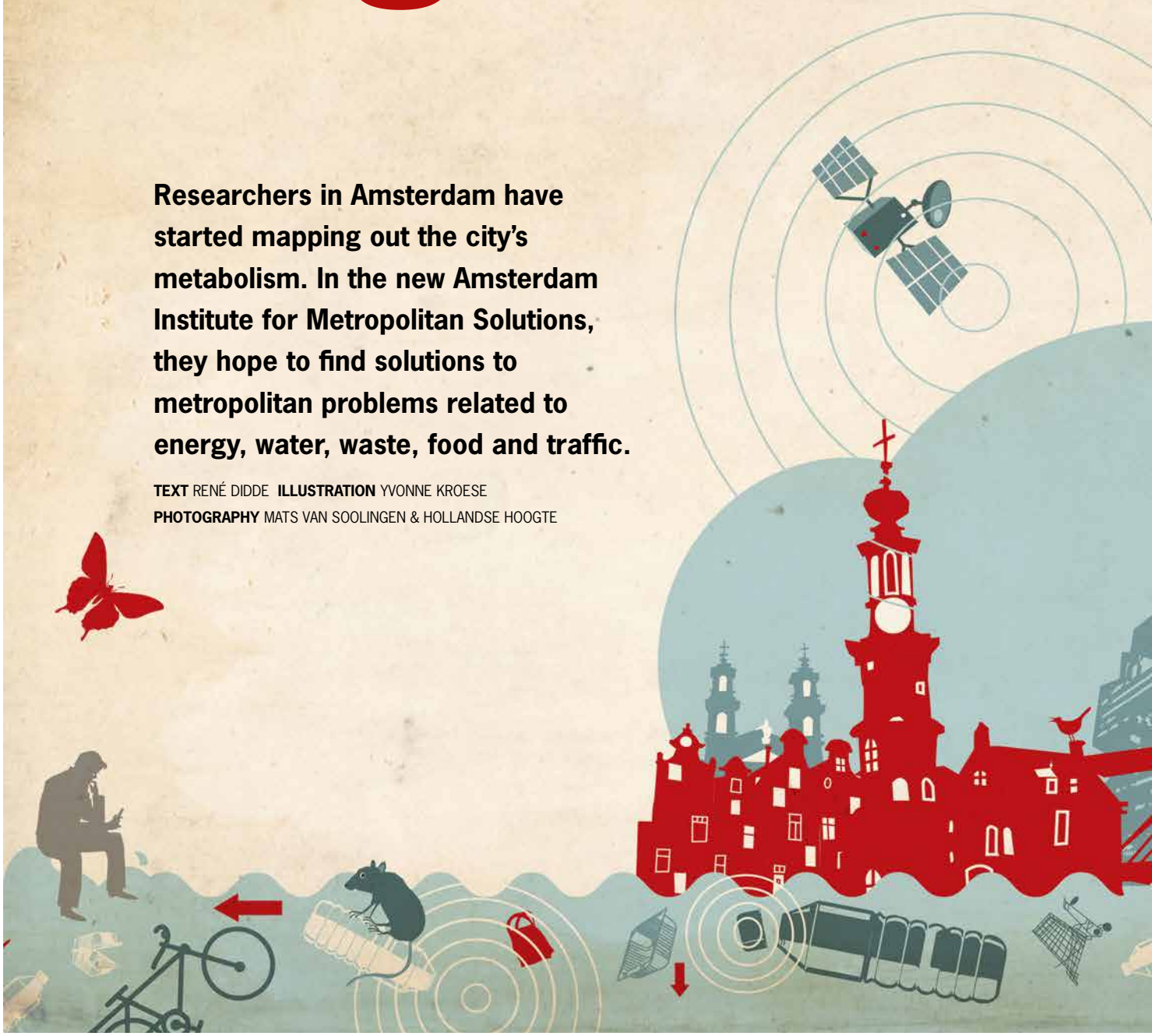
NEW INSTITUTE FOR URBAN PROBLEMS

Engineers in

Researchers in Amsterdam have started mapping out the city's metabolism. In the new Amsterdam Institute for Metropolitan Solutions, they hope to find solutions to metropolitan problems related to energy, water, waste, food and traffic.

TEXT RENÉ DIDDE **ILLUSTRATION** YVONNE KROESE
PHOTOGRAPHY MATS VAN SOOLINGEN & HOLLANDSE HOOGTE



Amsterdam

When at the end of June 2014, students on the MSc in Geo-Information Science threw PET bottles into an Amsterdam canal, it was not just a piece of hooliganism by a bunch of partying 'Wageningers' on a city trip. It was part of a serious trial. The bottles were equipped with a sensor making it possible to keep track of them with a GPS. Within a few days the bottles had travelled quite a way through the canals. The researchers also noticed that a few of them were fished out of the canal the next day by the municipal waste disposal service.

'I was inspired by this kind of 'trashtracking' when I saw it at the Massachusetts Institute of Technology (MIT) in Boston, and I copied it immediately,' relates Arnold Bregt enthusiastically. As professor of Geo-information Systems at Wageningen University, Bregt is involved in the new Amsterdam Institute for Advanced Metropolitan Solutions (AMS), in which Wageningen UR, the Technical University of Delft and MIT are collaborating.

The test with the plastic bottles was just one small project that coincided with the launch of AMS. It served to highlight places where garbage collects and where garbage collectors on boats can easily fish it out of the water. Hundreds of experiments of this kind, as well as larger research projects, often implemented by Amsterdam residents and visitors, are expected to deliver a huge database of useful information over the coming years.

'Photos of cars parked in the wrong places also provide information about litter'

LIVING LAB

AMS has an ambitious goal: finding new solutions to the problems facing big cities around the world in the areas of energy, water, waste, food and traffic. Not worked out in theoretical thought experiments, but developed and implemented in the midst of society by residents, companies and tourists, in a 'living lab'. Residents will also help to set the research agenda. AMS will work along three main lines. There will be an AMS research network, an AMS data platform in which research results will be made available to projects, and an AMS Master's programme (see box). Three projects have already started in the research network. 'In the project Urban Pulse, we want to map out the city's metabolism. What goes into it, in terms of energy, water and good, and what comes out, in terms of products and waste?' explains Bregt. In another research project, Rain Sense, sensors on street lampposts and umbrellas will enable an app to function as a kind of local rain radar, providing insight into where the rain falls in the city, and how much. You can then check on your smartphone whether your carpark, a tunnel or a metro station has been flooded by a downpour, says Bregt. These sorts of things only happen a couple of times a year at present but are likely to be more frequent in future. Geo-information about where rain falls and which are the most low-lying parts of the city should also help in taking steps to create a climate-proof city in which the public transport system is less vulnerable to flooding than it is now.

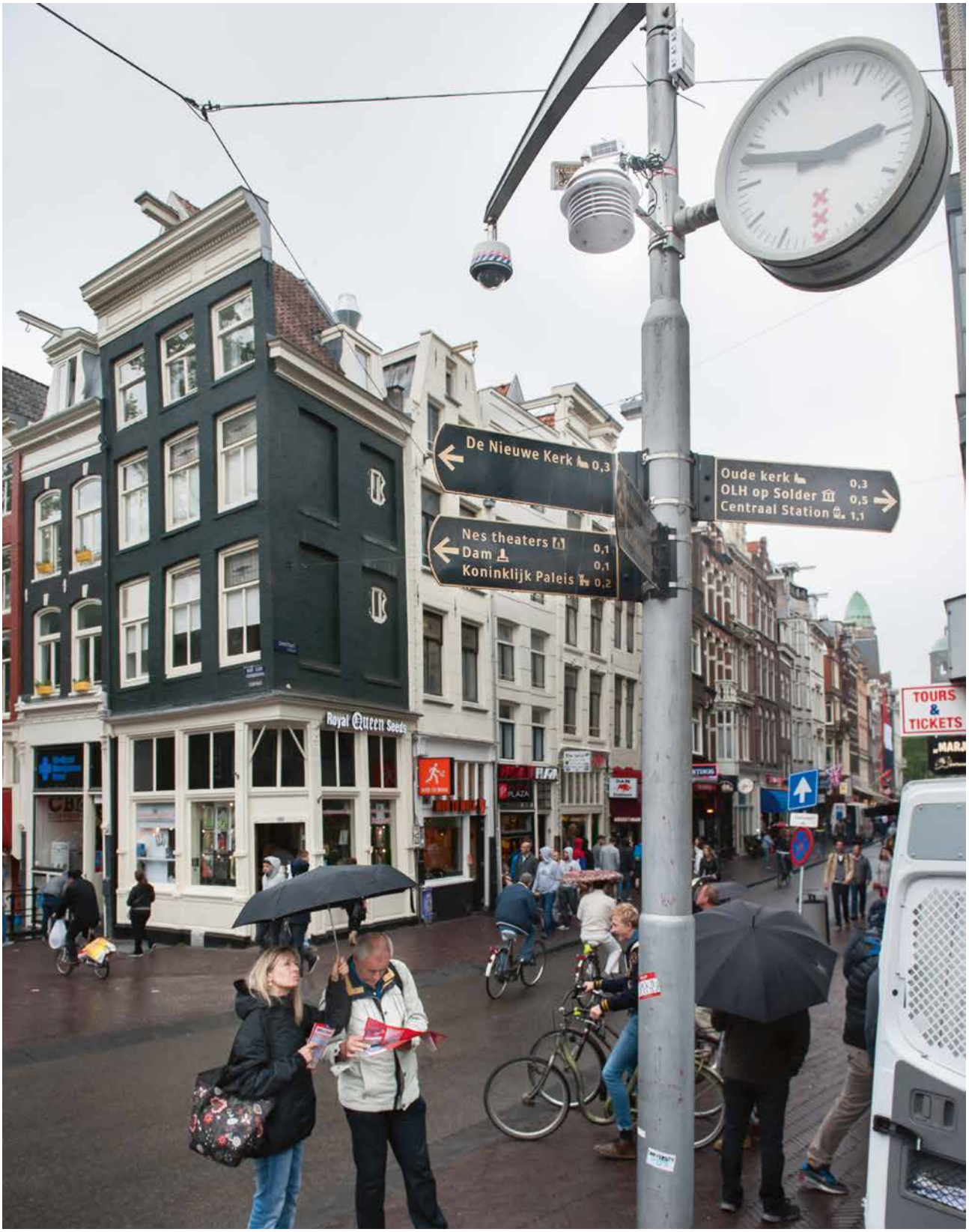
SHARING PHOTOS

Understanding and predicting traffic flows is the topic of a third research project: the Urban Mobility Lab. In this project, good use is made of information shared online, such as photos and tweets. Photos shared by tourists on Flickr show, unbeknown to the photographers, the most popular routes through the city. Tweets from residents about accidents automatically make it clear where the accident hotspots are in the road system. Where bus and tram passengers get on and off provides new information, and the routes taken by trucks cast light on traffic jams and bottlenecks in the city. 'This provides scope for taking targeted measures,' says Bregt.

Tens of researchers from Wageningen UR, TU Delft and MIT form the academic heart of AMS. MIT, famed around the world for ingenious measurement methods like the plastic bottles, makes its knowledge available so that movement in the city becomes visible. AMS also consists of a network of companies such as KPN, Shell, IBM, Cisco and Accenture, which are looking for a concrete starting point for their involvement, in the data platform for instance. Also participating in AMS are the research institutes TNO and ESA, numerous services of the municipality of Amsterdam, Waternet, Alliander, the harbour company and Waag Society. AMS has its headquarters in the imposing Royal Institute for the Tropics (KIT). Here, AMS director Renée Hoogendoorn explains that the parties met when they entered in a competition run by Amsterdam municipality. 'The then councilor Carolien Gehrels thought Amsterdam lacked the engineer's mentality,' says Hoogendoorn. 'The mentality that seeks practical solutions to help the city make progress.' The jury, led by Royal Academy of Sciences celebrity Robbert Dijkgraaf, considered the proposal of Wageningen UR, TU Delft and MIT the best. These parties had found each other through their executive boards.

TRAFFIC PROBLEMS

Migration to the city is increasing all around the world, says Hoogendoorn. 'People expect to be able to create a better life there than in >



Gauges on lampposts provide street-level information about rainfall in Amsterdam.

the countryside. The down side is that there is increasing pressure on a small area, with all the problems of traffic, waste and sometimes energy that that entails. What is more, new problems are cropping up all around the world, such as climate change, which is causing both flooding and droughts. These very complex problems can no longer be addressed by the old, separate disciplines.'
So a multidisciplinary approach is the order of the day, says Hoogendoorn. Mobility, food, water, waste and energy are the themes which researchers from different disciplines will be addressing. The research should also produce insights that are helpful for other big cities.
Wageningen UR will of course be contributing its expertise in scientific fields such as food, environmental technology and climate, as well as its social science and organizational expertise. It will address important themes such as water and vegetation in the city, neighbourhoods which generate their own electricity, more extreme rainfall and higher temperatures, says Hoogendoorn. 'Wageningen UR has the theme of 'metropolitan solutions' in its strategic plan. TU Delft did the same with 'intelligent cities'. Delft will contribute knowledge about building and civil engineering, and architecture,' says Hoogendoorn, who studied engineering at Delft himself.

SOURCING FUNDING

AMS has been allocated a budget of 50 million euros for 10 years by the municipality of Amsterdam. Wageningen University and the TU Delft will each contribute 20 million per year in the form of researchers and supervision of students and PhD candidates. Hoogendoorn: 'Researchers can apply as long as they come up with innovative projects with an international aura about them. And they must succeed in sourcing at least 50 percent of the funding from other financiers.' This brings the real budget to 250 million euros for 10 years. This approach is beginning to work, reports Bregt. 'I recently got an EU research project funded. I will be including Amsterdam in it as a case.'
The participants will also be studying applications of the immense set of data produced by residents and users in the 'living lab' of the city. That should produce 'feasible recommendations' for policy and government. It may sound rather abstract, but Arnold Bregt and Renée Hoogendoorn are trying to make it concrete. 'An example would be new instruments for improving Amsterdam's traditionally poor record in the area of waste,' says Bregt.
As an example he cites the photos being taken every day from traffic wardens' cars in order to fine people parked in the wrong places. 'Those photos are only used once now. But they also show information about full garbage containers, broken waste bins and litter,' says Bregt. 'Then the municipality can empty the containers more often, repair bins or send in more road sweepers.'
The city's waste disposal behaviour can also be improved when an element of fun and gaming is introduced, suggests Bregt. Following the example of the Efteling theme park, where 'Holle Bolle Gijs' statues of a greedy boy shout to be 'fed' with waste paper.

THE PROOF OF CONCEPT

There are already dozens of projects going on in Amsterdam in the fields of the environment, climate, traffic, energy and waste. Green roofs, water storage, electric rental cars and charging points, solar panels and roofs, wind turbines in the extensive harbour area. This raises the question of exactly what the added value of the scientists is. 'There is already a lot of local dynamism,' agrees Arnold Bregt. 'But I think we can add the engineer's mentality to that. In other words: after the wild ideas stages, keep going and demonstrate the 'proof of concept'. Now a lot of initiatives grind to a halt after a promising start, and they often depend on isolated individuals and egos.'

URBAN ENGINEERING PROGRAMME

Besides dozens of research projects and a data platform, the Amsterdam Institute of Metropolitan Solutions (AMS) will also be running a Master's programme. The two-year programme will be run jointly by Wageningen UR and the TU Delft. MIT in Cambridge US and the University of Amsterdam will both contribute to the programme as well.
It is the express aim that residents set the research agenda, emphasizes Erik Heijmans, one of the programme directors from Wageningen. 'In Amsterdam West, residents are dissatisfied with the quality of the water in their canal. Students come up with solutions such as dredging the canal or putting mussels in it. But they also warn the residents not to throw bread into the canal.'
The Master's programme should start up in 2017 and be offering about 200 places by 2020. The students on the programme will do fieldwork in Amsterdam but will follow courses in their own city, keeping in touch online. Using massive online open courses (MOOCs), lectures on the new programme can by then be made accessible to many thousands of students all over the world.

Plastic bottles fitted with a sensor so they can be tracked by GPS to provide a picture of where garbage collects.

To this end, AMS aims to get more departments of the large municipal system working together. The spatial planning service, Waternet, Alliander, and the waste company AEB have expressed the wish to collaborate more. 'That can lead to surprising collaborations, which we can make use of,' says Bregt. It requires more bureaucratic cooperation, for instance, to place solar panels on roofs and then ensure the electricity is supplied to offices and apartments. He also talks with enthusiasm about a Wageningen-designed walker equipped with sensors with which loose tiles, too high pavement edges and sunken pavements were identified this spring. 'This will help Amsterdam to cater better for the ageing population,' says Bregt. The big event SAIL later this year will also form part of the living lab. 'Crowdsensing will be used. This is measuring a crowd in order to be able to respond to stress situations better,' says Renée Hoogendoorn in Amsterdam.

Both Hoogendoorn and Bregt admit the programme is ambitious. 'We've hardly been going six months yet,' says Hoogendoorn. 'Looking at what has been set up already and which parties are already working together, it makes me happy. The collaboration with the various Amsterdam municipal services is going very well too.'

The municipality agrees. 'AMS started not long ago,' says Sebastiaan Meijer, publicity officer for the municipality. 'They are now in full swing and are giving international talent a start in science. We expect concrete contributions to innovative solutions which we in the city can apply, in the areas of environment, water, traffic and energy.' ■

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'We can add the engineer's mentality'