for the world.’

Nick Stevens, chief digital officer Digital Office Groningen
Bron: www.cityoftalent.nl/merkgroningen/quotes

‘In personalizing education ICT can be of enormous help. It helps us manage the learning process, give relevant feedback, and helps to keep learning costs low.’

Elmer Sterken, former rector magnificus Rijksuniversiteit Groningen
Bron: openingstoespraak academisch jaar 2017/2018, 4 september 2017

‘Digitalisering is dé driver voor verdienkracht en vooruitgang. Samen met de Nederlandse universiteiten wil de industrie hierin vooroplopen. Digitalisering verdient de komende kabinetsperiode topproriteit.’

Ineke Dezentjé Hamming-Bluemink, voorzitter FME-CWM (ondernemersorganisatie voor de technologische industrie)
Bron: het plan ‘De Digitale Samenleving’ van de Vereniging van Universiteiten (VSNU), 5 september 2016

‘Digital access is becoming the new dividing line, as millions of the children who could most benefit from digital technology are missing out.’

Anthony Lake, executive director UNICEF
Bron: UNICEF-rapport ‘The State of the World’s Children 2017: Children in a Digital World’, december 2017

‘With the potential to drive societies forward, materialise innovative business models and support governments to find solutions to legitimate policy concerns, the process of digitisation is set to be one of the most transformative to the way in which we all work.’

Mariya Gabriel, eurocommissaris Digitale Economie en Maatschappij
Bron: www.governmenteuropa.eu, 19 maart 2018

‘Digitalisering gaat razendsnel en de impact op de samenleving is overal voelbaar. Of het nu gaat om verkiezingen, werkgelegenheid of gezondheidszorg. (...) Door universitaire kennis nu te bundelen en actief te delen, kunnen we die impact niet alleen beter begrijpen maar ook meehelpen om sturing te geven aan een betere digitale samenleving, samen met partners zoals overheid en bedrijfsleven.’

Pieter Duisenberg, voorzitter Vereniging van Universiteiten (VSNU)
Bron: www.thedigitalsociety.info, 10 juli 2018

‘Het (decentrale sturing bij cybersecurity, red.) is de kracht van ons typisch Nederlandse poldermodel in plaats van centrale regie. Dat is ook in de digitale wereld de meest effectieve manier van samenwerking tussen overheden en bedrijfsleven.’

Patricia Zorko, plaatsvervangend Nationaal Coördinator Terrorismebestrijding en Veiligheid (NCTV) en tevens directeur Cyber Security bij deze organisatie
Bron: de Volkskrant, 15 mei 2017

‘Voor het kabinet is het uitgangspunt dat iedereen moet kunnen deelnemen aan de digitale samenleving. Dat betekent meer inzet op veiligheid, privacybescherming, zelfbeschikking en digitale vaardigheden.’

Mona Keijzer, staatssecretaris Economische Zaken en Klimaat
Bron: www.rijksoverheid.nl, 16 juni 2018

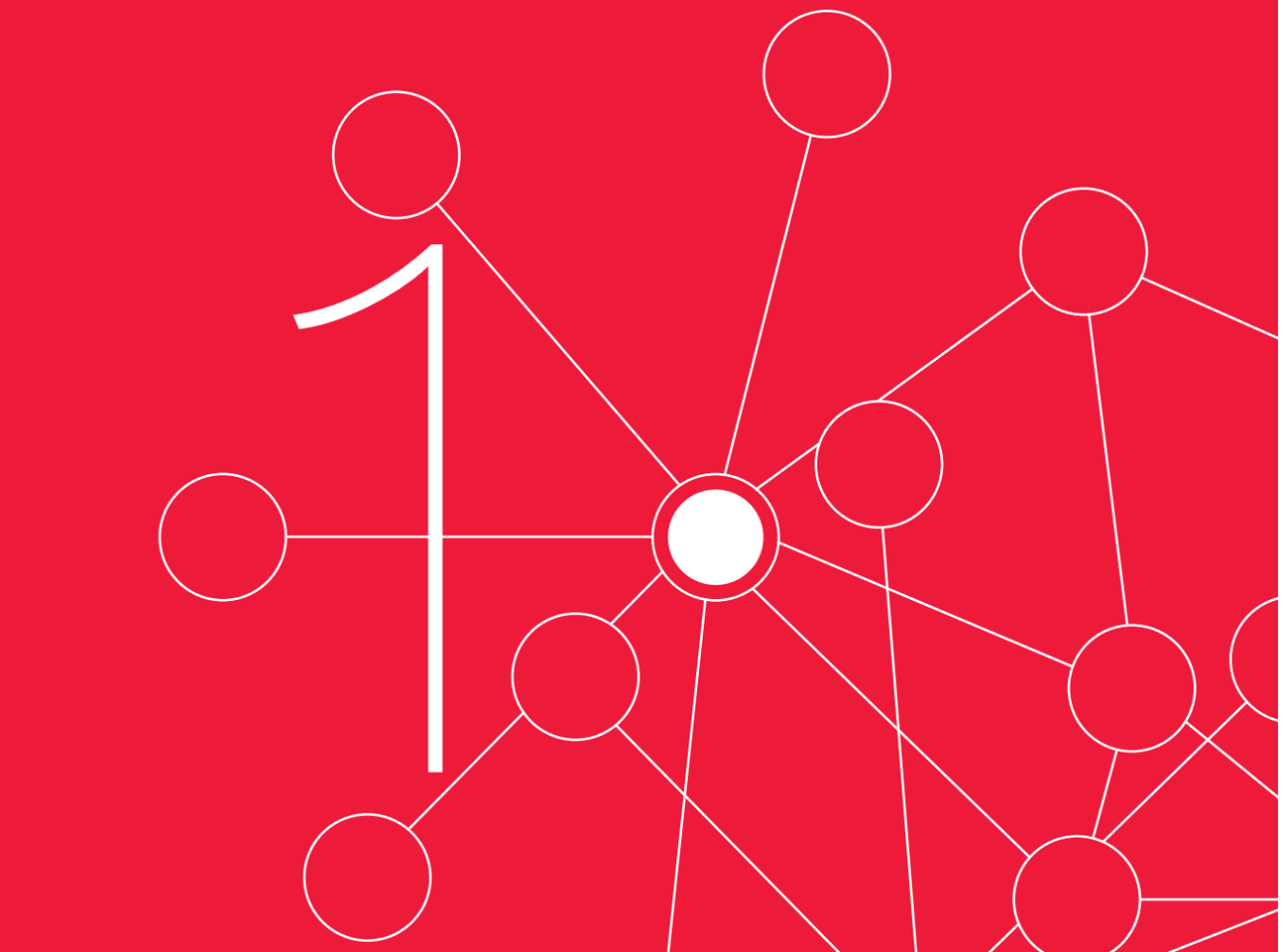
‘We zien het als onze gezamenlijke opgave om te excelleren in ‘digital literacy’. Dit gaat verder dan het aanleren van kennis en vaardigheden; digitale geletterdheid omvat een onderzoeksveld waarin wordt onderzocht hoe burgers omgaan met digitale technologieën, wat de impact is op hun dagelijks leven, en hoe we ontwikkelingen rond dataficatie en kunstmatige intelligentie op een duurzame en verantwoorde manier kunnen vormgeven.’

Rijksuniversiteit Groningen, Hanze Hogeschool Groningen, Universitair Medisch Centrum Groningen, Gemeente Groningen en Provincie Groningen (gezamenlijk statement)
Bron: het Akkoord van Groningen 2018-2022, november 2018



5Groningen transforms North-Groningen into a fieldlab for 5G, the latest generation of mobile internet. The University joins forces with nine other partners, including the initiator, the Economic Board Groningen. **The 5GFieldlab** at Zernike Campus Groningen is part of 5Groningen. Entrepreneurs and non-profit organisations join forces with students and researchers to test 5G applications.

The University of Groningen: at the heart of society



The University of Groningen is at the heart of society. It is fully engaged with companies, non-profit organisations, government bodies, knowledge institutions and members of the public. The goal: contribute to a resilient society that tackles societal challenges.

Broad and distinctive

The University of Groningen (UG) distinguishes itself, both at the national and international level, by its strong links between education and research. The three main focus areas are: 'energy', 'healthy ageing' and 'sustainable society'. The University's eleven faculties develop knowledge in disciplines such as engineering, philosophy, law, social sciences and economics. Such unique breadth offers ample opportunities for multidisciplinary and interdisciplinary education and research, while providing a fertile environment for knowledge and innovation. Cooperation with partners is an important aspect; this can pave the way for the creation of new developments, products and services.

Establishing links

The UG's Industry Relations team works to establish links between the University and other parties. An important step of this process is that the partners – each on the basis of their own core qualities and core values – formulate a common goal, to tackle societal challenges. This goal is then translated into a sustainable collaboration programme.

The collaboration may focus on research, education, talent development or societal impact. This involves aspects such as knowledge sharing, question-driven fundamental research, or the translation of knowledge into products or services. It could also include internal training programmes, student engagement and the establishment of new networking organisations. The images on pages 8 and 9 demonstrate plenty of options!

Are you curious to find out about collaboration in the digital society? You will read some highly interesting examples in **Chapter 2**!

Sustainable cooperation between the RUG and its partners

OPPORTUNITIES FOR COLLABORATION:

Interdisciplinary and multidisciplinary fundamental question-driven research

The formation of consortia and networks, joint research applications to, for example, NWO, the NWA or the EU, or as part of the national Top Sectors policy

Talent development among students through placements and participation in research projects

Sharing knowledge and inspiring people

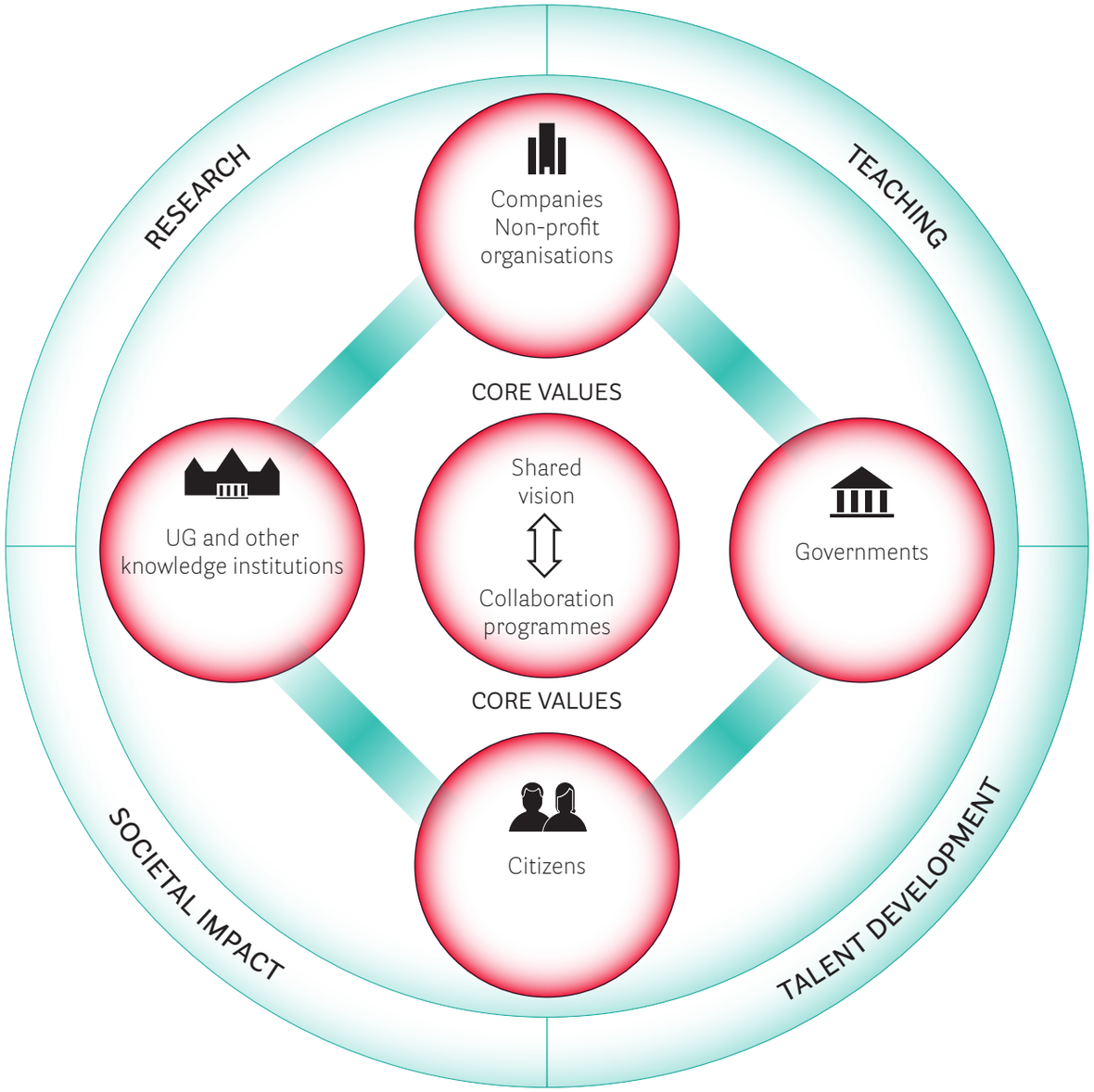
Transformation of knowledge into pilot projects, demo projects or end products and services

Joint infrastructure and facilities, working close to each other

Making results visible

Professionalisation of staff through training courses

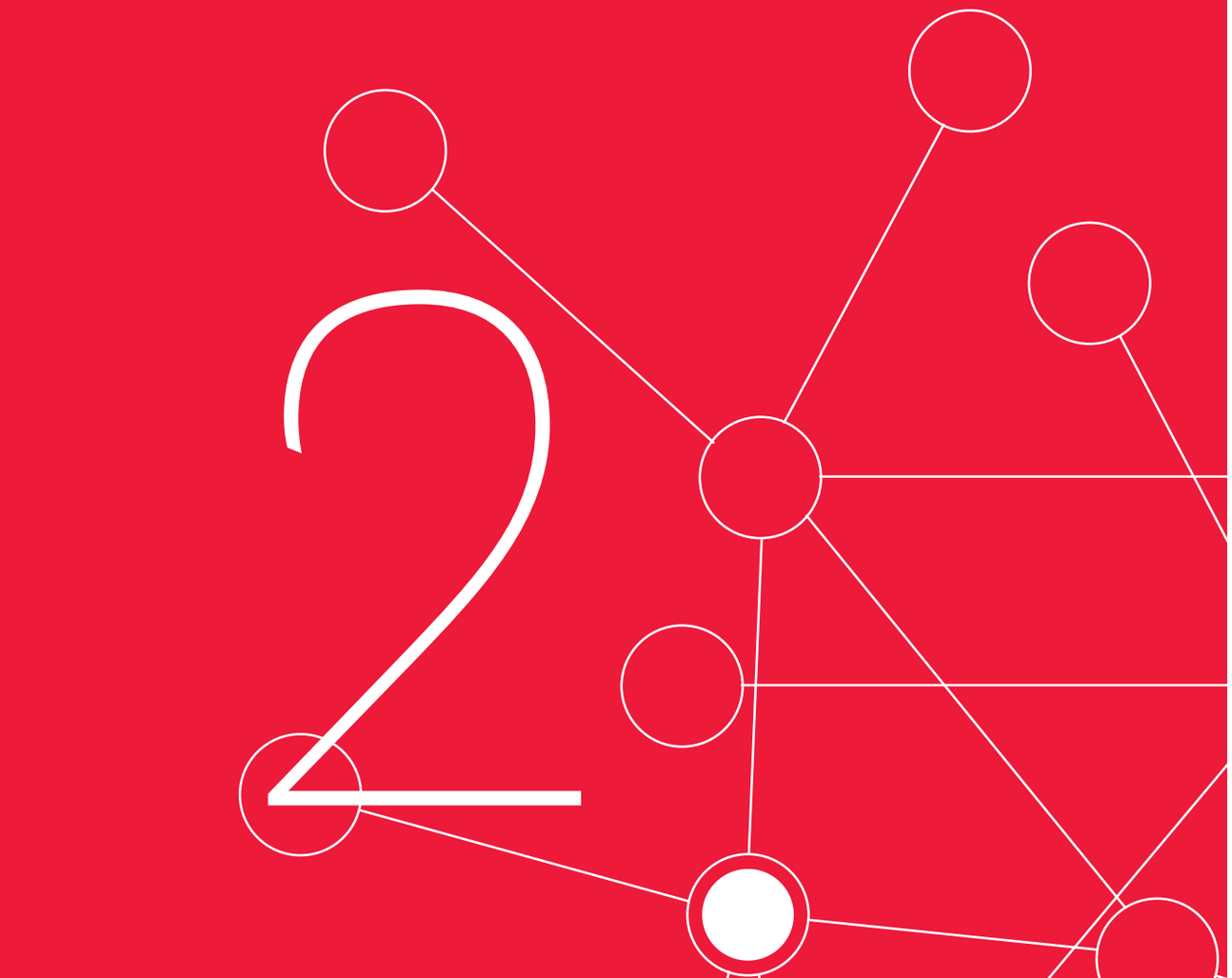
Identifying and addressing societal challenges





The Geodienst of the Center for Information Technology of the University of Groningen supports researchers and students in the field of geographical information, for instance by offering geographic data, software and courses and carrying out analyses. The Center also executes projects in cooperation with other partners, from inside and outside of the University.

Examples of research projects



Digitalisation is taking up a more substantial part of our lives. But how do we make digitalisation and society work together seamlessly? And that new technological expertise blends with knowledge of for instance economics, history, health, law and psychology?

VSNU programme ‘Digital Society’

The Netherlands is a world leader in human-oriented information technology. The Association of Universities in the Netherlands (VSNU) had this aim in mind when it set up its research programme ‘Digital Society’. Fourteen Dutch universities, among which the University of Groningen, collaborate in this programme to solve complex societal challenges using digital tools. They also jointly carry out a study into the impact of digitalisation on society.

University of Groningen research projects

The UG researches the digital society extensively. The key themes are:

- the consequences of digitalisation for society (digital security and digital literacy);
- digital technologies and data science as possible solutions for societal challenges;
- digital business as the driver of entrepreneurship.

The research covers many disciplines and sectors: from law and physics to history, philosophy and arts. You will find a small selection of these research projects in the following pages. These are projects in which collaboration is an important factor – either with other academics or with companies, non-profit organisations or members of the public, for example.

Are you curious to find out about the University’s other projects in the field of the digital society? Or would you like to know which other studies the UG carries out with its partners? Please visit **www.rug.nl/industry-relations** for inspiring examples.

Social media for a better spread of tourism

Details of the study

The city centres of Amsterdam, Paris and Lisbon are often swarming with tourists in the summer. The Faculty of Spatial Sciences of the University of Groningen examines how such amounts of tourists may be spread more evenly across the city. The data for the study come from social media such as Flickr and Panoramio that people use to share photos and experiences.

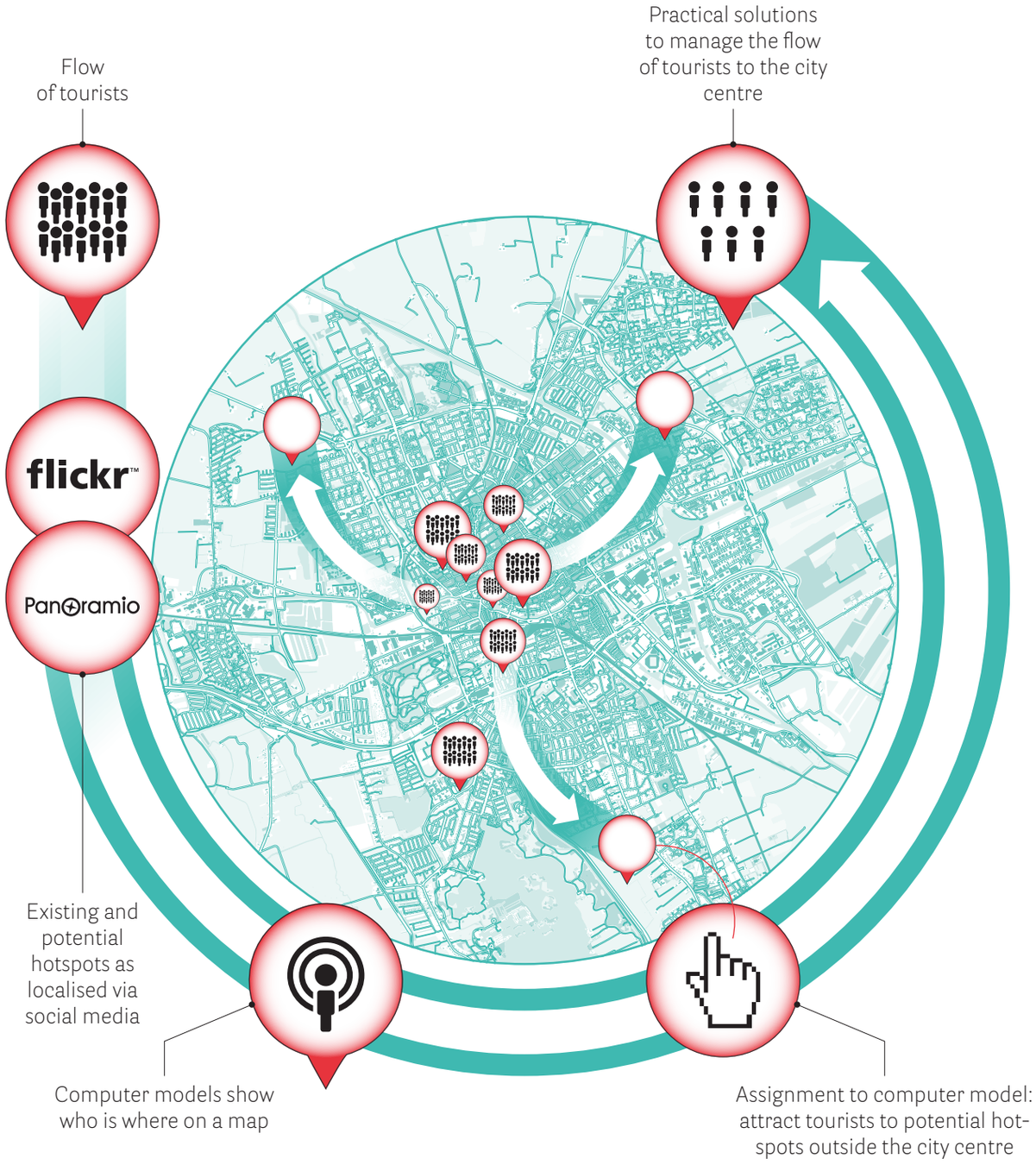
The data are used to create social media profiles of the tourists: what do they like, which places do they visit, how long do they stay there, and so on. The profiles are then used in computer models to find out how tourists can be tempted to visit the less crowded districts outside of the city centre. In other words: it gives us an indication of the usage of spaces in a city that attracts many tourists. The overcrowded places, the hotspots, can be separated from the areas that still have growth potential.

In everyday practice

The Faculty of Spatial Sciences' study helps municipalities to develop strategies for a better spread of tourists. In other words: how do you seduce tourists to leave the historic centre and go to quieter places on the outskirts? The study offers practical solutions, e.g., alternative means of transportation to manage the vast amounts of tourists. The results may also give cause to create new hotspots outside of the city centre.

Joint opportunities

Initially, the study focused on one city: Lisbon. The UG collaborated with the University of Lisbon and Turismo de Lisboa, Lisbon's tourist information. However, the project offers ample opportunities for other large cities that need to address mass tourism at an early stage. The University together with municipalities will look for solutions for a more evenly spread of tourists. Solutions that are comfortable for both the local population and the tourists.



'IMPACT ON SUBURBS INCLUDED IN RESEARCH'



Assistant professor Inês Boavida Portugal
Faculty of Spatial Sciences of the University of Groningen

'Drawing tourists from the city centre to the suburbs affects the entire city. We are researching the impact by programming the tourists' social media profiles in a computer model. The tourists appear as little figures on a city map. Those who undertake cultural activities are in a museum and those who like to enjoy the sun sit on the terrace. We can provide the model with instructions such as: "Draw tourists to hotspots outside the city centre." We can then see where the tourists head for and which routes they follow. It becomes clear how tourists' moving around affect the infrastructure and if the suburbs have sufficient hotel accommodation.'

Project partners
University of Groningen, University of Lisbon and Turismo de Lisboa, Lisbon's tourist information.

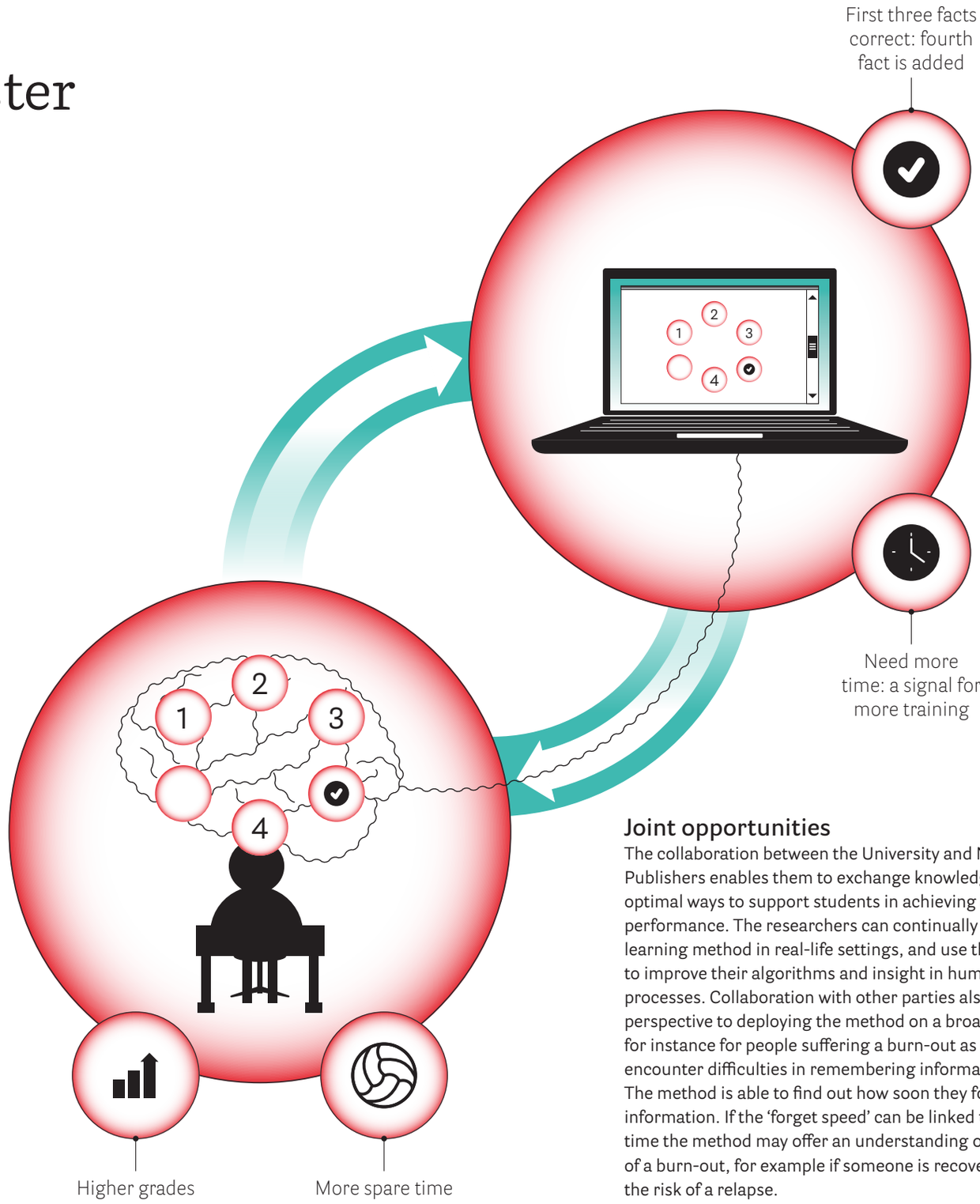
SlimStampen: learning facts faster

Details of the study

How can we study and then remember information better and faster? This question forms the basis of the new teaching method SlimStampen, developed by the Faculty of Behavioural and Social Sciences of the University of Groningen. The method uses scientific memory theories and enables you to learn facts as efficiently as possible. While studying, SlimStampen assesses the responses to find out which information you have already memorised and which you haven't mastered yet. If you take too much time to type the answer, the computer takes this as a sign that you need more practice. It adapts itself to the learning aptitude of each individual. For example, it starts with three facts, but only after SlimStampen knows that the learner knows them well enough, a fourth fact is added to the list.

In everyday practice

Noordhoff Publishers, the largest Dutch publishing house of teaching methods for secondary education, offers SlimStampen to Dutch schools. Over half a million students have access to the new system for learning English, French and German. Research shows that these students learn more efficiently with SlimStampen than with any other method: on average they achieve about 15% higher marks. Besides in secondary schools, the system is also deployed in a number of university courses at the University of Groningen and in a number of commercial companies and societal organisations.



Joint opportunities

The collaboration between the University and Noordhoff Publishers enables them to exchange knowledge about optimal ways to support students in achieving their best performance. The researchers can continually test the learning method in real-life settings, and use the results to improve their algorithms and insight in human memory processes. Collaboration with other parties also offers a perspective to deploying the method on a broader scale, for instance for people suffering a burn-out as they often encounter difficulties in remembering information.
The method is able to find out how soon they forget the information. If the 'forget speed' can be linked to moods, over time the method may offer an understanding of the progress of a burn-out, for example if someone is recovering or faces the risk of a relapse.

'THIS IS EXTREMELY REWARDING'



Professor Hedderik van Rijn
Faculty of Behavioural and Social Sciences of the University of Groningen

'Precisely because of the collaboration with Noordhoff Publishers, we can collect enormous amounts of data; much more than we ever could gather at the university. It allows us to refine our methods. From research we now know that students achieve higher marks if they use SlimStampen, a smart method for learning facts by heart. And because they study more efficiently, they have more time for other schoolwork or leisure activities – from playing their favourite games to soccer or ballet. For us, as a research group, the positive contribution to educational performance is highly satisfactory. This is how our academic work has an immediate impact on society.'

Project partners
University of Groningen and Noordhoff Publishers.

Specifics
Stichting Kennisnet, a Dutch service provider in ICT and education, awarded the project the initial kick-off grant.

Digital excavations: faster, more accurate and in 3D

Details of the study

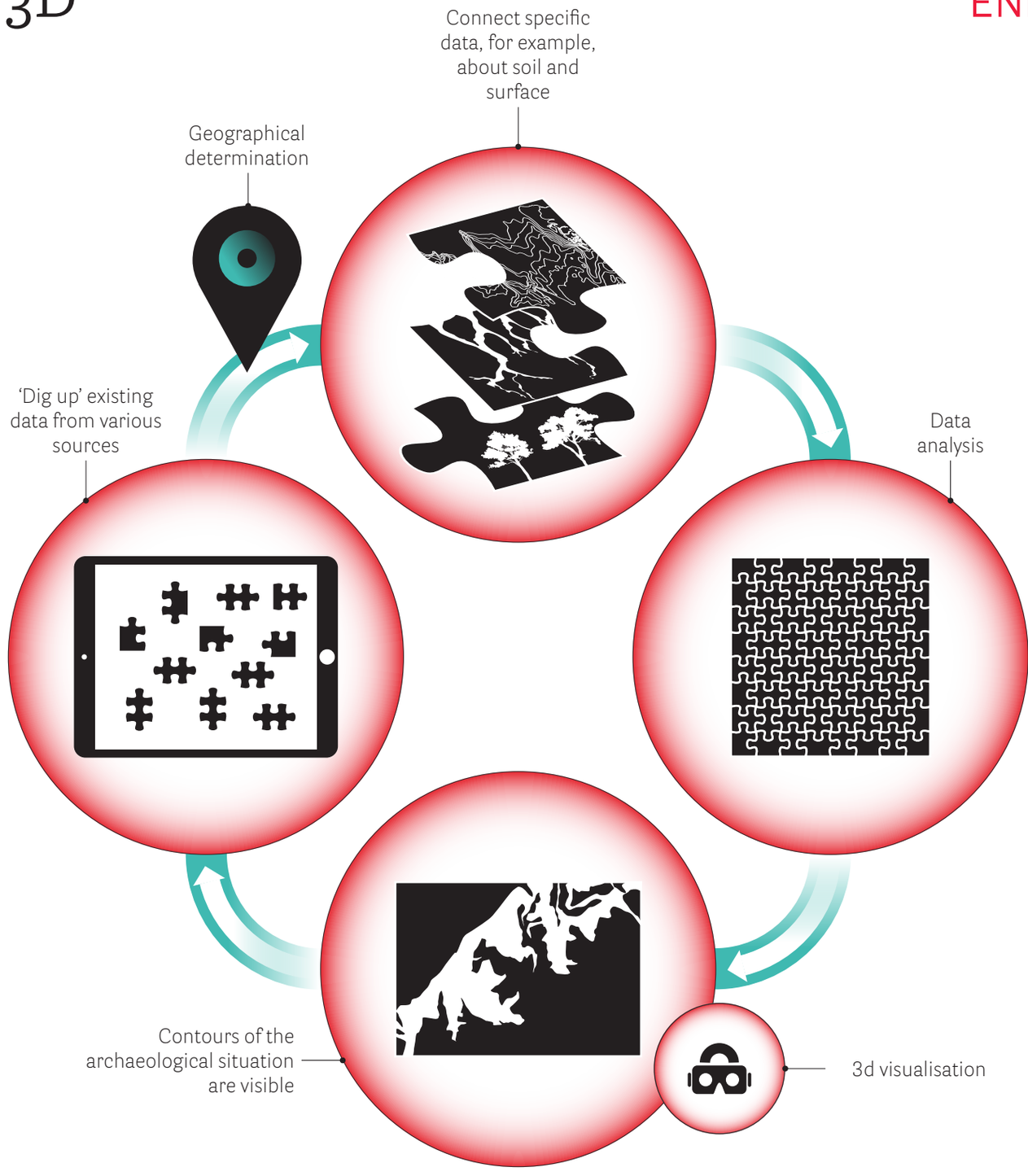
Since 2006, the Groningen Institute of Archaeology of the Faculty of Arts of the University of Groningen has been exploring Crustumerium, an ancient settlement just north of Rome. The researchers retrieve information about this Iron Age settlement from excavations with the help of digital techniques. When 'excavating digitally', the researchers first map out the area systematically. They link specific data to this map, such as information about the surface's magnetic characteristics that disclose structures showing the outlines of a historical discovery. All connected data is used to make a 3D visualization of what is beneath the surface, enabling a 3D tour of for instance a chamber tomb at Crustumerium.

In everyday practice

With the digital techniques the researchers can excavate faster and more accurately. A 3D reconstruction helps them to answer historical questions about a building's construction or the visual lines inside a city. Such a reconstruction also gives archaeologists something to hold on to in their further approach of an excavation.

Joint opportunities

The Roman soil leaves much to be discovered about the Crustumerium in the future. The University's research team, together with its partners secures the high level of the archaeological project. One of its partners is the University's Center for Information Technology (CIT). This ICT expertise centre helps to collect data and to link the data, and it creates the 3D visualizations. The researchers also collaborate with commercial companies such as Eastern Atlas (Berlin) and GeoRes (Rome); they provide the primary data to map the subterranean structures before the excavations start.



'DIGITAL TECHNIQUES ENRICH OUR WORK'



Professor Peter Attema
Faculty of Arts of the University of Groningen

'The Crustumerium project has expanded enormously since its start in 2006. In 2010, we received a grant from the Dutch Research Council (NWO), which allowed us to experiment with new digital techniques. They enrich our work: we can work much more precisely and faster to uncover the subterranean history. Crustumerium is extra challenging. Such an ancient pre-Roman settlement is much harder to map than, for instance, a Roman city, which has a predictable layout. That is why the help of 3D techniques is extra important for this project.'

Project partners

University of Groningen, Center for Information Technology (CIT) of the University of Groningen, the companies Eastern Atlas and GeoRes, and the Soprintendenza Speciale Archeologia, Beni Culturali e Paesaggio of Rome.

Specifics

- In 2010, the project received a grant from the Dutch Research Council (NWO) of more than € 500,000.
- Are you curious to see a 3D chamber tomb at Crustumerium? Watch the video on www.crustumerium.nl.

Can we detect cognitive problems resulting from ageing or psychiatric problems with an app?

Details of the study

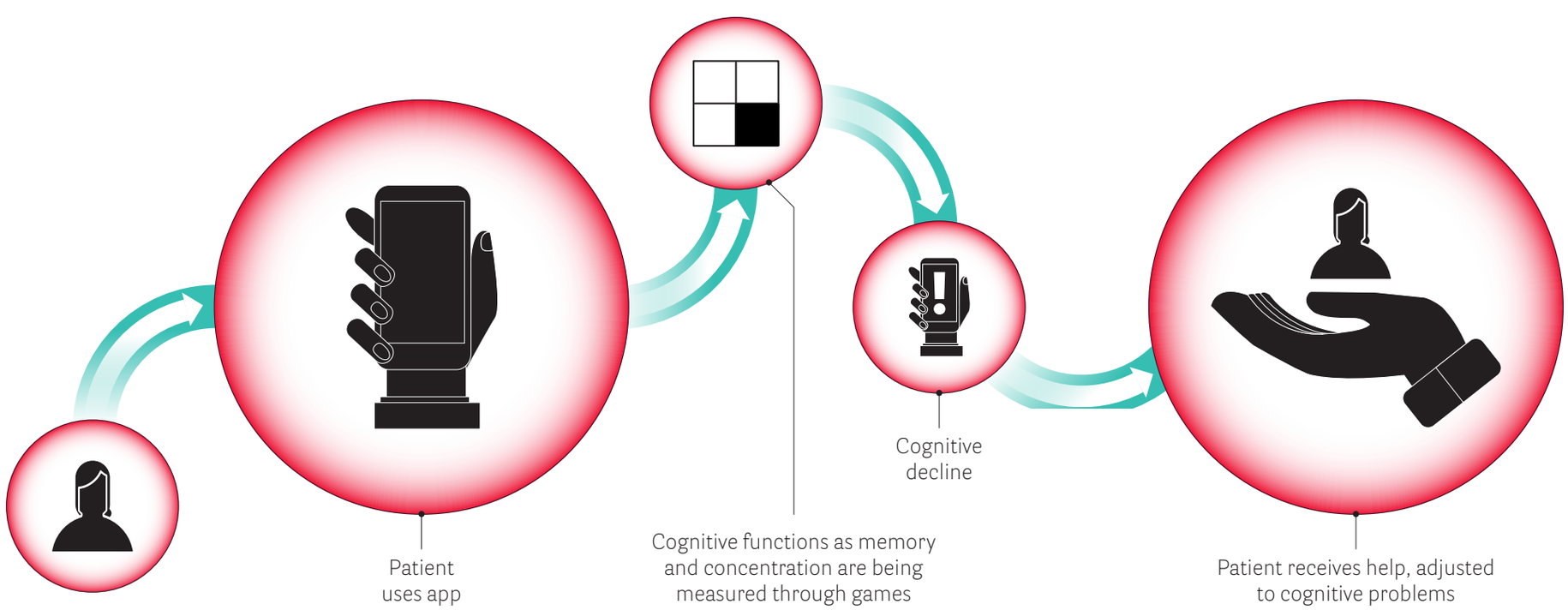
Cognitive problems, such as forgetfulness and reduced concentration, could be a precursor of depression. Researchers at the Faculty of Science and Engineering and the Faculty of Medical Sciences of the UG are developing an app to measure such cognitive problems and to test the possible connection with depression. The app comprises games that test cognitive functions such as concentration, memory and information processing. The games work in a similar fashion as tests in a laboratory, for instance by testing reaction speed. The researchers then compare the results of the games with the results of the more traditional laboratory tests. The only remaining question is whether cognitive problems can be linked to depression. To answer this question, the researchers test whether the game results of a person suffering from depression depend on their state of mind, and they use the scores of questionnaires about depression.

In everyday practice

The development of the app is still in progress. We aim to develop a system in which users who are afraid of cognitive decline or relapse can take the test periodically at home, and then the system learns their normal performance and when this performance suddenly drops. A decline in the subtle task measures could indicate (a relapse in) a depression, enabling intervention at an early stage, much before the more gross conventional measures could detect those.

Joint opportunities

The cognition app is now tested with human subjects in the University's laboratory. The next step for the researchers is to work with industry to make the app suitable for daily use. Researchers and industry together can turn the software into a user-friendly end product.



'TRACKING COGNITIVE FUNCTION ON A PHONE OFFERS SEVERAL POSSIBILITIES'



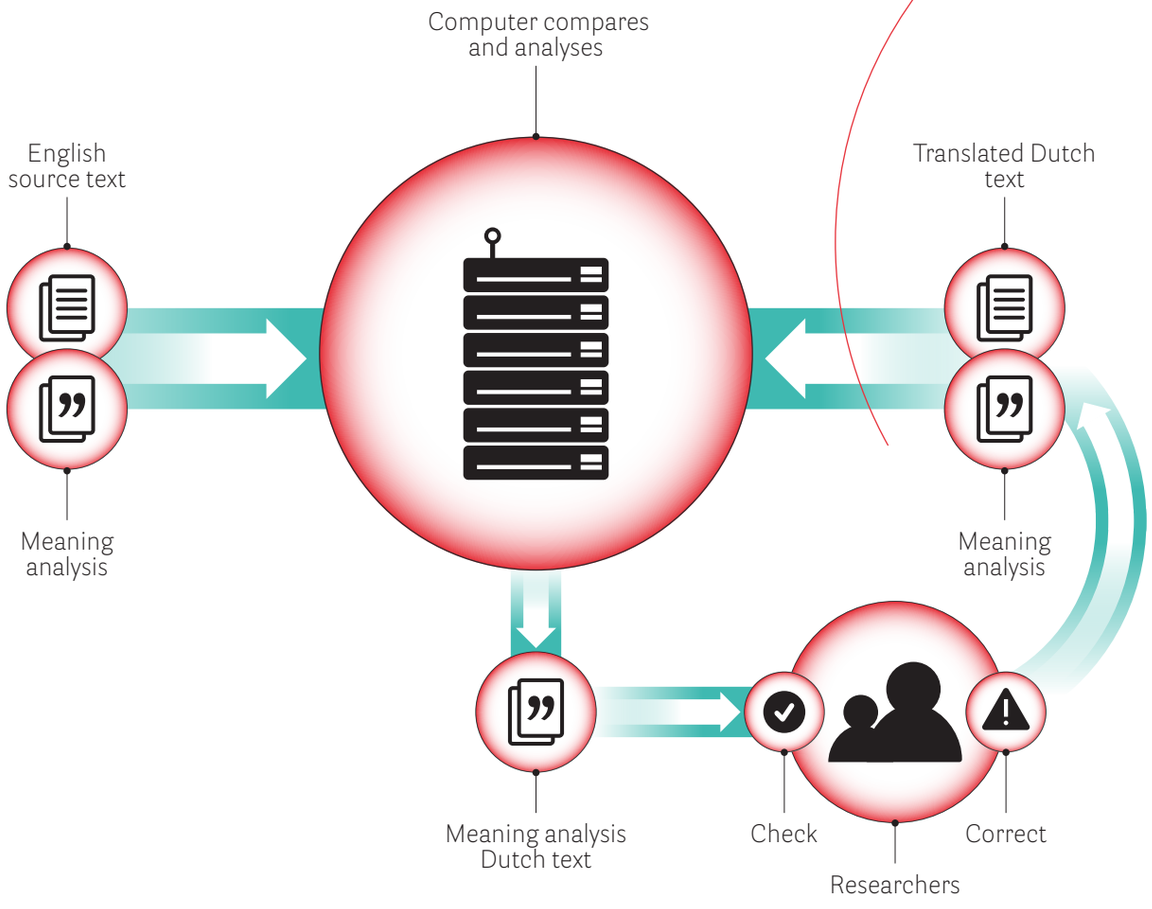
Assistant professor Marieke van Vugt and Assistant professor Marie-José van Tol
Faculty of Science and Engineering and Faculty of Medical Sciences of the University of Groningen respectively

'The app is still under development. We aim to create a user-friendly final version together with industry. We provide our expertise in measuring cognition in the lab, and ideas for how to transfer that to everyday life. For example, tests should not take up too much time but should generate sufficient data. It is also important that the app is attractive and works on all versions of Android and iPhone. To put it briefly: it should be easy to use. In this way, people can take tests at home, using their mobile phones, that before could only take place in the laboratory. Such easy accessibility offers other possibilities as well. Cognitive problems of the elderly may, for instance, predict the onset of dementia. In future, the app may help us to discover this at an early stage.'

Computer model checks meaning discrepancies in translations

Details of the study

When translating a text, the meaning must remain intact as much as possible. Consider for instance the instruction for the use of a parachute: a small change in meaning may have fatal consequences. Of course a translator can check the text for loss of meaning manually, but this can be tedious and time-consuming. That is why researchers of the Faculty of Arts of the UG try to find out how you can check automatically – and therefore faster – if a translation has retained its meaning. In the project Lost in Translation – Found in Meaning, they are developing computer programmes that show where the problems arise in a translation. This process is called bootstrapping.



Bootstrapping: how does it work?
Researchers at the University of Groningen use existing translations when developing computer models, for instance from English (source text) to Dutch (translated text). They already have a meaning analysis for the English source texts: what is the meaning of each word of a sentence and how are they related. The computer is then fed this English text and the meaning analysis. The translated text, in Dutch, is the output. The model compares, learns, and, after some time, can analyse the meaning of the Dutch text. The researchers check and correct this analysis and present the computer with the corrected text as input. The computer compares again, learns and comes up with a new meaning analysis. This process – called bootstrapping – makes a computer model work better each time so that in the end it can check where the problems arise in a translation.

In everyday practice

The computer models are being developed and at the moment, the first models are available for translations in English, German, Dutch and Italian. That means that the first few steps have been taken to automatically check the translated texts for retention of meaning. In addition, the project yields a database of texts and their analysed translations, suitable for further research into connotation analysis and language technology.

Joint opportunities

The researchers at the University aim at further improvement of the computer models, which is quite a challenge as many languages differ in, for instance, the sentence structure. That is why the University of Groningen puts the software and database at the disposal of other scientists, allowing knowledge institutes to collaborate better. The researchers also see opportunities for cooperating with other partners, such as companies in the language technology industry. The translation tools used by such companies become better all the time, but still make mistakes in meaning. The researchers hope to develop new computer models to uncover such mistranslations automatically.

‘AUTOMATICALLY CHECKING MEANING IS A VERY COMPLEX PROCESS’



Professor Johan Bos
Faculty of Arts of the University of Groningen

‘To check if the meaning of a sentence remains intact, you must know exactly what happens in a sentence. Consider for instance the simple sentence “Ze rammelde van de honger”, and its English translation “She was very hungry”. The sentences roughly mean the same but have a completely different structure. And yet the computer programme must produce a meaning analysis in which the female is hungry, and must note that it is a condition in the past. It shows you: computerizing a meaning analysis is an incredibly complex task.’

Specifics
- For this project, the Dutch Research Council (NWO) awarded professor Johan Bos a so-called Vici grant of € 1.5 million.
- This year, the researchers received the AI for Everyone Challenge Award from the American company Figure Eight. It enables them to use the company’s machine learning platform to train computer models, in particular to distinguish metaphors from literal meanings in sentences.

Influencer marketing: What about the law?

Details of the study

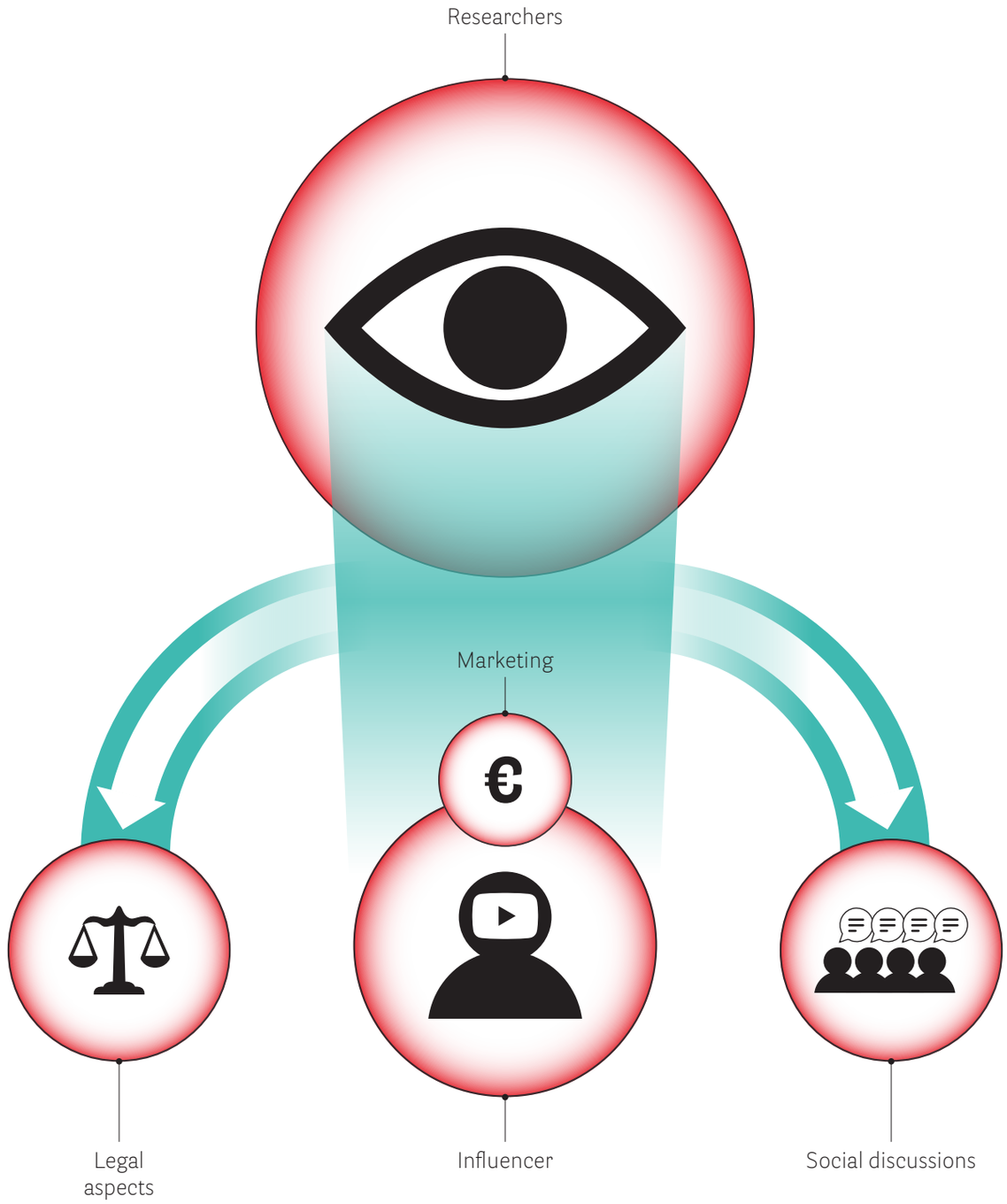
Influencers are ordinary people with thousands of followers on social media. They personally recommend products and give online advice about for instance sports, nutrition or make-up products. Companies deploy these influencers more and more to promote products and services, the so-called influencer marketing. But to what extent is this legally allowed? And what about the responsibility of the online platforms that act as a stage? Researchers at the Faculty of Law of the University of Groningen collaborate with those at Maastricht University, for instance by following several popular users of Instagram: how do they present themselves, what recommendations do they make and how do their followers respond to these?

In everyday practice

This project offers a critical view of the legal aspects of influencer marketing. The researchers would prefer the authorities to act on it and regulate this type of marketing better. It is important for the companies as well: they may offer their products and services within the limits of the law. Except for the judicial side, the researchers also envisage a social outcome: creating awareness. They would like to see that consumers and parents realise that influencers affect their followers' buying behaviour and lifestyle.

Joint opportunities

As part of the project, the researchers organise meetings for academics, teachers in primary and secondary education and influencers to exchange knowledge and experiences. It gives all parties the opportunity to gain an understanding of influencer marketing and the way our society should deal with it from both a legal and social angle.



'THERE'S MUCH TO BE GAINED LEGALLY'



Professor Sofia Ranchordás and assistant professor Catalina Goanta
Faculty of Law of the University of Groningen and Faculty of Law of Maastricht University respectively

'One of the issues we are investigating is: when are you an ordinary consumer and when are you an influencer? The dividing line between the two is thin and not recorded anywhere, but makes a distinction from a legal point of view. Influencers often get paid for promoting a product, and advertising law should enforce this to be disclosed. Another pressing issue concerns the responsibility of social media platforms. These offer influencers a stage for spreading advice among a large audience. But what if these bits of advice turn out adverse because of a lack of expertise? The platforms now operate purely as a medium and often cannot be held accountable. The question is whether this can be upheld from a legal point of view.'

Project partners
University of Groningen and Maastricht University

Specifics
At the beginning of 2018, the project received a grant from the British Independent Social Research Foundation to organise a workshop about influencer marketing.

The Dead Sea Scrolls: ancient documents, modern techniques

Details of the study

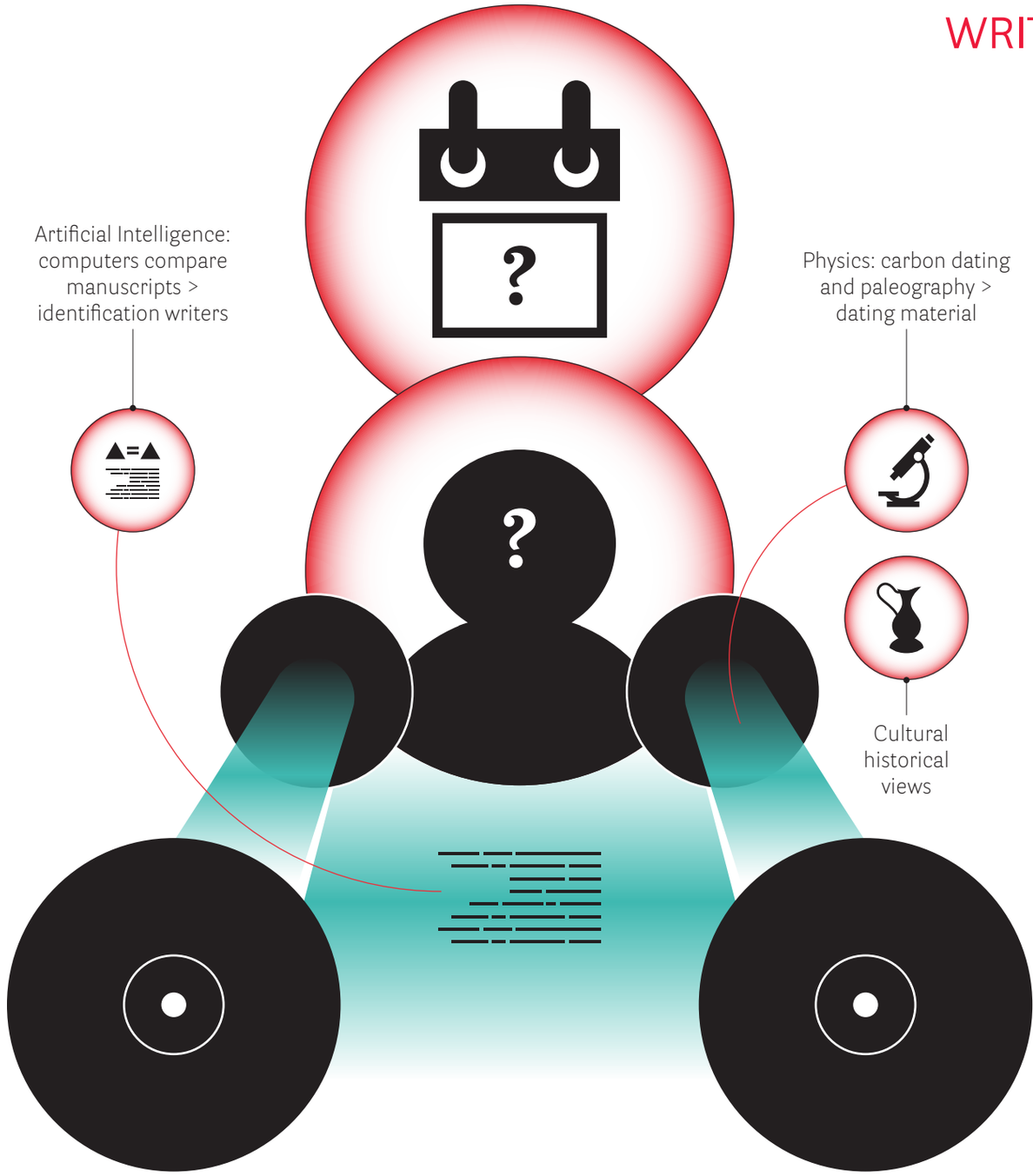
The Dead Sea Scrolls are hundreds of ancient documents, including texts from the Old Testament. They were found sixty years ago in the Qumran Caves, less than two kilometres from the western shore of the Dead Sea. The University of Groningen is one of the few universities that the Israel Antiquities Authority allowed to do new research on fragments of the scrolls. The Faculty of Theology and Religious Studies started the project The Hands That Wrote The Bible for it, in which the researchers try to find an answer to the question: Who wrote the Dead Sea Scrolls and when? They use modern techniques, such as artificial intelligence and carbon dating combined with palaeography.

In everyday practice

Some of the texts overlap with the Old Testament and thus with the Hebrew Bible. These are the oldest scrolls of the Old Testament ever found. They offer our society a unique understanding of the way of thinking and the writing culture of the people who wrote the Bible.

Joint opportunities

With this project, the University looks beyond the boundaries of scientific disciplines. The researchers combine cultural historical views with artificial intelligence and physics. Together they take major steps towards the answers. The researchers of the Faculty of Theology and Religious Studies collaborate for instance with those of the Faculty of Science and Engineering, who developed a self-learning algorithm. A computer uses the algorithm to compare anonymous fragments of the Dead Sea Scrolls with pieces of text by a known author. Both faculties also cooperate to find out the age of the documents, for instance with a sensitive particle accelerator that examines the composition of the materials.



‘THE COMPUTER CHECKS FOR A WRITING STYLE MATCH’



Professors Mladen Popovíc and Lambert Schomaker
Faculty of Theology and Religious Studies and Faculty of Science and Engineering of the University of Groningen, respectively.

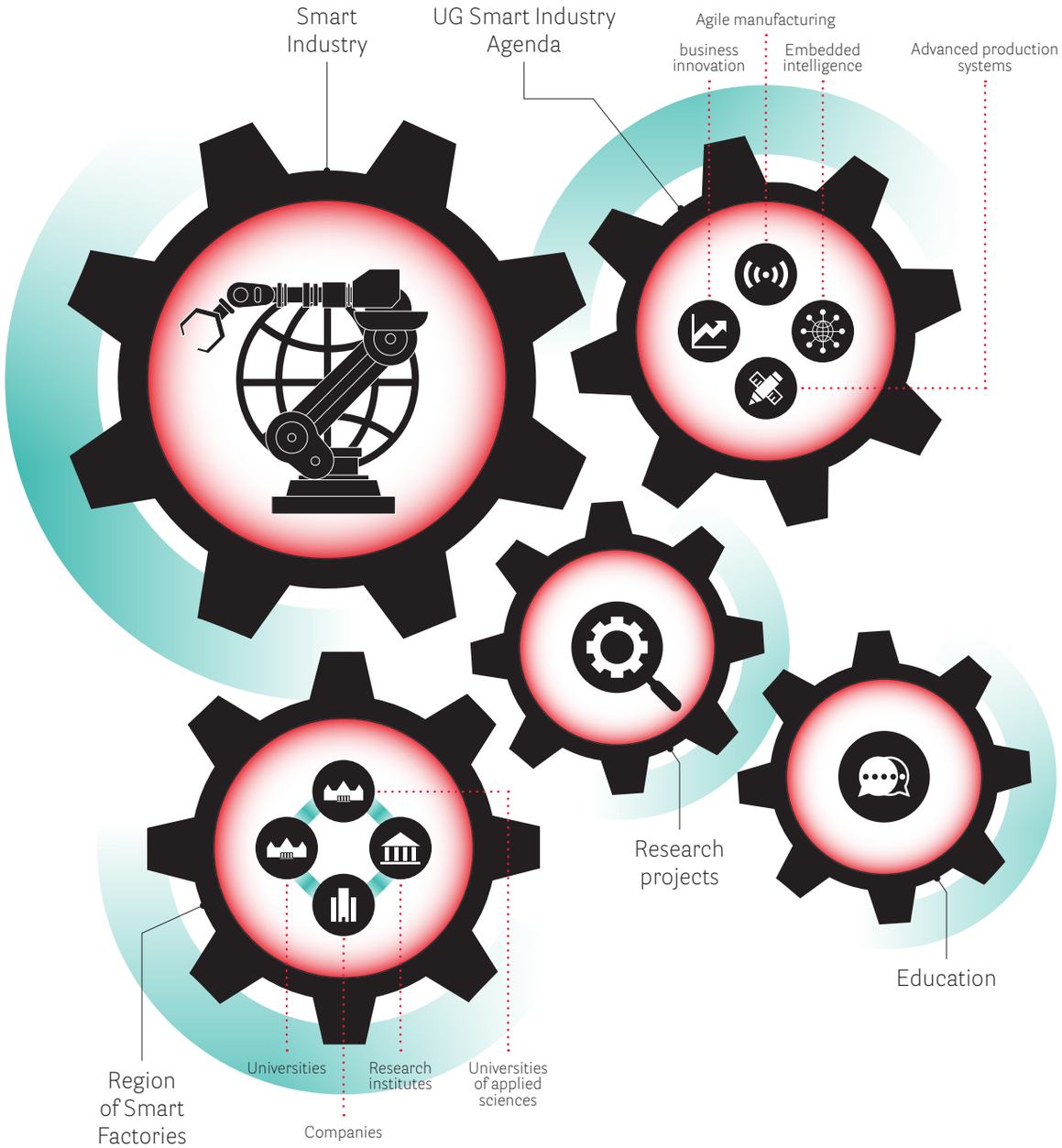
‘It is difficult to distinguish the various handwritings of the Dead Sea Scrolls with the naked eye. They have the same writing style and details which are hard to tell apart. That’s why we use a so-called self-learning algorithm. We know who the author is of some of the pieces. The computer uses the algorithm to find a fragment with a strong match. If the Qumran Institute of the University of Groningen confirms that the identity of the author is the same, the computer finds a third matching fragment. It is how the computer learns the algorithm and becomes more reliable in finding matching fragments.’

Professor Hans van der Plicht (Faculty of Science and Engineering) is closely involved in the project for carbon dating.

Project partners
University of Groningen, Israel Antiquities Authority (IAA), KU Leuven, University of Southern Denmark (Odense) and Università di Pisa.

Specifics
In 2014, the project received a € 1.5 million grant from the European Research Council and in 2016 a grant of € 500,000 from the Dutch Research Council (NWO) and the Research Foundation – Flanders (FWO).

Collaborating on smart industry



Collaboration

Smart industry is about far-reaching digitalisation of industries: products become intelligent and production processes learn to correct themselves. Forty partners, including knowledge institutes, companies and non-profit organisations have set up the Region of Smart Factories (RoSF) to develop a smart industry in the North of the Netherlands. The University extensively cooperates with several projects in the RoSF. In addition, the University has compiled the research agenda Smart Industry together with the business community. The research cooperation combines the latest developments from business administration, economics, engineering and natural sciences. Key issues are business innovation (including new revenue models); new and adaptive production processes (including self-regulating processes); efficient, demand-driven manufacture (custom-made) and integrated intelligence (including the internet of things).

In everyday practice

In the area of smart industry changes occur at high speed. The RoSF enables the northern region to implement and further develop the concepts of smart industry. The northern collaboration also provides a boost to employment. The development of smart industry will make specific tasks in the workplace redundant, but they are being replaced by new work, e.g., in ICT. Students of the University of Groningen will have ample opportunity to work with smart industry, for instance in educational programmes such as Industrial Engineering and Management and Supply Chain Management. In addition, the new Master's degree programme Mechanical Engineering will have a specialisation in Smart Factories. In this, the University collaborates with Frisian partners, in particular the Innovation Cluster Drachten and Campus Fryslân.

Joint opportunities

An interdisciplinary approach of smart industry offers plenty of opportunities for companies and organisations. Take the subject of the internet of things. It enables all sorts of devices to work through the internet without a person actually operating them, e.g., a machine in a factory that indicates maintenance must be performed and automatically schedules an appointment. From a technical point of view you may wonder what would be the best place for a sensor and from the business administration perspective you may consider how such a machine would affect the operational processes. Another angle would be the social perspective by focusing on the impact on the labour market.

'WORKING ON THE NEW GENERATION OF DIGITAL TWINS'



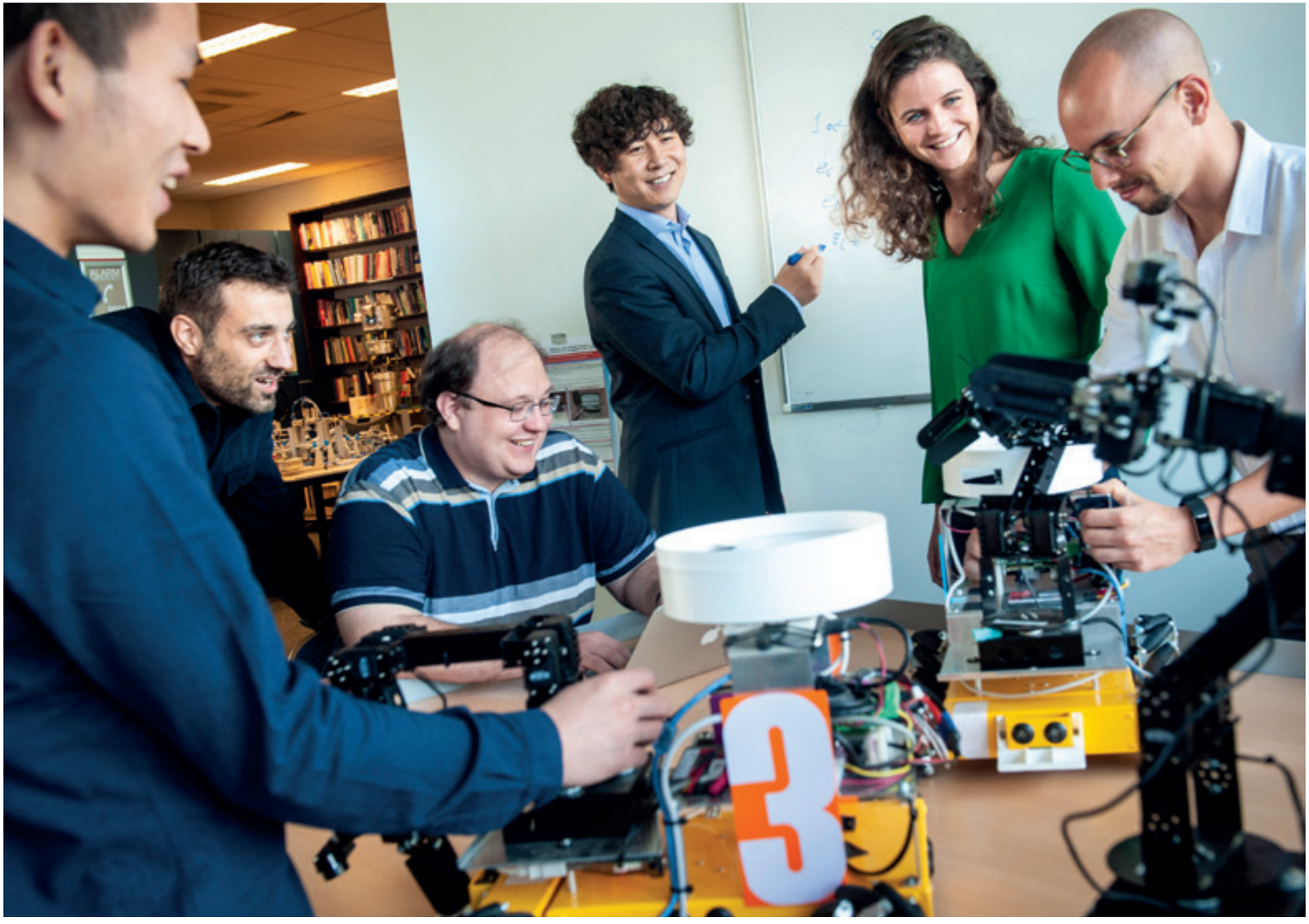
Professor Jacquelien Scherpen
Faculty of Science and Engineering of the University of Groningen

The representative of the University in the Region of Smart Industries and responsible for the University's Smart Industry Agenda.

'One of our research projects addresses the concept of digital twins. It is a virtual copy of a physical product or production process that allows you to constantly work on improvement: to prevent disruptions, to develop innovations more quickly, etcetera. Up to now, such digital twins have always been based either on computer models or digital data from for instance the production process. We integrate these two methods for the next generation of digital twins. In that way, you will have digitally mapped the basis of a product or production process, which you can constantly optimise using real-life data.'

Project partners
University of Groningen and 40 partners (large and small companies, non-profit organisations and knowledge institutes).

Specifics
The Region of Smart Factories is an official field lab for which the northern provinces of Fryslân, Groningen and Drenthe contributed about € 21 million.



In the **Discrete Technology & Production Automation (DTPA) lab** of the Engineering and Technology Institute Groningen (ENTEG), which is part of the University's Faculty of Science and Engineering, studies are performed how robotic networks cooperate. Examples are that these robots scan an area from above for forest fires or that they transport objects together (cooperative transport).

Research and education

3

The University of Groningen widely uses digital technologies in its scientific research and teaching. Furthermore, it aims at the development of new technologies and research into the impact of digitalisation on our society. Research centres have a prominent position in it, and researchers of various disciplines cooperate in it. The University offers several programmes, training and courses that include digitalisation. They are not only meant for the students, but also for students in secondary education, senior citizens and professionals from the business sector.

CogniGron: computers based on the principles of the human brain

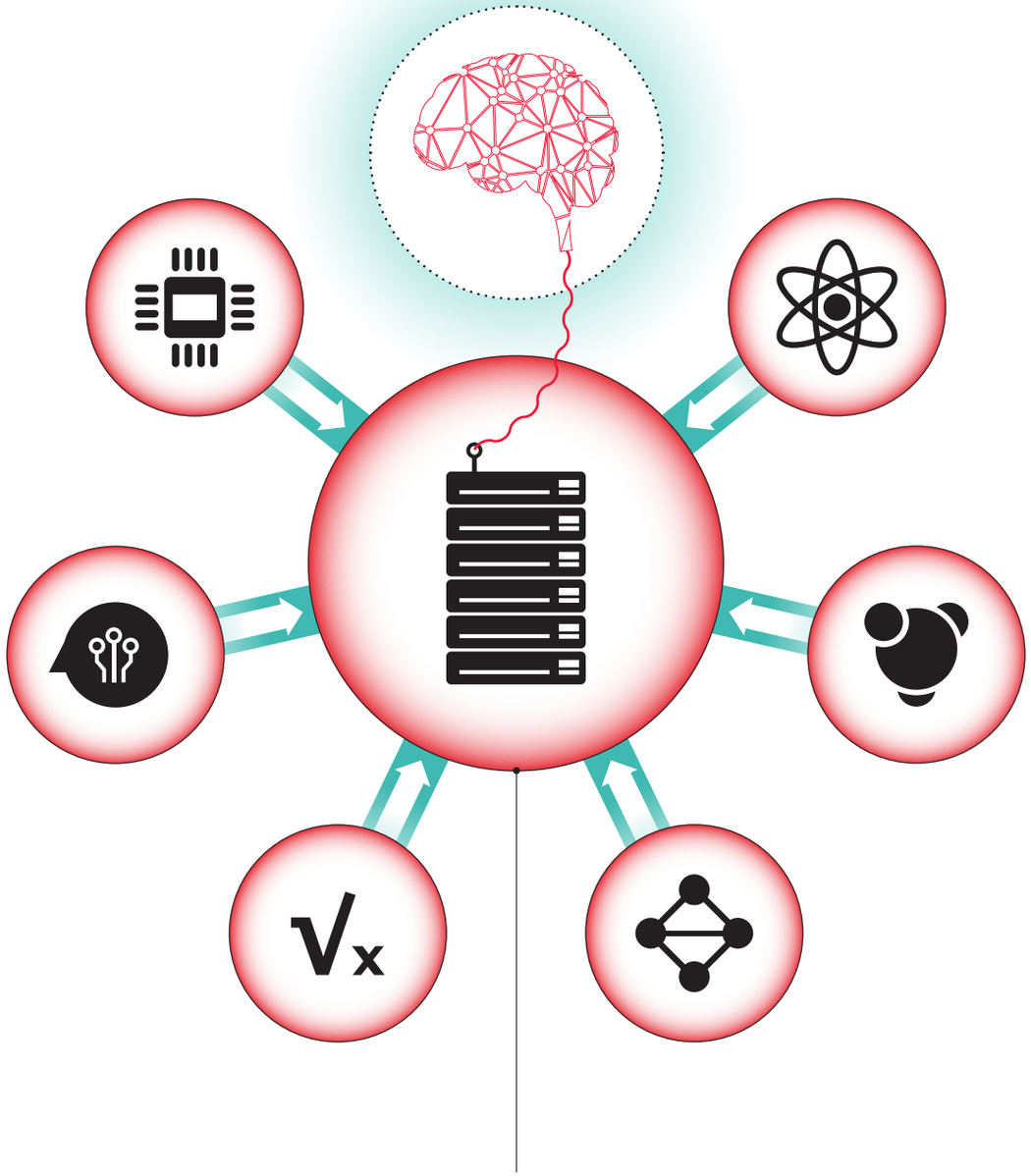
One of the University's research centres is the Groningen Cognitive Systems and Materials Centre, CogniGron for short – embedded within the Faculty of Science and Engineering. A holistic approach that coordinates efforts in materials science, physics, mathematics, computer science and artificial intelligence to develop new materials and systems for the advancement of a cognitive computers. In other words, a computer that is based on the principles of the human brain.

Mimic

A computer that works in a similar fashion as our brain: how should we imagine this? "Our brain is capable of performing many observations at the same time" says Professor Beatriz Noheda, Scientific Director of CogniGron. This is mainly due to the fact that our brain consists of a complex network of around 9x1010 neurons and 1.5x1014 connections in between them (synapses) through which the data is processed. In contrast, current computer technology is not capable or processing multiple observations in parallel. Moreover, our brain has the ability to adapt that allows for learning. In our research centre we design, create and analyse self-learning materials at the nanoscale that will perform the tasks that are now assigned to thousands of transistors and complex algorithms in a more efficient and straightforward manner, hence, forming the basis for a new generation of computer platforms for cognitive applications, such as pattern recognition and analysis of complex data. It forms the foundation of the computer that operates more and more like the human brain."

What to expect in the future

Our society is increasingly dependent on the ever larger and more complex streams of data that we generate. Noheda: "without knowing, a program like Netflix already makes use of big data to give us recommendations for movies or series. A normal computer is not sufficient for such a task and therefore supercomputers are used to handle big data. Existing computer technology is, however, not well equipped to extract useful information from unstructured data, resulting in a highly inefficient process and resulting in the IT sector being already responsible for over 10% of the world energy consumption. A cognitive computer offers a solution, as cognitive computers can be much more efficient. At CogniGron we try to develop cognitive computing, material and systems that learn by doing, getting better and smarter with every task.



Scientists of various disciplines join forces to develop a cognitive computer based on the human brain. Contrary to an ordinary computer, it can process data from several observations simultaneously.

Research centres: Collaboration brings innovative solutions

Developments in science often arise at the interface between disciplines. Such is the case in the development of new digital techniques or research into the impact of digitalisation on our society. The University of Groningen unites parties from various disciplines to perform multidisciplinary and interdisciplinary research. The research centres are pivotal in this. These centres offer facilities, networks and other amenities to academics who, together with other parties (government bodies, companies, non-profit organisations, knowledge institutions and members of the public), are engaged in question-driven fundamental research. This page presents several research centres of the University in which various disciplines cooperate in themes such as designing digital technological solutions for societal challenges. They also examine the impact of digitalisation on our society.

GRONINGEN DIGITAL BUSINESS CENTRE (GDBC)

THE PARTNERS INVOLVED
The UG's Faculty of Economics and Business and Faculty of Science and Engineering, and the Noordelijke Online Ondernemers (Northern Netherlands Online Entrepreneurs).

WHAT DOES THE GCDB HAVE TO OFFER?
Operating within the framework of the GDBC, the University of Groningen and the Noordelijke Online Ondernemers are helping to strengthen the structure of the digital sector in the northern region of the Netherlands. This involves knowledge development, training young professionals for careers in this sector, and sharing knowledge with companies in the digital sector.

GRONINGEN ENGINEERING BUSINESS CENTER (GEBC)

THE PARTNERS INVOLVED
the UG's Groningen Engineering Center (GEC) and various cooperatives from the northern region of the Netherlands, representing around 150 technologically-oriented companies.

WHAT DOES THE GEBC HAVE TO OFFER?
The GEBC directly pairs research questions from the business community with the range of teaching and research services offered by the UG. This ensures that a research question from industry is immediately taken up by the GEC research group that is best equipped to handle it. It also means that any students who are on the lookout for an internship or graduation project can more quickly find a company in the northern region of the Netherlands that matches their field and area of interest.

Are you curious to know which organisations collaborate with this and other centres? www.rug.nl/industry-relations contains a list of many interesting examples.

ALETTA JACOBS SCHOOL OF PUBLIC HEALTH (KORTWEG: ALETTA)

THE PARTNERS INVOLVED
The University of Groningen and the University Medical Center Groningen.

WHAT DOES ALETTA HAVE TO OFFER?
Aletta is rooted in fundamental research and is devoted to living a longer, healthy life. With its societal partners, it exchanges knowledge and expertise, monitors and evaluates policies and develops educational and research programmes. Furthermore, Aletta has a key part in combining and clarifying real-world health data. These can be the data of a large group of individuals with the same characteristics, but also the data accumulated by individual persons.

GRONINGEN CENTRE FOR DIGITAL HUMANITIES

THE PARTNERS INVOLVED
The UG's Faculty of Arts, Faculty of Philosophy, and Faculty of Theology and Religious Studies

WHAT DOES THE GRONINGEN CENTRE FOR DIGITAL HUMANITIES HAVE TO OFFER?
This UG interdisciplinary institute specialises in digital research methods. It encourages innovative research projects that link the humanities with computer sciences and information sciences. The Centre provides research infrastructure for various academic themes, ranging from media studies to archaeology. Since 2016, this institute has also been offering students a Master's degree programme in Digital Humanities.

GRONINGEN CENTER OF EXPERTISE FOR LANGUAGE AND COMMUNICATION DISORDERS (GELC)

THE PARTNERS INVOLVED
The Faculty of Behavioural and Social Sciences, the Faculty of Arts and the Faculty of Medical Sciences of the University, and the University Medical Center Groningen.

WHAT DOES THE GELC HAVE TO OFFER?
The GELC conducts multidisciplinary research into language and communication disorders of children and adults. Digitalisation plays an important part, e.g. the centre has developed a web-based programme to generate news texts that match the individual reading ability of people who suffer from the language disorder aphasia. Another example is the development of the app version of the so-called Token Test, a test used to identify language disorders.

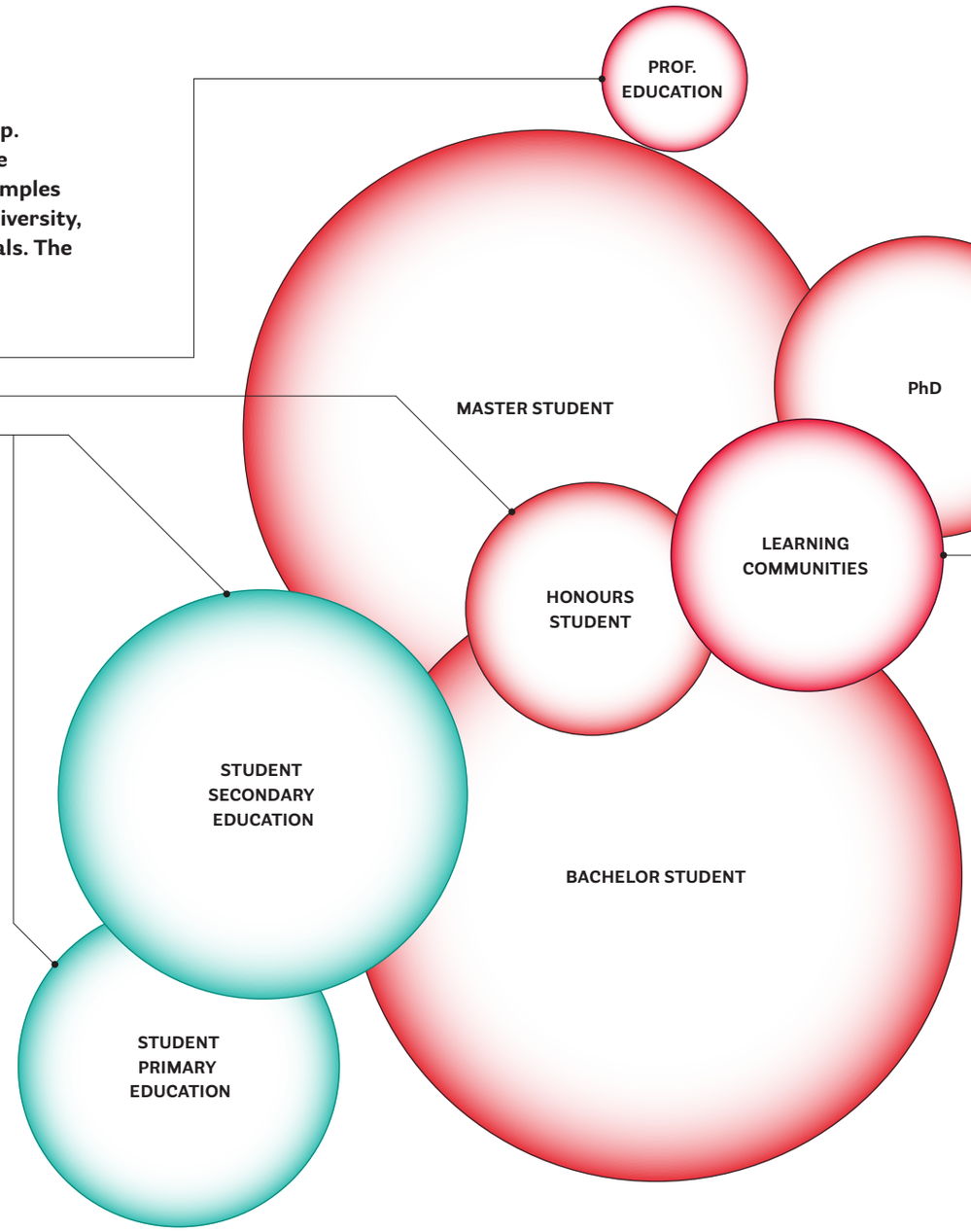
Education: lifelong learning

The University of Groningen offers young and old the opportunity to develop. Besides its 48 Bachelor's degree programmes and over 100 Master's degree programmes, the University has a wide range of training programmes. Examples are the so-called PhD programmes to obtain a doctorate, the Children's University, the "Scholierenacademie", the Senior Academy and courses for professionals. The University of Groningen is the place for lifelong learning!

PROFESSIONAL EDUCATION
The University of Groningen Business School (UGBS) is one of the institutes that support professionals in their professional development, aiming at both personal growth and organisational profits.

HONOURS STUDENT
The Honours College offers talented students the opportunity to challenge themselves even more by offering an extra programme that is followed in addition to their regular Bachelor's or Master's degree programme. An example is the Honours Master High Tech Systems and Materials. The main aim of the Honours Program is to develop talent and initiative.

PRIMARY AND SECONDARY SCHOOLS
The "Scholierenacademie" organises content-related activities for students in primary and secondary education, such as the web classes for grades 5 and 6 of pre-university education. During a four-week course they get to know the University's Bachelor's degree programmes, such as Business Administration, History or Artificial Intelligence.



LEARNING COMMUNITIES
Learning Communities are groups of students and teachers that collaborate in assignments that challenge them to share their expertise and learn from each other. The communities may take various shapes. They can vary in group size, subject and duration (subject, term or academic year, or after graduation as a circle of alumni).

'The ultimate challenge of our field is the huge information density caused by increasing digitalisation. The trick is to penetrate that abundance to come to the core and to separate relevant information from all dead weight that damages the quality of the report.'

Ralph ter Hoeven, Professor of Financial Accounting at the University and, also in that capacity, a lecturer at the Executive Master of Finance and Controlling of the Business School.

Source: www.rug.nl/feb-for-business/business-school

'Using digital learning tools, such as Perusall and Peerceptive, helps students to prepare for class, have online discussions and get peer feedback. This not only increases their performance, but also makes them more engaged.'

Jan Riezebos, Professor of Educational Innovation at the Faculty of Economics and Business of the University of Groningen

Source: final report University project on interactive digital learning tools in large-scale education, September 2018

'I (...) think that this web class has been an improvement for my English and this will come in handy, no matter which program I'll follow next year.'

Max Verhaar, participant web class Media Studies

Source: survey University, 2017

'To get to solutions, we often have to code computer programs to analyze data or solve complex mathematical optimization problems. My initial thought was 'that's really cool', but I was also intimidated because it sounded difficult. I decided to try it though, and studying Econometrics and Operations Research has changed my life. It was the first time I had to work hard to learn a skill, and conquering the challenges that you face during the programme is extremely satisfying.'

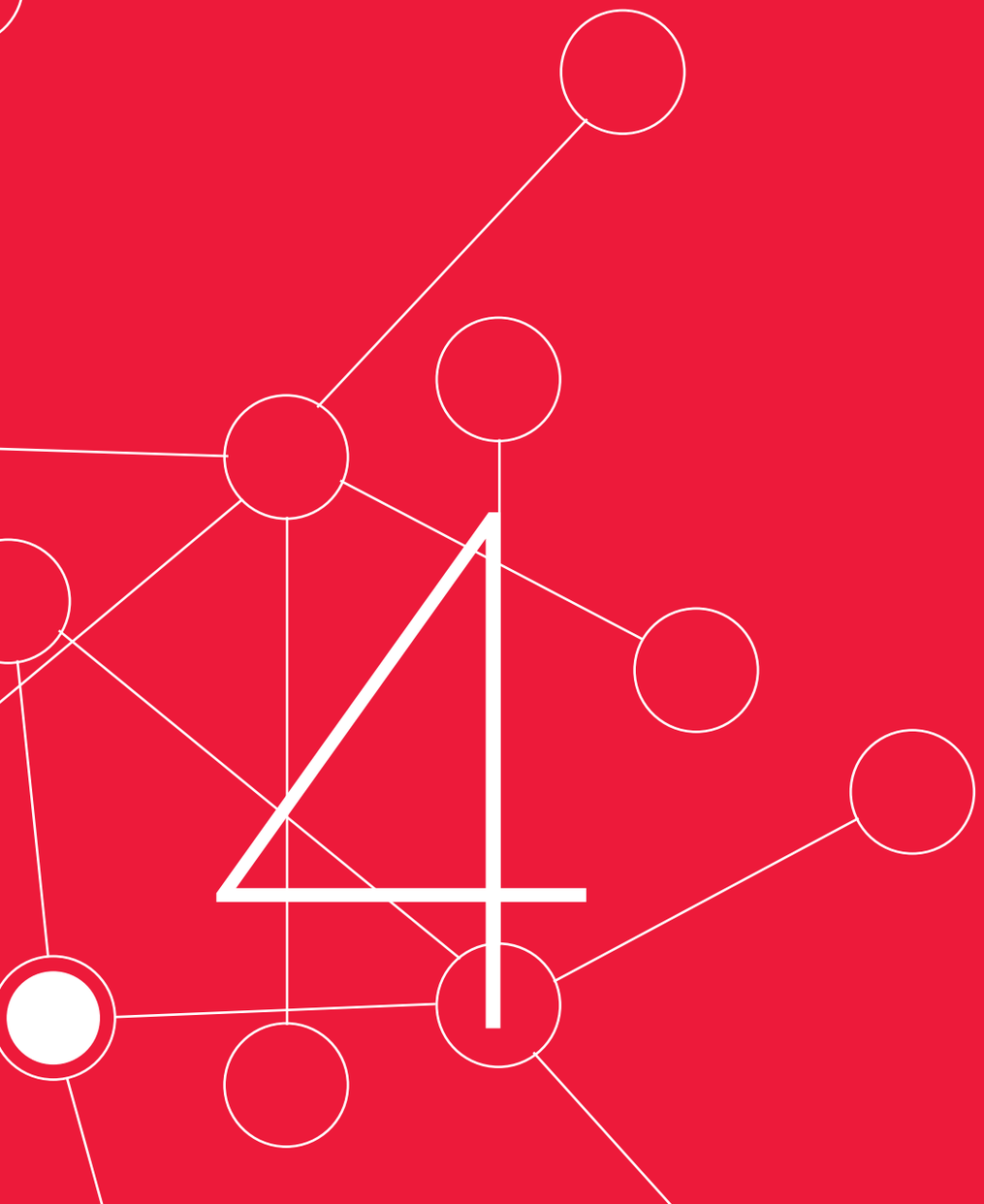
Shady El-Gewily, senior student Economics and Operations Research

Source: degree programme brochure, 2018-2019.



On **the GRAIL**, a sophisticated treadmill, convalescing patients learn how to rely again on their body and motor system in a safe and challenging environment. During a walk in a virtual world they must step over tree trunks and avoid bumps while the treadmill's movement follows the surroundings. The University Medical Center Groningen develops training applications for the GRAIL. Researchers of the Faculty of Medical Sciences examine this virtual type of convalescing.

Infrastructure and facilities



The University of Groningen offers its researchers and knowledge partners a high-level infrastructure and a wide range of facilities, varying from data management to pilots and from virtual reality to a campus where knowledge institutes, companies and other organisations meet. The possibilities are endless!

Fieldlab: the link between research and application

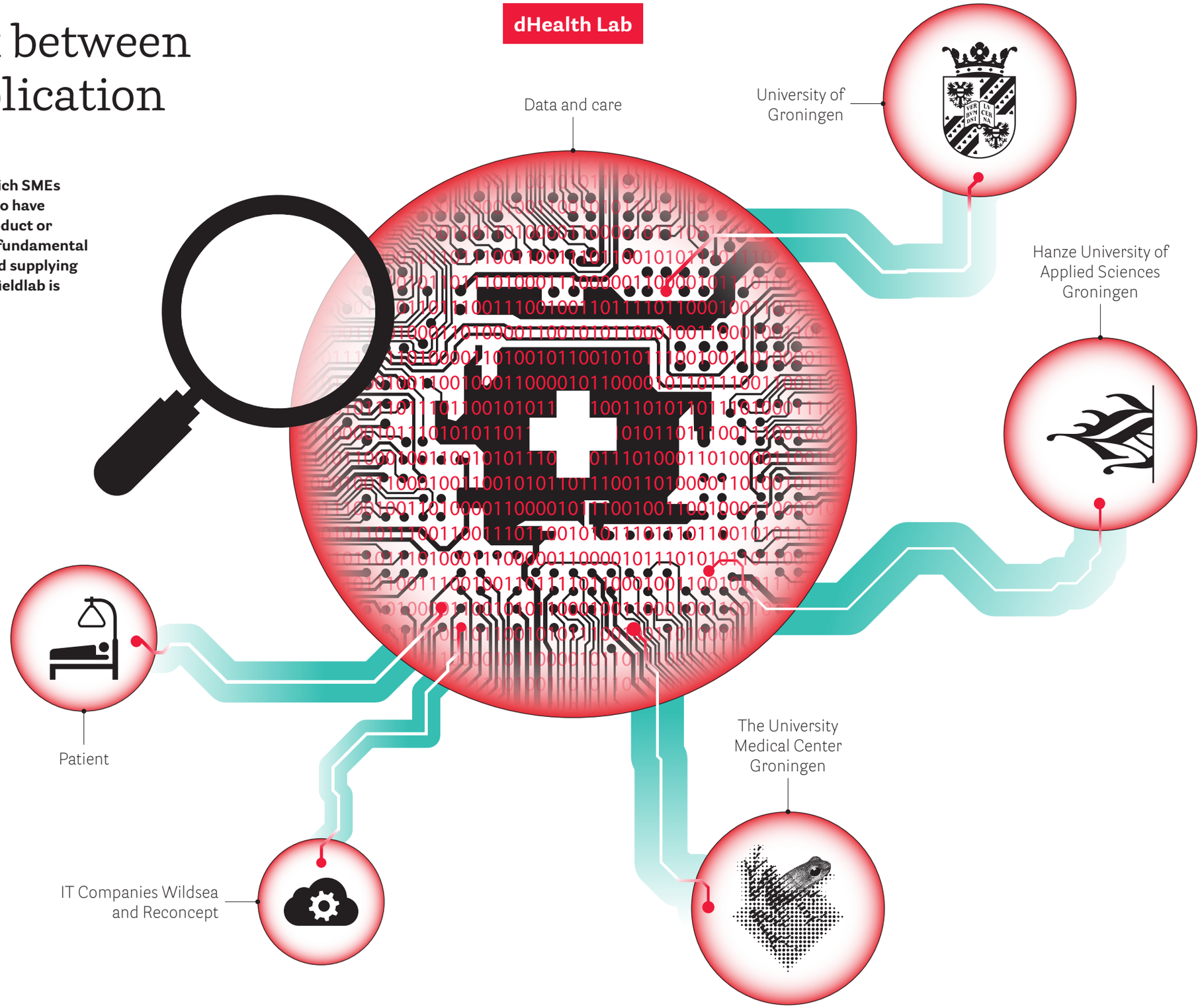
The University is a partner in several fieldlabs in which SMEs develop and test innovations. The joint objective is to have such innovations find their way into society as a product or service. The University contributes by carrying out fundamental question-driven research, sharing its knowledge and supplying infrastructure and facilities. An example of such a fieldlab is dHealth Lab.

What is dHealth Lab?

In dHealth Lab, companies, students, researchers, care professionals and end-users collaborate to test and refine innovations in the care and health sector in both a virtual and physical environment. If an innovation proves is successful, it can actually be marketed for end-users, such as civilians, patients, entrepreneurs and care professionals. The pilot is an alliance between the University of Groningen, the University Medical Center Groningen, Hanze University of Applied Sciences and the IT companies Wildsea and Reconcept.

Broad range of experiments

Except for dHealth Lab, the University collaborates in various other pilots, such as the **5G Fieldlab**. This pilot enables the SME sector to develop new 5G products and services, the next generation of mobile communication succeeding 4G. In the pilot **Mining Big Data**, the SMEs get support in making big data accessible and deploying it intelligently. This initiative, part of the so-called Target programme, received a grant of € 2 million of the Northern Netherlands Alliance (SNN). Another SME pilot received a € 360,000 grant from the SNN: **the innovation test lab of the energy platform Energysense**. This pilot offers the SME sector the opportunity to develop and test energy products and services for households.



Campus Fryslân

1 Frysk data lab

Campus Groningen

2 Zernike Campus Groningen

3 Healthy Ageing Campus

Groningen University Library

4 University Library City Centre

5 University Library Zernike

6 Central Medical Library

Groningen, other locations

7 dHealth Lab

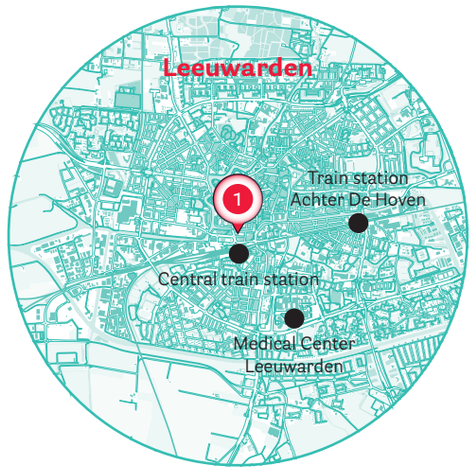
8 Center for Information Technology

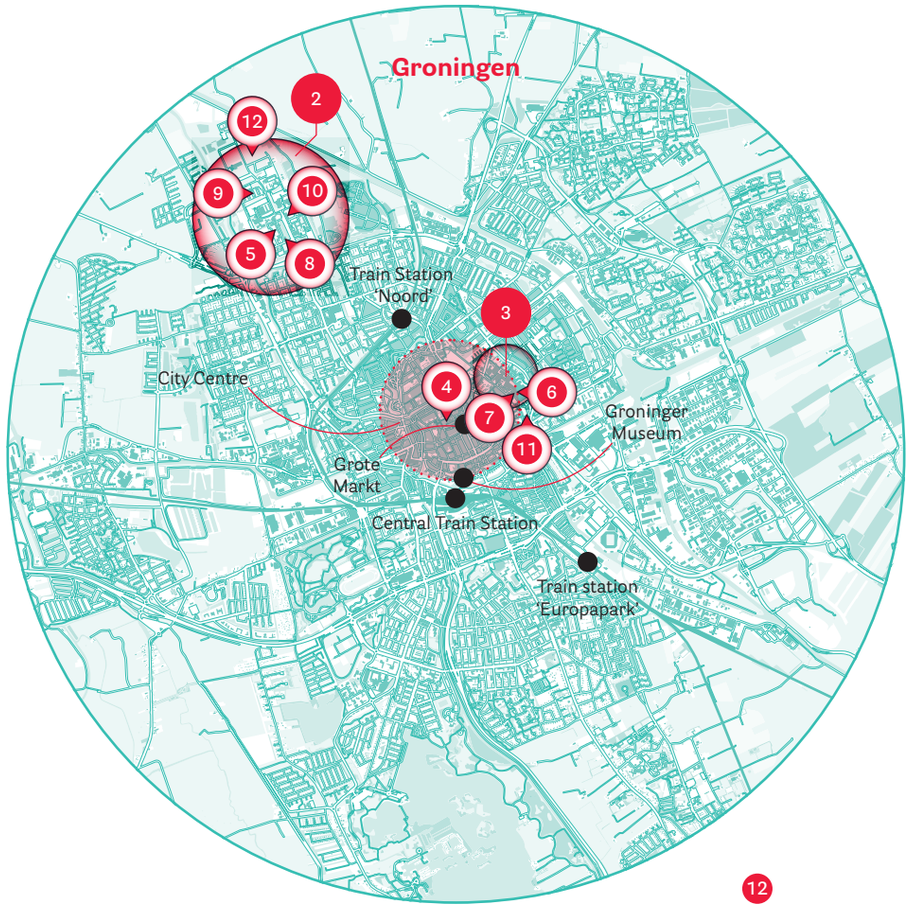
9 Northern Knowledge

10 Energysense

11 Carduso Capital

12 5G Fieldlab





1

FRYSK DATALAB

THE PARTNERS INVOLVED
the University of Groningen Campus Fryslân, NHL Stenden University of Applied Sciences and Van Hall Larenstein University of Applied Sciences.

WHAT DOES IT HAVE TO OFFER?
The Frysk datalab helps Frisian companies, knowledge institutions, government institutions and non-profit organisations to analyse the big data that they collect. This enables the UG, together with these parties, to conduct world-class research into big data and to create value for the organisation and for science. Once construction work on the datalab is complete, researchers and students will be able to analyse data by means of cutting-edge techniques.

2 3

CAMPUS GRONINGEN

THE PARTNERS INVOLVED
University of Groningen, University Medical Center Groningen (UMCG), Hanze University of Applied Sciences Groningen (UAS) and more than 190 companies (such as Siemens, AVEBE, Target Holding, Diagnoptics and Syncom) and facility providers (such as Innolab Chemie Groningen, the Zernike NanoLab Groningen, Energy Academy Europe and Cube050 – an incubator).

WHAT DOES IT HAVE TO OFFER?
Campus Groningen is the innovation engine for the northern region of the Netherlands. It targets public-private partnerships – with links to the region – that focus on growth. The campus has two adjacent locations, the Healthy Aging Campus and the Zernike Campus Groningen, both of which are managed as a single ecosystem for the purposes of collaboration. It is a place where knowledge institutions, companies, facility providers and students can encounter one another. The natural growth of this campus is sustained by ongoing increases in scale, by the professionalisation of business park management, by the acquisition of companies and by attracting large investment funds.

4 5 6

THE UNIVERSITY LIBRARY (UB GRONINGEN)

WHAT DOES IT HAVE TO OFFER?
UB Groningen (part of the UG) operates as a partner to those engaged in study and research. It is the principal information and study centre for students, UG academic and support staff and members of the public in the northern region of the Netherlands. The library can be subdivided into the University Library City Centre, the University Library Zernike, and the Central Medical Library.

7

DHEALTH LAB

THE PARTNERS INVOLVED
University of Groningen, University Medical Center Groningen and Hanze UAS Groningen, as well as Wildsea and Reconcept (IT companies).

WHAT DOES IT HAVE TO OFFER?
At dHealth Lab, companies, students, researchers, healthcare professionals and end users engage in collaborative projects aimed at testing healthcare innovations. They use both virtual and physical environments for this purpose. If an innovation proves is successful, it is then rolled out for end users (such as members of the public, patients, business people or healthcare professionals).

8

CENTER FOR INFORMATION TECHNOLOGY

WHAT DOES IT HAVE TO OFFER?
The Center for Information Technology (CIT; part of the UG) offers IT expertise and services to the UG, to companies and to other parties. It is also one of the leading academic parties in the field of big data.

9

NORTHERN KNOWLEDGE

THE PARTNERS INVOLVED
University of Groningen, University Medical Center Groningen (UMCG) and Hanze UAS Groningen.

WHAT DOES IT HAVE TO OFFER?
Northern Knowledge is a 'knowledge transfer office' for knowledge institutes and companies in the northern region of the Netherlands. For this purpose, the UG, the UMCG and the Hanze UAS Groningen have joined forces in the areas of valorisation and entrepreneurship. Northern Knowledge's services focus on patent management, expertise in the area of intellectual property, screening and scouting, facilitating business people and supporting business development.

10

ENERGYSENSE

THE PARTNERS INVOLVED
University of Groningen, Hanze UAS Groningen, EnTranCe, Energy Academy Europe and 10,000 Dutch households

WHAT DOES IT HAVE TO OFFER?
EnergySense facilitates the collection and storage of energy-use data from 10,000 Dutch households. This data specifically relates to factors such as attitudes and behaviour. Researchers, companies, government bodies and public organisations can access and use this big data for the purpose of research. They also have a special testing ground, where they can develop and test innovative products. This all has the same common objective – energy solutions for a sustainable future.

11

CARDUSO CAPITAL

THE PARTNERS INVOLVED
University of Groningen, Energy Academy Europe, Innolab Chemistry Groningen, EnTranCe, Carbohydrate Competence Center (CCC) and WaterCampus Leeuwarden.

WHAT DOES IT HAVE TO OFFER?
The business climate around the UG and the University Medical Center Groningen has fostered a growing number of initiatives by technology start-ups. These promising businesses are seeking venture capital that will enable them to grow. Carduso Capital gets involved in companies like this. In addition to funding, it also provides management support and strategic expertise.

12

5G FIELDLAB

THE PARTNERS INVOLVED
University of Groningen, Economic Board Groningen, Dutch Radiocommunications Agency, Ericsson, Huawei, Surf, KPN, Vodafone, TNO and Hanze University of Applied Sciences.

WHAT DOES IT HAVE TO OFFER?
5Groningen is the ultimate pilot for the latest generation of mobile internet. Entrepreneurs and non-profit organisations are joining forces with experts to test 5G applications in North-Groningen. The tests include sectors such as care, energy, agriculture and the living environment, e.g., monitoring crop diseases. Sensors perform measurements and thanks to the fast 5G the data can be forwarded quickly for analysis. The 5G Fieldlab is part of 5Groningen, an initiative taken by the Economic Board Groningen.



In **the Physical Internet Lab** of the University's Faculty of Economics and Business, researchers, students, companies and government bodies can share insights, exchange data and develop new knowledge regarding the physical internet. It also makes use of real-time simulations and visualisations; research findings are discussed and validated as a possible prelude to practical implementations.

About the University of Groningen

The University in figures

GENERAL

11
FACULTIES
Economics and Business, Behavioural and Social Sciences, Theology and Religious Studies, Arts, Medical Sciences, Law, Spatial Sciences, Science and Engineering, Philosophy, University College Groningen and Campus Fryslân

5.800 FTE
MEDEWERKERS

>120
NATIONALITIES, STUDYING OR WORKING AT THE UNIVERSITY

RESEARCH

3.500 FTE
ACADEMIC STAFF (1/3 FROM OUTSIDE THE NETHERLANDS)

300
FULL PROFESSORS

6.000
ACADEMIC PUBLICATIONS

500
PHD PROGRAMMES

19
PATENT APPLICATIONS

EDUCATION

30.000
STUDENTS (OF WHOM 20% INTERNATIONAL)

48
BACHELOR'S DEGREE PROGRAMMES

>100
MASTER'S DEGREE PROGRAMMES AND SPECIALIZATIONS

(Figures 2017)



The University's Faculty of Spatial Sciences offers its students and researchers various 3D applications for teaching and research in its **CASUS Virtual Reality Lab**. An example is that they can use virtual reality goggles to walk around and inspect a new park they have designed.

Awards



NOBEL PRIZE
Ben Feringa
Chemistry
2016

2016
SPINOZA PRIZE
Lodi Nauta
History of Philosophy

SPINOZA PRIZE
Bart van Wees
Applied Physics
2016

2015
SPINOZA PRIZE
Cisca Wijmenga
Human Genetics

SPINOZA PRIZE
Theunis Piersma
Migratory Bird Ecology
2014

2004
SPINOZA PRIZE
Ben Feringa
Chemistry

SPINOZA PRIZE
Dirkje Postma
Pathophysiology of Breathing
2000

1996
SPINOZA PRIZE
George Sawatzky
Physics



NOBEL PRIZE
Frits Zernike
Physics
1953

Trivia

After Leiden University, the University of Groningen (1614) is the oldest remaining university in the Netherlands.

In terms of size, the UG is the third largest university in the Netherlands, and – after the University Medical Center Groningen – it the largest employer in the province of Groningen.

Did you know that the UG also has degree programmes whose graduates are awarded the title of 'ir.' (ingenieur)? One example is Industrial Engineering and Management, others are Applied Mathematics and Biomedical Engineering.

The University has some famous alumni, such as Aletta Jacobs (the first female student graduated in the Netherlands), Job Cohen (a politician), Hans and Wim Anker (lawyers), Wubbo Ockels (the first Dutch astronaut) and Wim Duisenberg (the first President of the European Central Bank).

The UG has 432,500 m^2 of facility floorspace, including high-tech laboratories, study facilities and IT facilities (Center for Information Technology).

When it comes to universities that best prepare their students for the digitisation of society, the UG ranks fifth in the world. That was the conclusion of the annual Global University Employability Survey of businesses. The respondents were given a list of 150 universities to choose from.

CONTACT

The www.rug.nl/industry-relations website gives brief descriptions of the research projects being carried out by UG researchers and students, in collaboration with other knowledge institutions, the business community, government bodies, non-profit organisations and members of the public.

Here, you can also find more information about the Industry Relations team.

If you have questions, comments, or suggestions please get in touch with the team of Industry Relations.

You can do so via:

University of Groningen
Email: industryrelations@rug.nl
Telephone number: +31-(0)50 363 4508

Visiting and postal address:
Broerstraat 5
9712 CP Groningen

www.rug.nl/industry-relations



The team of Industry Relations

CREDITS

This portfolio book is a publication of the University of Groningen. This version is a translation of the original Dutch version published in 2019.

Composition and final editing:
Irma Kleine (LaDouce Tekst & Communicatie), Theo Smit, Iris Vis

Original Dutch texts:
Meinte Dirksen, Lars Edel, Herre Hooghiemster, Jon Hummel, Ilse Jansen, Dennie Kleijweg, Irma Kleine, Carien van der Velde, Inger Zeevalkink and William Zijlstra

Photography:
Reyer Boxem, Olivier Middendorp, Jussie Puikkonen/KNAW, Peter van der Sijde

Design and graphics:
Shootmedia

Printing:
Zalsman Groningen

A word of thanks to:
Peter Attema, Inês Boavida Portugal, Johan Bos, Ming Cao, Catalina Goanta, Jetse Goris, Roel van der Heijden, Juha Hijmans, Laurens van Kouwenhove, Beatriz Noheda, Lotte Pigge, Mladen Popovíc, Peter Rake, Sofia Ranchordás, Hedderik van Rijn, Bart Scheerder, Jacquelien Scherpen,Lambert Schomaker, Nick Szirbik, Marie-José van Tol, Jasper van der Velde, Daniella Vos, Marieke van Vugt, Claudia Yamu, Haije Wind

This portfolio book has been compiled with the highest possible accuracy regarding the references. The University of Groningen cannot be held liable for any (printing) errors or hiatus.

