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Dutch homecare goes global

The more powerful management is the less creative it becomes

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Care at home is like invisible holding hands.

Home care in the Netherlands worsened. 'The organisations grew bigger, involving more and expensive management,' observed nurse Jos de Blok. 'Registration procedures became unnecessarily complicated. I enjoyed my job when I started in 1986, but that feeling changed. I knew there should be an easier way, without managers and at a lower cost. So, in 2006, I began the Buurtzorg concept.'

This is similar to the way district nurses in the Netherlands formerly worked: autonomously and using their own initiative. Buurtzorg has self-managing teams of ten to twelve people, who give one to one care for about fifty patients each. When multiple care or other expertise is needed, several team members can handle it. Patients know their carers and care is tailored to their current needs. 'This makes it measurable: care becomes cheaper, less care is needed, and patient self-reliance can be increased,' de Blok explained.

The teams hire their own colleagues and organise the work, planning, training, assessment, etc. Everything revolves around questions: What's happening? How are you solving it? What's the result? There are no policy plans to meet, and therefore no complaints from employees; everyone focuses on their expertise and professionalism. 'We started with four employees; now there are 14,000. I'm still impressed by all those who quit their jobs in the early days to work with us. Families also made Buurtzorg known around the country. It's all viable now.'

The organisation is frequently acclaimed as the Netherlands' most attractive employer. 'We have just one office in Almelo to support the teams,' de Blok explained. 'All the support, including our software packages, were created by employees. Sixty other Netherlands organisations now use Buurtzorg's supporting software. Problems? No. But we face a shortage of new qualified staff.'

The concept's first year was financed by De Blok's consultancy firm, although his wish to introduce it to other organisations did not initially materialise. 'My ideas about less management and autonomous teams were too frightening. Some were willing to adjust, but all wanted to keep their management. I'm convinced that top down rules don't work, so I started Buurtzorg as an autonomous company. The best ideas come from work in the field, not from management. People must have the opportunity to come up with their own solutions.'

Example: In 2010 an employee initiated the 'walker race', after an 87-year old said there are no races for people using a walker. 'She raised 10,000 euros to get the race started. It became the Rolympiade, an annual walker race covering 400 or 800 metres. Last year six over 90-year-olds – oldest 104 years – participated.' This improves mobility, and reduces loneliness, he noted. There are around 100 more Buurtzorg projects.

Beyond the Netherlands

De Blok now sells Buurtzorg abroad. 'The concept runs in Japan, China, Australia, Germany, England, France, Switzerland and Austria. Recently, I explained at a conference how to implement the system in a test environment and adapt it to local conditions. The universal components, such as teams, self-organising process, back office and IT support, work everywhere.'

Financing can be done through government or insurer reimbursements and, for example, in partly through private contributions, as in China and India.

In the Netherlands healthcare is covered by Social Security Systems and health insurers. In the early years, De Blok faced finance problems: the system was too unfamiliar. 'Now there are good agreements with insurers. We signed three-year contracts based on results and not, as with other caregiving organisations, on fees, costs and volumes.'

Nurse and entrepreneur

Although De Blok sees himself primarily as an entrepreneur, he maintains patient contact. 'It inspires me, he explained. 'For example, I received a letter, after her death, from a 31-year-old breast cancer patient. She thanked us for the great last months of her life. 'She had four new (caregiving) girlfriends who even took her on a stretcher to places she wanted to visit, one last time.'

Jos de Blok was awarded the prestigious Albert Medal from The Royal Society of Arts (RSA). 'I received a letter from London about the nomination. I thought it was a joke, until they called me and explained they wanted to recognise the innovation and global impact of the concept. So, in 2014, I received this award, placing me on the same list as physicist Stephen Hawking. I feel really honoured.'

The future

'It's crazy that management is the least creative when it has the most power,' he observed. 'Buurtzorg has 14,00 creative brains which invent and develop beautiful innovations with an enormous impact on self-reliance and well-being.

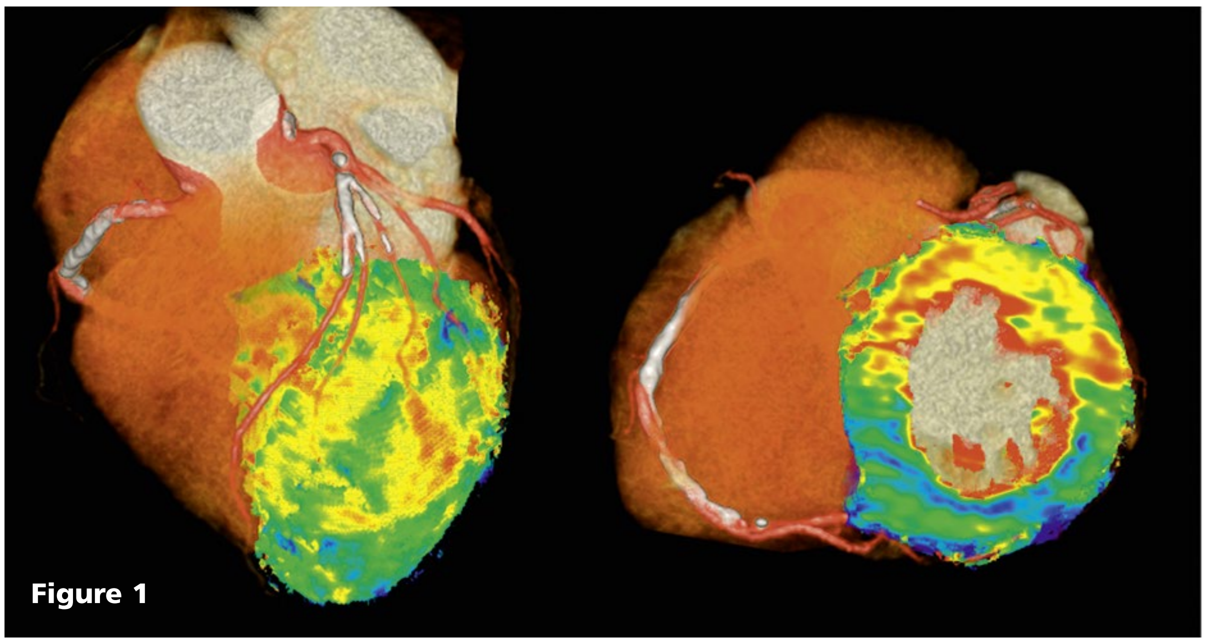
'I predict that, in five to 10 years many organisations worldwide will have reversed their approach, defeated by their own weapons: saving. And those savings will not be at the expense of healthcare providers and healthcare receivers.'

Buurtzorg is essentially a modern form of old Dutch community nursing. Now it is the largest provider of care. In addition, there is Buurtdiensten for community service, household and family assistance, like family care in the past.

The ‘bionic’ radiologist

Three steps towards healthcare improvements through new technology

Professor Marc Dewey, Vice Chair of the Department of Radiology at Charité – Universitätsmedizin Berlin, made value-based radiology the main theme of the Wilhelm Conrad Röntgen Honorary Lecture during ECR 2018. Radiology practice needs change, he said, and radiologists should grasp at new technology to drive their future. His lecture was summarised in a recent comment in The Lancet. See Link: www.thelancet.com/journals/lancet/article/PIIS0140-6736%2818%2931193-0/fulltext



4D-CT perfusion images of the heart
(Dr. Kakuya Kitagawa and Prof. Marc Dewey)

Marc Dewey is Heisenberg Professor of Radiology, Vice-Chair of Radiology at Charité – Universitätsmedizin Berlin, Germany, and he presided over the Berlin Röntgen Society from 2011 to 2013. He received the Röntgen Award in 2009 and the Curie Ring in 2012 – the German Röntgen Society’s two highest scientific awards. Dewey was also secretary of the 2011 German Röntgen Congress.

Report: Sascha Keutel

Dewey’s lecture presented a list of issues regarding current healthcare systems. Among foremost patients’ complaints on hospital admittance is being asked about their medical history multiple times from different staff members or departments.

Also, patient care services that decide the clinical strategy and tests to be made have conflicts of interests and different aims. ‘We’re not using evidence-based approaches to make those decisions,’ Dewey said.

Additionally, the idiosyncratic terminology in radiologists’ reports prevents major critical findings from being detected. According to Dewey, a recent study on determination and communication of critical findings in abdominal imaging found that one-third of it went undetected. (https://www.ncbi.nlm.nih.gov/pubmed/19581643).

A vision of the future

Dewey spoke of a Commonwealth Fund study that concluded that increasing healthcare spending per GDP does not equate to better patient outcomes, or the performance of the healthcare system measured by equity and accessibility. Reality: the more money nations invest in their health care system, the worse the outcome in terms of performance is – a really dramatic result and reason to introduce value-based medicine in radiology, he said. The general goal of value-based radiology is to improve patient outcome with lower cost. ‘Sometimes that means doing less – especially less imaging.’

Value-based radiology, he believes, will gain a central role in addressing three issues:

1. Improving personalised decision-making about if, when, and which patients need diagnostic imaging
2. Increasing consistency in how images are acquired and interpreted by the ‘bionic’ radiologist
3. Enhancing the link on findings and reports with treatment recommendations and management decisions.

Evidence-based decisions

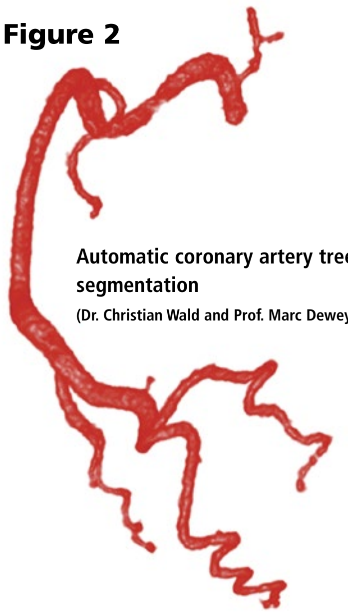
First: Decision support tools, based on evidence, could help to overcome too much imaging in the wrong patients. AI tools would allow better predictions and free up radiologists’ time to talk to a patient. This needs a patient’s data integration with decision support tools, such as the European Society of Radiology’s iGUIDE and eGUIDE.

The bionic radiologist

Second: The integration of AI with human efforts – the ‘bionic radiologist’ – has great potential to increase consistency in radiological image analysis and reduce errors.

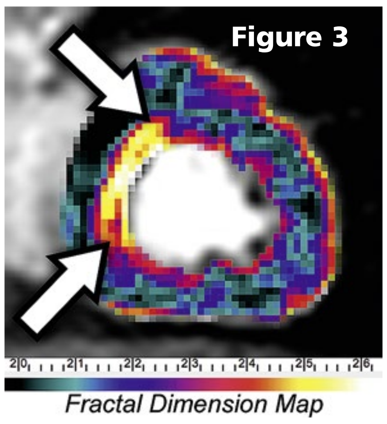
Dewey foresees a human doctor using a device to gain an automated analysis and then interpreting the results and strategies along with a patient. An existing example is 4D-CT of the heart, which produces three billion voxels for a single patient (Figure 1). Patients can’t hold their breath for long, so there’s heart and lungs motion. Can we manually adjust? Can we go through these three billion voxels? That’s very hard to achieve.’ Dewey then explained that radiologists need automated approaches that do registration and pre-processing before a doctor even begins. Figure 2 shows such a pre-processing example of automatic coronary tree segmentation based on 3D cardiac CT.

Figure 2



Automatic coronary artery tree segmentation
(Dr. Christian Wald and Prof. Marc Dewey)

The bionic radiologist makes use of automated pre-processed data, e.g. using fractal analysis (https://www.ncbi.nlm.nih.gov/pubmed/27436024) while still being the major interpreter and integrator of the data (see Figure 3). This combined approach to leverage both the consistency of automatic analysis and individual interpretation of human image analysis ‘is a paradigm shift,’ Dewey said.



Fractal analysis of myocardial MR perfusion imaging. Fractal analysis has been established as a method to differentiate obstructive coronary artery disease and microvascular dysfunction. In this patient, a perfusion defect due to coronary artery disease with a fractal dimension of 2.47 is depicted (arrows)
(Dr. Florian Michallek and Prof. Marc Dewey)

Linking findings to treatment recommendations

Third: Structured reports that combine audio-visual information linked to patient data make them searchable and analysable and therefore improve the reporting, Dewey believes. A study of pancreatic cancer imaging showed that the evaluation greatly improved with structured vs. non-structured reports (https://www.ncbi.nlm.nih.gov/pubmed/25286323). Dewey concludes that structured reporting improves the way radiologists’ discuss a case with referring physicians and plan treatment.

Natural language processing may also help radiologists to avoid a possible culture shock when classic dictation vanishes. While the structure is captured by natural language processing, standardised dictation could continue, he suggests. This would make transition easier because, in the end, ‘culture eats strategy for lunch’.

Challenges and conclusion

‘Everyone wants to be an innovator, yet no one wants to change,’ he said, adding that addressing cultural issues is also important in changing radiologists’ practice.

But, for Dewey, the ‘potentially greatest challenge is the half-life of clinical data’. A study on test order prediction tools found that the accuracy of data to predict inpatient orders has a half-life of only four months (https://www.ncbi.nlm.nih.gov/pubmed/28495350). As healthcare changes rapidly, researchers won’t be able to use robust data older than five years. Thus, says Dewey, ‘we don’t need big data; we need good data!’

Success in the three listed areas will free the radiologist to participate more actively in patient care, where automated systems are not good (yet).

LED lamp distributes shadow

STARLED5 NX, surgical lamp with LED technology boasts an excellent light quality, the specialist manufacturer ACEM reports. ‘The special optics of its LEDs generates a shadow-less, clear and homogeneous light assuring visual comfort and best working conditions for surgeons and medical staff.’ The lamp, under every condition, generates an IR-free light, excellent colour temperature and a practically endless life cycle at low consumptions, the firm adds. ‘The 43 LEDs which make the Starled5 NX are circularly positioned and divided into five reflectors (with seven LEDs each) and other eight LEDs are radially placed around the handle. In this way, the lamp produces a high illumination level of 130.000 lux (160,000 lux optional) for a steady life cycle of about 50,000 hours.

ACEM is at Medica Hall 10 / Stand B60

Acem’s development ACRIS ensures, via a microprocessor, the control of electrical curves typical of LEDs, to remain unaltered over time but maintaining a long life cycle, the company reports. ‘The colour rendering index of √ is 95 and its colour temperature 4,500 K.’

The lamp can produce a focused and ambient light, and the light field focusing system adjusts the light spot diameter accurately assuring an excellent sharpness of details in the operating area, Acem confirms.

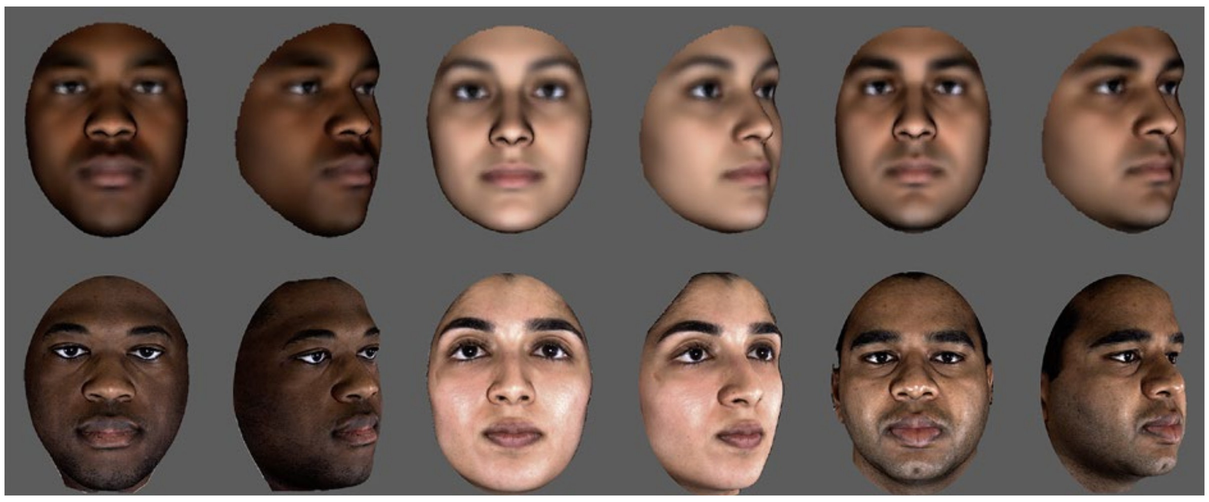
Starled5 NX is particularly suitable for minimal invasive surgery and is ideal for the preparation and treatment during the operation, monitoring of the patient and microscope operations. It has been designed for comfort and is light to move, due to its central handle, the medical team can move it from the lateral handles assuring stability and constant illumination even during movement.

The removable and sterilisable central handle also can house a video camera to video surgical operations accurately (alternatively, the video camera can be placed on a separate arm).

‘The lamp shape assures visual

The revolution escalates

New procedures in medical image analysis based on artificial intelligence offer numerous opportunities but still have their limitations, Michael Krassnitzer reports.



Face reconstruction from solely contextual properties (a set of gene variants responsible for facial development, supplemented with age, BMI and gender). Top: reconstructed face. Bottom: real face, unknown at the time of the reconstruction. The model was built using a database of 3-D pictures, DNA, age, BMI, and gender of an admixed population. (Courtesy of Professor M. Shriver, Pennsylvania State University, and Dr Peter Claes, KU Leuven. Reprinted from Paul Suetens, Fundamentals of Medical Imaging 3rd edition, Cambridge University Press, 2017.)

'Is image computing an opportunity or a threat?' asked Dr Paul Suetens, professor of Medical Imaging and Image Processing at University Hospital Leuven. During the recent European Radiology Congress 2018 held in Vienna he also provided his own answer: 'It's an opportunity if the radiologist takes advantage of this supporting technology. It's a threat if it is discarded by the radiologist – "I am too busy now" are words I often hear; then it's other specialists who are gratefully adopting this technology.

'Image Computing, including image analysis, artificial intelligence, artificial neural networks und deep learning, is starting a revolution,' Suetens is convinced. Artificial Intelligence (AI) is not new – research in this field was carried out as far back as the 1950s – but, whilst in the early days AI learnt from image descriptions, it now learns directly from the images, such as photometric image characteristics.

Suetens was involved in a project that used MRI images with BOLD contrast – with the image signal depending on the oxygen content in red blood cells – for a detailed investigation into which areas of the brain are active during hearing and processing of language. Other types of image computing are based on geometric image characteristics, such as segmentation of thoracic images. Image computing also includes the exciting field of image genetics, in which Suetens is also involved. As a member of an international research team, he linked a database containing 3-D facial images with genetic information. One of the results was that biomarkers, which point towards genetic mutations, were found in the image data. Certain characteristics of human faces suggest a mutation of the SLC35D1 gene, which is associated with chondrodysplasia with snail-like pelvis, a very rare, lethal form of skeletal dysplasia.

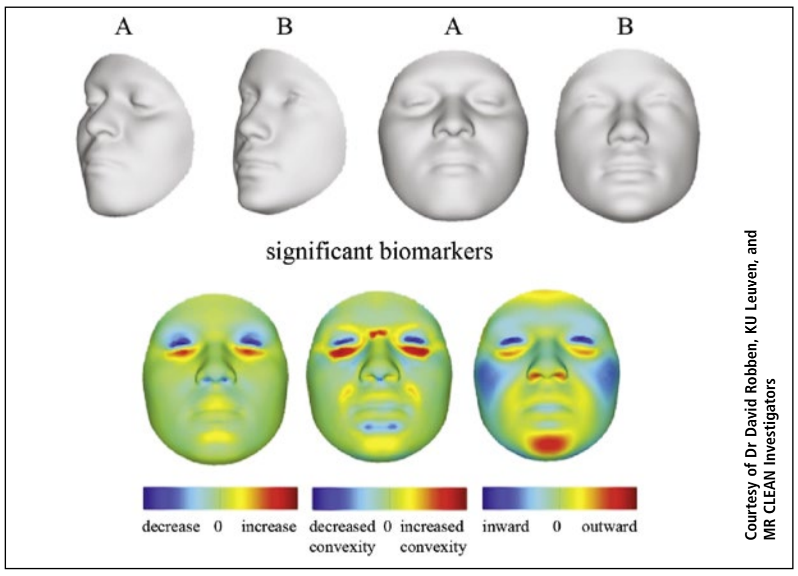
A further use of this link between facial images and genetic information is the reconstruction of faces from human DNA, making it possible for instance to reconstruct the features of well-known persons of whom, long after they have died, only artistic representations have been available. Respective reconstructions based on saliva samples from living test subjects achieve astonishing resemblances.

These applications are based on deep learning, which entails an artificial system learning from examples, then itself recognising inherent patterns and regularities. The basis of this is so-called artificial neural networks that are modelled on the workings of the human brain. 'Deep learning is a new paradigm with a strong impact on medical image analysis. It is sufficiently accurate and fast to compete with the human expert for specific narrowly defined tasks,' says Suetens.

However, deep learning still has its limitations. 'Deep learning is still in its infancy,' admits Suetens. If only a limited amount of data is available, or where the issue is around complex forms and deformations, neural networks do not function very well. 'A neural network is nothing other than a large number of individual data processors which are linked with one another – comparable to neurons in the human brain,' explains Suetens.

However, the human brain has around 86 billion nerve cells, whilst an artificial neural network only has 20 million nodes. 'When we increase the number of nodes the results become worse – and we don't yet know why this is,' Suetens admits.

Professor Paul Suetens heads the Division Image and Speech Processing in the Department of Electrical Engineering at Katholieke Universiteit (KU) Leuven, Belgium. He is also chairman of the Medical Imaging Research Centre at University Hospital Leuven. His research focuses on medical imaging and medical image computing, which methodologically lies in the domains of computational science and machine learning. He has authored more than 500 peer-reviewed papers in international journals and conference proceedings and is author of the book 'Fundamentals of Medical Imaging' (3 editions, 2002, 2009, 2017).



Result of a study of a selected set of SNP genotypes in a normal population. Faces A and B show the effect of two extreme SNP variants in gene SLC35D1. Mutations in this gene cause Schneckenbecken dysplasia. The colour images show the differences between faces A and B of some local features (from left to right: strain, curvature change and distance). Significant local differences, such as at the orbits, may define characteristic biomarkers for this particular genetic disorder. (Courtesy of Dr Peter Claes, KU Leuven. Reprinted from Paul Suetens, Fundamentals of Medical Imaging 3rd edition, Cambridge University Press, 2017.)

v-less light

comfort and is particularly suitable for laminar flows in the operating room,' the Italian firm adds. 'All the functions of Starled5 NX are managed by the handy, digital and easy-to-read I – SENSE control panel positioned on the cardanic structure and adjusting.'

Coronary angiography will lose diagnostic value

The changing face of imaging in cardiology

While the question is still debated as to whether MRI is the better CT, along comes a potential game changer – a new data based 3-D reconstruction method of heart anatomy and function that aims to replace diagnostic coronary angiography. In the near future not only adult patients with coronary heart disease could benefit from this new technique but also children with complex congenital heart defects. Meanwhile imaging is conquering the cardiac operating room (OR).

The physician, using smart glasses, in the virtual space has just removed the aorta at its root from the heart to examine it separately. Observers can follow on conventional screens.

Courtesy of S. Engelhardt

Report: Emilie Hofstetter

Long before coronary heart disease (CHD) manifests its presence on an ECG, CT and MRI can detect it due to low perfusion caused by a stenosis of the coronary vessels. Dr Bettina Baessler, radiologist and researcher at the University Hospital Cologne, Germany, looks into multiparametric imaging strategies. She considers both techniques complement one another although MRI definitely produces images that are 'more beautiful, almost works of art'.

Professor Ulf Teichgräber, Head of Radiology at University Hospital Jena, Germany, agrees and thus predicts the demise of cardiac angiography. His opinion is corroborated by the recently completed SYNTAX III study, whose results will be presented at the Transcatheter Cardiovascular Therapeutics Symposium 2018 in San Diego in September. A team comprised of a radiologist, cardiologist and surgeon (Heart Team A) evaluated the angiogram of a patient, calculated the SYNTAX II score and decided on the type of therapy, either invasive or non-invasive.

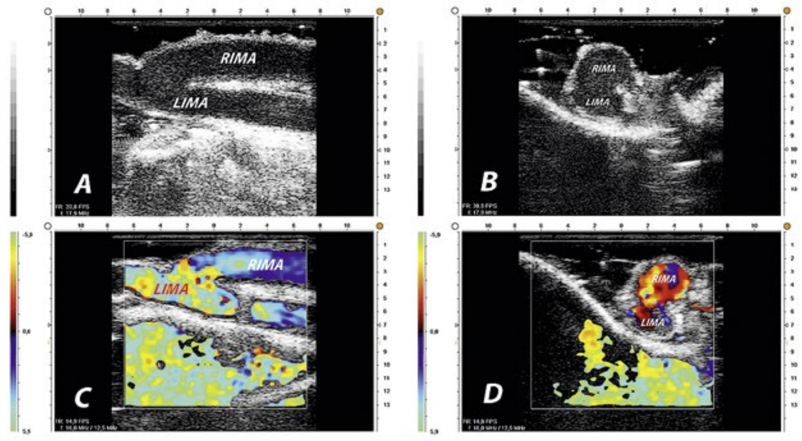
The team members then saw the multislice CT (MSCT) scan with 3-D reconstructed coronary vessels and the relevant fractional flow reserve (FFRCT) and could either confirm or revise their decision. A second team (Heart Team B) of those professionals received CT and FFRCT of the same patient first. The team members calculated the Syntax III score, decided on the type of therapy and then saw the angiogram in order to either confirm or revise their decision. 'The Syntax score was designed to inform the decision "invasive or non-invasive", based exclusively on anatomical features,' Teichgräber explained. 'Syntax II took comorbidities into account and now Syntax III includes a functional component – FFRCT. Thus coronary angiography will lose importance in diagnostics and therapy planning.'

Non-invasive first

To date, only the California-based HeartFlow Inc. can calculate FFRCT. Based on data obtained in a conventional CT, the company's software, using flow mechanics, can reconstruct heart, aorta and coronary vessels in terms of geometrics as well as pathophysiology and function in 3-D. Moreover it visualises the flow and can thus show whether a haemodynamically relevant blockage is present, i.e. whether the patient needs a stent or a bypass.

In 2015, Professor Pamela S Douglas, cardiologist and Head of Multimodal Imaging at the Duke Clinical Research Institute in Durham, North Carolina, USA, showed the potential benefit of this method using 584 patient cases from 11 hospitals. Ten patients with suspected CHD underwent diagnostic cardiac catheterisation, but the suspicion was confirmed only in three patients – seven underwent unnecessary catheterization. Six out of ten patients with suspected CHD, whose FFRCT was determined first, did not need angiography. In three out of the four patients who did receive angio, the suspicion was confirmed – i.e. only one patient underwent an unnecessary angiography. 'This feasible and safe method shows a significantly lower rate of unnecessary invasive angiographies,' Douglas confirmed. Investors seem to buy in: HeartFlow, which today is already cooperating with the Big Three – GE, Siemens, Philips – recently raised USD 240 million to further develop the technology, launch new studies and drive commercialisation of its product.

To establish 3-D imaging in congenital heart disease treatment, paediatric cardiologists Animesh Tandoon and Tarique Hussein founded VARYFII Imaging, LLC, in Dallas, USA. They construct complex anatomical models of the individual patient's pathologies using MRI or CT data. Cardiologists as well as surgeons can enter the virtual and augmented realities of the anatomical models with the help of data headsets to lift certain structures, analyse and reposition them and thus devise the best strategy to correct the heart defect prior to surgical intervention.



Y-conduit of right and left internal thoracic artery in epicardial ultrasound. A: 2-D Long axis view, B: 2-D short axis view, C: Colour Flow Mapping long axis, D: Colour flow short axis.

Courtesy of Di Giammarco

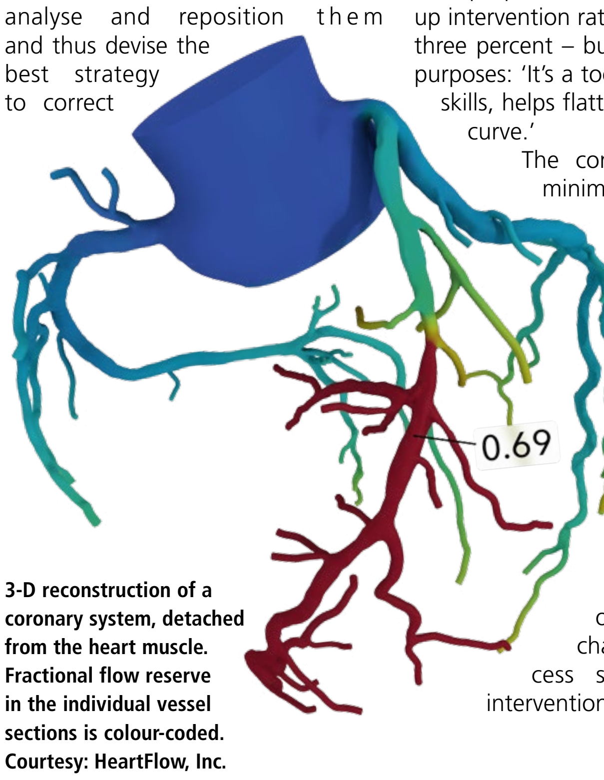
'Our heart beats in 3-D, so why not examine it in 3-D?' asks Dr Sandy Engelhardt, researcher at the Computer-Assisted Surgery Group at the Department of Simulation and Graphics in Otto von Guericke University, Germany. In addition to treatment planning and education she envisages a further application of this new technology: informing the parents of the young patients.

The flow must continue

Imaging has arrived in cardiac surgery – during the intervention itself and combined with flow measurements. Professor Gabriele Di Giammarco, cardiac surgeon at Gabriele D'Annunzio University Hospital in Chieti, Italy, considers the combination of high-frequency epicardial ultrasound (ECUS) and transit time flow measurement (TTFM) in a single device 'decision making' and explains: 'Hard calcifications in the aorta, I can feel. I do not feel the dangerous soft plaques. With MiraQ, I see them in intraoperative ultrasound, can adapt my strategy and perform surgery in no-touch technique and off-pump.'

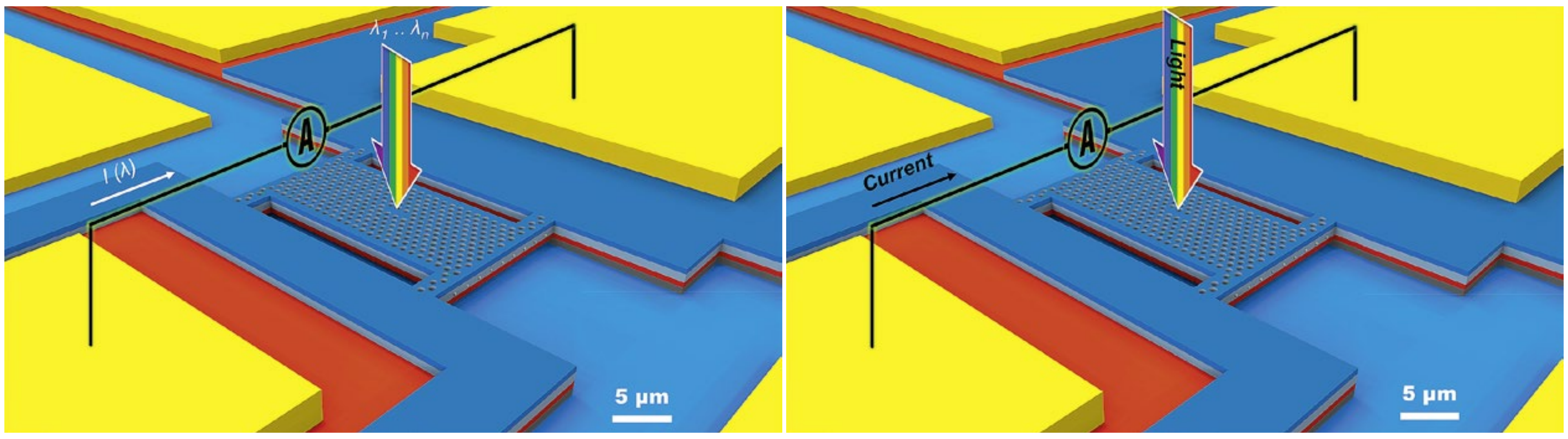
Dr Daniel Wendt, Managing Senior Physician at the Cardiac Surgery Department of University Hospital Essen, Germany, uses intraoperative flow measurement of newly created bypasses not only for quality assurance purposes – he records a follow-up intervention rate of slightly below three percent – but also for training purposes: 'It's a tool to improve your skills, helps flattening the learning curve.'

The combination of risk minimisation and quality assurance has proved successful. In 2017, the Oslo-based manufacturer Medistim sold products and procedures worth NOK 229.8 million, up 14.6 percent over the previous year – another chapter in the success story of surgical intervention in CHD patients.



3-D reconstruction of a coronary system, detached from the heart muscle. Fractional flow reserve in the individual vessel sections is colour-coded. Courtesy: HeartFlow, Inc.

Phone measures light spectrum



Sketch of the proposed microspectrometer

Report: Madeleine van de Wouw

Checking a lump for malignancy, find out if the air is clean or food is fresh just with your smartphone? It's possible, according to researchers at the Eindhoven University of Technology, the Netherlands. Their recently presented spectrometer is small enough for insertion into a smartphone. But the device is not yet ready for use on a big scale, Professor Andrea Fiore, supervisor of the Eindhoven research team points out.

Spectrometry is the analysis of visible and invisible light. Every material and tissue has its own spectrum of light absorption and reflection. Some information on the spectrum of visible light is already gathered by our eyes – it gives the colour of the material. The invisible part of the spectrum also carries a lot of useful information, and can be 'seen' by a spectrometer.

However, current devices are large due to the work: splitting light into frequencies (different colours). Each frequency must be measured separately, which can only be made some tens of centimetres after the splitting.

Small versus big device

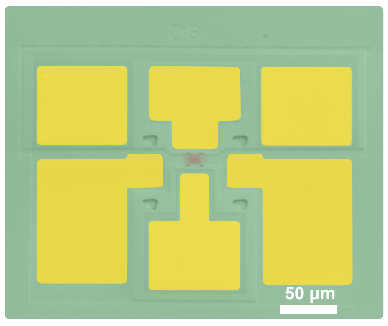
The new microscale device was created by Zarko Zobenica, a PhD candidate at Eindhoven under the supervision of Professor Fiore and colleague Dr Rob van der Heijden. It is a small version of the normal tabletop spectrometers currently used in scientific labs. The difference is the way the small spectrometer works.

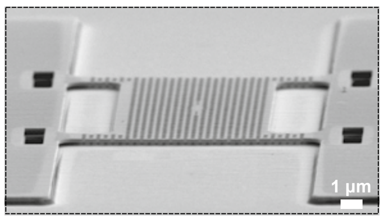
The researchers developed a sensor that uses a photonic crystal cavity, a 'trap' of just a few micrometers into which the incoming light falls if it has the right frequency. Fiore: 'This trap is contained in a membrane, into which the captured light generates a tiny electrical current that is measured. It is very precise, retaining just a very tiny frequency interval and therefore measuring only light at that frequency.' Two of the membranes were placed closely, one above the other, allowing them to influence one another: a slight change in distance means the light frequency that is measured also changes. To ensure a varying distance between the membranes the researchers incorporated a MEMS (micro-electromechanical system). A similar type of MEMS is already present in smartphones and other devices to sense free fall and put the sensitive parts in a secure mode before ground impact.

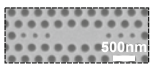
Fiore: 'Using our present system, the sensor covers a wavelength range of around thirty nanometres, within which the spectrometer can discern some hundred thousand frequencies. This is exceptionally precise because we can control distance between the membranes to just a few tens of femtometers' (one femtometer is one millionth of a billionth of a meter, or about one million times smaller than the typical atom size).

Applications of the spectrometer

Measuring light gives a spectrometer a wide range of applications - two most interesting being the medical and food industries, says Fiore. Used, for example, to measure CO2, check the pill you take is correct, measure blood sugar level via thin skin on the earlobes. Another application is for the OR, to get skin and tissue information . Also, during cancer surgery, the spectrometer may determine whether exposed tissue is cancerous and help decide how much tissue is removed, he suggests.







Top: Optical-microscope image of the fabricated microspectrometer

Bottom: Electron-microscope image of the active area, with a zoom-in on the photonic crystal cavity

The frequency range is too small to use in on a big scale, Fiore points out. 'The sensor covers only a few percent of visible and near-infrared, the most used part of the spectrum. We need to expand this range for more general use. We also will need to integrate a light source so that the smartphone sensor can function independent of external sources. So, it will take years before the new spectrometer will be integrated within a smartphone and at least ten years before it's on the market.'

The future

Many companies and scientists are developing microspectrometers, with different approaches. The Eindhoven team is also working to enlarge the measured spectrum width. 'The technology will get there,' Fiore assures. 'The question is only whether a market for these microspectrometers exists and, if so, which company will produce them. But if I am correct, the future will show that having a spectrometer in your smartphone is as normal as having a camera. The only thing is the future will have to wait a couple of years.'

Andrea Fiore graduated in Electrical Engineering and Physics from the University of Rome 'La Sapienza'. Between 1994-97 he wrote his PhD thesis on nonlinear frequency conversion in semiconductor waveguides at Thomson CSF Central Research Laboratory (Orsay, France). He held postdoctoral appointments at University of California in Santa Barbara, at the Ecole Polytechnique Fédérale de Lausanne in France and a research position at the Italian National Research Council. Between 2002-07, as assistant professor he led Quantum Devices activities at the Ecole Polytechnique Fédérale de Lausanne. Since October 2007, he has been Chair of Nanophotonics at Eindhoven University of Technology, the Netherlands.

DON'T MISS

MEDICA'S LABMED FORUM 2018

- **Thursday, 15 Nov 11.00 – 11.15 a.m.**

Liquid biopsy

Prof. Dr. Georg Hoffmann
Deutsches Herzzentrum
München, Scientific Organisation

Dr. rer. nat. Dr. med.
Christof Winter
Institut für Klinische Chemie und
Pathobiochemie der TU München

A solution to improve stroke prevention

AI system screens early Phase AFib

Here at Medica, the Taiwanese start-up Maisense is demonstrating Freescan, its artificial intelligence (AI) based solution to screen for stroke through the early detection of atrial fibrillation (AFib).

Speaking of the system's aims, Maisense summed up this huge health problem. 'Every four minutes, someone dies of stroke. Thirteen percent of these are classified as haemorrhagic stroke. When the arteries of the brain weaken or break, allowing blood to spread in the brain tissues, haemorrhagic strokes occur. They are most often caused by chronic hypertension. Up to 87% of strokes are classified as ischaemic. An ischaemic stroke occurs when a clot, or mass, blocks a blood vessel, cutting off blood flow to part of the brain. There are two main risk factors for ischaemic strokes: arterial stiffness and atrial fibrillation (AFib).

The research 'Changes in arterial stiffness independently predict stroke in patients with essential hypertension', published in 2018 European Society of Cardiology (ESC), shows a demonstrated association and prediction between arterial stiffness and stroke for essential hypertension patients, Maisense points out. 'The Framingham Heart Study (FHS) identified common factors and characteristics contributed to cardiovascular disease. Low-density lipoprotein (LDL), also called "bad cholesterol", is a notable enemy of arterial elasticity and fosters arterial stiffness. High LDL level raises the chances of a heart attack because it deposits in the walls of blood vessels that narrows the arteries or even clog. Other risk factors such as age, hypertension, smoking and diabetes are highly related to cardiovascular diseases.'

AFib patients have a five-fold increase in stroke risk compared to those without. 4.5 million people in the EU are affected. It, and accounts for approximately one-third of hospitalisations for cardiac rhythm disturbances. The European Heart Rhythm Association (EHRA), which published those quoted numbers, released a classification system of AFib-related symptoms in 2014. The EHRA also stressed the fatal consequence even if AFib symptoms are not noticeable to the patient or they may not feel uncomfortable. 'Since an AFib episode can come and go, many patients may be undetected and therefore didn't receive timely treatment,' said Benjamin Chiu, CEO of Maisense. 'That's why we take AFib screening seriously as a key measurement for stroke prevention.'

AFib is usually diagnosed on an ECG, but if a patient's symptoms don't occur while he sees the doctor, or if they are back to normal at the time, the doctor would could not give proper advice.

The Maisense Freescan device and my Freescan App deliver an all-in-1 solution, utilising artificial intelligence (AI) for early AFib detection, arrhythmia (bradycardia and tachycardia) detection, pulse wave velocity, and blood pressure monitoring in a single device. Users adopting Maisense's solution can assess their risk level of stroke anytime, the company adds.

Maisense is at Medica
Hall 11 / Stand B26

'From the patient's perspective, the solution makes it very easy to measure and record all these biomedical signals at any time. Patients can monitor their own health conditions and take early action. Through the web-based Patient Care System, doctor also can be informed immediately when abnormal incidents occur – if a patient activated this function under doctor-patient privilege. It also provides sufficient data for doctors to make a quick assessment, thus avoiding unnecessary healthcare spending, saving time and improving efficiency.

Since Apple announced its Watch Series 4, which can record ECG and has received FDA approval, it is believed that considerably more people know the importance of irregular heart rhythm detection. The all-in-one Maisense system screens the top three causes of stroke: arterial stiffness, hypertension, and AFib in just one device.

Founded in 2012, Maisense produced Freescan, the world first cuff-less blood pressure monitor, measuring directly from the wrist pulse. The firm gained the 'Best Investment Potential' award from Taiwan's Ministry of Economic Affairs, and the 2015 National Innovation Award in Taiwan, and was ranked second among the Top 10 Innovative Health Products at the Arab Health 2016 fair in Dubai. In 2017, Maisense received the 'Taiwan top 10 coolest innovative start-ups award' from the Ministry of Science and Tech in Taiwan. Freescan has received EU CE medical certification and is now among only ten of the significant finalists in the Medica App Competition, which will all be presented from 3pm on 14th November at the Connected Healthcare Forum (Hall 15. Stand C24.)

Even a special kind of foot control

'Sensational' innovations for radio surgery

Back in 1987 Meyer-Haake GmbH introduced the first high-frequency surgical device with an output power in the megahertz range. Due to the high-frequency it was possible to conduct surgery with minimal heat development, resulting in less thermal damage and tissue shrinkage. Thus, the firm's devices were quickly bought.

For its latest models – radioSURG 2200 'PT' and 'PTA' – innovations have been developed that are 'sensational', Meyer Haake (which also produces the tissue adhesive Epiglu) reports. 'A well-known designer in the medical field created the case, which offers a clearly arranged, self-explanatory touchscreen and five outputs – Cut, Cut Coag, Mono Coag, Bipo Coag and Bipo Auto ('PTA').

'In addition to the permanent coagulation, the coagulation degree can be set in nine strengths and the coagulation time in 10 steps up to one second,' the firm, explains. 'By pressing the finger switch on the handpieces, or squeezing the tips of the bipolar forceps together, it can be switched to the respective output mod, without touching the device itself.

'An absolute sensation is the development of the new foot pedal. With this, the modes can be changed, the output power increased, or decreased, and the device activated or deactivated.

'The device offers parameters for more than 40 surgical procedures from eight medical fields, which can of course be changed and saved again. Additionally, in all five output modes five personal settings for surgical procedures can be saved. All surgical parameters can be read out, printed, or saved on the computer via a USB stick.

'Never before were so many novelties offered in a radio surgical device that's Made in Germany,' the manufacturer adds proudly. Meyer-Haake also produces the special tissue adhesive EPIGLU.

Meyer-Haake GmbH is at Medica
Hall 5 / Stand P21

Seeing and navigating through a patient's body

Augmented reality to aid surgeons

Virtual reality (VR) has been widely used by video game developers and film and animation producers. The next technological advance – augmented reality (AR) – which many associate with Pokemon, has found a very different use.

During Medica 2017, the firm Taiwan Main Orthopaedics Biotechnology (www.surglasses.com) introduced the first ever smart surgical glasses featuring augmented reality and a navigation system. The demonstrated prototype focused on effects, such as burnt of soft tissue and skin, or in a worst case scenario it can cause cancer,' it explains adding that, according to studies, surgeons are the biggest victims, because they perform similar operations at least once a week. 'But,' the firm continues 'the world's first smart surgical glasses can make big changes. It dramatically reduces the necessity of taking X-rays during operations. Traditionally, in each session approximately 150 X-ray photos are taken, but this new technology lowers this number from 150 to about 20 X-rays. By reducing the number of X-rays taken it can prevent later side effects.

a trauma case. This year a completely new model for spinal surgery is on show. The company reports accuracy is less than 2 mm.

As one of the fastest growing start-ups in Taiwan, it won a most innovative product of the year award for this device, which is equipped with 3-D X-ray vision assisted by AR. This helps to reduce the radiation exposure of the whole surgical session and yet the surgeon can see through patient's body, the firm points out.

Surgeons usually perform orthopaedic surgery using a C-arm or another form of X-ray technology, which makes radiation exposure inevitable. 'Due to high level of toxic radiation both patient, surgeon and medical team can suffer from side

'But, it's not just radiation exposure; it also enhances accuracy, saves time and improves overall performance. The most important feature of this new technology is augmented reality technology. Which means, for example, when surgeons put on the glasses and look at their patient they will be able to see through the patient's body and understand the skeleton structure where they are planning to operate.'

Smart surgical glasses, Foresee-X was FDA-approved at the end of 2017 and, the Thai company predicts, 'in a near future it will be used in very delicate surgeries with a high level of risk, such as in spine, brain or in other soft tissues.

The smart surgical glasses Foresee-X also enables the surgeon to focus on the operational field instead of on computer screens and monitors, the manufacturer notes, adding that it enhances accuracy by monitoring every movement of the surgical tools, such as puncture needle, trocar etc. Also highlighted is the ability to zoom in and out.

Screening surgical procedures through smart tablets and collecting data for academic purposes is also listed as an asset.

Caduceus

Taiwan Main Orthopaedics Biotechnology has now produced Caduceus, the 2nd generation smart surgical glasses. During an earlier interview, Professor Wang Min-Liang said, 'We have submitted all the documents to FDA, CE and are waiting for approval. In the meantime, our R&D team is working to improve the hardware system, because every part and each factor has to be perfect.'

His firm's technology is to be adapted for spine, ENT and brain surgeries, with expected FDA and CE approval of the 2nd generation smart glasses by 2019

Bespoke engineering services

High frequency plastic welding

At UK firm Speed Plastics (www.speedplastics.co.uk) a team of expert engineers transforms ideas into commercial products that are ready for sale, by providing a complete design and development service from the initial concept.

Based in Chesterfield, the company is a proud partner to a number of United Kingdom healthcare companies, working as an extension to their in-house capabilities.

'The company is experienced in a wide range of manufacturing techniques including ultrasonic welding, CNC machine cutting, tool making, sewing and screen-printing,' Speed Plastics reports. 'Broad expertise delivers flexibility and responsiveness to customers' needs, ensuring lead times are short and products are made to the highest quality.

Operations Director Jane Collyer, adds: 'Manufacturing for the healthcare industry is a key market for us and Medica is a great platform to showcase the bespoke engineering solutions we have to offer.'

Speed Plastics is at Medica Hall 16 / Stand F18-7

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