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## Editorial

### Dear readers

We make decisions every single day – as consumers, voters, politicians, businesspeople or scientists. We make them in an increasingly networked and thus complex world where our decisions do not merely affect our own lives. In their entirety they have an impact on society as a whole. Or to put it in more concrete terms: they influence complex systems such as traffic, the energy supply or the financial markets. Complexity is becoming increasingly inherent to socially relevant areas. However, the behaviour of complex systems is difficult to predict. At ETH Zurich our natural and social scientists and engineers research complex systems by interacting with them, modelling or simulating them.

Complex systems can be thrown out of kilter by varying a single parameter. A trend in the sum of the individual decisions of many people can cause a complex system to collapse, as the financial markets recently demonstrated, with drastic or even catastrophic consequences for the whole of society. But the climate system is also influenced by the decisions of many millions, even billions of individuals. These examples show that complex systems in many cases also harbour tremendous risks.

Based on its profound expertise, ETH Zurich is looking to become one of the world's leading centres for integrated risk research. Within the framework of the recently founded Risk Center, it is pooling its diverse existing activities in teaching and research in order to gain a holistic perspective on different risk types and to investigate their interplay. The aim is to improve the management of risk portfolios and thus obtain pointers on how highly networked social systems can be rendered more robust.



The members of ETH Zurich's Institute for Environmental Decisions (IED) work out basic principles for decision-makers. Headed by Renate Schubert, a professor of national economy, five chairs from the humanities and the social, political and environmental systems sciences conduct research on the individual and collective decisions that are made in connection with resources and the environment. In doing so, these professors want to help private and public decision-makers to make sustainable decisions – despite considerable uncertainties, such as in the matter of the climate.

In this Globe issue we offer you a brief glimpse into the multifarious research areas of professors who are associated with the Risk Center and the IED. I wish you happy reading.

**Ralph Eichler**  
President of ETH Zurich



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## Flashlight



## Tower block slum

The “Torre David”, a 45-storey office block in Caracas, Venezuela, was never really completed due to the economic crisis of the 1990s. Today, the ruin is a makeshift home for over 750 families who have settled there. The residents live in this unfinished shell without any lifts or even façades, organising their own water and power.

Together with their teams from the architecture firm Urban-Think Tank in Caracas and ETH Zurich, and in collaboration with photographer Iwan Baan, the ETH Zurich professors Alfredo Brillembourg and Hubert Klumpner spent a year studying the physical and social organisation of this squatter community in order to find ways to make the tower block safer and more functional.

Their project was showcased at the thirteenth Architecture Biennale in Venice with the installation “Torre David / Gran Horizonte” (curator: Justin McGuirk) and won the Golden Lion for best project at the “Common Ground” exhibition. A book on the project was recently published.

About the project:

<http://torredavid.tumblr.com> →

About the book Torre David:

[www.lars-mueller-publishers.com/en/torre-david](http://www.lars-mueller-publishers.com/en/torre-david) →



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Society in Science

## Branco Weiss's legacy

In his will, the ETH Zurich alumnus and patron Branco Weiss, who passed away in 2010, made sure that his ETH-affiliated development programme "Society in Science – The Branco Weiss Fellowship" would be secure for the coming decades. His donation, estimated at CHF 100 million, has opened up new dimensions for the promotion of young talent. The Fellows are given a unique opportunity to pursue their research ideas unimpeded and to benefit from the greatest possible academic freedom. This development programme enables ETH Zurich to explore research fields of the future without running institutional risks, and to build relationships with young, highly talented scientists from all over the world.

Time and again, Branco Weiss was very generous to his alma mater. He

gave ETH 23 million Swiss francs to build the new HIT building at its Hönggerberg location, for instance. In 2002 he laid the cornerstone for his intellectual legacy by founding Society in Science – The Branco Weiss Fellowship.

In the first ten years of its existence, the postdoc programme supported 36 researchers in all, 21 of whom are still active fellows. In 2012, 434 candidates applied for a fellowship, eight of whom were accepted.

Applications for the 2013 fellowship are invited with a deadline of February 1, 2013. For more information visit:

[www.society-in-science.org](http://www.society-in-science.org) →

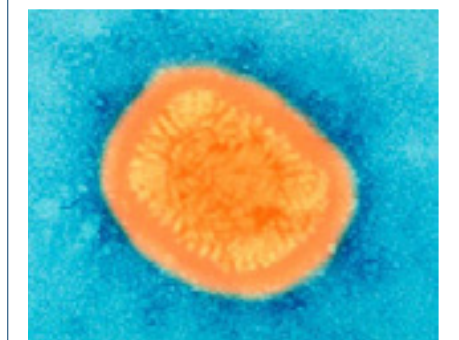
Cell biology

## Virus uses cell's waste disposal system

Using the example of the vaccinia virus, which formerly served as a vaccine against smallpox, researchers from ETH Zurich and the University of Zurich have gained new insights into the penetration of human cells by viruses.

The virus uses the cell's waste disposal system for reproductive purposes. This involves the small molecule ubiquitin, which marks molecules to be disposed of, and the so-called proteasome, which removes the molecule waste marked with ubiquitin in the cell. The virus allows its protein shell to be marked generously with ubiquitin. If it penetrates the cell, the proteasome is brought into play and breaks down the protein shell – thus releasing the virus's genetic information. Finally, the viral DNA is duplicated in the cell, and new virus particles are formed.

If the researchers immobilised the proteasome with an inhibitor, however, it was no longer able to crack the viral shell. This might constitute a general strategy to combat other DNA viruses that depend on cellular waste disposal besides poxviruses, such as herpes.



The vaccinia virus cunningly exploits the cell's waste disposal system to reproduce.



## Ticker



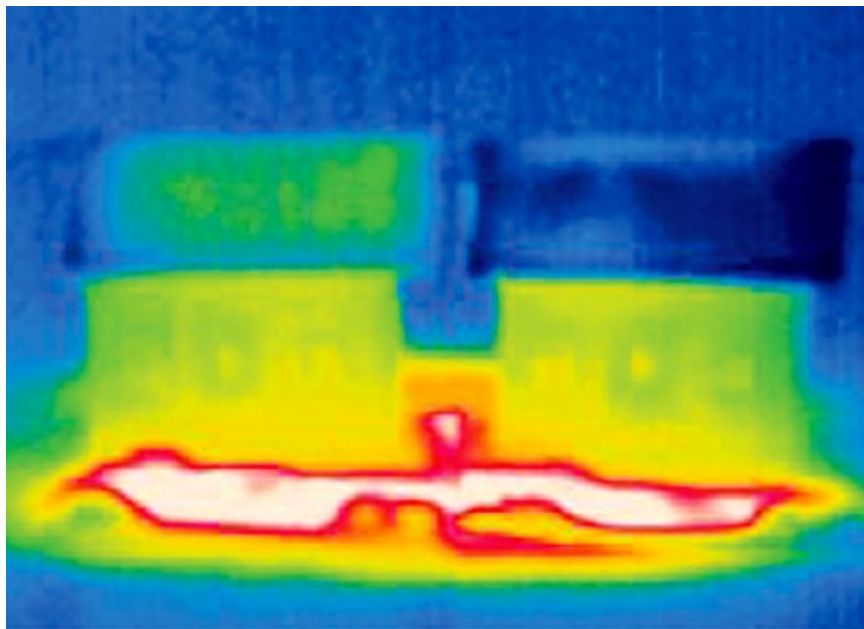
ETH Zurich Latsis Prize

## Young graphics specialist honoured

The 2012 ETH Zurich Latsis Prize went to computer science professor Olga Sorkine. This 31-year-old is a global leader in geometric modelling. One of her research interests is the representation and animation of complex three-dimensional objects. She would like to simplify these to such an extent that the objects can constantly be changed and adapted in real time. Her research can be applied in the film industry and in medical engineering. The ETH-Zurich Latsis Prize is worth 25,000 francs and is regarded as the most prestigious award for young researchers at ETH Zurich.

## Twelfth place

In this year's Times Higher Education World University Rankings, ETH Zurich leapfrogged three places into twelfth. In the latest QS World University Rankings, it came thirteenth. It thus remains the best university outside the Anglo-American world.



Infrared image: a special sweating polymer mat (right) cools a model house more effectively than a conventional mat (left).

New material

## Sweating rooftops cool buildings

Sweating is a simple process to cool bodies down. This principle is now to be used to cool buildings, too. Researchers from the Institute for Chemical and Bioengineering have developed a mat that sweats, and they want to cover roofs with it. For this, they used a poly-

mer, abbreviated to PNIPAM, which is protected by a water-permeable membrane. If it rains, the mat soaks up water; if the material warms to over 32 degrees, it shrinks up and adopts water-repellent properties. This squeezes the water through the membrane towards the surface of the mat, where it evaporates. The researchers believe that up to sixty per cent of the energy used in hot months for air-conditioning could be saved as a result.

"Hochschulmedizin Zürich"

## Harnessing unique potential

ETH Zurich, the University and University Hospital of Zurich have together launched the strategic initiative Hochschulmedizin Zürich ("University Medicine Zurich"), thus establishing a pact for research and innovation in biomedical and medical engineering. The unique potential of the three institu-

tions enables the swift transfer of knowledge between technical and medical research and clinical practice.

The first two competence centres are already being set up and will deal with personalised medicine and imaging processes. Further interdisciplinary research projects are to follow. However, Hochschulmedizin Zürich also sees itself as a contact point for interested researchers, donors and media.

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KOF Swiss Economic Institute

## Prominent new arrival

Ursula Renold, formerly the Director of the Federal Office for Professional Education and Technology, has joined ETH Zurich's KOF Swiss Economic Institute and will be developing its research field "education economics" from 2013 onwards. The main focus will be on improving the position of the Swiss system of education and employment, and in particular of vocational training.

Swissmem archive

## 270 running metres of industrial history

The Archives of Contemporary History (AfZ) at ETH Zurich have been entrusted with a substantial new addition: the complete historical archives of Swissmem, the umbrella organisation of the Swiss mechanical, electrical and metal industries. Around 270 metres of files and audio-visual sources document the history of the Swiss machine industry since 1883.

Pharmacy

## Cholesterol reducers inhibit lymphatic vessel growth

Researchers from the Institute of Pharmaceutical Sciences have made an unexpected discovery. While searching for new pharmaceuticals to inhibit tumour metastases and prevent organ rejection after transplants, they found evidence that a well-known group of drugs could lend a helping hand: statins.

They are used all over the world to reduce cholesterol for cardiovascular problems.

The scientists made the discovery with a new cell culture system. Instead of the usual two-dimensional cell layer in a cell culture dish, the researchers worked with cell cultures on tiny beads in a three-dimensional system. They tested over 1,000 substances and found 30 that inhibited lymphatic vessel growth. For some of the substances, including one that belongs to the statin class, this effect was previously unknown.



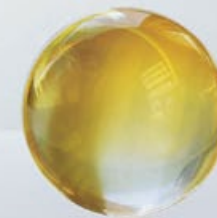
Brown patches on cross-sections of infected manioc roots.

Plant genetics

## New manioc species defies virus

Manioc is one of the most important crops in tropical countries, especially in sub-Saharan Africa. However, various plant viruses threaten its cultivation and thus the basic food resource for hundreds of millions of people. With the aid of genetic engineering, researchers from ETH Zurich have now developed a new strain of man-

ioc that is resistant to the dreaded cassava brown streak virus that infects the edible, starch-rich roots, forming brown patches and making the roots unfit for consumption. Although the virus originates in Eastern Africa, it is threatening to spread to Central and Western Africa, too. The researchers now want to team up with African colleagues to field-test the genetically modified variety. The technology will be placed at the disposal of research institutions in Africa for free.

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Jan Beutel (l.) and Samuel Weber (r.) need technical expertise and Alpine skills to service the various automatic monitoring devices on the Matterhorn's Hörnligrat.

#### Sensor network

# Eavesdropping on the Matterhorn

Peter Rüegg

**Even the coldest regions way up in the mountains have not been able to escape climate change. In an unprecedented measuring campaign spanning several years, researchers from various universities have been exploring what goes on beneath the cracked skin of Switzerland's landmark, the Matterhorn.**

Only moments ago, the whirring and screeching of the drill broke the silence before it was suddenly drowned out by a menacing rumble. An avalanche whooshes down the steep eastern flank of the Matterhorn, pouring over a rocky cliff like a waterfall and unrolling like a tongue a few hundred metres further down at the foot of the mountain.

Jan Beutel, a senior assistant at ETH Zurich's Computer Engineering and Networks Laboratory, carries on working regardless, as does his colleague Samuel Weber. Secured on a forty-metre rope, they drill holes into the grey gneiss, lay cables and screw in guard plates.

Since 2006, the researchers have regularly been dropped off by helicopter at the Hörnligrat on the Matterhorn. This time they are here to replace a crevice gauge that was torn off by a falling rock last winter. They have to be quick, as the thaw is setting in rapidly on this June day, the first day of the year when it has been possible to perform the urgently needed maintenance work on the PermaSense network's measuring points.

Only a few years ago, the steep face to which the researchers are attaching their measuring device was covered in solid rock. But during the hot summer of 2003 it tumbled into the valley as the extreme heat thawed the ice that had formed deep in the cracks. This caused the rock – 2,500 cubic metres of material in all – to slide.

The rock avalanche did not just alarm the public; researchers also pricked up their ears. After all, sheer ice appeared at the break line – ice that should really have held the rock together as a joint filler. Evidently, the scientists suspected, it is not just the permanently frozen tundra soil in the Arctic that is thawing out due to the increasingly warmer climate; the permafrost is also disappearing in steep rocky regions like here on the Matterhorn. This can cause rockfalls and avalanches, which means entire mountain regions are in jeopardy. However, experts knew little about the factors that encourage or trigger such events, and they barely had the technical possibilities for carrying out permanent monitoring operations at such altitudes and under such extreme climatic conditions.

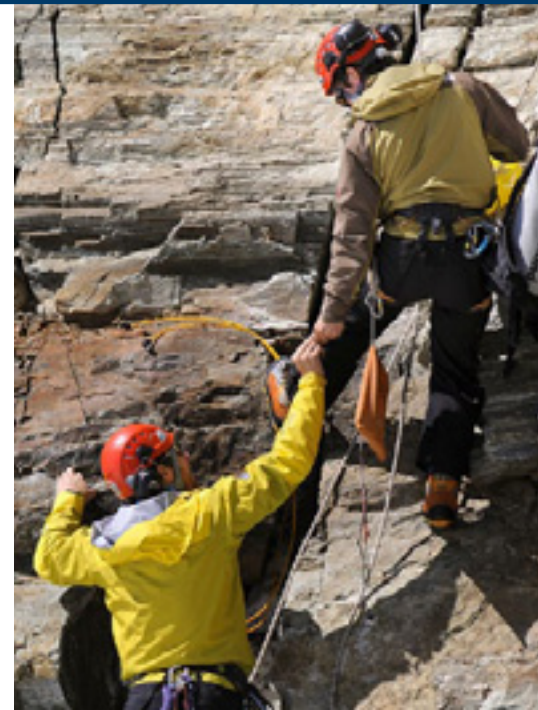
#### Sensor park moves mountains

This would all change in 2006 when researchers from various universities, including Jan Beutel as a representative of ETH Zurich, began to set up a wireless sensor network at the rock avalanche point on the Hörnligrat. It is part of the "PermaSense" project of the National Centre of Competence in Research "Mobile Information and Communication Systems" (NCCR MICS) and also received funding from the Federal Office for the Environment (FOEN).

With PermaSense, the researchers are looking to get to the bottom of what triggers rock avalanches, how climate affects permafrost in steep rocky areas high up in the mountains, and how the Alps change as a result. The Matterhorn is one of three regions where researchers from ETH Zurich and the universities of Basel and Zurich are studying what holds rock faces together (the other two being the Jungfrauoch and the Dirruhörn in the central Mattertal).



## Report



The helicopter that transports people and materials to the Matterhorn is sometimes what Samuel Weber (l.) and Jan Beutel need to get to work. Vertical teamwork: Jan Beutel (below) hands Samuel Weber a screw to secure a guard plate.

Jan Beutel replaces the control unit that regulates the automatic camera. Samuel Weber works at dizzying heights without much room to manoeuvre: the PermaSense test area on the Matterhorn's Hörnligrat.

Beutel and his colleagues have installed over 100 sensors on the Hörnligrat in recent years – some on the sunlit southern face, some on the shady, cold northern side of the crest. The sensors constantly measure the temperatures on and under the rock surface and in the cracks. They record the ice and water pressure, crack widths and the electrical conductivity of the rock. Wireless transfer systems feed the data into the internet in real time so that it can be freely accessed at their desks at any time.

#### Constantly in motion

Beutel and his research group played a key role in developing and setting up the wireless sensor network – and he personally mounted many devices on the rock and steep faces. The highly specialised network components developed in the project, the so-called nodes, send the data from the various measuring points to a base station installed on the Hörnligrat. In turn, the base station transmits all the data via broadband WLAN to an antenna that receives it on the Little Matterhorn, several kilometres away as the crow flies, and eventually feeds it into the internet via the mountain railway fibre optic network.

The scientists use these gigabytes of data to help them gradually determine the phenomena that form the mountain and cause rocks to fall. For instance, the measurements show that cracks in the rock expand and contract both during the day and in the course of the seasons – like train tracks that stretch in the heat. This makes the cracks narrower. Over time, these movements change the geometric arrangement of the chasms: the rock becomes increasingly weather-beaten. However, cracks can also expand suddenly and without warning, especially in the late summer.

These abrupt movements, the researchers suspect, are caused by mechanical processes triggered by changes in temperature. The meltwater thus sinks to greater depths in the summer and freezes when the temperatures drop below zero towards the autumn.

The researchers are only just starting to understand many of the processes involving permafrost in steep, rocky regions. In order to find out more about them, they expanded the sensor park on the Hörnligrat in August 2012. At two points where the rock broke off, they anchored sensitive microphones around the crevices to record the cracking sounds that are produced when tensions are reduced inside the rock and cracks form that are invisible from the outside. The methods and devices this requires were developed by Samuel Weber in his Master's project at the University of Zurich. He has been working in Jan Beutel's workgroup for half a year. In order for this system to be compatible with the wireless PermaSense network, it needed some adjustments. The sound sensors had to be adapted for use in high mountains.

Tests on the Jungfrauoch, where Weber launched the first rock eavesdropping campaign during his Master's project, reveal that acoustic emissions occur in unpredictable bursts and mostly when the temperatures are just below freezing. "However, freeze-thaw cycles aren't absolutely necessary for the emissions to occur", he stresses. They also come about if the temperatures are constantly frosty but do not remain too cold. Only in warm temperatures does the rock seem to settle down and creak less frequently. Weber hopes that the new sound sensors on the Matterhorn will shed more light on what goes on in the rock in the lead-up to rock avalanches.

#### New methods for use in practice

"The acoustic measurements work really well," says Beutel. For him, this phase is effectively the finale of the six-year project, for the third part of PermaSense is drawing to a close: the NCCR MICS is due to finish at the end of October 2012. So it's time to take stock.

Despite some teething problems, they have achieved a lot, the researcher sums up. The technology and methodology they have developed – a mixture of commercially available standard components and completely new concepts – is gradually being channelled into environmental monitoring practices. In July, for instance, Beutel and his team helped French research colleagues to install a light version of their Matterhorn network in the Mont Blanc region.

The method for measuring mass movements on rock glaciers using GPS – part of PermaSense and funded by the research initiative "nano-tera.ch" – is already being used in practice. For the environmental authority FOEN, GPS measuring stations were set up in other areas of Switzerland and documentation produced. For some time there have been talks with FOEN and the WSL Institute for Snow and Avalanche Research Davos (SLF) about continuing these stations for the purposes of long-term monitoring after the research project ends.

However, Beutel is still not yet satisfied with the evaluation and analysis of the data from the PermaSense project. "We're way behind schedule on that front", he freely admits in his Zurich office, casting a glance at a pile of paperwork – his mind already back on the mountain. A white aluminium tube about a metre in length, with a triangular base, is lying on his desk. "It just arrived", he says, reaching for the metal tube. It will soon be used on the rock glacier.

The electronics go in the tube and a GPS transmitter is attached to the top. The device is part of the network the researchers use to measure how individual blocks of rock shift over the course of time as they move down to the valley along the frozen ground.

Despite the conclusion of PermaSense, Jan Beutel will not be abandoning the Matterhorn entirely. This electrical engineer has already initiated a new project that uses the seismic measurements. In order to be able to listen in on the rocks even more closely, he envisages a very special microphone with sensors that work on a nanoscale. These could even pick up the tiniest of sonar or shock waves as they spread through the rock. He has already found a suitable partner for his endeavour: ETH Zurich professor and nano-sensor specialist Christofer Hierold. Now all that remains is for the project to be approved. ■

«PermaSense»  
[www.permasense.ch](http://www.permasense.ch) →

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# How we decide

Apple or pineapple? Car or train? Buy or sell shares? For or against the climate agreement? We buy goods, invest money and vote for or against things. Some decisions are made quickly, others are prepared well in advance, and often we have to decide without a clear view of the overall picture. Yet every one of these decisions has consequences. The following articles examine how we make decisions and how complex systems, such as the environment or financial markets, are influenced as a result.

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## Focus Complex systems



# Reason or gut feeling?

We make many decisions without thinking. They are routine and unconscious. Others we ponder over endlessly before finally making them. And others still we don't even make at all. Because it is easier not to. Or because we fear the consequences. Researchers from ETH Zurich reveal which factors influence our decisions, and the tricks used to nudge us towards the "right" ones.

*Christine Heidemann*

Imagine you had to choose between the following two alternatives. Decide on option A and I will give you 50 Swiss francs there and then, cash in hand. Should you go for option B, however, we will toss a coin. You will receive 100 francs if it comes up heads and go home empty-handed with tails. Which alternative do you decide on? Do you seize the opportunity to double your money? Or play it safe and take the 50 francs?

And what if the boot was on the other foot? If you paid me 50 francs the game would be over, or we could toss a coin and you had to give me 100 francs for heads and nothing for tails.

"Most people avoid risks if there is something to gain and take them if they risk losing something", says Ryan Murphy, a professor of decision theory at ETH Zurich. In other words, most people settle on the fifty francs in the first scenario. In the second case, however, they choose to toss the coin in the hope that they will not have to pay out. This variability in risk preferences is one of many phenomena in human decision behaviour that the expert has been studying more closely with the aid of various tests at ETH Zurich's own Decision Science Laboratory.

For three years, this state-of-the-art lab with a total of 36 booths arranged as in a language lab has served as a test centre for the researchers in their search for the factors that influence our decisions. Test subjects have to complete a wide range of tasks similar to those mentioned above – and can even earn some money into the bargain: from a decision-theory perspective, the better their choice among the alternatives presented, the more francs the scientists pay them at the end of the test.

The perfectly rational decision-maker serves as a kind of reference person for the researchers: the illustrious homo economicus. According to classical and neoclassical economic theory, this fictitious person acts completely selfishly, always weighs up the costs and benefits carefully and then chooses the alternative that promises him the most advantages. In this sense, homo economicus finds decisions easy: he is not swayed by emotions, preferences or experiences. His choice is predictable.

In reality, however, it is generally a different story. Most people tussle with a multitude of different feelings that influence their decisions. Often unconsciously. As a result, their behaviour deviates in varying degrees from economicus, who is solely governed by reason, Murphy explains. "We'd like to find out why and in which situations this is the case."

Based upon these results, the researchers hope to be able to predict modes of behaviour in everyday life – yes, even to steer decisions in a particular direction. Such as coaxing people into more environmentally conscious behaviour. Or, conversely, helping people to make difficult, sometimes life-or-death decisions as autonomously as possible and free of influence. Such as in hospitals.

## It's all in the wording

In earlier studies with colleagues from the USA, Murphy was able to demonstrate impressively that the way doctors phrase the prognosis for the progress of a disease influences patients or relatives incredibly strongly in their decision-making. "That's very serious from an ethical point of view", the expert from ETH Zurich is convinced. Especially if, as in the case he studied, parents have to decide on treatment for seriously ill, new-born children.

Accordingly, parents are less willing to take risks in the treatment if doctors phrase the prognosis positively, in other words if they talk about survival chances. By the same token, they are more prepared to take a gamble if mortality rates are mentioned – even though the outlook is the same in both cases. This is supported by tests which, for ethical reasons, the researchers did not conduct with those affected, but instead with expectant mothers and parents of older children. The results revealed that the decisions varied by ten to fifteen percent, depending on how the prognoses were phrased. "That's a lot, and induced the doctors in that hospital to formulate their statements both ways from then on."

The threat of loss thus makes us bolder. We risk more; sometimes even too much. "People feel losses about twice as strongly as gains", Murphy explains, and this sometimes leads to extreme reactions and unwise decisions – especially if real or perceived competitors are also involved.

This is also demonstrated by lab experiments that the decision researchers have been conducting based on so-called game theory. This enables different decision situations to be modelled mathematically and simulated in the computer. In these experiments, Murphy and his team set the participants tasks like those mentioned earlier, only that in this case, the gains or losses do not depend solely on the decisions of one individual, but rather on the reactions of an entire group of test subjects. In other words, in this scenario everyone competes against everyone else to earn as much money as possible and to beat their fellow competitors in the game.





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## Wir bauen Zukunft.

Vielleicht schon bald mit Ihnen?

These experiments are relatively new, considerably more complex but also extremely exciting, as Murphy assures us: “We see that people sometimes take astonishingly high risks in these competition situations. We wouldn’t have expected this on such a scale.”

### Many risk too much in competition scenarios

This kind of overambitious behaviour cannot just harm the decision-maker himself, as Murphy explains using the example of the bonuses with which many companies aim to motivate employees to perform even better. “As a result, key decision-makers often compete so hard and riskily against each other that the positive effect turns negative and no one performs as well as beforehand.” So this is a classic case of so-called “social dilemmas”, where individuals only consider their own interests, act in a purely profit-oriented manner and thus come off worse than if they had cooperated with other individuals.

For Murphy, typical problems that arise through social dilemmas also include traffic jams or pollution. However, particularly in the environmental sector “uncertainty concerning the behaviour of others” might be behind what, at face value, seems like purely selfish behaviour, suspects Renate Schubert, a professor of national economy and Head of the Institute of Environmental Decisions at ETH Zurich.

As Schubert explains it: as long as someone does not know exactly how others behave as regards energy-saving, for instance, he will initially behave in such a way that he comes out of it fairly well without making much of an effort, regardless of what the others do. By the same token, as studies from the USA confirm, the consumption of electricity also tends to drop most in households if the consumers are aware of the neighbours’ consumption figures; in other words, they have a reference point. Financial incentives or appeals to our environmental conscience, on the other hand, motivate consumers considerably less to opt for a more economical use of energy. What is more: the neighbour is absolutely becoming the norm in both a positive and a negative sense, researchers from the ETH Zurich spin-off BEN Energy have found in collaboration with the Bernese utility company BKW.

Equally, consumers who are below their neighbours’ consumption figures also take their cue from their values – and start consuming more power again. Personal praise or feedback in the form of smileys for above-average good behaviour, however, could put a stop to this negative development, the scientists say.

At least in energy-saving, personal feedback thus seems to be able to guide decisions in the desired direction. “How-

ever, we don’t yet know which feedback mechanisms people respond to best, how individual the mechanisms need to be, whether they also have a long-term impact and whether there are differences between different consumer groups, such as between men and women”, says Schubert.

The researchers at the Institute of Environmental Decisions have thus been conducting various projects in an attempt to find out more about the factors that ultimately lead to specific, environmentally relevant decisions. Schubert, her colleague Michael Siegrist and their teams, for instance, are carrying out an investigation for the Swiss Federal Office of Energy into why people buy so few energy-saving electronic devices. Is it because these devices only pay off after some time, meaning that long-term thinking and patience is required – traits that do not exactly suit our fast-moving, throwaway society?

In order to find the answers to questions like these, Schubert’s team have been interviewing customers of an online electronics distributor. Before they submit their orders, they are automatically redirected to a questionnaire which asks them, among other things, about their time and risk preferences, their knowledge of profitability calculations or their income situations.

In another project conducted within the framework of the European consortium “Climate KIC”, the researchers under Schubert are examining whether and how companies can help their employees to save energy at home. One important aspect here is to reduce the consumption of hot water. In collaboration with the ETH Zurich spin-off Amphiro, they are looking at designing devices that display the hot water used while showering so that people are motivated to have shorter hot showers. Is it the length of time the person before me spent in the shower that encourages me to have a shorter one? Or do I respond more to the image of a polar bear standing on ice as it melts beneath its paws, the longer the shower takes?

### Major role of emotions

One thing is clear: according to Schubert, emotions and psychological effects play a major role in the decision-making process and have long been neglected as an important factor. Accordingly, global warming is much too far off for most people. We can’t see, hear or feel it. It doesn’t threaten us directly. We don’t sense the potential losses it entails – losses that would get us far more worked up than potential gains or opportunities. Furthermore, if I do something against global warming today, at most my children or grandchildren will be the ones to benefit from it. “This temporal discrepancy”, Schubert says, “means that potential future events aren’t really taken all that seriously by



## Focus Complex systems

a lot of people." Moreover, no one can be certain that his own efforts will actually bear the desired fruits one day. In light of these uncertainties, many people simply let everything carry on unchanged.

#### Addressing the emotions more strongly

For measures related to climate policy, this ETH Zurich professor therefore recommends stressing more emphatically those positive side-effects that will occur soon, that are closer to us and affect us more strongly. Such as the positive effects on health from which we stand to benefit if we burn less fossil fuel.

And of course, says Schubert, the financial situation also plays a major role in the environmental decision-making process. For instance, Swiss consumers buy an above-average amount of comparatively more expensive bananas from fair-trade organisations. "In Switzerland, people can afford many environmentally friendly decisions without the household budget becoming too tight as a result." It is a quite different kettle of fish in other countries with a lower per capita income.

The lethargy of the individual is not to be underestimated as a limiting factor, either: if someone is used to leaving the television on standby when he goes out, he would have to change his routine to act in a manner more energy efficient and environmentally friendly. This is often perceived as tiresome.

"Consequently", Schubert believes, "it would also be a good idea for an electricity company simply to switch to more ecological electricity in general. Those consumers who do not agree would have to take the initiative to notify the company." Hardly anyone would protest, because people are generally lethargic and most would agree with it anyway. "But if you explicitly have to give the go-ahead to change the quality of the electricity provided, it would hardly ever happen, again because of lethargy."

#### The battle of the two thought systems

Ryan Murphy is also studying what role time pressure plays in decisions. "We want to find out when time-related stress helps people make decisions and when it is harmful." In the decision lab, he and his team measure blood pressure, skin resistance and breathing while their test subjects have to decide on one of the given alternatives within seconds.

These snap decisions, Murphy explains, stem from the intuitive thought system, which constantly grapples with the slower, more analytical thought system for supremacy in the brain. That is also why so many people have trouble

deciding – even though evidently we often unconsciously bypass the slower system and effectively decide on gut instinct.

Such a gut decision can certainly be right in individual cases. However, decision expert Murphy recommends that we keep reminding ourselves that things are often presented one-sidedly, and we might thus get coaxing into decisions that do not actually correspond to our convictions. In such cases it is better to pause for a moment and listen closer to the arguments of the slower thought system – in order to avoid making any unpleasant wrong decisions. ■

More information on the Institute of Environmental Decisions:

[www.ied.ethz.ch](http://www.ied.ethz.ch) →

Chair of Decision Theory and Behavioural Game Theory:

[www.dbgt.ethz.ch](http://www.dbgt.ethz.ch) →

ETH Zurich's Decision Science Lab:

[www.descil.ethz.ch](http://www.descil.ethz.ch) →

Online research platform with decision tests:

[www.globe.ethz.ch/vLab](http://www.globe.ethz.ch/vLab) →

#### Book:

Daniel Kahneman: Thinking, Fast and Slow.

Farrar, Straus and Giroux, New York, 2011, ISBN 978-0-374-27563-1.

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## Focus Complex systems



# Steering transport in the right direction

Roland Baumann

**Our society is becoming increasingly mobile. Every day we make decisions on which means of transport we are going to use – not always consciously and rarely rationally. Transport researchers from ETH Zurich have been studying how we decide, in order to develop tools for transport planning.**

Get up, shower, have breakfast, then off to the train, tram, bus and a few steps on foot – or perhaps into the car instead? We rarely ask ourselves which means of transport we are going to use in the morning. Our choice follows a daily routine. What if, however, there were a bus stop outside your house? Or if the daily traffic jam always meant leaving earlier to get to the office on time? Perhaps then we would consider switching our means of transport. If a large number of people made such a change, it would af-

fect the entire transport system. These altered conditions on the streets and in the trains would in turn have an impact on the decisions transport users make.

## Simplifying reality

In order to plan the transport infrastructure, it is extremely important to understand how individual transport users make their decisions. Kay Axhausen, a professor at the Institute for Transport Planning and Systems (IVT) at ETH Zurich, has been studying the behaviour of transport users and developing models that illustrate transport systems: "We make tools that can be used for decisions on transport policy."

The basis for these transport models is the "homo economicus", "rational man", who uses a transport service more if it gets cheaper. This kind of person chooses the means of transport that gets him to his destination the quickest and cheapest.

What might sound simple enough in the basic economic model, however, also has its pitfalls, because we humans do not always behave rationally.

## A minute is not a minute

Axhausen explains this based on the factors that influence the choice of transport: "Studies show that people are not keen on walking. We'd much rather drive for two minutes if it means avoiding one minute on foot. If we use public transport, we have an aversion to changing trains or buses. In urban areas, we'd rather travel seven minutes longer to reach our destination as long as we don't have to change. And if we're out and about in our cars, we'd rather drive for one-and-a-half minutes than spend one minute looking for a parking space."

The scheduled arrival time and reliability also play a role. How much buffer time do I need? Can I rely on the bus to arrive on time or do I need to take the earlier bus and wait around

at my destination? How long will I be stuck in a traffic jam in my car?

The costs also have to be weighed up in a similar manner. "The more unpleasant we find them, the more easily we can avoid them", Axhausen observes. "For instance, parking fees and tolls play a bigger role than petrol costs in deciding whether we use the car or public transport. Tolls are the biggest factor." Ultimately, the choice of transport is also about comfort and personal attitudes, such as those towards public transport.

## How the individual influences the system

These insights into our behaviour are channelled into models that allow conclusions to be drawn regarding the impact that different measures have on the transport system: what reactions can be expected if the transport network capacities are increased through new roads and tracks? Or lowered by introducing 30-km/h zones or reducing the number of parking spaces? What happens if the prices increase, parking fees go up, or a toll is introduced?

One of the models that can provide the answers to these questions is MATSim, developed by the IVT and TU Berlin (see box). It is based on artificial agents that are given particular characteristics. Every agent has a different set of preferences that, taken together, mirror the distribution of tastes throughout society. Based on an assigned agenda, the model works out all the decisions that have to be made by every single agent during the day. The simulation of the transport process is used to illustrate the interaction between the agents.

"We move vehicles through the network and simulate all the interactions along the route", says Axhausen. "For instance, we observe whether the

vehicles form queues and we can thus estimate the journey time. We can use these journey times the next time round and check whether the agent still does the same thing or makes an alteration."

## A decision-making basis for transport policy

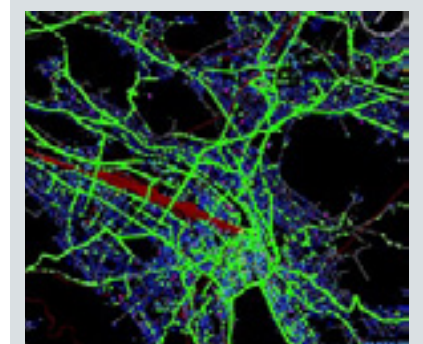
Concrete answers to questions of transport policy can also be found through empirical studies. In 2010 the IVT realised one such project for the Federal Department for Spatial Development: "We were given the task of devising experiments to find out the extent to which citizens were prepared to change their means of transport or route", explains Axhausen. Two of his doctoral students, Alexander Erath and Claude Weis, teamed up with former IVT colleagues and the market and social research institute LINK to conduct a two-stage study.

To begin with, 5,000 people were interviewed about their choice of transport over the telephone. The ETH-Zurich researchers then generated personalised experiments based on the routes reported in the interviews. This was the biggest challenge, as Axhausen describes: "Not only did we show possible alternatives for each interview; we also changed the values of the decision variables." If someone drives from A to B in thirty minutes, for instance, the researchers had to ascertain how long it would take the person on public transport or by bike. They then changed the observable realities systematically so that new prices, times and speeds arose.

In the second step, the interviewees received personalised questionnaires with fourteen such experiments. The researchers from ETH Zurich evaluated them using additional models and can now draw conclusions re-

garding the conditions under which the Swiss are prepared to switch their means of transport. ■

Institute for Transport Planning and Systems:  
[www.ivt.ethz.ch/vpl](http://www.ivt.ethz.ch/vpl) →



**Simulation of the Zurich traffic flow by MATSim**

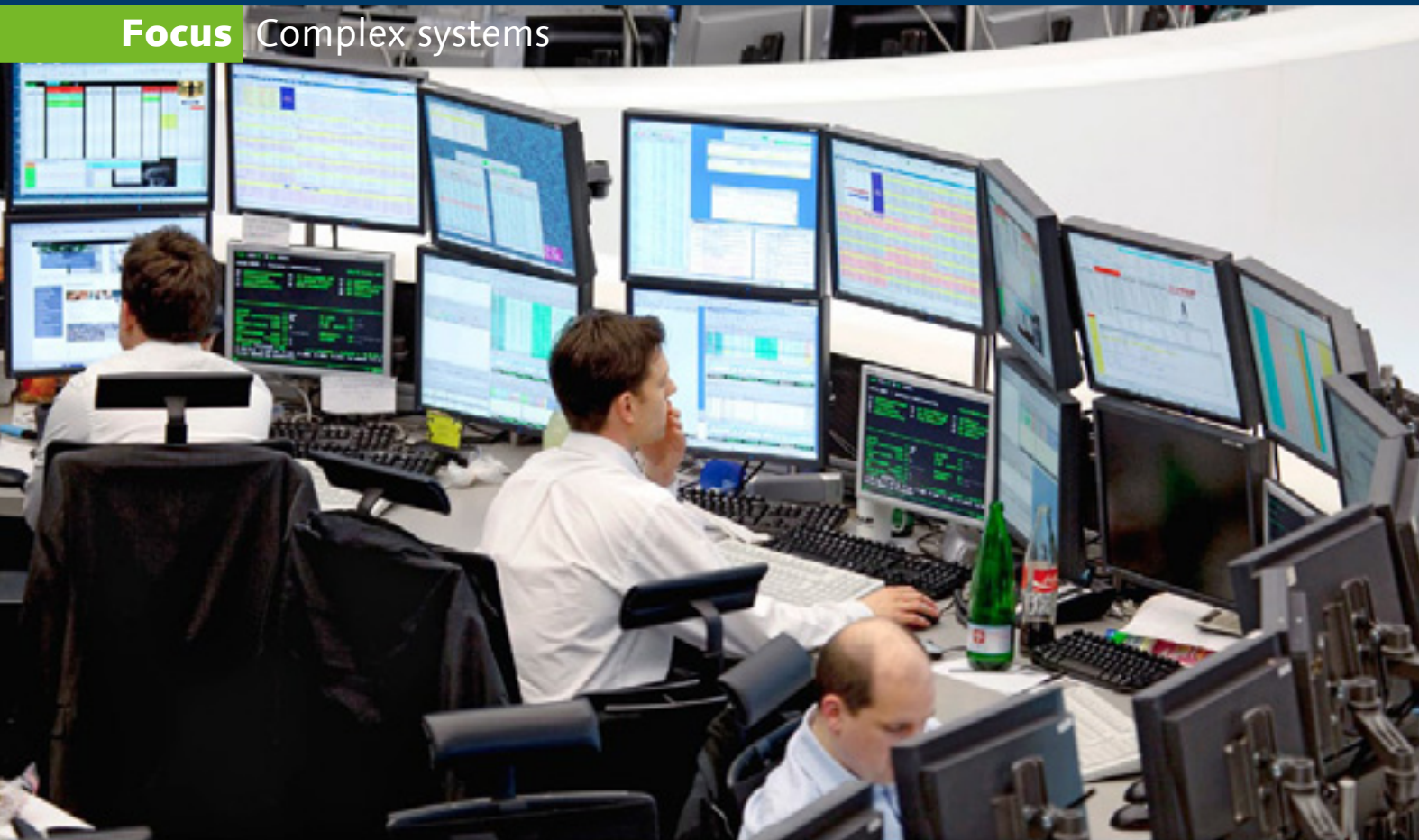
The agent-based transport simulation model MATSim was developed by doctoral students from ETH Zurich and TU Berlin before being implemented first in Switzerland. Meanwhile, it is being used by researchers all over the world and refined as an open-source project. The model's two core developers founded the ETH Zurich spin-off Senozon in 2010, which they are using to launch MATSim in practice.

[www.matsim.org](http://www.matsim.org) →

[www.senozon.ch](http://www.senozon.ch) →



## Focus Complex systems



# "Don't forget what happened!"

The global economy is repeatedly being rocked by severe financial crises. Paul Embrechts, a professor of mathematics from ETH Zurich, and Joachim Klement, Chief Investment Officer at Wellershoff & Partners, explain what we should learn from this and why the next crisis is probably inevitable.

*Interview: Felix Würsten and Roland Baumann*

*If you consider the last few years, it almost seems as if the global economy is stumbling from one crisis to the next. What exactly constitutes a financial crisis?*

**Joachim Klement:** There isn't one generally applicable definition. What is certainly required for a crisis is a shock that ripples throughout an entire system, such as a monetary or bank system, without petering out by itself.

**Paul Embrechts:** And this shock also has an impact on real life. We keep being hit with so many financial crises that it's almost as if we're condemned to live with them. But the reasons and effects are always different. The subprime crisis in North America isn't the same as the monetary crisis in Europe.

*The financial market participants play a key role here. Which factors affect the decisions that traders or investors make, for instance?*

**Embrechts:** One crucial aspect is the temporal horizon. If I'm a 60-year-old private investor, my temporal horizon is different from that of a pension or hedge fund. The various actors on the market also work with different volumes and have to comply with different regulations. Furthermore, their decisions are also affected by – for want of a better word – emotional factors as well as rational ones.

**Klement:** All our decisions are rational only in part. That goes for both traders on the stock exchange and for pension fund trustees.

**Embrechts:** And then there's the short-term, high-frequency trade, where purchases and sales are performed automatically by computers. Emotional factors hardly figure there at all anymore.

*In high-frequency trading, huge volumes change hands. But what of the economic benefits?*

**Embrechts:** I experienced the beginnings of high-frequency trading in Zurich back in 1988. Since then, the market has really come on in leaps and bounds. Nowadays, over 70 percent of Wall Street stock trading is carried out in this field. Naturally, those involved are emphatic about the economic benefits. First, they argue that a lot of liquidity results from this trade. This seems positive, as liquidity is like oxygen for the market; it doesn't work without it. Secondly, they stress that there is a more rapid exchange of information. I'm not sure whether this is really an advantage. Thirdly, it is said that the upward and downward turns are smaller because there are more offers on both sides. I'm sceptical whether the risk is actually reduced by

high-frequency trading. We lack the risk management structures to control these markets.

**Klement:** I wouldn't even accept the liquidity argument. Yes, we've got much more liquidity on the market. But it's pseudo-liquidity that is immediately lost in the event of a crisis. Sticking with the oxygen analogy: this liquidity is like the oxygen in an aircraft, which disappears in a heartbeat if there is a leak in the fuselage. I share Mr Embrechts' concerns: to this day, we haven't got an accurate risk management system for this field.

**Embrechts:** Nonetheless, we can no longer do without modern financial instruments. If you want to transform a variable mortgage into a fixed one, you need an opposing position. If you book a flight, you hope that the airline has hedged the kerosene prices. Modern financial instruments have also got their positive sides, you have to realise that. Most banks and funds do an important job for our national economy. But unfortunately certain developments were so powerful that there were negative consequences for the real economy.

*Isn't one problem also that all the parties involved use the same models?*

**Klement:** In normal times, we don't have to worry too much about whether we all use the same models. Even if I use the same model as you, I can have different expectations. It only becomes dangerous if models yield certain pearls of wisdom that everyone uses as a yardstick.

*So as long as I read in one paper that the euro will soon be gone, and in another that it is bound to survive, can I rest assured?*

**Klement:** Yes, only when all the papers write that the euro is to be abolished do we have a problem (laughs).

#### The interviewees:

*Paul Embrechts* has been a full professor of mathematics at ETH Zurich since 1989 and teaches insurance and financial mathematics. His main research interests include integrated risk management, the securitisation of insurance risks and the analysis of extreme values. He is also a consultant for various financial service providers and authorities.

*Joachim Klement* is Chief Investment Officer at the international business consultancy Wellershoff & Partners. He studied mathematics and physics at ETH Zurich and economics at the University of Hagen. Before taking up his current job, he held a number of positions at UBS Wealth Management in Zurich for six years.



## Focus Complex systems



Paul Embrechts (L.) and Joachim Klement would like to see more humility again from the actors on the financial markets.

*But mightn't there still be people who bet against it?*

**Klement:** But they are mostly overwhelmed by the masses in such situations. To my astonishment, for instance, I discover that a country like Italy suddenly finds itself in a national debt crisis while other countries in a similar situation are spared. I suspect that people homed in on this one victim because various papers said so. This produced a problematic cascade of information.

*Another issue is how we tackle extreme situations. Can the models reasonably illustrate such events?*

**Embrechts:** We don't need to read a book about black swans to understand that our world isn't normal. However, we are genetically programmed to assess normal situations better than extreme occurrences. How do we deal with events that take place once every 10,000 years? The theory on this has been around for some time. But translating the events into a practical language and drawing the right conclusions is hard.

*Why is that so difficult?*

**Embrechts:** It all comes down to asking the right question. Let's assume that you want a capital estimate from me for an event that happens once every 1,000 years. There are reasonable models for this; perhaps you even have enough decent data to solve the problem. Then I deliver the point estimate you wanted – ten million francs, say –

but you also get an margin of uncertainty of five to forty-five million francs from me. If that isn't precise enough for you, maybe you asked the wrong question.

**Klement:** As a former physicist, I'll put it bluntly. In physics I can only publish if I state the margin of error; in the financial sphere I can only publish if I leave it out. The theories of error calculation aren't applied very often in practice. They tend to be used more for reinsurance schemes, but these are precisely the ones that are left with the risks at the end of the day.

*Why aren't these models used in banking, too?*

**Klement:** If you talk to a pension fund trustee or investor who hasn't got a degree in mathematics, then as a consultant

**"It all comes down to asking the right question."**

Paul Embrechts

you have to translate what you believe is right into a language that the customer can understand. In doing so, you have to make simplifications. And thus the customer might only hear "aha, the shares are going up" and overlook the fact that the probability distribution stretches way into the negative.

*So it isn't the fault of the models if something goes awry?*

**Klement:** The problem with many models is that they aren't robust. They stand and fall with the quality of the data. In practice, however, we often haven't got particularly good data. So we mostly use simple but robust models. This brings me to the subject of regulation: if something goes wrong somewhere, the call comes instantaneously: we need better models! We need more regulation! No, we don't. We need more robust models, not better ones; we need better regulation, not more of it.

*Isn't the state, as regulator, increasingly finding itself overwhelmed by the complexity of the financial markets?*

**Embrechts:** No, you also have increasing complexity in other areas, such as the supply of energy. There are examples where the regulator has operated highly successfully. Canada, for instance, weathered the banking crisis fairly well. Why? In Canada, politics is more conservative about the banks and the regulators work closely with the financial service providers. Over here, on the other hand, the banks were able to introduce insane products. And if someone warned against possible losses, he was told: that's the new economy! People thought they'd found the Holy Grail and could turn base metal into gold. We live in a free world, so developing new products is legitimate. But if the volumes increase too steeply, someone needs to monitor the development.

*It is probably no coincidence that Canada hasn't got a leading financial centre.*

**Klement:** It takes a lot of courage and strength to face up to the mainstream. Those who didn't buy any new financial products before the bank crisis were regarded as fools. Anyone who didn't invest in technology shares at the end of the 1990s was ridiculed.

**"We need more robust models, not better ones."**

Joachim Klement

*International competitiveness speaks against greater regulation...*

**Klement:** Oh, that's nonsense...

*But that's the stock response.*

**Klement:** Now for my classic comparison: we all want to stay healthy. We aren't all capable of performing a heart operation, so we need doctors to do it for us. What does the state do? It regulates the health system and makes sure that every doctor has to have a certain qualification. Switzerland is one of the few countries where anyone can call himself an asset consultant.



## Focus Complex systems

*At a systems level, independent consultants are unlikely to play a major role.*

**Klement:** I don't mean to put anyone's nose out of joint, but the decision-makers in the larger banks don't always have the necessary qualifications, either. What's more, the banks are subject to a kind of self-regulation. Take the Basel III standard: basically, it's a group of international banks that call the shots here.

**Embrechts:** The Swiss Solvency Test, which we co-developed at ETH Zurich, is a step in the right direction. Since 2011 all insurance companies have had to submit their solvency figures to the Swiss Financial Market Supervisory Authority. We have thus created a sound basis for healthy cooperation. Unfortunately, that's less the case with Basel II and III.

*So you're somewhat sceptical about the Basel III accord?*

**Embrechts:** Yes, I'm sceptical. Admittedly, a document I call "Basel Three and a Half" was drawn up May 2012, proposing improvements that are a step in the right direction: a higher capital quota, a more precise definition of the capital types and a clearer definition of what the trading and banking books involve. But it is still a game of cat and mouse between the regulators and the banks. I'm convinced that we should reduce the complexity of today's banks.

**Klement:** I agree that the banks need to become smaller again. That especially goes for small countries with a large financial centre, namely Switzerland, Luxembourg and Singapore. The fact that a major bank like UBS or Credit Suisse shows a balance that is many times greater than Switzerland's GDP is simply ludicrous.

*Looking ahead: can future crises be averted, based on past experience?*

**Klement:** No chance! (laughs)

*Might they at least be predicted more easily?*

**Embrechts:** There are colleagues of mine at ETH Zurich who are conducting research along these very lines. We've had a serious crisis about every seven years so far. So we should take a leaf out of Cato the Elder's book, who called for the destruction of Carthage at the end of every speech. Our ceterum censeo should be: "Don't forget what happened!" Do you remember how much money the Swiss banks lost in the 1992 mortgage crisis? 42 billion francs! Have we learnt much from this?

**Klement:** We need to learn humility again.

**Embrechts:** Quite right!

**Klement:** We developed a certain hubris in this industry that ballooned with increasing modelling capabilities and computing power. It is remarkable that many are now trying to carry on simply as before.

*But that's only human...*

**Klement:** Yes, that's human. And it's a great opportunity for all those who want to learn something from the last few years. The customers aren't stupid. They know that

«We should reduce the complexity of today's banks.»

Paul Embrechts

things are done in the financial sector that you just can't do. No one can predict the exchange rate of the dollar. Nevertheless, we pretend that we can.

**Embrechts:** I always tell my students: "Be humble in the face of reality." If we break this "Master of the Universe" feeling that has prevailed for so long on Wall Street, including the remuneration aspect, then we can get somewhere. But I'm also a realist. I can only keep reminding my students of what happened, just as Mr Klement reminds his customers and we here are reminding the readers. ■



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## Focus Complex systems



## The consensus marathon

Martina Märki

**For 18 years, politicians and experts have been convening once a year for the United Nations Climate Change Conference to make key decisions on global climate policy – as also this year at the Doha conference. Too expensive, too much razzmatazz, too little gained is one common criticism. A glimpse into the inner workings of the quest for decision-making possibilities reveals what makes the climate summits worthwhile.**

With over 10,000 participants from some 200 nations, all struggling to agree on measures and decisions on the global climate, the United Nations Climate Change Conference is one of the largest political events in the world. It is referred to as a monster occasion or even a "climate bazaar", and there is talk of deals and threats. Reports in the media sometimes paint a far from flattering picture of the negotiations. Yet few events are prepared quite so rigorously nor designed

for the long term like the United Nations Framework Convention on Climate Change, or UNFCCC for short.

### The tip of the iceberg

This is also confirmed by Andreas Fischlin, a professor of systems ecology at ETH Zurich: "The public only sees the tip of the iceberg with the climate change conferences." He should know; he has been attending them regularly for the last 12 years as a science representative in the Swiss delegation. This year's Doha conference in the desert nation of Qatar is his thirteenth – a big commitment for a scientist whose chief responsibility is not politics.

"Yes", Fischlin admits, "as a scientist, I also have to set limits to my commitment." For the 2009 Copenhagen Climate Conference, for instance, he was busy with preliminary negotiations for 11 weeks. And he is not the only one. As many as five preliminary conferences a year are the norm in times when important topics are on the agenda, not to mention the countless smaller meetings and unofficial

visits from delegates of other countries. "The general public doesn't usually hear about that", says Fischlin. However, important themes are often discussed on a small scale, such as topics that the major negotiations cannot fit on the agenda. It also helps to cultivate bilateral relations and explore and exchange points of view in a relaxed atmosphere before moving into the hot phase of the climate conference, where the decisions are actually made. "This generates political capital", explains the climate researcher.

Since the Copenhagen conference, the main criticism has been that the climate conferences cost an immense amount and achieve little. Heinz Wanner, climate researcher and emeritus professor of geography at the University of Bern, criticised last year's Durban conference thus: 15,000 participants – failure inevitable. Meanwhile, the Zurich newspaper NZZ am Sonntag wrote that "This form of climate conference is ineffective, outdated and has caused too many CO<sub>2</sub> emissions." Fischlin strongly disagrees. "An awful lot of relationships and political capi-

tal have resulted from the global climate change conferences." He is utterly convinced that "this is vital if we want to solve the climate problem. It is a very valuable resource that is often underestimated." He has experienced how even nations that are at war with each other, such as during the Iraq War, negotiate on climate issues in an orderly and peaceful fashion at the climate summits. "You would only realise how valuable is this political capital if there were a break and you had to start again from scratch."

### Power and influence

Fischlin's argument is also backed up by Stefanie Bailer, a professor from the Center for Comparative and International Studies (CIS) at ETH Zurich, and her doctoral student Florian Weiler. The researchers from the Global Governance research group have studied multilateral negotiations in international organisations, including the climate negotiations.

Their arguments primarily relate to the impact of the global climate conferences on the general public. "Through the major annual climate summits, the public is constantly reminded that climate change is still a problem. This keeps piling pressure on the politicians", the two social scientists explain. The global climate conferences also reveal which nations obstruct negotiations and which ones behave cooperatively.

This is registered by the global public and commented on worldwide – and not without its consequences, either: "There are sociological findings suggesting that nations react to this", says Weiler. For instance, even small nations can also achieve a certain degree of influence, though they are otherwise powerless in international politics, he continues. As an example, he cites the small island states that are

in danger of being destroyed by climate change. They argue that they will fall victim to our CO<sub>2</sub> emissions if nothing happens, and this is highly effective publicity.

"NGOs and the media protest about this in equal measure, and thus the topic gets so much publicity in the western world that it is hard to ignore the existential concerns of these nations."

Public pressure, especially in one's own country, is particularly effective in democratic states. This means they tend to behave more cooperatively, the social scientists observe. Weiler asked over sixty delegations which strategies they use in climate negotiations. "The more democratic a country, the more it tends to favour softer negotiation strategies", he says, summing up one of the results of his studies.

Conversely: the bigger and more powerful a country is, but also the more undemocratic, the tougher the country's strategy might be. "If India and China are against a solution, no compromises will be reached", adds Bailer. "The USA's position is also strong, but it also depends on the political mood at home. Due to the strong opposition of the Republicans, not even a President Obama was able to sign a comprehensive agreement in Durban, especially as the next presidential election was just around the corner."

One might think this deals a poor hand to small democratic countries like Switzerland, playing climate poker with the big guns. But Fischlin's experiences at the climate negotiations tell a different story. "As a Swiss, you often play the bridge builder. As a scientist, you sometimes enjoy a particular level of trust and as a representative of neutral Switzerland twice as much again."

You can also accomplish something if you are able to contribute relevant,

current expert knowledge. Fischlin refers to the latest emission path studies, a field in which ETH Zurich is a world leader. "Switzerland will gain respect if its delegation can bring new scientific results to the negotiating table and thus help make debates more objective."

### Compromises and decisions

Bailer puts this into perspective: "It's important for the country to find its role." A small country can play a key role if it is responsible for the compromise or produces a majority in one camp with its vote. "Then it is sought after by the other participants." Knowledge and information are important resources too. "It is very useful to know your own position and that of your negotiating partners, and their willingness to compromise." From his own experience, Fischlin can only agree: "If you want to achieve something in such negotiations, you need to seek an information advantage and an overall view", he explains. This is particularly crucial for chairing a conference successfully.

Putting out feelers, persuading, looking for compromises and testing the water for coalition possibilities – despite all the modern communication technology, this all works far more effectively in direct talks. This is also why everyone wants to be at the climate summit – not only the delegates eligible to vote, but also observers, experts and stakeholders. And that is why there are also extremely different forms of negotiation at the climate summits – round the clock if need be: interest group meetings, bilateral meetings, unofficial contacts in the coffee breaks, negotiations among the especially important partners (so-called "Friends of the Chair") behind closed doors and much more.



## Focus Complex systems

The official decisions, however, are made by the plenary assembly. And these have to be unanimous – no mean feat with over 190 parties eligible to vote and given the complexity of the climate problem. Consequently, a step-by-step policy is often pursued at the climate conferences. The delegations start by first agreeing whether something should be treated as a problem. Then they set a timeframe for reaching a decision, and begin the actual negotiations. A roadmap process like this can drag on for several years.

Fischlin feels that the general public does not properly appreciate the difficulty in reaching an agreement with all the parties, not merely with a majority. The UNFCCC does not explicitly have vetoes like the UN General Assembly. However, decisions have to be made by consensus. Large nations practically have the power of veto, as do smaller countries if at least three of them band together. Even if this means progress can only be made slowly, with individual countries able to obstruct things with a “no”, Fischlin also sees advantages in the consensus system: “The consensus system is challenging but at the same time very strong”, he points out. “After all, a decision made in this way will gain far more support than a majority decision.” The social scientists are somewhat more sceptical. “There are also researchers who say that this approach towards negotiating the climate is bound to fail. Reaching an agreement among all nations within a reasonable period of time is practically impossible”, states Weiler. Some see a better alternative in a bottom-up approach: one geared more towards promoting the positive activities of individual countries in their efforts to achieve a CO<sub>2</sub>-free society, and one that invests more in research and projects.

### Unparalleled knowledge pool

Fischlin is not convinced by this argument. He believes that what constitutes a reasonable period of time and what qualifies as a meaningful agreement can and needs to be discussed. “Finding solutions that are viable in the long run requires a process of opinion-forming and implementation.” His argument is that the climate problem is a global one and cannot merely be solved on a local or national level. Moreover, through the climate summits, knowledge that is relevant for the climate is accumulated in an unprecedented form and made public.

Fischlin was also a coordinating chief author on the International Panel on Climate Change (IPCC) climate report, which was awarded the Nobel Prize in 2007. The IPCC’s job is to place the available scientific knowledge on climate issues at the disposal of the decision-makers: comprehensively, correctly and with its reliability verified. Even if the role of the IPCC is not undisputed, hardly any other scientific field has such an elaborate procedure to pool and publicise current knowledge.

The question remains as to whether more knowledge automatically leads to better decisions. Of course not, the climate researcher concedes. And, science cannot eliminate all the uncertainties as regards climate knowledge. If anything, the role of science consists in highlighting where uncertainties exist, so that we can deal with the risks in a reasonable manner. “That isn’t always understood by the general public”, the climate scientist laments. And on the other hand, after many negotiations in climate-policy circles, he knows that it is not only knowledge that matters in politics, but the interests of the assorted players, which can be very varied. The researcher sees this as an incentive:

“Seeking exciting ideas and new solutions is all the more important in this respect, which is clearly where science comes in again.” ■

Information on the UN Climate Change Conference:

<http://unfccc.int> →

Systems Ecology Group at ETH Zurich:

[www.sysecol.ethz.ch](http://www.sysecol.ethz.ch) →

Global Governance Group at ETH Zurich:

[www.gg.ethz.ch](http://www.gg.ethz.ch) →

### UN Climate Change Conference

The UN Climate Change Conference is the annual Conference of the Parties of the UN Framework Convention on Climate Change. The current aim of the climate conferences is to develop a follow-up regime to the Kyoto Protocol, which runs out in 2012. This is the only instrument of climate protection policy to date that is binding under international law. Following the decisions in Durban 2011, a global post-Kyoto framework is to be drawn up by 2015 and decided at the 21st UN Climate Change Conference. The treaty is to come into effect in 2020.



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## Zoom



Postdoc Anna P. Gawlikowska in front of the hybrid generator, the Smart Micro Grid System (SMiG), which combines diesel and solar energy.

## Mobile power supply

## Generating hope

Samuel Schlaefli

**Many people associate electricity with the hope of a better life. Master's students from ETH Zurich have therefore built a cheap, robust and easy-to-use generator that also produces clean water as a by-product.**

According to the International Energy Agency (IEA), one fifth of the Earth's population is without electricity – 85 percent of whom live in rural areas in developing countries. "Many people associate electricity with the hope of a better life" says Anna P. Gawlikowska, a postdoc at ETH Zurich's Institute of Energy Technology. An electricity supply has far-reaching consequences for remote villages in developing countries. Organic fuels such as wood or dried cow dung can be substituted with electricity, which in turn relieves

women and children of their firewood-collecting duties and prevents them from suffering smoke poisoning while cooking in their small huts. At the same time, electric lighting increases safety – especially for women. And children can even do their homework after dark.

Studies from developing countries today indicate a strong correlation between an electricity supply and quality of life. Studies like these, coupled with her own experiences in Africa, gave Gawlikowska the idea of developing a mobile generator at ETH Zurich that would be cheap, robust and easy to operate. Together with Reza S. Abhari, a professor from the Department of Mechanical and Process Engineering, she incorporated her idea into the New Enterprise for Engineers (NEFE) programme at the Laboratory for Energy Conversion in the 2011

autumn semester. In a course on entrepreneurial thinking, budding engineers began contemplating the architecture and operation of one such generator. The foundations they established should serve as the basis for a Master's dissertation later on – and perhaps even an ETH Zurich spin-off.

### Robust, cheap and easy to operate

John Oldridge, a Master's student at the Laboratory for Energy Conversion, immediately liked the idea. Together with fellow student Till Richter, he decided to devote the next six months to building one of these generators. As some initial market research revealed, existing mobile generators were either too expensive or still in a research phase without any possibility of distribution anytime soon. However, Oldridge's and Richter's generator was to be designed for low-cost, high-volume production from the outset. They showcased their first prototype at the department in September: the "Smart Micro Grid System" (SMiG), a compact system that fits on a trailer and can be assembled in less than 20 minutes.

The centrepiece is a diesel generator that produces sufficient power to supply 100 people in 20 households daily with 75 kilowatt hours of electricity. While that is about 20 times less electricity than is consumed in Swiss households, it is still enough to power a hotplate, several lamps, a small television and a refrigerator. The students optimised the diesel consumption by connecting the system to a battery to store electricity. Consequently, the generator can run continuously at peak performance for a longer period of time, and rest during periods of low electricity demand. This takes the load off the generator and increases the conversion of energy from fuel to electricity by 60 percent.

Currently, the generator consumes between ten and twenty litres of diesel a day for six to eight hours of operation – depending on the mode of operation and the contribution of the photovoltaic cells that can be folded out on the sides. Photovoltaics cater for up to ten percent of the total output. More would be feasible, but at the expense of a portion of the system's compactness and straightforward handling. Moreover, the initial investment costs for the SMiG would be considerably higher.

### Treating water with waste heat

The diesel generator also has another important function: water purification. According to the UN, 900 million people do not have access to clean drinking water, most of whom again live in the country. So SMiG uses the waste heat from the generator – some two thirds of the total energy – to pasteurise contaminated water. The water is pumped through a heat exchanger and heated to over 70 degrees Celsius, which kills off any pathogenic germs. According to Oldridge, 1,000 litres a day can be purified with the system operating at full capacity.

What also sets SMiG apart is the possibility of controlling up to 30 power connections centrally by computer. This prevents the system from overloading and collapsing at peak times when all the lights in the village are on and people are cooking. The central control has another advantage: the electricity consumption of every household can be calculated exactly.

This is the prerequisite for embedding SMiG in the local economic cycle as a social enterprise, which was Gawlikowska's goal. After all, many SMiG components are meant to be produced in developing countries in future. And entrepreneurs who invest in such a generator should be able to cover their

expenses via the sale of electricity. Together with students from the University of St. Gallen, Gawlikowska has conceived a credit system for individual payment much like that for a prepaid mobile phone. The users can buy electricity credit from the village kiosks and can activate it on the central computer by entering a code. If the villages have mobile reception, electronic payment via text message would also be conceivable.

### Well on the way to a spin-off

However, even if the generator is robust and easy to operate, numerous unsuccessful development projects have shown that providing technology is only half the battle. To succeed in the long run, mechanics and engineers also need to be trained to operate and service SMiG on the ground.

As a result, Gawlikowska is currently trying to establish as many contacts as possible with engineers, politicians and village elders in developing countries. "The biggest challenge for the distribution of SMiG is to find a suitable business model that includes all the major decision-makers", she says.

However, there is still a lot of work to be done on the technical front, too: SMiG has to become cheaper and the water treatment module is being optimised for different water qualities in another student project at the EAWAG. Up to ten SMiG units are then to be tested in developing countries, for which Gawlikowska is currently on the lookout for funding. Once the system has been refined, it might eventually be marketed by an ETH Zurich spin-off. The young engineers Oldridge and Richter are certainly not averse to the idea. ■

New Enterprise for Engineers:

[www.nefe.ethz.ch](http://www.nefe.ethz.ch) →



Master's student Till Richter checks the inner workings of the diesel engine.



The generator can easily be transported by trailer to remote areas.



## Inside



As the new rector of ETH Zurich, Lino Guzzella is looking to support the departments in developing their degree courses further.

## Executive Board of ETH Zurich

# A passion for teaching

Felix Würsten

**Lino Guzzella has been Rector of ETH Zurich since the beginning of August. A professor of thermodynamics, he made a name for himself as both a researcher and an enthusiastic university lecturer. He is now looking to apply the same level of dedication to educational interests from his position on the Executive Board of ETH Zurich.**

The transition to his new position proved a jump in the deep end: Lino Guzzella managed to cause a media stir with his very first interview as the new rector of ETH Zurich, just before taking office at the beginning of August. He suddenly became aware of what can be triggered off when a mem-

ber of the ETH Executive Board speaks his mind to the press with spirit and candour on such delicate topics as matriculation quotas and elitist thinking.

In hindsight, he would probably have phrased some sentences less pointedly. As regards content, however, he still stands by what he said. "ETH Zurich supports grammar schools so that they can preserve a high level of achievement", he says. "Switzerland mustn't make the same mistake as our neighbouring countries. Otherwise, it won't be able to maintain its high standards in the longer term."

## One cog among many

In the course of his career, Lino Guzzella has gathered a lot of experience both at the university and in industry. For this very reason, he is a staunch ad-

vocate of the dual education system – not least in the interests of the young: "Many young people are happier with vocational training than with an academic education", he notes. To compare the situation with an image from his traditional field, Switzerland has a delicately balanced educational machine that needs to be oiled. As one of the many cogs in it, ETH Zurich has a clearly defined role: it trains the technical and scientific elite. This word "elite" for Guzzella goes hand in hand with responsibility, as he immediately adds: "The elite gets more from society – in the form of this expensive education, for instance. Therefore, it also has a duty to give more back to society."

Ever since his appointment in 1993, Guzzella has been a dedicated researcher – and an enthusiastic univer-

sity lecturer, as is plain to see in the ETH Zurich video on YouTube. "I find teaching fascinating," he explains. "The greatest moment for me is experiencing the instant a student grasps something." The decision to switch to the Executive Board was therefore far from easy, he confesses.

## One of the best of days

Nonetheless, he took the step with conviction: in the last 20 years, he has built up a motivated research team that can look back on a number of successes. "But when things go too well, I get nervous," says Guzzella. "That's why I need a new challenge." Moreover, being Rector is a nice job: you have plenty of opportunities to shape things.

All the same: despite his new position, he has not left practical teaching and research entirely. One day a week is set aside for precisely this: in the morning, he holds his two-hour lecture on control engineering; in the afternoon he talks to his doctoral students about the progress of their projects.

When he was nominated for election by the Professor's Conference with a large majority, it was one of the best days of his life. "However, I also sense the huge responsibility that I have taken on with the position."

First of all, he has pledged to continue along the path laid down by his predecessor, Heidi Wunderli-Allenspach. "She helped lift teaching to a higher status at ETH Zurich", he says of her achievements. "I also want to take up the baton in this respect."

## Growth as a challenge

Guzzella principally agrees with his predecessor's assertion that teaching does not need any major reforms in the next few years. However, there are some areas under his jurisdiction that are in need of improvement, which he now intends to tackle.

For starters, there are the rising student numbers. Since the year 2000, student figures at ETH Zurich have ballooned by sixty per cent and the university even expects over 20,000 students in the medium term. In order to cope with this growth, Guzzella would like to use more information and communication technology in education.

He can also envisage new teaching methods, such as those he instituted with his colleagues in focus projects at the Department of Mechanical and Process Engineering some years ago. "But we need to have a careful look at what makes sense" he says, dampening any excessively high expectations. "At the end of the day, it is always about improving the quality of the tuition. Not every teaching format is suitable for every subject."

## Initial priorities

Guzzella regards curriculum development as another priority. Apart from Hans Ruedi Heinemann, who supervises the processes and operations in education, and Thomas Vogel, who will be responsible for the doctoral programme, Andreas Vaterlaus has been a third Prorector since the beginning of October, supporting the Rector in the field of curriculum development.

"We would like to systemise the further development of the courses", Guzzella explains. "The departments bring their specialist expertise to the table and we at the Rectorate contribute methodological and pedagogical know-how."

He expects his colleagues to channel a substantial proportion of their energy into teaching. He still spends a lot of time on preparation himself, too. "Even though I've been giving my lecture for many years now, I always have to read up on it again for two hours before stepping in front of the students", he

explains. For him, a good university lecturer's commitment also includes attending a didactics course every so often, or striving for a clean presentation – or to put it another way: as a professor, taking teaching just as seriously as research. ■

## About the man

Lino Guzzella studied mechanical engineering at ETH Zurich. After completing his doctorate in 1986, he worked in corporate research at Sulzer in Winterthur and in the mechatronics development department at Hilti in Schaan. He was appointed as an assistant professor at ETH Zurich in 1993 and has been a full professor of thermodynamics since 1999. His main research interests include system modelling, dynamic optimisation and reducing the consumption and pollutant emissions of drive systems. He has been on the Executive Board as Rector of ETH Zurich since 1 August, with responsibility for education.



## Inside



A gangplank leading through a nature reserve. This model was designed by students from ETH Zurich using the interactive learning environment eQUILIBRIUM.

## Innovedum

## Teaching breaks new ground

Florian Meyer

**For over a decade, ETH Zurich has been fostering innovative teaching projects and degree-course initiatives through the Innovedum Fund. Over 100 teaching innovations have emerged from the programme to date, many of which use the potential that teaching technologies offer for maintaining educational quality.**

Interactive, explorative and cooperative learning is a recurrent theme in discussions on achieving the highest standards in higher education – in other words, forms of teaching that do not merely rely on lecturing and communicating subject matter, but also incorporate independent study, research and discovery. Current web technologies and mobile devices provide good opportunities to use these new forms of learning in the classroom.

eQUILIBRIUM is a prime example of the kind of web-based teaching and learning platform supported finan-

cially by ETH Zurich through the Innovedum Fund.

It was developed by Philippe Block, a Professor of Building Structure at the Institute for Technology in Architecture, and project supervisor Tom Van Mele. Their aim was to offer students an intuitive introduction to the art of structural design. The interactive learning environment is entered easily via the internet. Then it begins: the perfect curvature of bridge arches or roof constructions can be tried out effortlessly. What used to mean crunching through monotonous calculations can be tested here on the screen in a few simple mouse movements. The lectures are accessible in the form of interactive presentations, and additional explanations can be downloaded. These are rounded off with exercises, modules for self-study and design projects.

### Virtual experiments

An increasing number of universities all over the world are uploading their teaching programmes onto the web. ETH Zurich particularly endorses teach-

ing platforms that can be used in combination with the traditional classroom. Video sequences, exercises and multiple-choice questions with wikis, blogs and networking tools accompany, complement or supplement bricks-and-mortar teaching, thereby enhancing its quality. Since January 2000 ETH Zurich has funded over 100 innovative teaching projects and degree-course initiatives through the Innovedum Fund.

What the teaching innovations at ETH Zurich all have in common is that they stem from concrete needs, and that technology and the internet play an important, though not exclusive role in them. In these new forms of teaching, the lecturers are more like learning coaches than knowledge brokers. A sizeable number of innovations affects the way lecturers and students work together. Engineering students, for instance, also acquire creative techniques through team exercises and individual reflections, thus rounding off their specialist knowledge.

Rapidly growing degree courses favour web-based platforms because they maintain the quality of supervision while relieving lecturers and assistants of routine work. On the learning platform ePhEx, for example, physics students can find over 120 experiments on video with texts, exercises and simulation programmes. It was developed by physics professor Bertram Batlogg and his team to enable students to understand the experiments interactively by themselves. ■

Teaching innovations at a glance:

[www.innovedum.ethz.ch/index\\_EN](http://www.innovedum.ethz.ch/index_EN) →

Design platform eQUILIBRIUM:

[www.block.arch.ethz.ch/equilibrium](http://www.block.arch.ethz.ch/equilibrium) →

Physics learning platform:

<http://ephex.phys.ethz.ch> →

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## Connected

## Alumni Ball

## Glittering ball night

Fittingly, the theme of the seventh ETH Zurich Alumni Ball was "007". Although there was no sign of James Bond on 6 October 2012, it certainly did not put a damper on the mood in the Dolder Grand. After a two-year hiatus, around 120 former students of all age groups convened at the traditional Zurich hotel – where once again they eagerly reminisced and swapped contact details. Needless to say, there was plenty of food and drink to go round, too. The entertainment was provided by Swiss band This Masquerade, whose singer Claudine Weber-Hilty and her five professional musicians kept to the theme and got the guests fired up with various Bond tracks. Practically all the guests were on their feet to show off the dancing skills they had learned in a dance course organised especially by the Academic Sports Association Zurich (ASVZ).



## Heidi Wunderli-Allenspach

## Riveting farewell dialogues

"When the chemistry's right" was the motto of the farewell evening of Heidi Wunderli-Allenspach, former rector of ETH Zurich. It was well chosen, for as the audience learned in the packed Audimax in ETH Zurich's main building on 25 October 2012, good chemistry with her surroundings was crucial to Wunderli-Allenspach's towering achievements as a researcher in the pharmaceutical sciences, as a developer

of education and as the first female rector of ETH Zurich. The official farewell was not marked by a lecture as is usually the case, but rather by a round of exciting discussions during which some of her colleagues looked back on the glowing career of Heidi Wunderli-Allenspach.



## Singapore-ETH Centre

## Federal Councillor on a flying visit

Johann Schneider-Ammann and a 20-strong economic delegation took a five-day trip to Malaysia and Singapore at the beginning of November, where they visited the Singapore-ETH Centre for Global Environmental Sustainability (SEC). Schneider-Ammann was welcomed by SEC Director Gerhard Schmitt, Programme Manager Kees Christiaanse, Science Coordinator Stephen Cairns and Managing

Director Remo Burkhard. Together with scientists from the research centre, they showed the Federal Councillor the first SEC research programme, the Future Cities Laboratory. Later on, Schneider-Ammann also met Singapore's President Tony Tan and Deputy Prime Minister Teo Chee Hean, who were also paying the SEC a visit.



## Alain Berset at ETH Zurich

## All good things come in threes

In March, he was in Singapore for the inauguration of the new ETH Zurich research facility. In August, he opened ETH Zurich's new Swiss National Supercomputing Centre (CSCS) building in Lugano. And finally, at the end of October, he accepted an invitation to Zurich from ETH Zurich President Ralph Eichler. Here, Alain Berset, Federal Councillor, Minister of the Interior and thus also of Education and Research, learnt about the university's scientific range. Although the education and research dossier will be the responsibility of Federal Councillor Johann Schneider-Ammann as of this coming year, Berset assured ETH Zurich that his interest in the university would also continue after the redistribution of responsibilities.



## Profile

ETH Zurich alumna Regula Hotz

# "I like making decisions"

Felix Würsten

**What Regula Hotz really cherishes about working in a family business is the proximity to customers and employees. At the beginning of this year, she took the helm. In doing so, she also accepts that she now needs to put her passion for fine foods on the back burner.**

The family tradition is plain to see: behind the desk, above the bookcase, hangs a picture of her grandfather, who founded the company 99 years ago. To the left of the door hangs her mother's degree from ETH Zurich – she was the first woman there to study electrical engineering, and took over the company from her father in 1970. And in the middle stands Regula Hotz, who has now been running the company in the third generation since the beginning of the year.

## Direct and honest

"Working with her runs surprisingly smoothly", says Hotz when asked about her relationship with her mother. After a three-year induction period, this dynamic woman handed over the reins to her daughter, although she is still involved in the company on its board of directors. There are various reasons why the two women get along in everyday life: Regula Hotz had already worked in the company at a young age and thus knows the firm like the back of her hand. And in many respects she thinks like her mother. "Above all, however, she lets me get on with it", says Hotz, lauding her predecessor. "Her experience is important to me. But it's also good that I can now bring another approach to the table."

Hotz especially has similar views to her mother when it comes to personnel management. "We're a family business

with 80 employees in five locations so I'm very close to the staff, and am active in operational matters myself." It is precisely this proximity to customers and employees that she likes. "We have got short decision-making paths, we deal with each other directly and honestly, and there's no treading water." As the boss in a business like this, she has got a lot of room for manoeuvre – which suits her down to the ground: "I like making decisions", she says with a smile.

The company, Kowner, has established itself as a traditional business in the Zurich region for electrical installations, telecommunications and building automation. It covers the full range of services from planning and construction to facility maintenance. "We concentrate on the upper customer segment", explains Hotz. "That's why the two branches in Erlenbach and Pfäffikon (Canton of Schwyz) are so important to us."

At a very early stage, Hotz already thought that she would one day take over the company. Consequently, it

## "Only satisfied customers come back to us."

Regula Hotz

only seemed natural for her to study electrical engineering at ETH Zurich. "For me, it was always clear that I would study at ETH Zurich, as my mother had always raved about her university days." The reality at university, however, was somewhat sobering. The dry material in the first few years of the degree did not really suit Hotz, and she also struggled with computer science. "On a general level I find

Regula Hotz has been running the family business Kowner in Zurich since the beginning of the year. She enjoys the elbow room she has as boss, even if she and her company have to assert themselves in a highly competitive market.



## Profile

technology fascinating", she says. "But when it comes to calculating the details, it no longer grabs me quite as much and stops being fun."

### Detours on the way towards her goal

When she flunked the second preliminary diploma, it was a setback – and a sign that it was time for a change. She decided to study food science at ETH Zurich instead. "I definitely find food more fascinating than electrical appliances", she notes. Her passion is immediately palpable when she talks about her internship in Piedmont during the grape harvest. And the idea of opening a delicatessen particularly appeals to her.

After her degree, however, she left fine foods behind for the harsh world of mass consumer goods. She joined beverage giant Coca-Cola because she wanted to experience the working world in a major corporation. "As an employee with high potential, I had numerous opportunities in the company", she reflects. However, she gradually began to realise that a major corporation was not for her in the long run. "All the administrative idling, sluggish decision-making

### "At ETH Zurich, I learned to solve problems analytically."

Regula Hotz

paths and the constant changes of direction in the management were increasingly difficult for me", she explains.

"I feel much more at home in a smaller company." Nonetheless, she does not regret in the slightest having worked for Coca-Cola: "I headed my own department, had budgetary responsibilities and learned a lot that has stood me in good stead in our company today."

In hindsight, Hotz says, switching degrees was the best thing that could have happened. "It enabled me to pursue my own interests. Then, when I joined the family business, it was completely my own decision. I could easily have continued along the other path."

### A small company on the market

The switch from a major corporation to an SME may well have brought Hotz more leeway in terms of decision-making – but also more uncertainty. After all, a small company depends far more on the fluctuations of the market and the contingencies of day-to-day business. "It's not unknown for me to have a sleepless night now and then", she admits.

She finds it difficult to see anything positive in the fact that a bitter price war is raging in the industry today. "We're destroying the prices for each other, which is tragic really." Consequently, she is glad that she does not have to accept every contract at any cost.

A key factor for success is customer relations. "We have to look after our customers. They only come back to us if they're satisfied." Hotz also has an eye for detail: when the photographer sets off in search of an attractive backdrop for the photo shoot after the interview, she is not very impressed with the clutter that greets her – especially the employees who have not cleaned the makeshift electrical hook-ups properly. "If you turned up at a building site with equipment like that, it wouldn't make a good impression", she explains. "As the boss, it's important to me that the staff pay attention to that sort of thing."

### Family balance

Hotz's family provides the perfect balance to her job. "When I leave the office, I am really at home." Like her mother. "She might have worked a lot as head of the company, but at home she was there for us 100 percent." As a child, she did not feel neglected in the slightest. "I've got five siblings. We learned to look after ourselves from an early age." For Hotz, it thus goes without saying that her two-year-old daughter will not grow up an only child. "I'm not talking about half a dozen", she says with a grin. "But I would like to have my own little gang of rascals at home."

And Hotz also takes after her mother in another respect: not only does she regularly attend the legendary keep-fit classes at the ASVZ, she still feels a close tie to the university as an alumna. "ETH Zurich is a fantastic university", she says. "It's where I learned to solve problems analytically, which serves me well every single day in my current job." ■

#### About Regula Hotz

Regula Hotz initially studied electrical engineering at ETH Zurich before switching to food science. After completing her degree in September 2005, she worked in the supply chain sector at Coca-Cola Beverages for three years. At the beginning of 2009 she took up a managerial position in the family business in Zurich, J. Kowner, before taking the helm at the beginning of this year.

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Spitzenprogramm der  
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7. Durchführung 2013/2014  
42 Präsenztage

Bewerbungsschluss: 14. Dezember 2012  
Programmstart: 28. Januar 2013



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For forty years it was an eye-catcher at the entrance gate to the Hönggerberg campus: the HIL and HIF Building.

1972

## Controversial growth

Christine Heidemann

**Forty years ago, the second stage of the expansion project got underway at ETH Zurich's Hönggerberg location. The result was the HIL and HIF Building, into which the building scientists and architects moved in 1976 – the latter only under protest. For decades, however, the building defined the entrance to the Hönggerberg campus.**

Albert Heinrich Steiner was indignant. His concept of a "parkscape" seemed to be in tatters. Accordingly, the architect and urban planner refused to accept the designs for ETH Zurich's second expansion phase on the Hönggerberg, which he felt did not even attempt to blend in with his plans from the first stage that had already been realised. It all began in 1957. Steiner had that same year resigned from his position as city architect and accepted a professorship of architecture and urban planning at ETH Zurich. He was now commissioned to find a site for an outside facility for the university and to plan its construction. Things had become too cramped in the centre and, what with the increasing student numbers and the growing need for research, the university was literally bursting at the seams. The physicists in particular needed more space for their experiments.

Steiner vetted various locations before settling on the Hönggerberg, where he had free rein on 46 hectares and

could realise the vision of a university campus that had been born when ETH Zurich was founded in 1855.

### Open and green

The architect based his ideas on the city expansion plans he also designed for Zurich, which were characterised by an open, transparent building style. With a scattered, green layout, he was looking to preserve the Hönggerberg as a local recreational area and leave room for further expansion projects. Consequently, the buildings for physics, molecular biology and infrastructure were constructed between 1961 and the end of the 1970s.

While Steiner was still putting the finishing touches to his work, however, the second expansion phase was already due to begin: in 1968 the Swiss School Board decided to accommodate the civil, cultural and surveying engineers on the Hönggerberg, too. Architects Max Ziegler and Erik Lanter were awarded the contract – not least because they had already won the competition for the new buildings on the former EMPA compound next to ETH Zurich's main building in 1947. However, these buildings never materialised – for reasons of space. For the area turned out to be far too small for the projects planned, including a new building for the civil, cultural and surveying engineers.

From then on, Ziegler and Lanter shared the project: Ziegler took on the lecture building while Lanter planned

the research building. Like Steiner before them, they both left room to cope with any future shortages of space. Even before the shell had been completed, however, it was clear: the building was too big for the construction departments alone. For student numbers had fallen drastically during the slump that followed the economic boom years. Consequently, those responsible at ETH Zurich suddenly decided to relocate the architects to the external site. But the architects were far from convinced about it, and some of their subsequent protests became fierce.

However, the architects needed a new location as they were also suffering from an increasing lack of space. Moreover, the City of Zurich had cancelled the lease of their provisional location in the Globus building on the Bahnhofquai near the Central Station. Apart from the Hönggerberg, the "Polyhang" between Leonhardstrasse and Sempersteig was also considered as an alternative.

The big question was which site offered the most advantages. The main argument in favour of the city location was its significance as an "exercise room for the eye" and that it "was at the intellectual heart of things." What the "hill" of the Hönggerberg had going for it, on the other hand, was the beneficial effect on concentration that might result from its seclusion. Back in the 1961/62 winter semester, a design class had already examined the topic. Spontaneously, the students marginally choose the Hönggerberg – only to change their minds following the subsequent discussion and choose the Polyhang instead. In the end, however, it was over ten years before the final decision was made in favour of the Hönggerberg.

### Denser and more compact

Meanwhile, the motto there was concentration rather than transparency. Against Albert Heinrich Steiner's philosophy, Max Ziegler and Erik Lanter constructed buildings that were flexible on the inside but compact on the outside – thus, in Steiner's eyes, destroying his relaxed "parkscape."

In the book *Bauten für die ETH 1855–2005*. Hochschulstadt Zürich (see reference below), Zurich architecture and art historian Michael Hanak describes Ziegler and Lanter's preferred construction style as follows: "The compact concentration of the building wings and enormous expanse of the building complex added a new dimension to the Hönggerberg. Ziegler and Lanter thus pursued an urban concept that deviated from Steiner's design. A packed, concentrated, large structure rose up next to the scattered individual buildings interspersed with greenery. Only the orientation of the neighbouring physics building was retained."

As Hanak writes, however, the architects did follow Steiner's master plan in one aspect: "The approaches and highly frequented groups of rooms on the site are in a central place opposite the hexagonal physics lecture building and thus help create a focal point on the campus."

### Appeal turned down

For Steiner, however, this concession was nowhere near enough. He disagreed with the choice of location for the library depot and the sports hall, too, and discussed it with those responsible at the Swiss Federal Office for Buildings. Ultimately, his master plan, which he had constantly expanded and developed, was not deemed authoritative by either the federal government or the Executive Board. And lastly, in 1994 Steiner's appeal against the third expansion phase, which was conducted between 1996 and 2004 under the watchful eyes of architects Mario Campi and Franco Pesina, was also dismissed by the federal court. Steiner invoked copyright, claiming that the recent expansion project had "maimed" and "disfigured" his work.

Meanwhile, the construction scientists and architects had moved into the new building in April 1976 – but not without further criticism. Among other things, there was talk of "the cold splendour of monotony". And a feeling of sitting "in an air-conditioned box behind panes of glass with a coppery sheen on the outside like in a submarine", "where it becomes eerie as soon as the gentle sound of the equipment stops."

Nonetheless, the HIL and HIF Building defined the entrance area to the Hönggerberg campus for decades, a role it still has not lost entirely to this day. The Alumni Lounge erected in the former architects' cafeteria in the summer 2010 welcomes visitors today. For the growing architecture community, however, the building has become too small over the years. A scheduled expansion of the Institute of Technology in Architecture is to road-test new construction methods right behind the HIL Building. By 2015 the building will well and truly have taken centre stage on the campus. Then, the first thing visitors to the campus will see will be the new student residences, the construction of which is due to get underway to the southwest of the Hönggerberg compound from next year onwards. ■

### Further reading

Werner Oechslin (ed.): *Bauten für die ETH 1855–2005*  
Hochschulstadt Zürich, gta Verlag 2005



## Alumni life



At the biannual Materials Alumni reunions, members learn how materials are used in the field.

### Specialist alumni groups and local branches

## Primary goal: networking

Felix Würsten

**A wide variety of activities is what distinguishes the various groups united under the umbrella of the ETH Alumni Association. The aim is to connect the graduates of ETH Zurich, be it in regional groups or subject-specific associations.**

The Department of Materials Science is one of the smaller departments at ETH Zurich. In terms of student numbers there is no way it can keep up with the frontrunners – mechanical engineering and architecture. When it comes to alumni, however, materials science is a real leader: the Materials Alumni Association, founded in 1999 to unite graduates in this field, now has over 500 members.

One special feature of the association is its traditionally close ties with ETH Zurich, maintaining a close collaboration with the Department of Materials Science. For example, the alumni re-

ceive the departmental publication Mat-Blatt, where they report on their activities themselves. And the undergraduate and postgraduate students are also invited to the alumni's biannual reunions.

"Our goal is not only to establish a network among the alumni, but also to promote contact with the students", explains Elisabeth Sinner, who runs the association as co-president. "We have got a major advantage in that my colleague Sara Morgenthaler, who shares the presidency with me, still works at ETH Zurich. This means we have good contacts with the department."

These reunions are a key aspect of the association's activities. Various topics are addressed at these events, which naturally are centred around materials, their properties and applications in everyday life. The themes covered can be anything from chocolate and contact lenses to racing yachts and radioactive waste, offering the audience exciting, practical insights and a stimulus for interesting discussions.

"Apart from these reunions, we also hold other events of a social nature", explains Sinner. Besides visits to companies, for instance, the programme also includes trips to museums or sporting events such as a golf course for beginners or a sledging excursion. "We group our activities around a particular theme for the year to give them a common thread", reports Sinner.

In 2012, for instance, the theme was "It's about time." Under this banner, Materials Alumni examined such diverse topics as newspaper printing, the restoration of works of art, the storage of radioactive waste and the historical development of chronometry.

### Common thread throughout the year

That Materials Alumni is such a large alumni group even though it only represents a small department is also down to the fact that it is very active in recruiting members. For instance, the Materials Alumni Association attends

the Master's ceremonies, where it also presents the Materials Alumni Award – a prize that honours social commitment as well as professional accomplishments. It goes to graduates who stood out in this respect during their studies, be it in university politics or as party organisers, and thus contributed towards solidarity in their course. There is a follow-up half a year after completing the degree. Then the alumni invite the new graduates to a brunch – the first proper get-together since graduation.

### Networking in central Switzerland

Connecting graduates of ETH Zurich is also the main objective for the Zug branch. This regional group, founded in 1966, has around 310 members. "It isn't only alumni from the Canton of Zug that are involved in our group, for we also approach all ETH Zurich alumni who live or work in central Switzerland," explains Kurt Petak, the president of the Zug branch.

Petak also observes that younger alumni tend to join subject-specific groups rather than regional ones these days. "It isn't all that easy for us to find younger members", he says. "So I support the idea of ETH Zurich Alumni members being able to join both a regional and subject-specific group."

### Popular visits

In its activities, the branch limits itself to three or four events a year. "Our philosophy is to do what we do well, not just to do as much as possible", explains Petak. The social aspect is clearly the priority for the branch. "Which is why members' families are also welcome to attend our events." This year's programme provides a taste of the activities organised: apart from Menzingen Monastery, the Africa Museum and the Baar Brewery, the alumni also had the

opportunity to visit the former artillery fort of Vitznau, which was subject to military secrecy for many years.

Visits to buildings are especially met with great interest among the members, Petak observes. "Wherever possible, we try to arrange visits to places that aren't yet open to the general public", he explains. The alumni were given a tour of the Roche Tower building site in Zug and the recently completed Zug ice rink, for example. "On such exclusive occasions, our members are given an interesting peek behind the scenes", says Petak. ■

[www.alumni.ethz.ch/association](http://www.alumni.ethz.ch/association) →



### Greetings from the President

## Dear ETH Zurich alumni

I always take great pleasure in attending the annual event "Meet the Talent" – as a donor, of course. After all, I want to help ETH Zurich to get the best talent. In doing so, much to my delight I am constantly reminded of how committed the alumni network is to this programme. Perhaps this is because no one understands better than we alumni what it means to study at a top-flight university. And precisely because of our education, we are now able to promote young talent. If you would also like to get involved, you will find information at [www.ethz-foundation.ch](http://www.ethz-foundation.ch).

And there is something else that pleases me immensely: more and more young graduates are joining the ETH Zurich Alumni Association!

Dr. Eduard M. Brunner  
President of the ETH Zurich Alumni Association

## job<sup>up</sup>date

Vacancies for graduates of  
ETH Zurich

[www.career.ethz.ch](http://www.career.ethz.ch) →



## Alumni life

## Agenda

## Exhibitions

## Fossil Art

The touring exhibition Fossil Art is all about the amalgamation of science and art according to the principle of "art forms in nature." The exhibition is also especially geared towards people with visual impairments, who can experience the artfully presented exhibits by touching them.

**Until 12 May 2013**  
FocusTerra, Sonneggstrasse 5, Zurich  
[www.focusterra.ethz.ch](http://www.focusterra.ethz.ch) →

## «Mensch ist Mensch»

Max Frisch the Man  
**Until 29 March 2013**  
Max Frisch Archive, ETH Library  
Main ETH Zurich Building, H27  
[www.mfa.ethz.ch](http://www.mfa.ethz.ch) →

## "Pièces à conviction"

**From the periphery to the city**  
An exhibition by Archizoom-EPFL in collaboration with the bureau schéma directeur de l'Ouest lausannois (SDOL) and the Institute for the History and Theory of Architecture (gta)

**7 December 2012–17 January 2013**  
Main ETH Zurich Building, Main Hall

## Building the city anew

An exhibition by the Internationale Bauausstellung IBA Hamburg and HafenCity Hamburg in conjunction with the Institute for the History and Theory of Architecture (gta)

**24 January–14 February 2013**  
Main ETH Zurich Building, Main Hall



In the exhibition Mensch ist Mensch, for once the Max Frisch Archive at ETH Zurich is not examining Frisch the author, critical observer and committed intellectual, but rather the man behind the public figure.

## Graphics collection

## Between the Lines

Graphics series by Louise Bourgeois  
**Until 18 January 2013**

## Fischli &amp; Weiss and friends

Works from the collection  
**6 February–28 March 2013**

## Markante Köpfe

A portrait of Anton van Dyck and his illustrious circle  
**24 April–28 June 2013**

## Schattenreisen

Etchings by Peter Bräuninger  
**21 August–18 October 2013**  
Main ETH Zurich Building, E53

## Alumni business events

## Roger de Weck

Director General of Schweizerische Radio- und Fernsehgesellschaft (SRG SSR)

**11 April 2013**

**Networking aperitif from 17:30, event begins at 18:45, main ETH-Zurich building, Dozentenfoyer**

**Register at:**  
[www.alumni.ethz.ch](http://www.alumni.ethz.ch) →

## Alumni Symphony Orchestra

## 14th concert, spring 2013

*Johannes Brahms (1833–1897)*  
**Symphony No. 3 in F major, op. 90**

*Richard Wagner (1813–1883)*

## Lohengrin:

**Prelude to Acts 1 and 3**

**From the Wesendonck Lieder:**  
"Der Engel" and "Schmerzen"

**From Tristan und Isolde:**  
"Liebestod"

## Tannhäuser: Overture

Mezzo-soprano: Jordanka Milkova  
Conductor: Johannes Schlaefli

**17 April 2013, 19:30**  
Reformed Church Gossau (ZH)

**20 April 2013, 19:30**  
Zürich Tonhalle, great hall



Branco Weiss fellow Dr. Lea Haller investigates the history of global commodity trade in the 20th century.

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