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Cursor

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Shock and awe

Ever since they've fought in Iraq and Afghanistan, Americans seem to have patented the approach: warfare using the 'shock-and-awe' technique. It's a tactic developed at the National Defense University in Washington some fifteen years ago, and it involves a massive and spectacular display of power to the point where the opponent loses the will to fight back. It seemed to work like a charm initially, but after a while US opponents always seemed to rise again.

Fine, I may be slightly exaggerating, but it seems the Departmental Council of Chemical Engineering & Chemistry knows of this particular tactic. Well, that's the impression I was left with after having talked to two members of the council earlier this week. The planned reorganization that was announced in December had come as a shock to many employees. They just dropped the bomb, one of them recalls. Sitting near the Christmas tree and eating 'oliebollen' staff had a chance to recover from the first blow. The departmental council has had the chance to recover too, and negotiations are currently underway. Still, it's clear the council won't back down in the months to come. Other departments are probably eyeballing the shenanigans. Perhaps the approach could be used for whatever other plans they have lying around.

Math is rad

Last week, the Study Group Mathematics with Industry (SWI) was at work at TU/e. An opportunity to bridge the gap between mathematics and the industry, and to show that bridge. It's harder for mathematics to prove its added value to society than it is for say, chemistry. Everyday things are brimming with math – CD players, railway timetables – but nobody knows! However, ever since SWI presented a problem involving the construction of an actual Dutch mountain, math has been rad. The media are talking about it.



Because the idea is absurd? Not anymore. You'll be hearing about it more often from now on. Thanks to our mathematicians. See page 8-9.

TU/e Technische Universiteit
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◀ Rewwwind www.tue.nl/cursor

Our Rewwwind feature provides you with snippets of last week's news. What happened online after the previous Cursor magazine was published?

No warm sweaters necessary for February 10

February 8, 2012 - On February 10, TU/e had planned to participate in National Warm Sweater Day for the second time, an initiative of Vereniging Klimaatverbond Nederland (Climate Alliance Association Netherlands). Heating was to be set to night mode throughout campus

(eighteen degrees Celsius). Due to the ongoing cold and after having received several complaints, TU/e has decided not to participate in Warm Sweater Day this year after all. Heaters will remain at their normal temperature, and Warm Sweater Day will probably be held at a later date.

Foreign student more critical of catering

February 1, 2012 - A satisfaction survey conducted last year shows staff and students are happier with TU/e's catering facilities now than they were back in 2004 and 2007. Nearly all catering services received a higher score than before, except for those at

De Zwarte Doos and University Club, which received a lower score this time. Foreign staff and students are more critical than their Dutch colleagues: for almost half, the offer doesn't meet their needs.

Vici for alternative statistics

January 31, 2012 - Prof.dr. Harry van Zanten will receive a Vici grant from NWO. The mathematician is the only TU/e researcher receiving the

prestigious 1.5-million euro grant this year. For this round, a total of 31 Vici grants have been awarded. A record number of 236 researchers applied.

Honorary doctorate TU/e for computer science trailblazer Harel

January 31, 2012 - At the Dies Natalis on April 27, Israeli computer scientist David Harel will be receiving an honorary doctorate from TU/e. Prof.dr. Harel, who's currently a professor at the Weizman Institute for Science

(Rehovot, Israel), is a pioneer in the field of computer science. His visual modeling technique Statecharts is used by software and system developers worldwide.

Carnival 1985 versus 2011

◀ Flashback

In 1985, the university had four Carnival Princes, including an unrecognizably young Harry Roumen, who was the prince of carnival association De Limburgers. The princes were members of D'Onderzoekers (the researchers), the university's carnival association that was founded in 1973. Left, the association's prince, Jo Bollen (a Ph.D. student of Mathematics at the time), next to him Eindhoven's city prince Willem van der Sommen (Student Sports Center), Harry Roumen (Rekencentrum), and PSV's prince Jan Willems (Central Technical Service). A year later, the carnival association disbanded; attendance was waning. The association said goodbye by means of a festive funeral.

Since 2007, there's been a new student society that wants to reinstate carnival at university: GELIMBO, part of student association GEWIS. In the picture that was taken on March 1, 2011, Prince Rick I is clinking with his retinue. He's holding the tankard that was presented to him by Grolsch just then. The society will hold another carnival foundation day meeting this year, on February 13. (EdG)



Foto | IEC Archive



Photo | GELIMBO

≡ Clmn 'Brainwashed by Dutch people'



The name above is the one given to me by one of my international colleagues. It all happened during our discussions at De Hal. On our coffee breaks we often talk about studying in the Netherlands and I observed that people usually support one of two opposing positions on the topic. First, there are 'Supporters' to which I belong, and then there are 'Complainers' to which my anonymous colleague belongs.

So, what are the main complaints? The complaints can be divided into two groups. The first group consists of general complaints about living in the Netherlands. Disgusting food, gloomy weather, harsh language, extremely tall

girls – I could continue, but the general idea is that, compared to the Complainers' home countries, the Netherlands is less comfortable for living. Supporters reply that we're not tourists and our goal is not to enjoy our free time but to gain knowledge. So, if our quest for this goal is to go hand in hand with a certain loss of comfort, then that's tolerable. The second type of complaints is related to the complexity of studying at TU/e. Complainers state they're excessively challenged and have to live the 'Nerd-life' at the library in order to get a six in the end. Supporters respond that our future employers are aware of that fact and greatly appreciate it. If getting a master's degree were too easy then everyone would have one and the value would decrease dramatically. Therefore, being a nerd in the present is the price you pay for better employment in the future. Back to the title of the article. It's not so much about being brainwashed, but rather about having a positive attitude and a readiness to overcome possible problems along the way, so we can achieve our ambitious goals.

Sultan Imangaliyev, from Kazakhstan, is a student of Systems & Control at the Department of Mechanical Engineering

Prof.dr. Keita Ito, professor of Orthopedic Biomechanics,
Department of Biomedical Engineering

Will future prosthetic bones come from 3D printers?

It's said to be a world's first, the implantation of a lower jaw that came from a 3D printer. Last week, the University of Hasselt announced an 83-year old woman with a seriously infected lower jaw was fitted with a custom implant. It's made from titanium powder and was printed in mere hours thanks to a special 3D-printing technique called Additive Laser Melting. Belgian researchers think computer technology will revolutionize the medical world. "The doctor and engineer at the operating table, now that would be innovative." But what are the exact advantages of a printed 3D bone compared to micro-surgical operations or artificial methods for growing bone 'in a jar'? And will all bones be printed in time?

"It's a world's first for people outside of the field of bone implantation. For specialists it's more of the next step in a process. In the past years, a lot has happened for 3D-printed implants. The new lower jaw is beautiful, but not as spectacular as media would have you believe", Keita Ito explains from San Francisco. He's a professor of Orthopedic Biomechanics at the Department of Biomedical Engineering.

He's attending the annual conference of the American Association of Orthopedic Surgeons. Apart from general bone research and research into bone defects, the latest trends in implants are also discussed.

"It seems very new, but especially in dentistry people have been working with titanium implants for years, and these too have been 3D-printed. They're often used as replacements of roots and are placed into the jaw bone so it can lodge there. What did change is that we can now print larger implants. After all, a lower jaw is huge compared to a dental implant measuring several millimeters. It's definitely a major step and it does open up new perspectives for future implant technology."

"The technology involved in the 3D printing of prosthetics is fine. Methods are often copied from the aviation industry, because they work with 3D-printed titanium parts a lot. The problems we encounter tend to be of a biomedical nature. After all, for a bone to function properly, it's attached to tendons, muscles, and nerves. But how do you attach those to an implant? The skeletal structure in the lower part of the body is especially complex when it comes to

tendons and muscles; it has to carry much heavier loads than the rest of the body. And nerves are supposed to run through the implant. I'm not sure how that problem was tackled for that lower jaw, but maybe the woman now has a numb jaw. I'd love to know the details of the implant, because these new developments can be valuable to our own research as well, even though we're not working with implants directly. We focus on the surrounding bone tissue, how it adapts to a synthetic implant and whether or not it affects the bone's function. Those questions are equally valid for larger implants, of course. We'll have to await the scientific publication, because so far I've only been hearing non-specialist accounts."

"For example, if someone's in urgent need of bone tissue after an accident or after the removal of a tumor, 3D printing is perfect. The implant is ready to use in a few hours and it can be modeled very accurately. The latter is a great advantage when dealing with more complex structures. A bone chip has to fit the skull perfectly or you'll have a problem... Titanium is a great material to work with. Somatic cells like the material and it doesn't interfere with the immune



Prof.dr. Keita Ito. Photo | Archive Bart van Overbeeke

system. It does get tricky in places where friction occurs, because titanium particles can rub off causing inflammation. Fortunately, there's already a solution to that problem."

"Prosthetics printed in 3D are a fine solution for situations in which the implant isn't required to last a lifetime. But eventually, we'll want to use prosthetics that are grown from bone, or course. And that involves more than

just piling cells in the proper shape. We'll also need blood vessels to provide the tissue with oxygen and nutrients, for example. We know ever more about bone regeneration and we're technically more and more advanced, but it will be awhile before we'll have 'bone-in-a-jar'. Researchers at the University of Twente are currently using a 3D-printed scaffold for bone cells to grow on, so they're one step closer to the jar scenario. I say keep those 3D prints coming..." (NT)

Wonderfully wintery campus

2 times they've come snow-shoveling last week, immediately after every snowfall. There were **5 instances** of salt-scattering on paths and roads on TU/e campus.

2,750 kilograms of salt and **250 kilograms** of thawing agent have been used.

It was coldest on Saturday morning: **-19°C**. Heijmans was shoveling snow at the time.

There have been significantly fewer complaints regarding iciness than last year: only **5 people** took the time to contact DH about the matter.

Our request for winter scenes of TU/e campus yielded **16 pictures**. The most beautiful entry is pictured here. (NS)



Photo | Matthijs Lodewijks

About parking, stimuli and pain

Parking pain | Monique van de Ven

No matter how bravely the university is aiming at 'sweet measures'; in an attempt to cope with the impending parking pain on campus, sooner or later 'sour measures' will become inevitable.

A first measure: abolition of the free exit cards as of March 1. For, as independent parking policy coordinator Jos Hermus assures us, there is nothing out of the ordinary in paid parking, for guests and eventually probably for staff members as well.

As regards its intended parking policy, the university is "heading towards disaster", was the warning issued in Cursor by drs. ing. Jos Hermus last month. Due to the deliberate 'greenification' of the campus over the next few years, a large number of the current 2,153 parking spaces will disappear. Some will go temporarily, because of

various construction projects scheduled between now and 2018, whereas a number will disappear permanently. The university wants to get rid of parking at ground level as much as possible, which the city is also forcing it to do. Instead it wants to build several parking garages.

Their construction and maintenance may

easily amount to four times the cost of an ordinary car park. On the plus side, they occupy less ground surface and the square meters won this way can generate money for the university, says ing.

Bert Verheijen, a cost expert and policy official at the Accommodation Department (DH).

According to prognoses the university will be losing a couple of hundred parking spaces as of April -when DH hopes to start the construction of the Green Strip. The exact number will be fluctuating over the next two years, depending on the start and completion of the various construction projects and the shifting with parking spaces. It is estimated that in October 2013 TU/e will only have 1,676 parking spaces - 477 less than today.

A working group featuring staff members from various departments

investigated last year how the university may on the one hand respond proactively to the coming scarcity of parking spaces and, on the other hand, how the mobility of staff members may be influenced. "TU/e does strive for getting more people to leave their cars at home", Hermus explains.

"It is not abnormal to pay for a parking space"

Last April and November measurements were conducted by means of the barrier system to find out who is coming to the campus by car, how often people do so and where they come from. Of the 3,300

TU/e staff members about half live at less than seven kilometers away from the university and an average of 600 to 700 people come to work by car. Of around 1,700 regular guests of the university, the so-called 'noppers' (not on payroll), some 370 park on the TU/e grounds every day. Around thirty percent of those live within the radius mentioned. Including other campus dwellers and visitors (of, among others, Fontys, TNO and various enterprises), motorists occupy between 1,900 and 2,100 parking spaces in the grounds at busier times. According to Hermus this data caused "an aha experience. For whom in fact will we be building those parking garages?"

And: hadn't we better try first to encourage those who now come by car and live at less than seven kilometers away to make another choice?"



Impression of the campus in 2020. Illustration | Master plan Atelier Department of Architecture, Building and Planning

For this reason Hermus hopes to disseminate a TU/e-wide survey before March 1 so as to investigate this. It should result in a mobility plan a few months later, which may include, for example, other employment conditions in order to encourage people to select another mode of transport. At first instance TU/e will be looking for “positive stimuli” as much as possible, Hermus emphasizes. Nonetheless, the first measure is undeniably of a discouraging nature: it is for a very good reason that the 7.50 euro to be paid by departments within a few weeks for exit tickets for their guests is higher than the ordinary daily rate of 5 euro. Bert Verheijen thinks that it is a utopian dream to think that the university will achieve its goal merely by using “sweet measures” and can thus avoid imposing “sour measures”. Hermus, too, cannot deny this: “There is no other university in the Netherlands that has managed to avoid paid parking, but one does not exclude the other. It is an important step in the process first to try and provide people with positive stimuli to make another choice”.

In addition, TU/e will consult with the municipality about the eventual use of car parks across Dorgelolaan; at ground level or in the garage below the Kennedytoren. The university also wants to examine whether there are any commercial parties interested in investing in car parks on campus and their management.

However, according to Hermus the extent of parking pain on campus is determined especially by the behavior of its inhabitants. Whatever you do, people will moan, he realizes. “While we may be used to doing things differently, we should really try to convince people that it is not abnormal to have to walk a little bit farther. Nor that it is abnormal, whether as a guest and perhaps eventually also as a staff member, to pay for a parking space.”



Photo | Bart van Overbeeke

Nijmegen roads

In the development of its parking policy, campus management and mobility plan for staff members TU/e is not only looking at its own plans, restrictions, needs and possibilities, but also at the way other universities have tackled similar items. For there are more roads leading to Rome – but those of Nijmegen in particular may serve as an example, says TU/e parking policy coordinator Jos Hermus.

Over the past six decades more and more university buildings were erected around Huize Heyendaal in the Nijmegen estate by the same name. From the rural park-like environment of old to today’s bustling Radboud University (RU): the passage of time did not go without a “fair measure of friction” as far as accessibility was concerned, Michel ter Bergh, deputy manager of the University’s Real Estate Agency, informs us. “As a university we clamped down on this at a certain moment.”

Also with a view to the much-needed greenery on campus, Nijmegen came up with “a combination of sweet and sour measures”, says Ter Bergh. For one, the travel allowance for car use was “systematically decreased” while alternatives like the bicycle and public transport were made more attractive. In this way the university successfully managed to push back the “avoidable car use”, Ter Bergh explains.

Furthermore, the university decided some eight years ago to have people park their cars as much as possible in (semi-)underground garages and to levy parking fees – also for its own staff members. By mid-2004 this made Nijmegen the first university outside the Randstad conurbation that introduced paid parking for its personnel.

The introduction of paid parking led to people sulking and moaning - “predictably so”, says Ter Bergh. It was not only the university’s own staff that moaned -about paying, but also about the fact that in the first few years the university was only incurring losses with paid parking-; the moaning also came from residents of the nearby district of Brakkenstein, where many university visitors then started parking their cars to avoid paying for this.

The deputy manager does not really think that RU misjudged that latter development; according to him, things went wrong in particular because the municipality decided to drop the intended residents’ parking permit in Brakkenstein. “The level of support for this in the district proved to be insufficient. Still, I have now gathered that they are moving towards parking regulations yet.”

At present students and staff members of RU pay 15 euro per month for a car park season ticket, without any distinction between part-time and full-time users. Regular guests not employed by the university pay 45 euro per month. This price difference, which at present is quite considerable, will lapse later this year when the university’s own students and staff members will also be paying around 40, 45 euro according to Ter Bergh. Earlier this year the rates for separate parking tickets were increased already. A “stiff price tag”, he admits, “prompted by an accelerated attempt to make parking fully cost-effective. A principal choice made by the Executive Board with a view to the cutback issues faced by the university”.

If Ter Bergh had to give any advice to TU/e, this would especially have a bearing on the environment. “Try to arrive at a policy that does not generate all sorts of repressive effects in the periphery of the campus. You can introduce or raise certain prices, but if this results in scaring people away from the campus, there will be no beneficial effect for your own parking operations nor for your relationship with the neighborhood.”

Parking space TU/e campus

Prognosis October 2011

Total unavailable: 242 spaces

Requiring new access road after construction Green Strip: 0 spaces

Total parking plazas: 1460 spaces
Total parking lanes: 501 spaces
Total parking garage: 0 spaces
Temporary parking: 192 spaces

Total: 2153 available spaces



Parking space TU/e campus

Prognosis October 2013

Total unavailable: 560 spaces

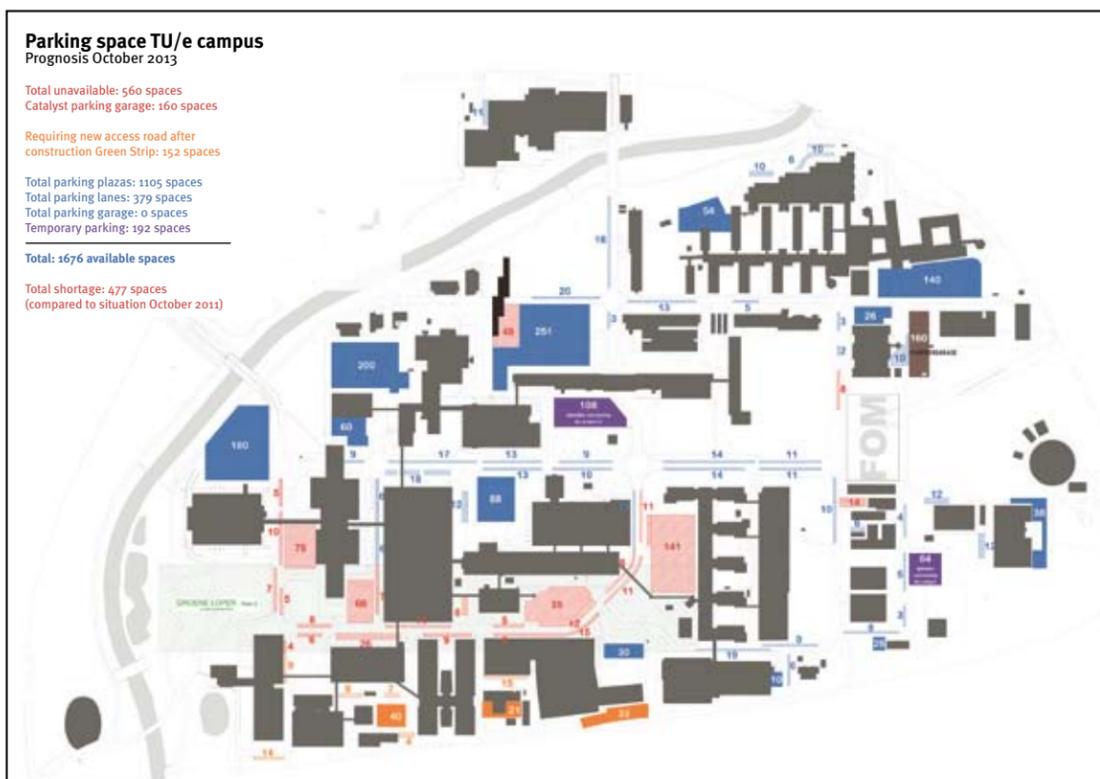
Catalyst parking garage: 160 spaces

Requiring new access road after construction Green Strip: 152 spaces

Total parking plazas: 1105 spaces
Total parking lanes: 379 spaces
Total parking garage: 0 spaces
Temporary parking: 192 spaces

Total: 1676 available spaces

Total shortage: 477 spaces
(compared to situation October 2011)



Valuable wearables

Don't expect a cool WS Collection to hit the catwalks or shop windows any time soon. Temporary trends and fleeting fashion aren't on the agenda of the (future) designers and researchers at Wearable Senses. Fashionable is fine, but valuable is a must: discovering new products and concepts that may help people lead a healthier, more communicative and efficient life, that's what it's mostly about within this theme at the Department of Industrial Design.

Ever since the foundation of Industrial Design in 2001, the department's designers have been touching, smelling and thinking soft materials, searching for ways to combine technology and fabrics. "Electronics are so tiny these days they can be worn on the body, and they have been for some time. But how can we use technology in, say, clothing in a way it actually adds value?"

Ir. Maarten Versteeg, part-time lecturer and coach at Wearable Senses, is thinking out loud.

Whether it's applications for healthcare, sports or communications, integrating technology and textiles offers all kinds

of new modes of interaction as well as challenges, Versteeg continues. "The electronics are very close to the skin - they're close to getting under your skin, so to speak. Apart from that, we're faced with practical challenges such as the products' washability. After all, electronics aren't too keen on water." The artisan tradition of textiles is another thing to keep in mind, says Versteeg. "It all started with traditional handiwork having certain quality standards, love and refinement. We want to retain the same level of refinement, even when electronics are involved."

Wearable Senses was founded several years ago by dr.ir. Stephan Wensveen, dr.ir. René Ahn, ir. Michel Peeters, and part-time lecturer Ann De Gersem, who all shared an interest for the relation between electronics and the human body. The reason for the new program was Peeters' graduation project for Adidas at the time (see box). Today, Wearable Senses is one of seven themes that are interwoven in all levels, years and groups at Industrial Design.

For example, students are free to choose any project assignment, yet especially during the bachelor phase they are stimulated to choose projects from all themes.

Wearable Senses is based on three research pillars: sports and health (Ph.D. students Carl Megens and Michel Peters, smart textile services (Ph.D. students Kristi Kuusk and Martijn ten Bhömer), and perceptive product quality. The latter subject is the domain of Ph.D. student and coach Eva Deckers. She's currently working on a second 'PeR' prototype: a perceptive carpet in which sensors and led lights have been

incorporated (see main picture).

In 2009, Deckers was one of the first students to graduate on the theme. According to assistant professor dr. Oscar Tomico, it was important to claim Wearable Senses as a theme "to be able to explicitly combine education and research and have people from various groups collaborate, but also to merge research and practice". Whereas ID's capacity groups are fixed, its themes are more organic, says Tomico. This has to do with changing internal and external trends as well as changing needs from society and business.

This external need is crucial to Wearable Senses. Tomico: "How can we change society and help people in the field of healthcare, for example?" They don't start from a problem: "We start by discovering new possibilities. By experimenting, testing and experiencing, preferably without having our final product in mind. It makes quite the difference for companies as well".

One project that showcases their signature approach is multi-million-euro

project CRISP: the Creative Industry Scientific Program. The program has designers, scientists, and companies conduct joint, four-year research into product service systems. Tomico is leading the Smart Textile Services project within CRISP (www.crisp-platform.nl), in which research is conducted into the use of smart fabrics in healthcare.

He's very excited about the collaboration with TU Delft, the Design Academy and textile industry organizations.

"This project allows us to combine our strengths to gain new knowledge as we're designing, experimenting, and creating." Versteeg adds to this:

"Enschede and Tilburg have always been especially large textile regions. Mass production may be situated in Asia now, but the latest developments are realized here, and CRISP can boost these".

Although a link to the fashion industry may seem obvious, and PhD student Kristi Kuusk recently showed some of her work at Amsterdam International Fashion Week, Versteeg explains fashion's not their main focus.

"Of course, the theme touches upon fashion, but people shouldn't be expecting a WS collection any time soon. We're not interested in temporary trends, but rather try and create valuable concepts."

Tomico adds: "Anything is possible, but you have to make sure that in the long run, things will actually be accepted and used. The quest for the added value in a product may be the biggest challenge. You shouldn't add technology for the sake of adding technology - then I might as well wear ordinary pants". (MvdV)



Eva Deckers' 'perception rug'. Photo | Bart van Overbeeke

Acceptance of 'messing' with the body as challenge

The combinations of technology and design, science and business, experiment and production, and experts and beginners – for designer and freelance student coach Marina Toeters, Wearable Senses is perfect. She also considers the work for this theme to be 'extremely intimate, since you're working closely with people as well as their future'. We're fairly open to changes in our surroundings or society, but changes close to the body are not that readily accepted, Toeters knows. For designers involved, this issue comes with 'great responsibility', she says.

Toeters herself studied Graphic Design and Fashion Design. For her master's thesis, she studied the collaboration of technicians and designers in the fashion industry, and what aspects of

this collaboration could do with improvement. She now has her own company and offers her freelance services to companies that are or want to become active in the field of fashion technology. She's currently conducting research and designing for portable technology and its uses in textile, activities that are often based on questions from companies. She's also coaching ID students at TU/e, and teaches fashion students in Utrecht, Enschede and Rotterdam. Right now, she's working on the improvement of a yoga shirt with fellow designer and ID alum Ralph Zoontjens, among other things. The shirt is welded and glued according to fairly new techniques and carries several sensors and other electronics that help the wearer to balance movement and breathing during their yoga routines.

She's happy she can add to the innovation of fashion, and hopes to be able to innovate the industry "from the inside out". According to the Utrecht researcher, the world of design is becoming ever more aware of other solutions and new materials that are better for society. "I want to help the industry realize what responsibility they have. It's ambitious, but it could happen by spreading knowledge and by introducing businesses, institutions, and research centers to one another, and helping them."



Marina Toeters. Photo | Ivar Pel

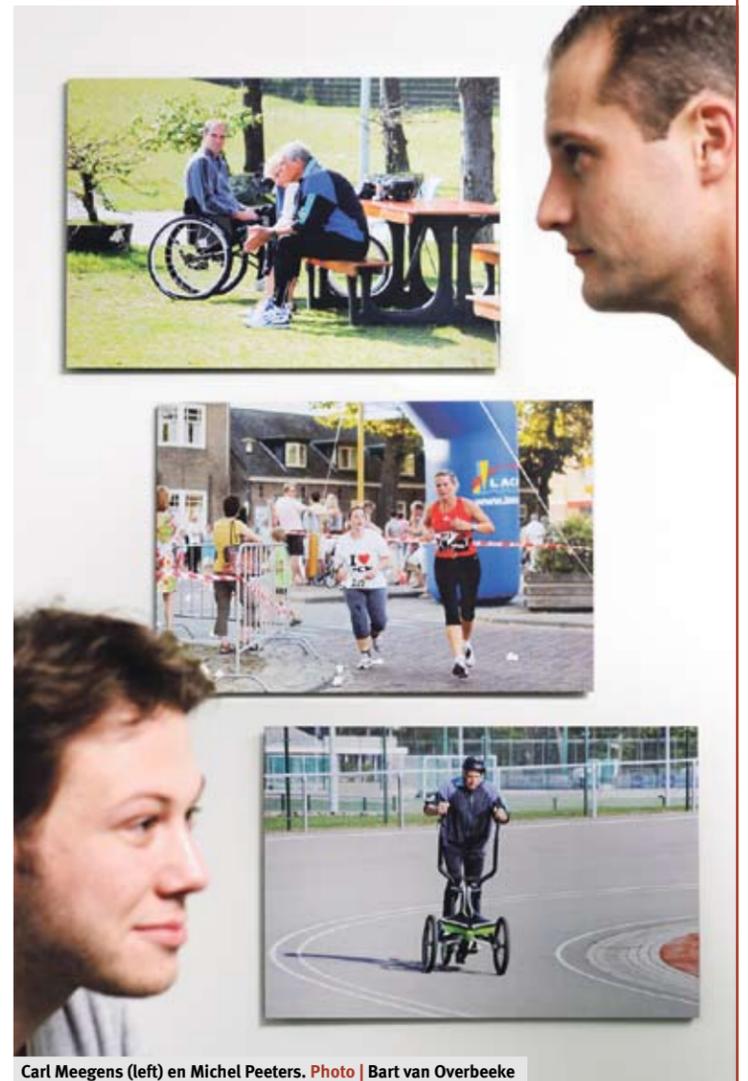
Designing for a more active and healthier life

It's not that hard to get couch potatoes to exercise, according to ir. Carl Megens. "If only you keep insisting, at some point people will come running, cycling or walking with you. But the trick is to keep them off the couch, to intrinsically motivate people to stay active." For a large part of the workweek, this issue is haunting Megens and fellow Ph.D. student ir. Michel Peeters. In 2001, they were both part of the first-ever class of ID students.

One graduated at Adidas, the other at Decathlon. Megens says they're both "hooked on sports and exercise. Michel was initially working with technology to improve performance, while I was focused on sports in a broader sense: how do we get society moving?" That last question has now become the main question for both researchers. "How do you design something that can actually change people's attitude in the long run, something that really changes something in people, and has a positive influence on their health at that? We've let go of the idea of integrating electronics in fabric somewhat. Instead we now aim at the effect of things." Peeters explains: "The connection with the body remains important, but there's other technology that's also located close to the body. Think of smartphones and watches". Peeters points at a picture of two women running. "They're at the same spot, participating in the same running event; you'd think they're doing the same thing. However, the woman on the right is running 15 kilometers and wants to

improve her personal record. Her clothing is tailored to that goal entirely. She has a drinking system, and is wearing a GPS watch and MP3 player. The other woman is running 5 kilometers for fun, and although she's wearing decent running shoes, she's wearing a wide T-shirt and sweat pants. She's running in her home town and really just wants to finish the 5K while being cheered on by her friends in the crowd." He continues. "The first lady isn't thinking about the audience for a second; she hasn't even noticed the woman running next to her. She has a goal: improving her personal record. Many companies design for the woman on the right. The industry thinks that whatever it designs for her will eventually be purchased by the other woman as well." Partly, that assumption's correct. Peeters: "When a popular brand designs soccer shoes for Cristiano Ronaldo, some recreational players might buy them, too". But people doing recreational sports don't care about the more intelligent products out there. "Intelligence interacts with the user, but it has to be tailored to the user first. That's why we want to know: What concepts can we design for the lady on the left to make sure she's motivated and stays that way?" A lot of sports products are designed for performance indicators like time, distance, speed and heart rate, says Megens. "For many recreational sportspeople, these indicators are unimportant." The challenge for the two Ph.D. students is to design something "that stresses the user is being healthy

without the focus being on 'stronger, faster, better'. Say someone would rather just walk to the beach and back, without really caring about distance and time. In that case you could use sound to augment the environment and make it seem as if someone's feet step into the sand at some point. Then the beach can be anywhere." The idea was developed by ID student Josje Wijnen with their help, and is one of the trial balloons the designers are currently working on. It's not the design itself that's most important, but "we especially look at methods and tools for companies to come up with designs themselves. Right now, the industry is mostly designing incrementally: new products are usually existing products that have been expanded or modified. It's difficult and risky for companies to present something that's entirely new and radical. At ID, they're free to test things in an experimental environment. And users are involved in a very early stage of the process already, so we can realize true innovations, together."



Carl Meegens (left) en Michel Peeters. Photo | Bart van Overbeeke

QR-coded traditions

It was actually her striking, mixed background that brought her to Eindhoven. In her native country of Estonia, Kristi Kuusk received her bachelor's degree in Computer Science, and went on to do her master's at art school, for which she lived in the Brazilian city of São Paulo for a little under a year as an exchange student. The Wearable Senses theme at TU/e turned out to be the perfect place for her combined interests. Being a Ph.D. student, she's conducting research within the CRISP program (see main article).

From the heaps of fabric that are on the table in the Hoofdgebouw, Kuusk finds two tiny balls of wool. "It started out with this, really", she says, and puts the two balls together with her fingers so they light up. While doing her master's at art school, she used the idea for a set of crocheted neck warmers that would light up when in each other's vicinity, and a LED dress and accompanying ring that would stimulate the other product's lights.

In Eindhoven, Kuusk recently delved into traditional designs and also studied her own country's traditional attire.

She shows a small book containing pictures of various regional attire: "I noticed similarities in the colorful patterns in these gloves, for example, and the QR codes you see everywhere these days - and I'm not just talking about the idea, but the visuals as well. I started experimenting with that." She shows us a bright yellow pillow bearing embroidered QR codes (Quick Response) in gray-green and red. In this case, scanning the code with a smartphone camera, will redirect the user to a website with an Estonian fairytale from the island of Muhu. For the pillow, Kuusk was inspired by the patterns of a folkloric skirt from the island. Another QR code on a white-and-blue bag the researcher recently produced was inspired by a blouse and provides access to proverbs and sayings from the respective region. She continues: "It's really a modern translation of the meaning traditional attire used to have. The patterns and colors on the garments said something about the wearer's family, or the village someone was from. The major difference is that today, we can 'read' such information in many more ways, like by using our phones".

According to Kuusk, the concept has countless possibilities. "It's a highly communicative idea. The clips, stories, and drawings behind the QR codes - or any other digital data you choose to connect them to - may inspire the wearer, or connect him to people in the street. On top of that, it's a nice way to make sure age-old traditions, norms and values don't die." And, she says: "The idea is chockfull of technology, without it being a part of it physically. That last bit is what I really like about it".



Kristi Kuusk. Photo | Bart van Overbeeke

Science for society: Study group Mathematics with Industry

Mathematics at its best

Mathematics for Industry | Norbine Schalijs
Photos | Bart van Overbeeke

Once every year, for one week, mathematicians from the industry and the academic world concern themselves with industrial problems, somewhere in the Netherlands. The problems have been contributed by companies and are always presented on Monday. Five days later, the group of fifty to eighty scientists presents their solutions. The 84th edition of the 'Europese Studiegroep Wiskunde' (SWI, European study group mathematics) was held at TU/e from January 30 through February 3rd.

The setup, having mathematicians from various backgrounds tackle specific modeling questions, has been a success for dozens of years. SWI started in Oxford, Great Britain, in 1968. Several companies were invited to bring a problem that mathematics might solve in order to bridge the gap between science and industry. The first Dutch SWI was held in Leiden, in 1998. A year after that and in 2006, TU/e hosted the event. On the initiative of dr. Adrian Muntean, assistant professor at Mathematics & Computer Science (W&I), SWI was hosted by TU/e this year once again.

Dr. Alessandro Bucchianico, associate professor at W&I, was responsible for gathering problems from various companies.

For example, Eindhoven transmission system operator Endinet wants to know how to build an electricity grid for the near future that allows e-car owners to charge their cars and owners of solar panels to donate their energy to the grid (see box 1). Thales has introduced a problem about the lifespan of mobile networks used for rescue missions. Firefighters and

ambulance staff shouldn't have to deal with exhausted batteries. Thales wants to know how to optimally use their network junctions in order to maximize the lifespan. The Maritime Research Institute Netherlands MARIN wants SWI to look at the safety of ships and oilrigs this year.

Bridging the gap between science and industry

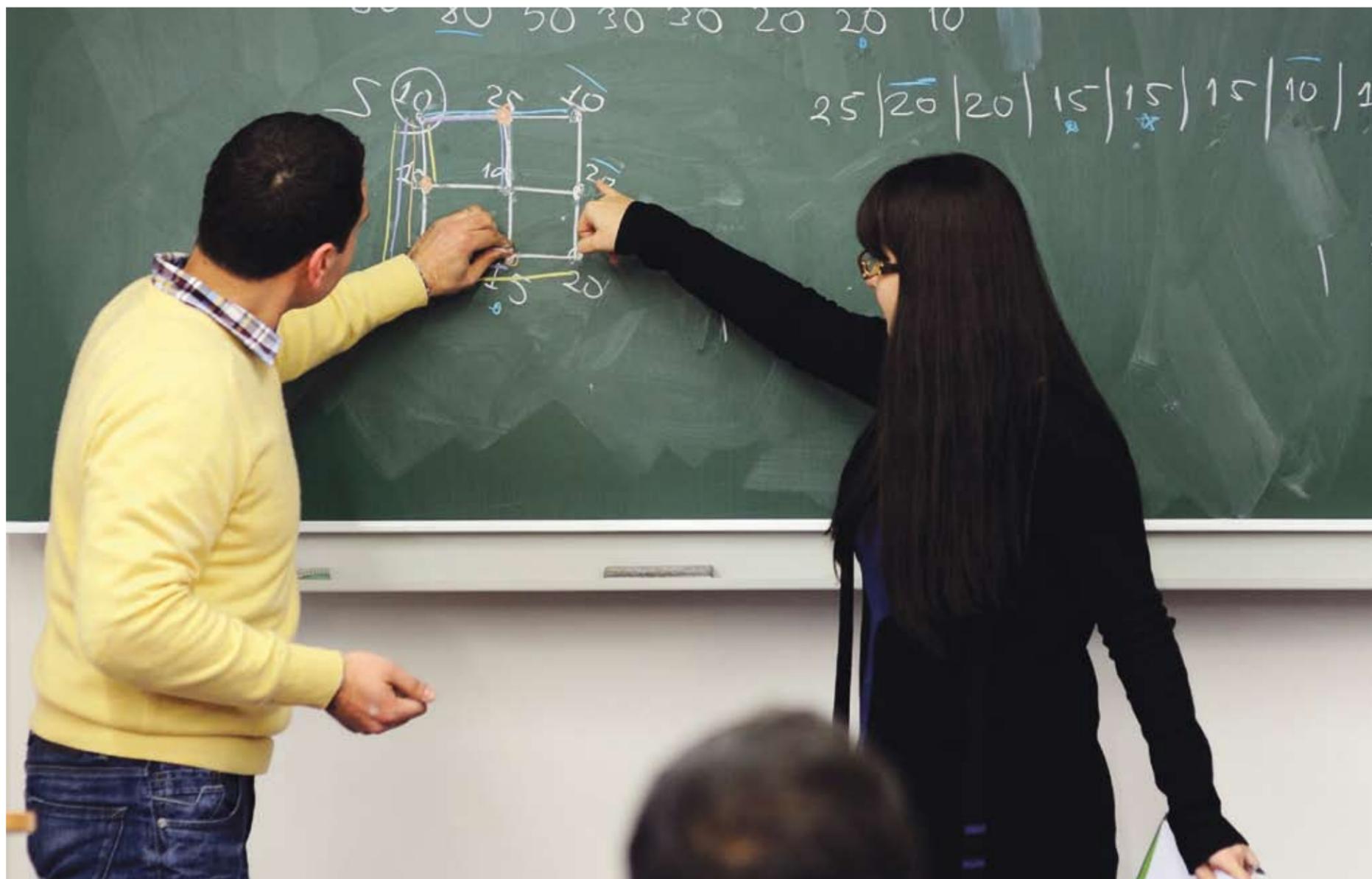
It's the fourth year in a row MARIN has contributed a problem (see box 2). Tata Steel (the former Hoogovens) wants damaged steel coils to be identified at an earlier stage. The company rolls large slabs of steel into thin steel coils, but these can damage when they're cut. Philips Lighting is searching for a way to calculate the loss of light in the design of complex, new-generation LED lighting faster than current techniques are capable of. The most mediagenic problem concerns the building of a mountain in the

Netherlands. Partly on behalf of 'Stichting Haalbaarheidsonderzoek Die Berg Komt Er' (feasibility study foundation we'll have that mountain), Bartels Consulting Engineers wants to know what an artificial mountain should look like (see box). Endinet, Thales, Tata Steel, MARIN, Philips Lighting and Bartels Consulting Engineers don't expect to be presented with revolutionary ideas by the end of the week. "We may be in for a surprise", says Endinet's Yolanda Knops. Thales is happy with anything that will contribute to their understanding of the issue. "We'll see what happens", says ir. Sigrid Mulders, structural engineer at Bartels. "We're still at brainstorm level, so any idea is more than welcome." Anyway, all companies intend to strengthen, maintain, or expand their ties with the academic world. To that end, not only do they bring in their problems, but 1500 euro as well, and they're prepared to put a lot of man hours into SWI. They're required to shape the problem, present it on Monday, stand by for questions all week, and attend the final presentations on Friday. After that, they may want to implement the results. Endinet, being an

Eindhoven company, feels it's important to exude a connection to their region. "Being in the spotlights at TU/e for a week fits into that picture", says Knops. It's was quite the challenge for Di Bucchianico to find participants. Not all companies want to expose their problems to the competition, and some don't have the resources for 'third-party research' (Endinet), 'innovation budget' (Thales), or 'communication and marketing' (Bartels). On top of that, not all companies that were approached have a problem requiring mathematic solutions.

New people were met and old ties were strengthened

During the week, participants spend a lot of time together. They enjoy common dinners and spend the evenings together. On Tuesday, they were at eatery De Verlenging at the PSV stadium, and on Wednesday they were guests at prof. Mark Peletier's (W&I) for dessert and drinks. A man from Sri Lanka who



had never been in Europe before, had to buy a fleece sweater right away. Runliang Lin from Tsinghua University in China is combining SWI with a visit to the University of Amsterdam. He's taking it all in this week, because he'll be organizing a similar event in the future.

On Friday, Tata Steel's presentation is the most interesting, mathematically speaking. Still, media is only interested in The Mountain. ANP, TV network Omroep Brabant, newspaper Eindhovens Dagblad: they all report that TU/e claims the mountain can be realized. There have been some fun ideas. To avoid investing a lot of money all at once, it could be constructed layer by layer. Bert Blocken, professor of Wind Flows at the Department of Built Environment, taught the group that using wind turbines at two kilometers can generate six to ten times more energy. There has been talk of a solar chimney as well: a high, glass column through which water can flow. "It's all been a big brainstorm session. We had more ideas than actual calculations. The mountain project is slowly taking shape. Thijs Zonneveld, initiator of The Mountain, told us he'd like to organize lectures on the subject and asked us if we were willing to help out", says Di Bucchianico. "We're on a roll now."

"The group that had been working on the Tata Steel problem came up with a neat solution for recognizing irregularities on steel coils", says Di Bucchianico. A staff member for Tata Steel's R&D department attending the presentation thinks the algorithm may be implemented next week. Endinet was presented with a less clear-cut answer, but the transmission system operator is very pleased nonetheless. Knops: "One of the results showed that problems in the grid occur when seventy percent of homes have solar cells, a percentage that more or less corresponds to our expectations. However, combining the Monte-Carlo method to stimulate the required grid load and the load-flow calculation to figure out the implications for the grid's electricity and voltage was very refreshing to us." Endinet will be studying the details more closely and then decide whether or not they want to implement the combination. If anything, they've met new mathematicians and strengthen old ties, says Knops. After SWI, each group writes an account of their work, which will be presented in a scientific report. This year, science journalist Ionica Smeets will be putting together a non-specialist booklet as well.

Future-proof energy grid

Endinet is the transmission system operator for gas in Southeast Brabant, and electricity in Eindhoven. "Grids are laid on underground and stay there for dozens of years. The current grids still work with old technology mostly. Since we're facing an energy transition, we have to prepare our grid for the near future. The current grid wasn't designed for locally adding solar-panel energy, for example. Returning energy is new for us. We can do it, but we'll have to recalculate the consequences first. Apart from that, our grid will be faced with e-cars that need charging, which will cause an upsurge in capacity demand. This won't just influence the grid's electricity capacity, but its voltage quality as well. Endinet is required to keep voltage level at around 230 volts. How can intelligent charging strategies make sure grid investments don't soar? How big or intelligent should the grid be in forty years' time?" Yolanda Knops, specialist Asset Management at Endinet, asked SWI to model part of a Tongelre residential area after future scenarios, and predict when voltage or electricity capacity will cause problems. They want SWI to develop charging strategies for electric-car batteries that minimize these problems. It's been researched before, hypothetically, for the Dutch situation, but never for the Eindhoven context. Eindhoven's network is meshed, while most municipalities have radial ones. "We need a refreshing perspective. It's not realistic to have high expectations, but it's a fun math problem and it may even spark interest in our line of work."

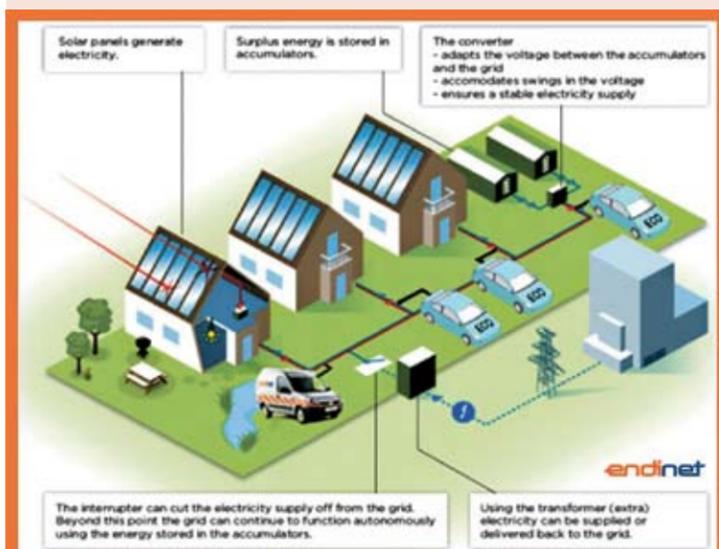


Image of what the smart grid of the future may come to look like. It was presented to participants, so they were clear on the problem.

Math at its best

Ed van Daalen, senior researcher at MARIN, is a big fan of SWI. He's already contributed a problem for the Maritime Research Institute in Wageningen three times before. They involved oscillating ships, the dynamic positioning of oil tankers, and the maneuvering behavior of marine vessels. MARIN is perfectly able to carry out complex model tests in a basin, but it's a very costly endeavor. In 2009, they asked SWI to develop a quick calculation model providing insight into the combination of waves and the ship's loading conditions, which can lead to serious oscillation. "Mathematicians tend to cry 'that's parametric excitation!' and subsequently get to the core of the problem. And in this case, it involved a single differential equation", says Van Daalen. "Based on the SWI results of 2009, MARIN wrote a new program that's both fast and accurate."

A year later, MARIN asked whether it was feasible to design an allocation algorithm that directly considers the restrictions of thrusters: propellers that keep an oil rig in place, for example. Once again, mathematicians managed to find the right approach for a solution. The follow-up study is still ongoing.

Last year, an entirely different problem was tackled. The maneuvering of a vessel in open water or harbors can also be described by means of mathematical models. MARIN asked for a fast way to show the turning circle's diameter with a certain rudder deflection, preferably in a split second. "They had a very clear answer to that issue, and we were especially surprised to hear there's generic (and free!) software for that. See, you never know what might happen at SWI. If you ask me, mathematics is at its best when it's successfully used for practical problems."

Will that mountain be?

Is it even feasible to create an artificial, 200-meter mountain in the Netherlands? It would contribute to sports, tourism, and could help generate renewable energy. In August of 2011, initiator, journalist and former cyclist Thijs Zonneveld published a column on the idea on Nu.nl. And since then, the idea is good for more than just laughs: the project is being taken seriously. There is now a feasibility study foundation named 'Die Berg Komt Er' (we'll have that mountain), and Bartels Consulting Engineers has offered its services.

There have been a few minor feasibility studies already, but the practical aspects haven't been studied on a large scale yet.

Since building a 200-meter-high mountain will present problems the engineering firm has never encountered before, SWI's help is more than welcome. During the week, mathematicians calculated the best shape for the mountain. It's clear it should be hollow; a massive mountain would exert too much pressure on the soil of the Netherlands. Other unwanted side effects such as earthquakes, wind flows, and climate changes must be prevented. The group is also studying possibilities for storing energy in the mountain by pumping up water. It won't be meant for gaining energy – it'll actually require quite some energy – but it might be used to regulate any peak loads in our grids. "It's one big dream", says Andrea Fernandez from Spain, currently doing her Ph.D. at the British University of Bath, "but that's what makes it so exciting."



Wind-energy system Vertigo worldwide premiere

If all goes well, by the end of 2012 the Vertigo building of Built Environment will be the first in the world to have a wind-energy system installed that's integrated in the building's construction. Expectations are high: the system is supposed to generate more energy than any other system currently available.

The office of Italian dr.ir. Rosella Ferraro on floor 9 is situated right under Vertigo's roof, which is where it's all about to happen later this year. The researcher for 'Renewable Energy in the Built Environment' has worked with dr.ir. Alexandra Suma in Miami in 2008 and 2009, a TU/e alum and inventor of an integrated wind-energy system bearing the working title IRWES: the Integrated Roof Wind Energy System. Both Suma and Ferraro came to TU/e to further develop and expand on the concept. The Italian researcher was awarded a European Marie Curie Grant, enabling her to conduct research at a host institution of her choice. IRWES is different from 'normal' wind-energy systems in one important respect, Ferraro explains. Usually, wind turbines are used, but these have the disadvantage of being heavily dependent on the weather and their built surroundings. A wind turbine starts working at 3.5 meters a second. However, at some 2 meters a second the average wind velocity in the built environment in the

Netherlands is less. "There's a reason windmills in the countryside aren't spinning a lot of the time", the researcher illustrates.

The solution: building a system around the turbine. The idea is that wind is collected by so-called louvers and funnels (channel system with horizontal panels). The major upside to this setup is that wind pushed through the constriction, accelerates. "In physics, this is called the venturi effect", Ferraro explains. The turbine has an accelerated drive that generates a relatively large amount of energy. The plan is to store the energy and use it in part of Vertigo. The exact amount of energy that's released and the maximum wind speeds IRWES can handle has yet to show from measurements, and Ferraro is reluctant to provide any hard numbers. Still, she can give some indications: the system should generate more energy than an average family home uses. And a business plan designed by students Stefan Suntjens and Nicolas Nelson for the certificate program Technology

Entrepreneurship shows construction requires an investment of some fifty thousand euro, costs that should be recovered after ten years. IRWES' life span should be at least twenty years. Ferraro calls IRWES an 'open sky lab' - a laboratory in the open air. The system will be used for education and research. For example, we may gain more insight into the workings of air currents, and the use of wind turbines can be optimized.

IRWES should recover its costs after ten years

With the project, the research group wants to take an internationally prominent position in the field of scientific activities regarding wind energy in the city center. It's no coincidence the system will be located on the roof of Vertigo: the building is facing southwest and knows a relatively high exposure to wind, there are few surrounding buildings blocking wind, and Vertigo has a high visibility from both the city and campus. It's also 'an easy location' to build, says Ferraro, stressing the quotation marks. After all, relatively easy as it may, it's certainly no picnic. There's the hassle of paperwork,

working with the design and last but not least: taking into account the technical aspects and logistics.

The research process knows many aspects, which is why the team consists of members with various skills. Suma is mostly focused on the business aspect, while Ferraro concentrates on the scientific side. Dr.ir. Faas Moonen works on logistics, coordination and practical issues. Master students Rianne Dekker and Adelya Khayrullina are studying the best way for IRWES to be placed onto the roof, taking into account aerodynamics, the Vertigo design, and the building's structure as a whole. Student ir. Rubina Ramponi is working on the design. DH will take care of all the necessary paperwork, including a stricter safety policy. In the near future, the group wants to involve more students in the project as well.

Last year, Technology Foundation STW awarded the project with a 250,000-euro Valorization Grant. The Anniversary Award the group was presented with last September also brought in extra money. And because of the university's 55th anniversary, University Fund Eindhoven (UFe) made available 55,000 euro, part of which went to IRWES for winning in the category 'energy'. At the time, director Rick Harwig of the Energy Research Cluster said their idea is "an elegant combination of an architectural solution and efficient, clean energy supply". Right now, a prototype of the wind-energy system is pretty much ready for testing, and it's expected to be done in Maastricht later this month. TU/e has access to an open field over there, enabling researchers to test the effect of wind in the very best of conditions. Based on test results, the group will start working on improvements, and after that the system is scheduled for the roof of Vertigo, which will probably be by the end of 2012. In the meantime, Innovation Lab is helping the group with the startup of a company to commercialize their invention, and the researchers will be checking whether IRWES may be integrated in other TU/e buildings as well. (JvG)

Check www.irwes.com.



An impression of Vertigo with IRWES on top of the roof.