

# Who's in Charge?

Summary of Lectures, Discussions and Workshops  
Rotterdam International Internet of Things Day 2019



**Stay in Charge!**

**Things as Citizens**

**Future Mobility**

**Crapular Analytics**

**Algorithmic Storytelling**

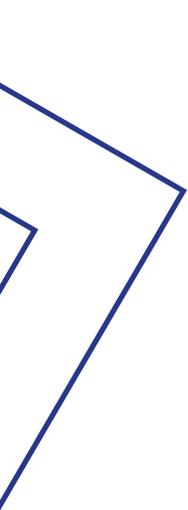
**Filter Bubbles**

**Security & Peace**

**Smart Healthcare**

The cover of this publication contains an NFC tag. NFC is short for Near Field Communication, a wireless communication technology.

Hold your smartphone against the tag to access the complete video documentation of this year's keynotes and lectures. If your phone does not support NFC tags, you can also scan the QR code above.



## INTRODUCTION

On April 9, 2019, Creating 010 proudly presented the eighth edition of the Rotterdam International Internet of Things Day. Several years ago already, April 9 was adopted worldwide as the occasion for reflecting upon this then new phenomenon. In an age in which change takes place faster than ever, and hypes move in cycles, the theme of the IoT has shown remarkable staying power. Admittedly, it increasingly serves as a broad starting point for our yearly conference, rather than as a precisely delineated field of study.

This was also the case for this year's edition, where the chosen theme was *who's in charge?* The programme we presented at Het Nieuwe Instituut demonstrated that, though our future is increasingly shaped by technology, the outcome is by no means determined solely by this technology. Keynotes, debates and workshops by experts from both within and outside the Rotterdam University of Applied Sciences examined from a variety of perspectives the complex interactions between technology, society and culture - sometimes on a more abstract level, then again very concretely. A recurring topic was the key role that civil society still has to play in these developments. Dystopian visions of the future, where American and Chinese tech giants dictate the conditions in which our society and economy will develop, were contrasted with alternatives where agency remains in the hands of private citizens and local initiatives, as well as governments representing the public interest. The assignment for the hackathon, a regular component of our annual event, invited participants to consider how we may 'Stay in Charge'.

With this publication, which includes extensive summaries of all lectures and discussions, we wish to share with a broader audience the productive atmosphere and enthusiasm of the event itself. The outstanding reporting by Johanna Monk will provide readers, this year again, with a fascinating insight into the spirit of that day. We see this publication not only as a valuable contribution to the ongoing debate, but also as a source of inspiration - for students, educators and researchers, and hopefully also for executives, managers and policymakers. Those inspired by the glimpse offered here, and wishing to hear and see in more detail what was said at the event, can find video recordings of the lectures by visiting the website [www.iotrotterdam.nl](http://www.iotrotterdam.nl). Finally, this publication should also be seen as a teaser for the 2020 edition, which again will take place on April 9, focusing once more on the broad theme of the Internet of Things as a constructive starting point. Only time will tell whether this will remain the case for our tenth anniversary edition in 2021.

Paul Rutten  
Programme Director, Creating 010

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# THE INTERNET OF THINGS AS A STORYTELLING TECHNOLOGY

William Uricchio

**If you search online for the words 'IoT' and 'story', what you will inevitably find is a sales pitch: the story that marketers tell us about the internet of things, how it came to be, where it might be heading, and all the wonderful things it can do for us. But there is also another, more intriguing, perspective: the idea that IoT and artificial intelligence technologies are increasingly also being used to tell ourselves new stories, or to tell existing stories in new ways.**

The opening keynote to the eighth edition of Creating 010's International Internet of Things Day was given by William Uricchio, Professor of Comparative Media Studies at Massachusetts Institute of Technology and Professor Emeritus at Utrecht University. Beyond the now-familiar narrative of a global network of sensors producing data streams and regulated by artificial intelligence platforms and cybernetic feedback loops, Uricchio showed how these same technologies are increasingly being deployed, for example, to generate highly personalised media content in real time. Uricchio also invited the audience to critically consider the resulting challenges in terms of authorship, agency, authority, cultural cohesion and governance – in other words: who's in charge?

### Changing times, changing stories

In 2013, Amazon founder Jeff Bezos bought the Washington Post for \$250 million. The next year, Facebook purchased WhatsApp for \$19 billion. In other words, one of the world's leading providers of journalistic content is worth 76 times less than a trendy new app that has no content or even value of its own, beyond the promise of future communication between its users. In the meantime, as young people continue to

abandon television, YouTube's 1.3 billion users go on uploading no less than 300 hours of content every minute. What all these new platforms have in common, beyond a shift from *consuming* to *sharing and producing* media content, is how our access to this content is increasingly being determined by algorithms: rather than choosing for ourselves what we want, we rely on the platform to know us and give us what it thinks we want.

But if the ecosystem for telling stories is changing, then what about the stories themselves? Uricchio distinguishes three types of narratives in this regard: *fixed*, *experienced*, and *algorithmic*. *Fixed* narratives are the ones we know best: movies, books, documentaries, articles. Their purpose is to reliably transmit identical information to as many people as possible, but also to amplify an individual point of view: everyone who reads the same book is exposed to the same ideas. Stories thus also function as a *cultural operating system* for passing knowledge from generation to generation, and for propagating norms and values. We tell our children stories, and these stories always have values: those who control our stories thus control our culture.

The second type of narrative, the *experienced* story, is in fact (and perhaps surprisingly) the oldest. According to the cultural critic Carlo Ginzburg, storytelling was originally invented by prehistoric hunters exploring their environment: each of us generates a different story within the same environment. This kind of storytelling is thus a way of making sense of our world, and of formulating memories.

The 2014 Nobel Prize in Physiology or Medicine was awarded to researchers who (perhaps inadvertently) demonstrated a neurological basis for the ancient Greek spatial memory-enhancement technique known as the 'memory palace', and more generally for the way we orient ourselves in any physical environment: we literally build a space in our brain and find our way within it. From cathedrals in which every single architectural or ornamental element is designed to evoke the story of Christianity, to a theme park like Disneyland that allows each visitor to leave with a broadly similar yet individual story, to live-action role playing games and open-world computer games in which players become characters bound by shared sets of rules, to branched or interactive narratives ('choose your own adventure') in books, games and nowadays even movies – what all these storytelling forms have in common is the role of the author as an *environmental architect*, constructing a space and planting story elements within a narrative world defined by multiple, shifting points of view.

As a useful analogy, we might think of a *fixed* story as a guided tour: the narrative experience is linear, every user gets the same story. An *experienced* story is more like wandering on your own through a city. The urban environment is designed (combining the overlapping narratives of city planners, zoning regulations, commercial property developers, etc.) – and within the constraints of this design, the wanderer can go wherever they want, stop whenever they want, construct whichever narrative they want. This is perhaps where the analogy breaks down: contemporary experienced narratives usually feature some aspect of fixed narrative. There is almost always something the author is nudging you to

look at, while still providing you with at least the illusion of free will.

The third and most recent type of narrative, the *algorithmic* story, is constantly re-adapted to each individual user, based either on 'historical' data (offering me more of what I or 'others like me' have viewed or liked in the past) or on real-time data (immediately responding to my current behaviour), in order to navigate environments and generate relevant narrative elements and events. In a sense, the algorithmic story is also an experienced story, except that the user is not required to consciously make decisions – this is done by the algorithm, usually as invisibly as possible, so that it may in fact retain the 'look and feel' of a fixed narrative. Sensors and/or algorithms constantly 'read' the reader, make assumptions, and use these to generate and structure the story.

#### **Reading the reader, viewing the viewer**

Anything that contains structured data – for example time-marked events, such as a sports match – can nowadays be algorithmically (and instantly) 'storified' with little or no human intervention, and with results that are indistinguishable from a human-written text. Increasingly, video and audio material can also be edited into a coherent sequence, from a variety of perspectives and in real time. But surely the most troubling application must be the 'deepfake' videos, where anyone can convincingly be made to say or do anything you want them to. Then again, people said more or less the same thing about Photoshop twenty years ago, and nowadays everyone knows that photos can easily be doctored.

Also, anything – or, in the context of the IoT, any 'thing' – that can produce biometric data in real time can be used to build stories and navigate environments. Algorithms thus 'read' the reader, 'view' the viewer, based on a variety of data sources, from facial emotions to eye movements, from pupil dilations and pulse measurements to EEG brainwaves. Obviously, a platform that knows exactly what I'm looking at, and even how it makes me feel, has tremendous potential not only as a navigational storytelling system – for example,

by developing the character or storyline that interests me the most, adapting the narrative on-the-fly to my emotional reactions, or just ramping up the action at the earliest sign of boredom – but also as an unparalleled, and potentially quite nasty, marketing and surveillance tool.

Uricchio described a number of recent applications of all these technologies, including an installation called *Eat | Tech | Kitchen* by the artists Klasien van de Zandschulp and Emilie Baltz: an IoT kitchen that observes and communicates with the visitor in order to instantly generate a customised recipe, which you can then cook in the kitchen (in another related installation by Van de Zandschulp called *Hey Honey*, which happened to be set up in the lobby of Het Nieuwe Instituut, you gradually come to realise that all of the objects surrounding you, from the utensils to the ingredients, are in fact observing you and communicating with one another). Other applications include algorithmically constructed responsive beings in computer

games and virtual reality environments, and humanoid robots that not only learn from interacting with humans, but are also able to sense and respond in real time to changes in our emotional state.

### Narrative governance

Moving on to the complex and enduring dilemmas of ethics, agency and governance with regard to these brave new worlds of storytelling, Uricchio sounded a mostly critical note: if we visit, for example, the web page of Stanford University's new Advisory Council on Human-Centered Artificial Intelligence, we see only three women and one African American man among the nineteen members. And the stakes are huge: stories aren't just harmless entertainment, they are, as we have seen, our cultural operating system; they allow us to make sense of the world. So in the end the most important questions may well be: who determines who has access to these technologies? Who buys and sells the data that is being used to train the algorithms? Who's in charge?

**Stories are more than just harmless entertainment. They are our cultural operating system. They allow us to make sense of the world.**



### **Discussion: the future of storytelling**

Lotte Willemsen, Research Professor of Communication in the Networked Society at Creating 010, opened the subsequent discussion with a question about the future of storytelling as a fundamentally human enterprise: historically, we have always assumed that only humans could create stories. Now that this is no longer the case, what will be the future role of humans in AI-generated stories, other than as a passive audience? And, on a broader level, what will be the implications in terms of human agency – the ability to be in control, to make practical and moral decisions, to have intentions and to act accordingly?

Uricchio replied that there has always been some degree of chaos and suspicion whenever any new media technology is introduced, from the printing press to the telephone to the internet. Also, stories have always been shaped to a great extent by whatever material platform happened to carry them: the printed book, for example, yields much more stable narratives than an oral storytelling tradition. Perhaps our real concern should be the potential loss of shared narratives, as we move toward new media forms that allow each of us to have our own experience of the world, to see only the world that the algorithm thinks we want to see – and the potential resulting erosion of social cohesion.

Willemsen's next question addressed the blurring of boundaries between reality and fiction: should there be some kind of protocol or even regulation for disclosing how a story was produced, by whom or by what? Someone in the audience observed that we've been telling each other stories forever, both true and untrue, about people who may or may not exist, and whether we believe them or not says as much about the audience as it does about the author – so in that sense there's nothing really new under the sun.

Willemsen noted how ironic it is that people often consider an AI-generated character to be more relatable and thus more 'real' than some billionaire celebrity, and what this says about a culture in which everyone is busy exhibiting online an embellished version of

their private life. Uricchio noted that we naturally tend to relate to stories in which we recognise something of ourselves; but what happens when such a character is able to develop an individualised relationship with a billion different people? And again, what is the cost in terms of social cohesion, when we believe we share a common reference point, while in fact each of us is relating to a different narrative? The bottom line for the marketers who present such characters is, of course, the need to keep the customer engaged for as long as possible, meaning that the algorithm will be programmed to be as addictive as possible.

Willemsen asked whether anyone in the audience ever tried to 'hack' the algorithm of, say, Netflix, in order to get offered less predictable content? After some discussion as to whether such algorithms indeed tend to suggest increasingly middle-of-the-road content, someone in the audience brought up the topic of fake news – and how, in this case, the algorithms have been known to push users toward increasingly extreme content. Uricchio sees no contradiction here: often the easiest way to keep you looking is to go on offering you more of the same, only a bit more sensational. Someone else asked how YouTube, for instance, measures the 'extremeness' of content? The answer seems to be that no one really knows, not even YouTube. This is the black box of 'deep learning': the AI simply does whatever it needs to do to keep people watching. Only in hindsight can we determine that this entails a move towards increasingly extreme content.

### **Discussion: raising awareness**

Moderator Geert Maarse, who had been quietly overseeing the discussion from the sidelines, now posed the question as to how smart today's AI really is, beyond all the hype? Maaïke Harbers, Research Professor of Artificial Intelligence & Society at Creating 010, replied that, regardless of how near any 'technological singularity' may or may not be, AI really doesn't need to be smart in a human sense in order to have a huge impact on our lives and on society: it just needs to be good enough to make us dependent on it. Lotte Willemsen added that, since AI is created by humans, perhaps the way for us to remain in charge is to focus on these





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humans: on education, on critical thinking, and on the arts, which not only help make us aware of issues, but also provide us with a critical and emotional framework to discuss these issues.

Uricchio questioned the extent to which AI is actually created by individual humans, rather than by corporate policies, with their own blind logic of profit, optimisation and competition. If we are indeed seeing here the end game of an economic system based on the accumulation of profit, with a tool that does it better than any we've ever had before, then the result is not only a huge loss in terms of missed opportunities (for education, for example), but also a real risk of social breakdown.

But how, asked Maarse, can education and the arts ever hope to compete against corporations? Paul Rutten, Programme Director at Creating 010, and Willemsen agreed on the need to raise awareness among the people who populate these corporations, again beginning with education. However, Willemsen wondered whether awareness is enough: for example, regarding data privacy, people are well aware of the risks, but still voluntarily give up agency whenever they want the services or the content.

Ben van Lier, Research Professor of Industrial Internet of Things at Creating 010, pointed out that here in Europe, we are increasingly dependent on AI technologies developed in the



US and China, on which we have no influence whatsoever. And as these technologies play an increasingly important role in our society, we are gradually losing more and more of our own culture: our European values simply do not play a role in these developments. We have thus lost this first battle, and what we should be focusing on now is the next battle, of finding some way to bring our values and our governance into these systems.

After a long discussion with many interesting side roads, Creating 010's Maaïke Harbers brought the discussion back to the main topic of storytelling, by asking Uricchio to comment on the situation in which technology makes it easier to construct a fictional story that seems real, or in which people unwittingly communicate with an AI character that seems human.

Uricchio replied that even real-life stories have always relied heavily on narrative conventions – and conversely, that fiction only works when it constructs worlds which we can understand and navigate. The bottom line is that people often don't care, as long as it helps them get where they want to go. Lotte Willemsen countered that research has shown that people actually do feel cheated when they discover they've been talking to a chatbot which they thought was human – which they usually only find out when the system fails. Uricchio, however, sees this as largely cultural: children for example interact very naturally with robots, much as they attribute human characteristics to inanimate objects, in order to make sense of the world. We educate children away from this animistic worldview, and teach them to see stories as things we consume – but all of this may be changing faster than we realise.

For the complete video documentation of this keynote, see: <https://crea010.com/jotrdam19williamuricchio>

# THE FUTURE IN MOBILITY: FROM MOBILITY AS A SERVICE TO CONNECTED LIVING

Alwin Bakker

The traditional infrastructures of mobility, traffic, parking and delivery logistics that have shaped our cities over the past century are quickly becoming unsustainable, and not only on an environmental level: we are quite literally running out of road. At the same time, ongoing developments in artificial intelligence and other technologies mean that we can now actually begin to envision alternative scenarios. Imagine, for example, your own street without all the parked cars - 95% of cars are in fact parked at any given time - which becomes a realistic prospect once cars are able to drive themselves off to a less valuable location, and pick you up again when you actually need them. Then again, who is to say that all this freed-up space won't just be used to roll out even more lanes of traffic?

Also, anyone who worries about robot drivers making life-and-death decisions on our behalf, should consider the fact that 90% of road accidents are due to human error, and that these accidents kill twice as many people as homicide, war and terrorism combined – worldwide, year after year. How hard can it be, really, to program a robot to drive more safely, more ethically and more courteously than the average human driver?

### From research to legislation

Alwin Bakker is founder of The Future Mobility Network, which describes itself as a platform for collaboration between professionals in the field of autonomous transportation. Bakker began his presentation by showcasing a

number of projects in which he and The Future Mobility Network are currently involved. These include small-scale public transportation buses and shuttles (known in the trade as 'last-mile connections'), mostly on land but also across water, and often in semi-controlled environments such as airports or hospital parking facilities – but also experimental bus lines on public roads, including one that features the additional regulatory challenge of operating across the Dutch/German border.

Current Dutch legislation still requires the physical presence in the vehicle of a 'steward' – already a step beyond a 'driver' – who can intervene in the event of any unforeseen circumstances; the new Dutch legislation

governing the experimental use of self-driving vehicles (*Experimenteerwet zelfrijdende auto*) goes one step further by issuing exemption permits that allow certain vehicles to be operated and monitored remotely.

The Future Mobility Network is also closely involved in applied research partnerships with the Delft University of Technology, as well as exploitation partnerships with several public transport operators, so that these pilot schemes can gradually be integrated within existing networks and infrastructures. Other projects include monitoring and managing bicycle traffic flows in order to prevent biking congestion

(a serious issue in places such as the city centre of Amsterdam) by providing real-time routing and timing advice to cyclists.

More speculative fields of research, specifically in the domain of 'smart logistics', include the possibility of using aerial drones to deliver, for example, a warm pizza directly to your home. Since architects are now busy designing buildings that will only be completed by the time such scenarios could actually become feasible, it may be well worth considering in these designs the logistics of having such deliveries made to a dedicated landing area on the roof of a building – or even straight to your private balcony.



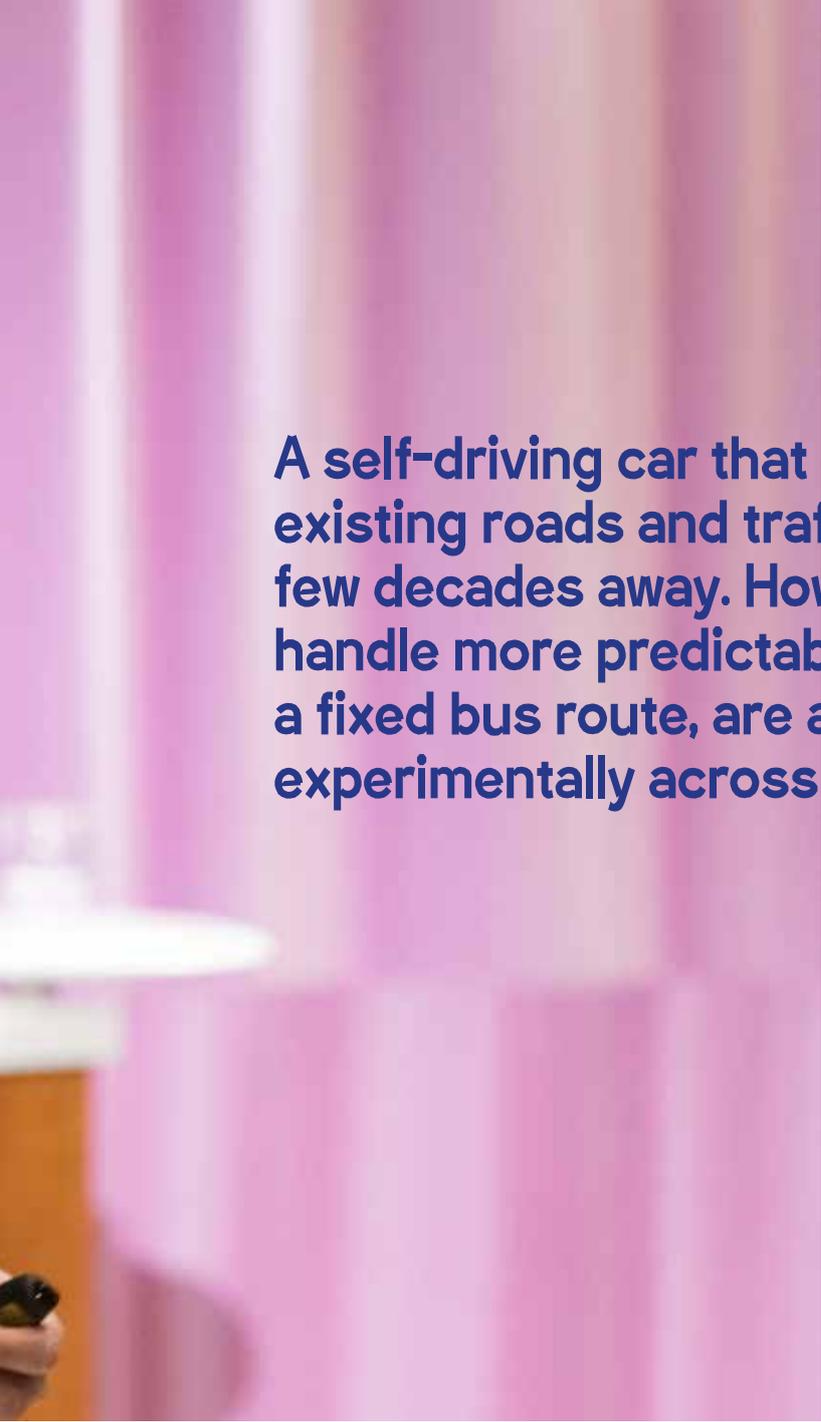


### **Incremental development**

But we're not quite there yet. For example, a self-driving car that can reliably negotiate all existing roads and traffic situations without any need for human intervention is, by all accounts, still a few decades away. However, systems that can handle more predictable environments, such as the fixed route of a bus line through a modern suburb, are already being deployed experimentally across the world. Also, as the 'autopilot' driver-assistance systems in today's cars become not only smarter but also cheaper, we will see them gradually being deployed in more vehicles and activated in increasingly challenging situations.

Today's research thus focuses on an incremental development and application of the resulting technological knowledge, in which each new step not only builds upon the past to shape the future, but must also address an actual demand in the present in order to gain acceptance in terms of funding, regulations, user behaviour and market impact.

The Future Mobility Network develops (together with partners such as The Rebel Group) working prototypes and relevant business models, as well as the necessary framework agreements for financing these projects within existing and upcoming



**A self-driving car that can negotiate all existing roads and traffic situations is still a few decades away. However, systems that can handle more predictable environments, such as a fixed bus route, are already being deployed experimentally across the world.**

The subtitle of Bakker's lecture was *From Mobility as a Service to Connected Living*. The first part, mobility as a service – as opposed to the traditional model of vehicles as goods, personally owned by individuals – seems relatively straightforward. We can already see it happening, as automobile manufacturers offer an increasing variety of transportation-related services, from leasing to electric charging, from ride sharing to parking management – either directly, or by acquiring smaller businesses and startups that offer such services.

'Connected living' is an altogether more distant and speculative concept, and in a sense even seems to be evolving in the opposite direction. Bakker played a video advertisement by the French automotive brand Renault, featuring a semi-autonomous concept car designed as an integral part of your house (and thus by definition non-shareable), with dedicated parking space on the roof, as a highly visible status symbol – the exact opposite of a car that drives itself away to be used by someone else when you don't need it. Also, to anyone who has ever experienced motion sickness, the prospect of turning around to face the passengers in the back seat of such a living-room-on-wheels may seem less than appealing; of course, there are also intrepid researchers currently studying motion sickness itself as just another problem waiting for a technological solution...

legislation and regulations. Other key areas of research include user behaviour (will we actually use these new technologies, and how do we respond to being suddenly confronted with them?) as well as market and societal impact (which can only be measured once products and services are actually deployed at scale). All research questions are pragmatically market-driven, and are developed through time from trial-and-error probes in closed testing facilities, to working prototypes in public spaces. All use cases are application-driven rather than technology-driven – the bottom line being that if the product or service does not solve an actual problem, no one will buy it.

## Discussion

So when exactly can we expect all these developments to move beyond the current stage of prototypes, concept cars and pilot projects? A question from the audience addressed the emotional attachment, particularly among men, of driving and owning a car. Leaving aside for now whether the reality of commuting, parking and taxes actually reflects such dreams of freedom and power, Bakker replied that we now already see each new development being readily embraced by consumers, first as a luxury option in high-end models, then as a safety feature that eventually becomes mandatory (for example, backup cameras are now required by law for all new cars sold in the United States).

The gradual transfer of control and responsibility from human to machine thus seems inevitable; the next step, according to Bakker, is an autonomous vehicle that can change lanes and overtake slower vehicles on highways – or slow down or even accelerate in situations where stopping would not be the safest course of action. Another intriguing possibility is to integrate data from nearby street cameras and other IoT devices, allowing the vehicle to perceive objects outside of its own field of vision, for example a person or object about to appear from behind a building or parked vehicle. In a sense, the term 'autonomous vehicle' is a misnomer: the car of the future will in fact be highly networked, and thus much less autonomous than a human driver.

Interestingly, most questions from the audience had to do with safety and ethics, reflecting ongoing concerns with regard to trust, expectations, and our own behaviour when confronted with these systems, whether as a pedestrian or as a human driver. Bakker described experimental scenarios in which a car can project pedestrian crossing markings on the road, or will 'blink' with green eyes to signal that it has 'seen' you waiting to cross. Still, all research shows that, at least for the time being, people tend to be very suspicious when they see a vehicle approaching with no one behind the wheel.

The now-familiar 'trolley problems' of choosing between two disastrous outcomes – for example, what should the car do when it has to decide between the safety of its two passengers and that of a larger number of pedestrians – is, according to Bakker, a fundamental misunderstanding of the actual situation. The machine itself will not be making any decisions: it will simply be performing whatever its human designers have instructed it to do. But, someone asked, what happens when the system encounters an extreme condition for which it has not been explicitly programmed? Bakker replied that there is no such thing as a system, either human or artificial, that does not make mistakes; the real measure will always be whether the system is at least as safe as a human driver – which, again, is really not setting the bar very high.



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# THE CRAPULARITY IS HERE

Florian Cramer

**Prior to his career as a researcher and educator in the field of contemporary visual culture, Florian Cramer was a scholar of comparative literature, where he developed a keen awareness of the biases and ambiguities that inevitably arise during the interpretation ('hermeneutics') needed to make sense of any kind of data - from ancient religious scrolls to IoT sensor readings, from the stream of consciousness of prophets and oracles to the never-ending stream of big data output.**

In his lecture, Cramer critically examined the unintended side-effects of these powerful new technologies, and how their ongoing convergence and exponential growth often lead not only to 'solutions' that are not always as 'smart' as they are made out to be, but also to much more troubling developments such as social discrimination, cultural alienation and political extremism. The key issue at hand here, according to Cramer, is that the applied science of data analytics structurally oversimplifies and underestimates the problems of data interpretation. How will the methods of interpretation influence the outcome? Who gets to choose these methods? What is the real price of the assumptions and shortcuts taken in order to save valuable time and resources?

Florian Cramer currently holds the position of Reader in 21<sup>st</sup> Century Visual Culture / Autonomous Practices at the Willem de Kooning Academy, Rotterdam University of Applied Sciences. He was previously the founding Director of Creating 010.

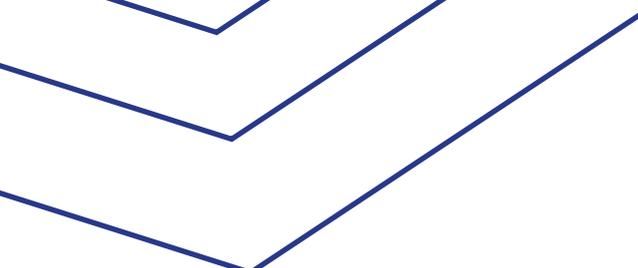
## Data mining in the arts and popular culture

Public events produced by the Fluxus art movement in the 1960s often began with a performative counting of the audience, for the simple pragmatic reason of trying not to get

swindled by the ticket sellers. Cramer sees here a basic data-mining algorithm, with the same hierarchy of programmer (artist-composer), software (performers) and data (audience), and the same illusion of participation and interaction characteristic of today's 'gamification' and social networking platforms.

The mainstream TV show NUMB3RS (2005-2010) depicted the application of (surprisingly realistic) mathematical formulas, statistics and algorithms toward solving crimes. The use of 'big data' – a term not yet coined when the show first aired in 2005 – in law enforcement was in itself nothing new, and was used for example by the West German Federal Criminal Police in the 1970s to track down members of the terrorist Baader-Meinhof group, by feeding entire population databases into computers and progressively narrowing down the lists of possible suspects. Here Cramer played a record from 1980 by the German punk-rock band Abwärts ('Downward'), with the chillingly prescient lyric 'we live in the computer state' and ending with the voice of Federal Criminal Police director Horst Herold endlessly repeating: 'We'll get them all!'

Today's 'predictive policing' algorithms in fact go much further, by identifying crime



'hotspots' and forecasting where the next crime might happen. The goal is thus no longer to understand the present based on the past, but to guess the future based on statistical probabilities and patterns of behaviour. Unsurprisingly, the focus of these predictions tends to be on poor, non-white neighbourhoods, thus reinforcing age-old vicious circles of violence, mutual mistrust and guilt by association. More broadly, artificial intelligence has been shown to have a systemic 'white guy problem', with sexism, racism and other forms of discrimination structurally built not only into the datasets, but also into the algorithms themselves – which are usually the intellectual property of corporations, who of course have no interest in journalists or civil rights groups critically researching their trade secrets.

Where a TV show like NUMB3RS depicted algorithmic policing as clean and reliable lab science, the reality is usually much messier. And, whenever reality turns out to be more complex than was originally assumed, the usual response of the engineers is to increase the complexity of the algorithm. The real problem, however, is the very idea that there can be such a thing as unbiased data, and the belief of users in this objectivity, and thus in the reliability of the systems.

### **The invisible hand of crapularity**

Technology has a way of casting a new light on what may have once been esoteric discussions among academics, by bringing the underlying issues into the real world. The age-old debate as to whether the social sciences should apply 'objective' methodologies of controlled observations under reproducible conditions, rather than 'subjective' models based on perception and observation, in fact anticipated the key paradox of today's computer analytics: by ignoring or dismissing the inevitability of interpretation, ambiguity, speculation and bias, or by seeing these as mere 'bugs' rather than as intrinsic features of the system, we actually end up amplifying their negative effects. And the implementation of AI is by no means an academic debate: regardless of the cracks in the foundations, AI will be deployed whenever it is shown to 'deliver results', with little or no regard for the side-effects.

The term 'crapularity' was coined in 2011 by the technology anthropologist Justin Pickard, as a dystopian alternative to the much-hyped 'singularity'. However, unlike the 'invisible hand' of the liberal free market – which according to Cramer also constitutes a historical singularity, and where any unintelligent choices of individual actors are presumed to cancel each other out – the AI singularity will in fact require society to 'dumb itself down' in order to become more machine-readable. Again, the key issue is one of interpretation: why should we expect businesses to expend huge resources in making sense of our complex and ambiguous world, when it would be much easier to just rebuild the world to make it idiot-proof for even the most clueless AI? If this seems far-fetched, one need only remember how our cities were completely redesigned in the 20<sup>th</sup> century to make them more car-friendly.

The crappy singularity envisioned here by Pickard, Cramer and others is a very bleak one indeed, where self-driving cars in standardised shapes and colours drive on perfectly straight roads, and where most of humanity lives, works and studies in self-cleaning buildings and self-teaching online schools, while a 'legacy' world of scenic routes, picturesque towns and brick-and-mortar schools becomes a luxury for the rich who can still afford human services. Another variation on this theme is the popular Twitter feed 'Internet of Shit', that satirises the endless proliferation of unintelligent and wasteful technology ('The Internet of Shitty Things is here. Have all of your best home appliances ruined by putting the internet in them!'). The microblog invites readers to share their own IoT horror stories, from operating system crashes in 'smart' elevators and unexpected software updates in moving cars, to sex toys that inform the manufacturer every time you use them...

### **The politics of engineering**

Anyone who has ever designed a software program, a database or a web page has encountered the need to make subjective (and thus potentially contentious) decisions: how many multiple-choice options do you include, for example, in specifying a person's gender?

Cramer sees populism, on both the left and the right, as a predictable counter-reaction to the widespread denial of the political dimensions of system design. Against the dubious liberal promise of a universal technological meritocracy based on objective (and thus fair) quantitative measurements, populism proposes a return to the 'good old days' of us-versus-them street politics, before our lives were ruled by systems beyond our control – from AI to the EU. Ironically (and tragically), the algorithms that reinforce racial discrimination through

higher crime risk assessments and lower credit ratings are based on the same fundamental design flaws as the algorithms that bring together angry white people, first in online social media echo chambers, and then in torch-bearing street rallies.

Either way, human decisions – and thus human biases – will continue to find their way into these converging information systems, and the underlying issues will certainly not be solved through further system optimisations.

**The goal of data interpretation is no longer to understand the present based on the past, but to guess the future based on statistical probabilities and patterns of behaviour.**



## Discussion

Creating 010's Paul Rutten noted the irony of regressive populist movements being amplified and shaped through cutting-edge schemes of individually targeted advertisements, but also questioned whether this populism should itself be understood in terms of resentment towards new 'systems' of big data and AI; rather, what people seem to be rebelling against are the traditional elites such as the EU, mainstream politics and mass media.

Cramer replied that any political or economic analysis must recognise that all these complex systems, both new and old, are already completely integrated with each other; someone who loses their traditional catering job and ends up working for Foodora, for example, may rage against the 'traditional' political and economic system, without necessarily being aware of the role of data systems in these new models of exploitation. To take another example, the prospect of food and medicine shortages within one week of a no-deal Brexit, is really due to the transformation of supply chains and 'just-in-time' production managed through data technologies.

Someone in the audience commented that the real problem with Brexit has been the lack of any coherent narrative, to which Cramer replied that such narratives are in fact subjective representations of systems: making a personal story or vision out of an abstract framework. Creating 010's Ben van Lier questioned how far such personal stories and visions can bring us, and to what extent we are in need of new collective narratives to replace those we have left behind; Cramer replied that formulating such narratives can only be done through ongoing social and political discussions about the nature of the systems that shape our lives, while also realistically recognising the limitations of personal agency, as we struggle to develop together some new social contract – which is precisely what has brought all of us here today.

For the complete video documentation of this lecture, see: <https://crea010.com/iotrдам19floriancramer>



She was moving them about, as she spoke, but no result seemed to follow, except a little shaking among the distant green leaves

As there seemed to be no chance of getting her hands up to her head, she tried to get her head down to *them*, and was delighted to find that her neck would bend about easily in any direction, like a serpent. She had just succeeded in curving it down into a graceful zigzag, and

down to `<em>them</em>`      down to `<cite>them</cite>`



# FILTER BUBBLES: MAKE ME THINK!

Maaïke Harbers & Bas Krommenhoek

**To advertisers and other communication specialists, the possibility of individually targeting every single consumer with a message perfectly tailored not only to their tastes and impulses, but also to their actual needs, in real time, sounds almost too good to be true: the perfect sales pitch, at the perfect time and place. In reality, professionals in this field increasingly find themselves confronted with ethical dilemmas for which there are no clear guidelines. And ethics is not only a matter of being nice to others: as every public relations specialist knows, even the appearance of deceitful behaviour can be hugely damaging to the image of a business, and thus to its ability to generate revenue.**

So what is to be done? Wait for governments to pass laws that protect consumers and level the playing field for businesses? Let the free market sort it all out? A team of researchers at Creating 010 decided upon a more collaborative approach, bringing together various interested parties and encouraging them to think out loud about the ethical implications of targeted advertising – by playing what seems, on first sight, like a rather innocent and old-fashioned board game.

Maaïke Harbers is Research Professor of Artificial Intelligence & Society at Creating 010, and Senior Lecturer of Creative Media and Game Technologies at the Rotterdam University of Applied Sciences; Bas Krommenhoek is a graduating student at the School of Communication, Media and Information Technology, Rotterdam University of Applied Sciences.

### Filter bubbles

We've all heard the bad news: the promise of an internet that was supposed to connect us all together, has turned into something quite

different. My internet is not at all the same as your internet. The most common term for this phenomenon is 'filter bubbles', coined by the internet activist Eli Pariser. Algorithms that select content for us, based on our past preferences and behaviour, lead to an increasingly distorted view of the world, with far-reaching negative effects for civil discourse, basic scientific literacy, consumer awareness, and even democracy itself.

In a sense, individually targeted advertising can be seen as the ultimate and most deliberate way of generating filter bubbles: presenting content that is both personalised (rather than shared, such as the editorial perspective openly embraced by a newspaper), and pre-selected (rather than self-selected, which is what we do every time we explicitly tell an algorithm 'show me more of this'). Most people, of course, do not usually go out of their way to consume advertisements. The advertising specialist is thus in the unusual (though by no means unique) position of creating a product which is often considered undesirable by those who are most exposed to it.





In order to address the research question: 'When is it ethically acceptable for professionals to offer personalised, pre-selected content to users?', Harbers and her team started by conducting a number of exploratory workshops with communication professionals, policymakers, educators, researchers and students. What they encountered was a clear and pressing demand for increased clarity and transparency, as well as a willingness to participate in potentially uncomfortable conversations. Harbers' team then began designing a 'discussion tool' in the form of a board game for facilitating further encounters. Prototypes of the game were tested extensively with students and educators. The game was also the focus of the graduation project of student Bas Krommenhoek, who briefly addressed the participants at the end of today's session. This was the sixth time the tool was used in the field.

#### **Make Me Think!**

The title of the game is a variation on the theme of *Don't Make Me Think*, a book published in 2000 by 'user experience

professional' Steve Krug, who argued that the user interface of software and websites should be as intuitive as possible – to the point that people barely notice it, and can get on with whatever it is they really want to be doing. On the other hand, there are many situations where it might be a better idea to step back and consider the broader perspective – in other words, to think – particularly when professionals find themselves confronted with ethical issues for which there is no clearly defined course of action.

The game focuses on the (fictitious) case study of a smart advertising column in a train station, fitted with cameras, microphones, sensors and network connections. Software inside the object can determine the age, gender, skin colour, physique and clothing of people walking by, and can also hear conversations and connect to mobile phones; the column instantly displays personalised advertisements based on the collected and computed data.

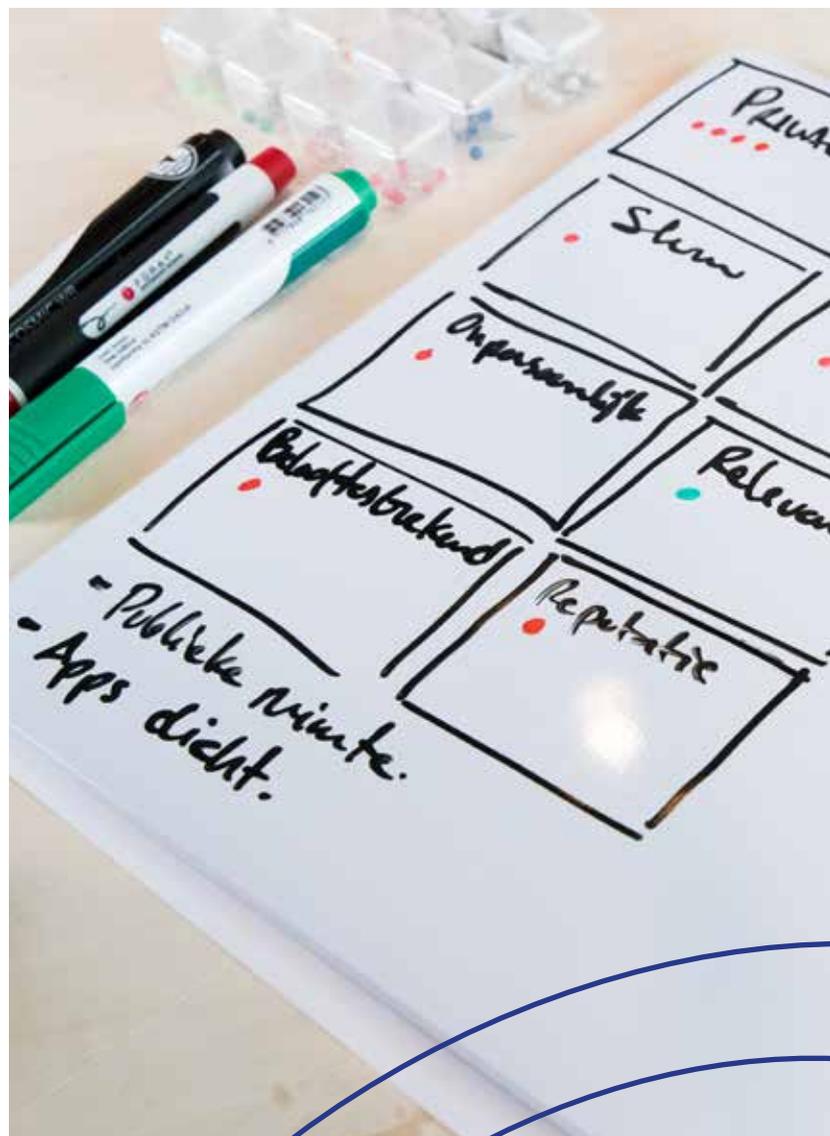
The audience was divided into small groups of 4 to 5 participants, each led by a moderator.



The board game proceeds as follows: participants are asked to respond to a series of possible scenarios, both as a 'professional' and as a 'consumer' (which is apparently not quite the same thing as a 'citizen'). Participants express their initial response by sticking two differently coloured pins into a square board divided along two axes or dimensions – positive/negative and strongly/mildly. One could, for example, feel mildly positive about a certain scenario as a professional, while feeling strongly negative about the same scenario as a consumer. Participants are then asked to identify and discuss the underlying values that determine their responses, for example in terms of convenience, privacy, agency, trust, safety, respect, accountability, transparency, etc.

The scenarios proposed today were:

1. If it starts raining, the column displays an advertisement for umbrellas which can be purchased nearby.
2. The same scenario as above, except that a voice from the column addresses you by your name.
3. Two people are talking about a possible holiday. The column immediately displays an advertisement for flight tickets.
4. When an overweight person walks by, the column displays an advertisement for diet products.
5. You have just made an appointment using WhatsApp to go jogging together with a friend. You look up and see the column displaying an advertisement for running shoes.





## When is it ethically acceptable for professionals to offer personalised, pre-selected content to users?

### Insights and feedback

After a brief plenary discussion of the experiences of participants, graduating student Bas Krommenhoek summarised the insights and feedback of the various iterations of the game up to this point.

The game clearly succeeds in its goal of raising awareness and generating interest in the topic of personally targeted advertising, leading to lively and productive discussions within the groups. Participants leave with more questions than answers, and tend to be more optimistic in their role as professionals than they are from the perspective of consumers; where professionals see opportunities, consumers see potential threats.

Consumers are used to the idea of their information being stored, processed and traded online, and there is a growing sense of inevitability with regard to personalised content; in the offline world of shopping streets and train stations, however, people still feel quite differently – especially when others can see and hear the personalised messages being addressed to them. Consumers also feel that if they are going to be targeted anyway, that the algorithm should at least be accurate, and reflect not just a momentary snapshot but a broader long-term profile.

Professionals are keenly aware of ongoing developments in the professional field, of the added value of personalised content for generating revenue, and of the need to keep up with – or better still, remain ahead of – the competition. On the other hand, they also realise how a perceived lack of transparency or consideration for ethical questions can quickly become a public relations nightmare. At the end of the business day, professionals feel that they have little choice but to make the best use of whatever possibilities are legally allowed – and that it is not up to them, but to governments and society at large, to determine the boundaries of ethical behaviour.



# Resourceful Ageing

NWO Research through Design (2016-2018)



NGI  
AWARDS  
2019



@elisagiaccardi #morethanhuman



# MORE THAN HUMAN: DESIGNING PARTNERSHIPS WITH THINGS PART 1: RESOURCEFUL AGEING

Elisa Giaccardi

It is not technology itself that has the power to transform our world, but rather the questions that technology will allow us to ask. Designers still see machine-learning algorithms mostly as a set of tools for optimising design and research processes, understanding and predicting user behaviour, or revealing patterns that can identify design opportunities. But what would happen if designers started thinking of artificial intelligence and IoT solutions as possible *resources* that can empower users to improvise and share their own strategies, rather than as mere *interventions* that impose desired behaviours upon these users?

*Resourceful Ageing* is an interdisciplinary research project funded by the Dutch Research Council (NWO) that brings together social scientists, computer scientists, and designers from both the private and public sectors. The project focuses specifically on the design of IoT solutions that empower elderly people to live longer and more independently, based on a positive vision of this target group as active and resourceful, rather than frail, passive and technologically illiterate.

Elisa Giaccardi is Professor and Chair of Interactive Media Design at the Delft University of Technology, where she leads the research group Connected Everyday Lab. She is also

Visiting Professor of Post-Industrial Design at the Umeå Institute of Design, Sweden.

## Strategies of resourcefulness

Technological products and services often have the unwanted effect of imposing choices made by designers and researchers, rather than empowering individuals – the owners of the problems in question – to make their own decisions and improvise their own solutions. The traditional design approach of identifying a problem and providing a solution thus too often results in products and services that fail to become adopted when they are seen as enforcing lifestyle behaviours that are at odds with the image people have of themselves.

**Rather than providing quick solutions, machine learning can also be used to help formulate interesting questions to which there are still no answers.**



The starting point for *Resourceful Ageing* was to find ways of translating into the digital realm the strategies of resourcefulness which elderly people have been observed to apply quite naturally in dealing with physical objects. By including some of these objects as 'participants' in the design process, the researchers aimed to reveal overlooked and unexpected coping strategies and perspectives that would have been very difficult to access otherwise, and of which the participants themselves may be unaware – or may be reluctant to admit to, for example any non-standard or 'improper' use of products or services.

By applying a variety of IoT sensors to selected household objects, the researchers were able to combine traditional design ethnography – the methodical observation of interactions between users and objects in their everyday environments – with sensor data showing when exactly each

object was being used, as well as any sudden interruptions in regular patterns of use. Subsequently feeding this data into machine-learning algorithms then made it possible to reveal unforeseen combinations in the use of these objects, and thus to learn from the participants and their household objects how resourcefulness can be designed in everyday life.

After categorising the observed materials, uses and combinations, and developing prototypes together with the users in co-design sessions, the researchers eventually settled on four small devices that could be either used in isolation or combined together in different ways (for example, one object visibly lights up when another remote object detects sound or movement), as well as a service (a tablet app) in which the user can establish connections between the devices, reflect upon their own strategies, and share their solutions with other users.



### Insights and questions

Obviously, the goal of the research project was not to implement an immediately marketable product, but to develop insights into possible new approaches toward designing IoT solutions. One of these insights was that, although machine learning can help ethnographic researchers identify hidden patterns, it is of little use in telling them which of these patterns are actually meaningful. Thus, rather than providing quick solutions, the generative power of machine learning in this case seems more suited to helping formulate interesting questions to which there are still no answers.

Also, machine learning, ethnographic work and design experimentation each have very different workflows and bottlenecks – a fundamental misalignment in their moments of slower and more rapid progress. Ethnography, for example, quickly yields large amounts of raw data, which then requires a great deal of time and effort to process qualitatively; machine learning, on the other hand, can't even get started without coherent data, which can take long to acquire but can then be processed very rapidly; and designers, of course, just want to start designing and re-designing.

However, the design process itself seems to provide the most suitable 'backbone' for a multidisciplinary effort of this type, since it is almost by definition flexible enough to accommodate and make good use of valuable input from either ethnography or machine learning at any point in the process.

For the complete video documentation of this lecture,  
see: <https://crea010.com/iotrdam19elisaiskander>

# MORE THAN HUMAN: DESIGNING PARTNERSHIPS WITH THINGS PART 2: DESIGNING THINGS THAT PREDICT

Iskander Smit

**We have become accustomed to thinking of the internet of things as a collection of increasingly smart objects that are able to perceive and influence their environments, and to communicate with us and with each other. Although these 'things' may respond to our actions, they cannot yet anticipate our behaviour, at least not in the way we can anticipate theirs. What will happen when the technological objects with which we surround ourselves become smart enough to predict the outcome of their interactions with us, and to modify their behaviour accordingly? How does a designer go about designing a 'thing' that may actually know more about the near future than its users do?**

Iskander Smit is head of LABS, the innovation lab of the internet agency *info.nl*, and a Visiting Professor at the Connected Everyday Lab, part of the Delft University of Technology's faculty of Industrial Design and Engineering.

### **Predictive interactions**

Smit began by showing the audience a short film about a smart spoon and a smart box of facial tissues that together arrive at the conclusion that, since their owner has been eating a lot of ice cream and using a lot of tissues, the obvious diagnosis is heartbreak, so the smart radio should play some suitably sad songs. Eventually, we see that the owner

was in fact using the tissues to clean up some ice cream dropped on the front of their shirt. Clearly, there is still some way to go before we arrive at even this very imperfect scenario. Still, the writing on the wall is clear: as our technology gets better at perceiving its environment and drawing conclusions based on these observations, we may find ourselves increasingly tempted to let it make decisions on our behalf – for better or for worse, and with possibly far more serious consequences than an ill-informed music playlist.

Whenever we use a technological object – a tool, a household appliance, an IoT device,



Although 'things' may respond to our actions, they cannot yet anticipate our behaviour, at least not in the way we can anticipate theirs.

Het  
In



What is the role of predictive relations in the  
design practice of the future connected product-  
service designer  
Research question

a complex industrial machine – we formulate expectations in the present of its behaviour in the future, based on our experiences with it from the past. This has always been a one-way transaction: the decision-making process that includes these predictions takes place entirely on the human side, even though we may choose to delegate certain tasks and responsibilities to the object.

Networked smart objects, however, exist not only in their current physical manifestation,

but also in the cloud, as a 'digital twin' that can be seamlessly transferred to another suitable device – or even exist independently of any physical manifestation. This makes it possible, for example, to purchase a new device that 'remembers' our interactions with a previous physical object.

But what happens when the object becomes intelligent enough to predict our interactions with it? The mental space in which we anticipate the behaviour of the object is



For the complete video documentation of this lecture, see: <https://crea010.com/iotrdam19elisaiskander>

Partnerships in Cities of Things, that focuses on the problem of urban air purification as a case study for developing more generally applicable knowledge of how to live together with smart objects in an urban environment. Do we start to see them as functional citizens, with their own form of agency and accountability? Do we say 'pardon me' when we bump into them in the street?

The U.S. State of Arizona has already passed legislation granting small delivery robots the same traffic rights and obligations as human pedestrians. It's fascinating to observe how people respond to these little autonomous vehicles rolling along on the sidewalk: do they step aside, whether out of courtesy or out of fear? Do they block its path? Do they try to pick it up or break it open to steal what's inside? In one widely shared video, a human parcel delivery worker can be seen shouting at the robot: 'Get off my territory, Robbie! I want him out of here!'

Perhaps more importantly, what conclusions will the machine-learning algorithms that determine the behaviour of these new functional citizens be drawing from our own behaviour? As the smart objects that populate our world get better at predicting the outcomes of their interactions with us, they will increasingly be able to feed-forward to situations which we ourselves are unable to clearly anticipate. And the more complex and unpredictable the behaviour of these objects becomes, the more our interactions with them will be determined by their assessment of the outcome of these interactions. We may well end up becoming more predictable than our machines.

then effectively mirrored, in a virtual space in which the object is simultaneously busy anticipating our own next move – with growing accuracy. The decision-making process may then start to shift toward the virtual space, leaving the human partner in this transaction as an increasingly passive user.

### **Functional citizens**

Smit is closely involved in the Delft University of Technology's research programme

# ARTIFICIAL INTELLIGENCE AND HEALTHCARE

Ron Bormans

In engineering and computing, a black box is a system that can be used without having to understand *how* it works - all you really need to know is *what* it does. From small children to highly specialised professionals, we all use technological black boxes on a day-to-day basis to perform a variety of tasks, from switching on a light to interpreting the output of the newest medical diagnostic tool. But what happens when even the external functionality of the black box becomes so complex and so elusive that we find ourselves routinely using it without really knowing what it exactly does? This is precisely the world which we have been busy creating for ourselves over the past few decades: the world of the algorithms.

As Chairman of the Executive Board of the Rotterdam University of Applied Sciences, Ron Bormans is frequently invited to speak at conferences and take part in consultations on a variety of topics relevant to the broad range of education programmes offered by the University. Today he was asked by Creating 010 to discuss with the audience the rapidly growing role of algorithms, artificial intelligence and IoT technologies in the field of healthcare. Or, as moderator Geert Maarse bluntly put it: are evil machines already busy taking over our hospitals?

### Who owns the algorithms?

The average professional in any given discipline – including highly educated people in key positions – would probably struggle to offer even a simple dictionary definition of the word 'algorithm'. At this most basic level, an algorithm is a formal description of a set of step-by-step instructions for performing a task, in which decisions (if/then) are made based on circumstances (data) encountered during the process. But the 'algorithms' we read about in the news are an altogether different kind

of beast: huge, complex, interconnected and multi-levelled ecosystems of algorithms, for example Google's search engine, a self-driving car, or the AI-driven systems increasingly being deployed in the field of healthcare.

According to Bormans, the problem arises when we start telling ourselves that algorithms are by definition too complex and mysterious to even try to understand: we have then provided ourselves with an irresistible excuse to avoid confronting their more problematic aspects, of which there are many.

**Who owns these algorithms? The hospital? Google? Some obscure Russian coder? A Chinese company no one has ever heard of?**



To begin with, the fact that algorithms, like dogs, tend to take on the biases, values and ethics of their owners. The underlying phenomenon of bias is in itself nothing new: consider for example the fact that biomedical and psychological research (still) tends to be conducted on a segment of the population that is far from representative: overly young, male, white, educated and healthy. In other words, the kind of people that typically conduct research and write algorithms.

The key question then becomes: who owns these algorithms? The hospital? Google? Some obscure Russian coder? A Chinese company no one has ever heard of? And, perhaps even more importantly: who will be looking over their shoulder to make sure everything is done according to the laws and standards we have collectively put in place in order to ensure our health and safety? In the traditional world, there is ultimately always

some regulatory agency – often in a stately building with a bronze plaque on the front door – that has been set up in order to certify to society at large: yes, this is a legitimate business, which has met all applicable requirements. Furthermore, this regulatory agency is itself accountable to democratically validated processes, and can if necessary be investigated by journalists. All of which might be a reassuring thought, when we are lying on an operating table, just before the anaesthetic kicks in and the AI-driven surgical robot starts performing a complex procedure, based on an accumulation of knowledge that no single human specialist present in the room is expected to fully understand.

And so, concluded Bormans, doctors and hospitals cannot afford to pass on responsibility and accountability to whoever happens to show up with the most exciting new algorithms – they must continue to claim

the leading and supervising role that comes with their traditional prestige and authority. In other words, to remain in charge.

### **Creating problems for the future**

Ben van Lier, Research Professor of Industrial Internet of Things at Creating 010, was invited to kick off the discussion by responding to Bormans' opening statement. Van Lier found much to agree with, but also a few points worth examining in more detail. The lack of knowledge of algorithms observed by Bormans among highly skilled professionals, in fact extends all the way up to the level of politicians and policymakers, who typically consider the side-effects too complicated to engage with, and prefer to focus on the expected benefits – mainly expressed in terms of lower costs and increased functionality. In doing so, they are creating huge problems for future generations, which will eventually become so deeply entangled in all aspects of our lives that they will be effectively impossible to solve.

Nowadays a hospital can lease a fully-equipped operating room from a single manufacturer, with the lease contract stipulating that all of the algorithms running on the heavily patented devices, as well as all of the data generated during the procedures, will remain the intellectual property of the manufacturer. Today these are mostly American or German companies, but five to ten years from now they will surely be joined by new Chinese competitors.

Bormans spoke of the problem of ethics and biases that find their way into the design of algorithms, but what about the choices we make in embracing these new technologies – isn't that also an ethical question? Should we automatically choose the cheapest, fastest, smartest solution, or should we instead be investing more on developing knowledge on a European level, while remaining critical of any solutions that hand over control to parties beyond the reach of our democratic institutions?

Already these algorithms and devices are linked together in emergency rooms, operating rooms and intensive care units, in ways that

ultimately lead to life-and-death decisions for which no one can be held accountable anymore. Eventually these devices will become self-learning, self-configuring and self-optimising, deciding for themselves how they should be upgraded, and thus determining the costs, benefits, possibilities and limitations of healthcare in our everyday lives.

### **Countervailing powers**

Before inviting the audience to join in the discussion, moderator Geert Maarse asked Bormans and Van Lier to comment on the role of an institution such as the Rotterdam University of Applied Sciences in developing the knowledge, skills and attitudes necessary to address the complex issues raised here today. Bormans replied that, though no one knows how the labour market will look like a generation from now, the University is able to put its students in contexts where it sees the most promising developments, while also making them aware of the underlying issues of ethics, neutrality, transparency, ownership and agency. This applies, by the way, to all education programmes, from nursing and design to management and software development. Van Lier added that the curriculum of nurses urgently needs to be updated to include technological literacy, and that professionals from all disciplines need to be involved in these discussions, which will otherwise be determined by software developers.

Returning to the question of who owns the algorithms, Bormans had mentioned hospitals and Google, the Russians and the Chinese. But, someone in the audience asked, what about the open source community? Bormans acknowledged the potential of open source as a countervailing power, to established institutions as well as to the commercial interests that have gradually taken over many aspects of public life. But open source is also vulnerable – when something goes wrong, where can you lodge a complaint? Who exactly is 'open source'? Then again, perhaps the open source movement can help us – or force us – to think of governance and validation in other terms than these institutions with bronze plaques on the front door. Van Lier added



that many of the algorithms deployed in the field of healthcare are in fact embedded in hardware devices, which are protected by industrial patents and will thus never become available for tinkering by the open source community.

At this point someone in the audience asked: what about all the people who have no idea what we're talking about here? Not the specialists and policymakers who are asleep at the wheel, but the 30% of the population of Rotterdam who are in fact digitally illiterate? We at the University also have a responsibility toward less educated people, who are completely lost in the maze of algorithms that we have created.

Bormans replied that the upheavals of the modern world are driven not only by technology, but also by globalisation, the environment, changing lifestyles and values – and that discussions of how to deal with the resulting tensions too often exclude those who will be impacted the most. The new divisions emerging in society are thus quite different from the traditional ones, which were based on social-economic status. Van Lier added that the needed rapid transformation of a profession such as nursing is in fact not driven by technology, but by the exploding healthcare needs of an ageing population, for which technology may well provide the only feasible solution – or, as Bormans put it: we're running out of young people.



# IN THE INTERNET OF THINGS, SOMETHING LIES BETWEEN SECURITY AND PEACE

Denis 'Jaromil' Roio

**As we continue to fill our homes and our workplaces with devices that have the potential to undermine long-established norms of privacy, safety and agency, we may well wonder: in our desire to maintain or reclaim our sense of peace and security, is there any alternative to the familiar militaristic terminology of attack and defence, firewalls, shields and watchdogs? Could it be possible to embrace instead a more peaceful narrative of trust, awareness, cooperation, engagement and empowerment?**

The closing keynote to this year's International Internet of Things Day was by Denis 'Jaromil' Roio, Chief Technology Officer and co-founder of the Dyne.org foundation, an Amsterdam-based non-profit 'think & do tank' specialising in the development of 'tools and narratives for community empowerment'. One of Dyne.org's initiatives, an 'awareness box' for home IoT devices called Dowse, was also the underlying platform used for this year's hackathon.

### Changing the narrative

Whereas the concept of 'security' implies a sphere of suspicion, deceit, attack and defence, 'peace' means that we can actually be safe without the need for armed guards patrolling the perimeter of our house. We are now increasingly surrounded by IoT devices that are observing us and communicating on our behalf, but what exactly are they saying about us, and to whom? In the worst case this leads to a condition of paranoia, where we become suspicious of the household objects in our

own home, which is traditionally presumed to be the ultimate zone of peace. Regulations (such as the EU's new General Data Protection Regulation) and certifications specifying what these devices are allowed and not allowed to do, are usually too complex and technical for most people to understand – to say nothing of the question of whether such regulations are even able to keep up with the exponential pace of change.

An interesting, and by now already historical, case in point is e-mail, which is still the medium of choice for 'serious', official communications (as opposed to more informal platforms such as WhatsApp). The underlying SMTP (Simple Mail Transfer Protocol) architecture was originally designed as an open system, meaning that anyone could run an e-mail server from their own home. However, as a result of the proliferation of spam, today some 98% of our mailboxes are managed by a few big companies such as Google, Yahoo and Microsoft.

The moral of the story thus seems to be: be careful who you allow into your home, be aware of who you are exchanging data with. But what do such warnings really achieve, besides fostering paranoia and thus limiting many of the valuable opportunities otherwise provided by ongoing IoT developments? And the opportunities are many indeed. The business model (and thus the value) of platforms such as Airbnb and Uber is based entirely on their ability not only to bring together supply and demand, but perhaps more importantly to extract valuable data from the transactions they facilitate. As this model expands to increasingly intimate aspects of our lives (in a sense, an app like Tinder is really just an Uber for dating), the arms race of privacy and agency often seems hopelessly rigged against individuals.

Jaromil sees two basic approaches toward maintaining or regaining control: *purchasing security*, and *increasing awareness*. The difference

between the two is mostly one of scale: large organisations that handle substantial amounts of data have no choice but to hire dedicated security experts who monitor the system 24/7 for potential attacks. On the scale of the home or the neighbourhood, however, we have another option: empowerment through awareness, which is precisely what can be facilitated through a platform such as Dowse. And this awareness, according to Jaromil, is what lies between security and peace.

### Empowerment through participation

Another Dyne.org project called D-Cent (Decentralized Citizen Engagement Technologies) focuses on research and development of distributed social networking platforms that facilitate participatory democracy and economic empowerment. In concrete terms, this means that citizens are provided with tools and applications that allow them to remain informed of policy issues that



For the complete video documentation of this keynote, see: <https://crea010.com/iotrдам19denisrojo>



**Whereas the term 'security' implies suspicion, deceit, attack and defence, 'peace' means being safe without having armed guards patrolling the perimeter of our house.**

affect them, and to collectively develop, debate and vote on policy proposals. Currently, some 75% of procurements for the city of Barcelona are being allocated through such a platform, and there are plans to implement something similar in Amsterdam in the near future.

According to Jaromil, there are two approaches toward designing IoT applications: *machines perceiving us*, and *us perceiving machines and each other*. The first, unfortunately, is what we encounter most frequently in any 'smart city' proposal: increasingly sophisticated AI, fed by increasingly detailed sensor data, that predicts our behaviour and makes decisions on our behalf, hopefully with the goal of providing us with safer, more efficient and more pleasant living and working environments. The second approach, of developing opportunities that help us perceive our machines and each other, is far from obvious or trivial (particularly if we consider the exponential growth of 'deep

learning' algorithms that are increasingly more difficult for humans to understand, and which thus seem to be bringing us ever closer to the much-hyped 'singularity') – which only makes it more crucial to invest in this approach, at least if we are really serious about maintaining or regaining any form of human agency over these systems.

Jaromil concluded with an open call to submit a proposal for an initiative called *Ledger*, a 'venture builder for human-centric solutions'. 32 selected projects will each receive €200,000 in EU funding, as well as technical coaching by Dyne.org and additional coaching from a business mentor, in order to build with their team a minimum viable product (MVP) within a period of nine months. Keywords: decentralised technologies, privacy by design, openness, and citizen data sovereignty. For those who missed the April 2019 deadline, there will be an additional open call next year.

# DATA WALK: CENTRE FOR BOLD CITIES

By Luuk Schokker, Merlina Slotboom & Peter Troxler

Immediately after the morning keynote, participants could sign up for a data walk through the civic space of Rotterdam, to see for themselves how IoT devices actually collect data in the city.

Data walking is a research process for producing radical data through collaborative walks. Data walking generates a process for observing, reflecting upon, and seeking to intervene in how data influences our civic space. By assuming the role of photographer, note-taker or map-maker, participants develop ways of thinking about and reflecting upon what data can be, and the role it plays in key social issues.

- *Define 'data'* – Together we ask 'what is data'? The answer depends on who is in the room and what we wish to achieve. Here we will map or note some of our ideas on a board or a sheet of paper.
- *Form groups and assign roles*
- *Walk!* – The groups walk in different directions. Each group must return with a photo, a map, and one illustrative object. Look for: data-rich, data-calm, data aspects related to your theme: citizenship, commons, ethics, etc.
- *Tell stories*
- *Create responses*
- *Consider outcomes*

*Centre for BOLD Cities (BOLD: Big, Open and Linked Data) is a multidisciplinary research project and a joint venture of the Leiden University, the Delft University of Technology, and the Erasmus University Rotterdam.*



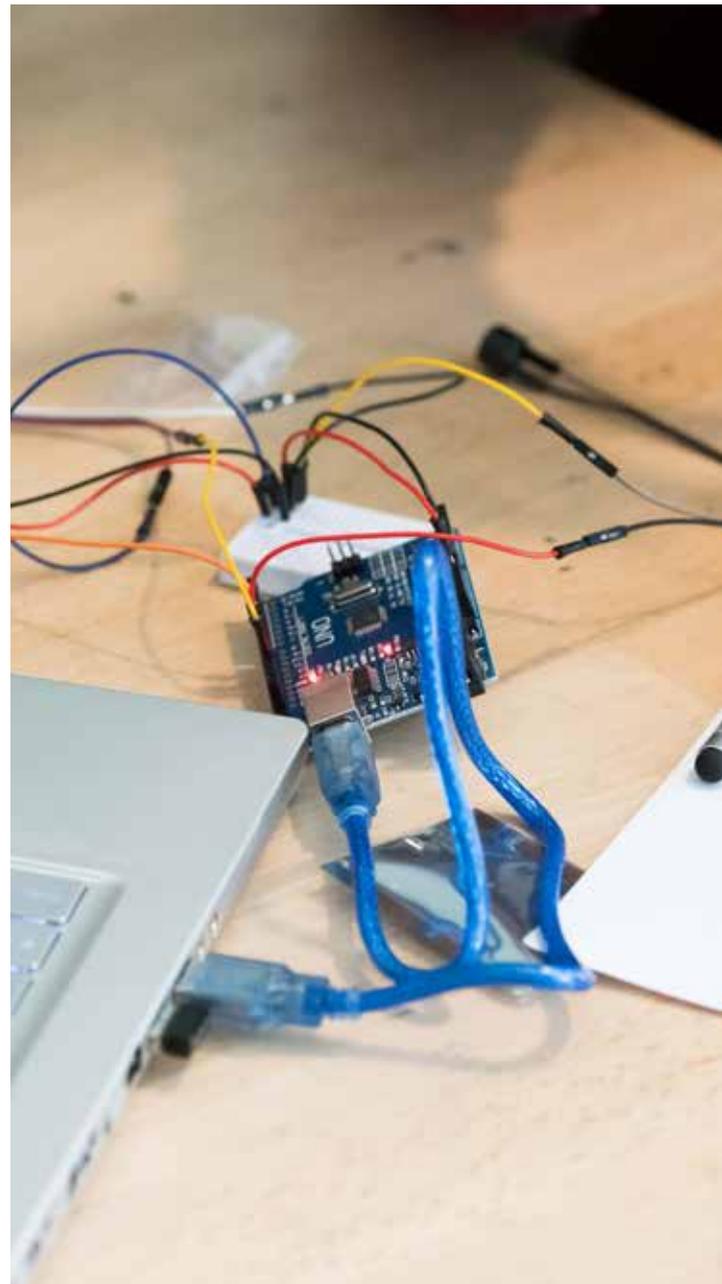




# KILLER ROBOT: IS IT POSSIBLE TO BUILD A KILLER ROBOT USING ONLY CHEAP, READILY AVAILABLE ELECTRONICS?

By Ornella Schavemaker

What is a killer robot? And what would you need in order to build one? These are the two key questions addressed in this workshop – first by researching the definition of a killer robot, and then by exploring whether it is possible to build one ourselves, while of course also considering the ethical issues involved.



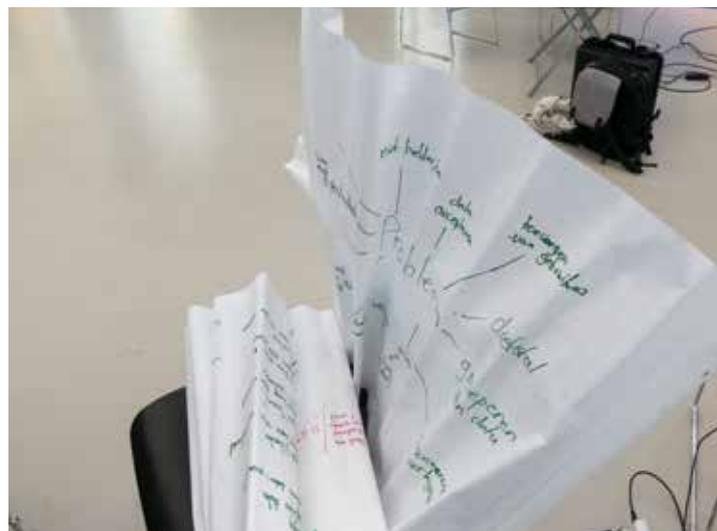
# GOING NATIVE: DOING DATA SCIENCE AS PART OF DOING DESIGN RESEARCH

By Jasper Schelling

In this workshop, Jasper Schelling showed how modern data science methodologies and tools can be used to perform design research at scale. Participants were introduced to modern data-driven research methodologies such as network analysis and predictive modelling, and learned how digital products and services can function as living labs.







## STAY IN CHARGE!

Federico Bonelli

We rarely stop to think about the huge amounts of data flowing through our homes. During this year's hackathon, four teams of contestants worked on designing and prototyping applications – based on the free and open source software Dowse – that would allow users to visualise and control the data collected by the increasingly smart appliances and other IoT devices that are gradually finding their way into our most intimate living spaces.

The Dowse platform can be described as 'the missing on/off button for the internet of things'; besides allowing or denying access to and from each device connected to a home network, it also provides real-time qualitative and quantitative information on the data flows generated by these devices, while also

selectively preventing external parties from accessing data without explicit permission.

The challenge for participants in the hackathon was to develop a user-friendly application that would empower non-specialist citizens to intuitively understand and control the various connections between the devices in their homes and the outside world.

The hackathon was led by Federico Bonelli, 'Chief Magical Officer' at the Dyne.org foundation; for more information on Dyne.org and the Dowse platform, see the closing keynote of this year's event by Denis 'Jaromil' Roio on page 40, which explored in more detail many of the concerns addressed in the hackathon.





# Hackathon



## ABOUT CREATING 010

Creating 010 is a Research Centre of the Rotterdam University of Applied Sciences that focuses on transformations in society that are related to ongoing digitisation and to developments in the field of information and communication technology. Creating 010's research always considers people within their social context. Designers, developers and appliers of technology all play an important role in this regard; the choices they make allow them to address the often difficult challenges posed by technology, for example by opting for secure data storage and open source software. They are also in a position to shape future developments, by considering the needs of users, stakeholders and society at large in the design of not only products and services, but also shopping districts and cities.

The main sectors we consider are the creative industry and ICT, both of which play a key role in defining the form and content of transformations in sectors such as social care and healthcare, entrepreneurship, retail, and urban development. Creating 010 collaborates closely, though by no means exclusively, with the Institute for Communication, Media and Information Technology (CMI) and the Hub: Technology (HR WERKplaats Techniek).

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## **The research themes of Creating 010 are:**

### **Design in the 21<sup>st</sup> Century**

Designers are increasingly called upon to address a wide variety of often complex challenges, while relevant stakeholders participate more frequently and intensively in design processes. At the same time, there is a growing awareness of human values and the social impact of design, as the role of digital technology continues to expand. This research theme focuses on how designers are currently approaching new challenges and opportunities, and which methods are most suitable in this regard.

### **Mapping Creative Rotterdam**

The creative industry and creative professionals play a defining role in the development of Rotterdam's innovative urban environment. Creative professionals in particular may also benefit from a more systematic understanding of emerging social and cultural trends. This research theme applies quantitative and qualitative research in order to compile a current overview of Rotterdam's creative sector and opportunities for creative talent.

### **Communication in the Networked Society**

Communication professionals require strategies that allow them to bring organisations and individuals together more effectively. The projects within this research theme focus on how these strategies can be applied within today's networked society, characterised by increasingly horizontal organisational structures and individual bonding. The project focuses specifically on the effectiveness and applicability of online content and influencing behaviour, both essential considerations in today's interconnected world.

### **Data Driven Society**

The internet of things functionally connects not only objects but also people, and links them both to powerful applications of algorithms and software, resulting in cyber-physical systems. This research theme addresses the new manifestations of technologically connected people and things, focusing on themes ranging from big data analysis and blockchain technology to privacy and security, as well as the related technical, ethical, social and design challenges.

### **Business Model Innovation in Creative Industries**

Though the creative industries are usually associated with innovation of products and services, they also play a pioneering role in creating, providing and claiming value: the innovation of business models. Here too, the creative industry can serve as an inspiration to other sectors. The goal of this research theme is to identify, based on qualitative research, patterns of innovation in how actors within this sector are designing their business models – particularly, though not exclusively, within the sharing economy and the circular economy.

### **Maker Education and Contextual Learning Environments**

Combining the maker movement's constructionist educational model with the paradigm of socially structured learning within communities of practice, provides us with an excellent starting point for educational innovation within an institute such as the Rotterdam University of Applied Sciences. In this research theme, educators develop and research their own educational practice through the methodologies of action research; they implement concrete changes in their professional activities within their own educational contexts, while also researching these activities and contexts.

## COLOPHON

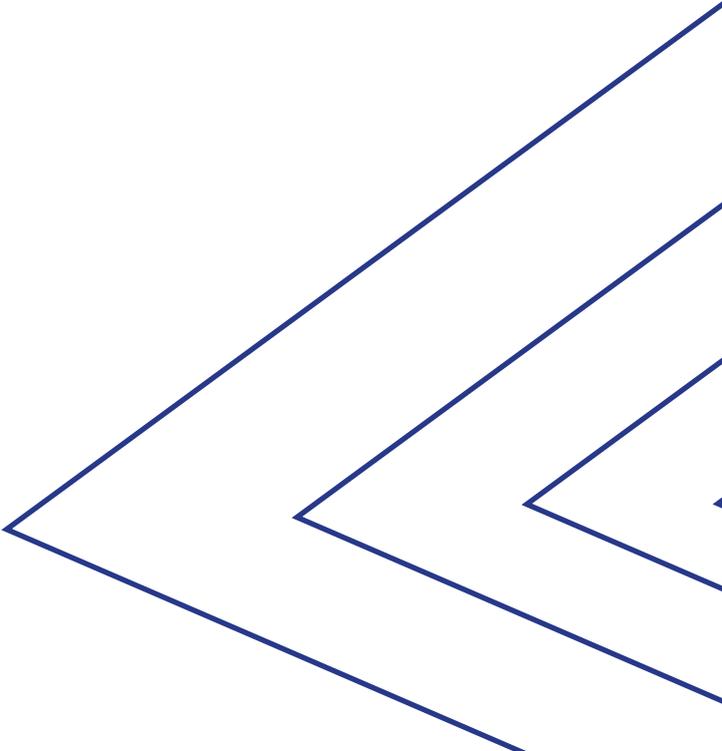
*Who's in Charge: Summary of Lectures, Discussions and Workshops, Rotterdam International Internet of Things Day 2019* is a publication of Research Centre Creating 010, Rotterdam University of Applied Sciences.

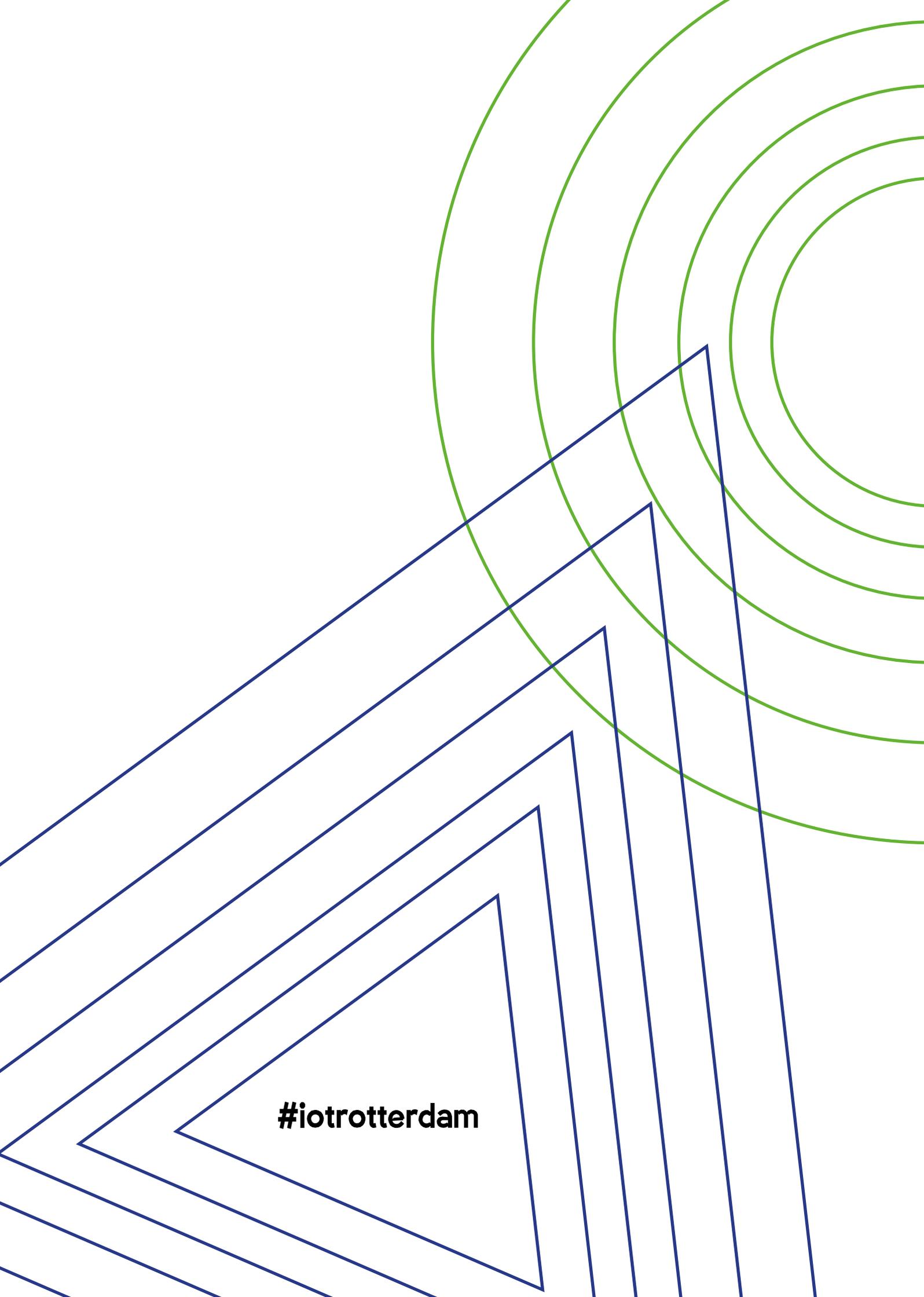
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**#iotrotterdam**

Our perspective of the future continues to be shaped by technology. This is particularly true of contemporary society, which is affected on all levels by ongoing digitisation. However, the day-to-day development of these technologies, as well as their application in actual products, services and processes, is something that is still very much being done by humans. This in turn leads to complex discussions regarding the role of institutions and business, governments and civil society - and ultimately also of private citizens in their capacity as users and consumers, and as sources of value derived from the data trails they leave behind. The human factor also brings with it a great deal of confusion. The initial belief was that the internet, and the services made possible through its growth, would lead to a new golden age in the inevitable advance of democracy and citizen participation. In reality, we see the discussion shifting toward the need to curb the increasing power of the big tech companies that have surged on the online wave.

The eighth edition of the Rotterdam International Internet of Things Day, which took place on April 9, 2019, thus focused on the following question: *Who's in Charge?* More than 200 professional practitioners, researchers, students and educators, brought together by Creating 010, a Research Centre of the Rotterdam University of Applied Sciences, examined this theme from a variety of perspectives during a number of keynotes, lectures, workshops and discussions. As in previous years, the conference also included a hackathon in which participants were challenged to develop applications based on the motto: *Stay in Charge!*

This publication is the third issue of a richly illustrated documentation of the Rotterdam International Internet of Things Day. It provides the reader with an accessible overview of both the content and the engaged spirit of this annually recurring event, which took place on April 9, 2019, in Het Nieuwe Instituut, Rotterdam's museum for Architecture, Design and Digital Culture. The publication also provides an inspiring foundation for the 2020 edition, which will again take place on April 9.