BRAIN STORM

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●○○ Entertaining article, no scientific content. A puzzle or a Cover related article are examples of this category.

●●○ Easily readable article on a scientific topic. Should be comprehensible, even without any prior knowledge.

●●● Scientific article that explores a certain topic in depth. Might assume the reader has taken a course that's related to the topic.

BY: Annet Onnes, layout

What if I didn't have a writer's block? Then I might have been able to entertain you with a great introduction to this edition of the Brainstorm, as well as inform you about all the articles waiting for you in the rest of this magazine. However, I do have a writer's block and I appear incapable of producing anything more creative than a list that is even more boring than the table of contents you can see on the left here. Of course, an introduction does not need to be as hilarious as the comic you find when you turn this page. Of course, it would be awesome if I were able to write an article all about the theme and with a lot humor. But wait, that would be a column, not an introduction! The column was already written by Arryon and can be found on page 26.

The rest of this Brainstorm offers a variety of articles that we as editors always try to collect for you. This time around we have an article by Sander Feringa, a former Cover member who recently graduated as a Computing Science master. He shares his experiences on finding a job. Interesting to read, because what if it is not all that easy to find a job?

What if you have no clue what a smart electricity grid is? Well, no worries! Mente Konsman from TNO wrote an article all about them, tackling the question 'What if we could just use our electricity more efficiently?'

An article by Lieve de Vreede, who shares her thoughts on computing science and philosophy can also be found in this edition.

What if we would not have found all these kind authors willing to contribute to the Brainstorm? Would we have been able to find other content or would this Brainstorm not exist?

In conclusion, writing about having a writer's block while thinking 'what if I didn't have writer's block?' is the solution to writing with a writer's block. Fortunately you as the reader won't have to deal with a reader's block. Happy reading!

PHOTO: **Annet Onnes**

GOODBYE

Dearest reader,

All good things must come to an end, and so we regretfully announce that you hold the final Brainstorm in your hands. We hope you enjoyed reading the Brainstorm throughout the years with themes such as Poetry, Plagiarism, Spam and Sims - whether the articles made you laugh, think or wonder. We would like to thank all present and past Brainstorm members for their effort and creativity, and you, our reader, for making it all worthwhile. While this may be the end for the Brainstorm, who knows what the future may bring?

Yours sincerely,
The Brainstorm

BY: Board XXV

The discontinuation of the Brainstorm has created room for new creative input!
Do you have an idea to fill the void the Brainstorm will leave behind? Then feel free to send an
e-mail to intern@svcover.nl.

By helping the association bring life to your idea, you can produce something that will be
appreciated by an association of more than 500 members, in addition to gaining both a
creative outlet and learning to improve your creative skills.

You can apply both individually and as a group! Good ideas will receive funding from Cover,
so do not hesitate to speak your mind!

Deadline: 21 May
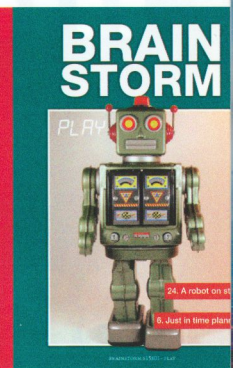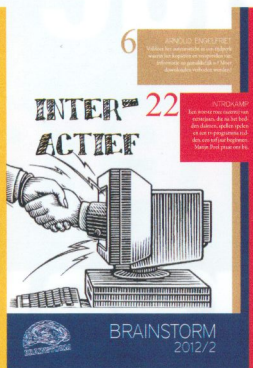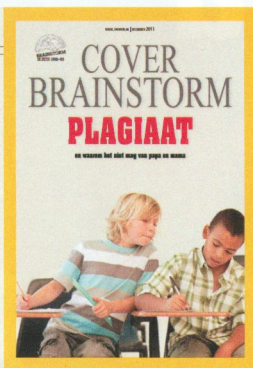
BY: Sander Feringa

What if I had made a
made a
different
career choice?

"If no one comes from the future to stop you from doing it, then how bad of a decision can it really be?"

I am working on a humongous SQL query in the office of the client where I am posted , when all of a sudden a concerned manager shows up at my desk and asks: "I got this weekly report from you by mail, but this important new customer I'm working on isn't included! Can you fix this?". I answer: "Okay, I'll have a look at it. Which customer is it?". "zgon", the manager replies. I start to query the database on that CustomerCode and what the system returns makes it hard for me not to start laughing. I reply to the manager: "Uhm, you do know that this customer hasn't been entered into the system yet, right? If the customer doesn't exist according to the system it obviously won't be in the report." "Oh yeah, right... thanks." the manager answered showing a slightly abashed look. After a quick chuckle when the manager had gone away, I try to regain my focus on the SQL query that I was working on when I slowly start to daydream:

'What if I had taken that Java programming job? The number of stupid questions I have to answer might be lower! Oh no wait! *remembers the bachelor's course Software Engineering*. People can be just as annoying in Java programming jobs and maybe in even more ways than now! So, maybe a Matlab programming job? I know a lot of Matlab! Aaaah but no! Matlab is almost exclusively used in the academic world, so there aren't any of those... Maybe I can find a job at some startup with only a few employees, so I can do fun stuff! A company that really stands for something... However, most of them don't have the money to pay their employees as much as the bigger corporations. They often have long working hours, less training options, no lease car, etc... Should I have done my whole master's degree abroad? It was so nice over there and I would have liked to

Should I have done my whole master's degree abroad?

stay there longer! But then again, I wouldn't have been provided with a room and would have had to look for accommodation myself and over there that is almost impossible! Oh I would have loved to...' Wait, hold on to those "what if's". Let me explain some things first.

Back in 2006 a young Sander started his bachelor's in Computing Science. He was full of bold plans: pass all courses on the first attempt, and therefore finishing within 5 years. I won't get bad grades, I am going to do all kinds of cool side projects and I will be a very good programmer. Oh! And the subjects of my thesis and other projects will be super interesting!

As the months went by he noticed he was not performing as planned. He got fed up with all the school-based learning he had done since he was four years old and he figured: "Let's take a break. No uni, no school. Just have some time off and after that work for a

while. I do like Computing Science a lot so I will get back to it later."

And so I did. I started the bachelor again in 2008 and slowly but surely, with some extra delay, sometimes with a few low grades, but also with a few very good grades, I passed all the courses. The "what ifs" were on my mind of course. Hell, they are here all the time. So when I finished my bachelor's and started with the master Computing Science in 2012 I got another "what if" session:

'What if I go abroad with the Erasmus Exchange program? Be like the (well okay, be like some of the) international students I met in our university! Go to an exciting country in Europe and experience how things can be done differently!' But this one was different. This "what if" actually became a reality. I really did go abroad for a semester to Uppsala, Sweden in the autumn semester of 2013. Yeah, I got the "cool" part correct. I can tell you: it was fantastic! I made great friends, some of which I still occasionally meet. Living in another country, you start to see that some things are better in other countries, but also that some things are better at home.

Go to an exciting country in Europe and experience how things can be done differently!

However, when the dream of being an international student has ended, you fall back into your normal domestic student live. After a few semesters of studying, when I was nearing the end of writing my master's thesis, I started to generate a lot of "what ifs" again:

'Well... I have seen enough of the academic world now. Let's go to the dark side for a while: business. The next logical question is: in which direction within the IT business world will I go? Definitely not web design. Nah, I don't want to be a pure programming nerd. But on the other hand: I don't want to be a salesman-in-disguise consultant either. I probably will not find a job in Visualisation or in Computational Science. At least not here in the north, where I want to stay for now. Okay, I might like something related to Intelligent Systems since I have experience with that as well. In the IT business world they often describe such functions as "Data Science Analyst" or the even further diluted "Business Intelligence Consultant".'

I ended up becoming the latter.

I started my professional career as a low rank BI consultant. So far, I am actually totally happy with it. I learn about a lot of things now that you will not experience at university. More on databases, more on ETL, more on reporting and they even send you to soft skills training sessions. However, to me the most important thing you will learn is this: how do people actually work in the bog-standard IT business world and what do they find important. It is surprisingly different from the academic world. We will see how I think about all of this in a few years, but I am happy for now.

The company I work for even had a surprise: in my second week of employment they sent me to New Delhi, India for three and a half weeks with around a dozen others for a training program. Thanks to that, I gained

another big experience and this time I did not even have a "what if" that goes with it! Anyway, it was a great time. Hot, I got to know some new colleagues very well, hot, so different compared to western cultures, hot, six days a week of training in a small room with air conditioning but no windows, hot, but I saw the Taj Mahal! However that was even hotter and more humid... Did I mention it was hot?

As we all can see in retrospect: in the end the "what ifs" on their own do not really matter that much. What you actually do, however, does. They are dreams and dreams might become true. Or not. There is nothing bad about dreaming "what ifs" of course. My time as a student has ended last summer. I am part of the business world now. We will see where Sander ends up in the future. As the title quote from an unknown author describes it, or how Carl Sandburg once described it :

Sitting at my desk, I stare into space, my thoughts wandering off again:

'What if I start my own IT company with some friends? I know, there's a strong chance we'll fail, but at least we are doing what we actually like to do! What If I go back to Sweden to find a job there. Maybe they even have something Visualisation related! Or real Data Science jobs! Or maybe Germany? Berlin maybe? Or or or... What if I...'
I snap out of my thoughts. Before I get back to work I walk to the coffee machine to get another cup of coffee. When I get there I see a paper sign on the machine saying "#coffeemachineisbroken #noactuallyforreal", surrounded by a bunch of complaining people. I let out a small sigh, make myself a cup of tea using the kettle and I get back to work finishing up that humongous SQL query that it is needed for a report that a weird non-IT manager asked for...

" I'm an idealist. I don't know where I'm going, but I'm on my way. "

...

BY: Steven Warmelink

PUZZLE

Each row on the page on the right contains a word or name, specified by cryptic clues found below. Boxes with identical numbers contain identical letters. If an answer consists of multiple words, spaces are not used (e.g. the answer to "who is currently the president of The United States" would be barackobama). Found everything? Then send the phrase in the highlighted column to Brainstorm@svcover.nl before April 6th to have a chance to win a prize!

1. Creator of twisted Disneyland clone
2. Universally recognizable by just 1 letter, turned 75 years old in 2015
3.
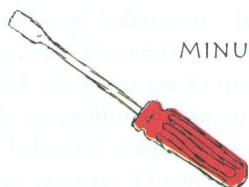
MINUS

4. Little boy weather
5. "you know nothing, _____"
6. <13
7. The ¬Northern Lights
8. Jeb, Raúl, Orville, Casey
9. Middlemarch, Shooting an Elephant, Fevre Dream
10. Crazy Cat Lady Simulator
11.

12. ●——— ●●●●— ————● ●●———
13. Anglicus sermonis scientia
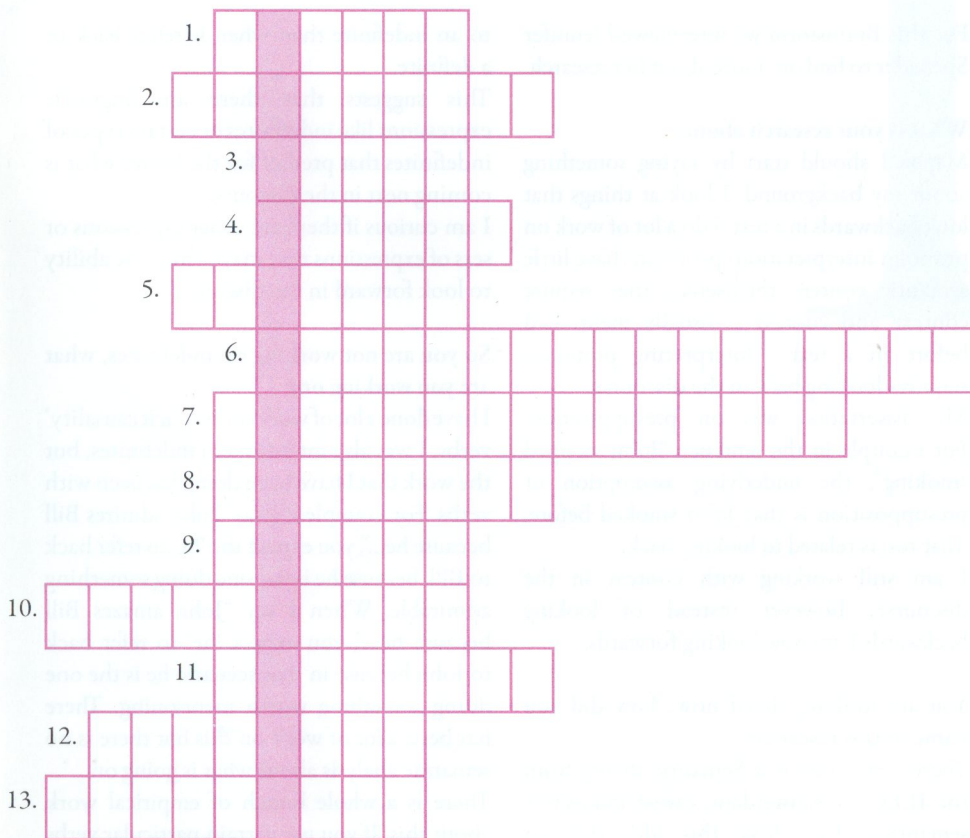
Winner of last edition

In our last edition, we asked you to find out the cipher that encoded a couple of different phrases. The cipher we were looking for was

```
BFGHJNPQVWXYZ
DECKSIMULATOR
```

Diederik Eilers was the lucky one among the participants to find out the correct answer to the puzzle! Congratulations Diederik!

WHAT CLUES IN WHAT WE SAY PREDICT WHAT WE SAY NEXT?

BY: Sanne Bouwmeester

For this Brainstorm we interviewed Jennifer Spenader to find out more about her research.

What is your research about?
Maybe I should start by saying something about my background. I look at things that look backwards in a text. I do a lot of work on pronoun interpretation; pronouns have little semantic content themselves, they require context and context is usually mentioned before in a text. Interpreting pronouns requires looking back in the discourse.

My dissertation was on presupposition. For example in the sentence "John stopped smoking", the underlying assumption or presupposition is that John smoked before. That too is related to looking back.

I am still working with context in the discourse, however instead of looking backwards I am now looking forwards.

You are looking ahead now, how did you come to this research?
There is this idea in a Semantic theory from the ILLC in Amsterdam, called inquisitive semantics. They have this idea that an Indefinite noun phrase raises a question. So for example if I say: "the teacher was talking to a child", you do not expect to be hearing much more about the teacher. Maybe about the both of them and what they are doing, but mainly you expect me to tell you more about that child.

There is also some experimental research, that shows that if you give people sentences with definites and indefinites they are quicker to respond when the continuation refers back to an indefinite than when it refers back to a definite.

This suggests that there are linguistic expressions like indefinites or certain types of indefinites that predict for the hearer what is coming next in the discourse.

I am curious if there are other expressions or sets of expressions that maybe have the ability to look forward in the discourse.

So you are not working on indefinites, what are you working on?
I have done a lot of work on 'implicit causality' verbs. I was also interested in indefinites, but the work that I have been doing has been with verbs. For example if I say "John admires Bill because he...", you expect the 'he' to refer back to Bill, because he is the one doing something admirable. When I say "John amazes Bill because he...", you expect 'he' to refer back to John because in that scenario he is the one doing something worth mentioning. There has been a lot of work on this but there is no semantic analysis about what is going on.

There is a whole bunch of empirical work about this. If you use certain particular verbs we always get that it refers back to the object; if we use certain other verbs it refers back to the subject; if we use because... etc. There is no theoretical analysis of what is going on, yet.

But you are creating that theory now.
Yes, take for example the verb to eat. The verb eat takes an object of which you know that it is edible. And it also includes a covert indefinite, a hidden indefinite. I claim, with a

whole bunch of arguments, that that covert indefinite could be raising the question.

A verb is a complex thing, some verbs have an indefinite quality, which means that there is a cause for it. For example the `amaze'-event from before. There is something that amazes, something that is causing the `amaze'-event. When it is a person, it is something that they do. You get expectations of an event that is amazing. If John amazed, he did something. The sentence doesn't say what it is that raises the question, and people expect you to tell them what it is. You don't expect someone to say: "John amazed Bill and then he left the room." No, you expect someone to say: "John amazed Bill because he had amazing ukulele skills"!

What I am doing in all of this is a semantic analysis. Semantics has its roots in philosophy. My theory is - in a way - piggybacking on this other analysis with overt indefinites that raise questions. What I do is show the argument and the analysis. I don't claim that the analysis is right. I show that with this analysis, I can make the right predictions.

So it's very theoretical research...

Yes it is. I haven't done theoretical work for years. I used to do that before I came to the AI department. Since coming here, they encouraged me to do experimental work. As a result, I didn't do theoretical work much, but I really enjoyed it when I did. When you are doing experiments you are running around, finding participants, collecting data; it is very busy work. Thinking about your research and other things happens at the beginning, when you think about what you are going to test, and at the end, when you interpret your results. With theoretical work you really get the opportunity to sit and think. You read other people's work and read about other people's thinking and reasoning,

which also makes you reconsider you own. Another part is armchair linguistics, where you come up with your own sentences. What is my intuition? It is rewarding and fun in different way.

Are you doing theory first? Will that be its own paper?

Yes, I have written a paper about it, I just haven't published it yet. I presented it in Amsterdam just before Christmas, at a colloquium, the AC2015. I have done a lot of work already, it is just not completely done. During the process of writing my theoretical paper I would think: "I can do a pilot study about this and show this!" "I bet I could prove that. " When I came home from the office my husband would say: "no no no". The people that read theoretical papers are not convinced by data. They want to see a clean sharp theoretical argument with an example... They want a prediction, and want to see the theory applied to that prediction. They don't want to see theoretical work sullied by experimental work. My husband also does experimental and theoretical work. He is a philosopher.

In retrospect, now that I have done it, he is completely right. These two things have to be separate.

But you are still doing experimental research later, to support your theoretical research?
Oh yes.

A hot thing in semantics right now is that everyone wants to do an experiment. However, as a field, they are not so good at it. People who are good semanticists are generally not good with experiments. It takes a while to understand how to set up an experiment and how to do these things properly. If you never did statistics before,

you might struggle with that for more than a year.

I have an advantage there. I have a lot of experience in experimental work. After working on the theory, maybe I can go test it. I have the experiments already planned, but I just don't have the time... I mean, this is my passion right now. But I haven't had a chance to work on it since December.

So you are writing and doing this completely on your own? Have you been influenced by others?

In our field this seems abnormal. But it is quite normal for semantic or theoretical papers that people work alone or with one other person. I worked with several people.

Floris Roelofsen works on implicit semantics in Amsterdam. He is very encouraging. Floris works on inquisitive semantics.

Prof. Dr. Edgar Onea in the university of Göttingen. He has also worked in this field. He has done really nice work, great to talk to. There is also Prag Roberts, she was a visitor here. She was in the AC2015 colloquium in Amsterdam as well. She developed a theory on questions and discourse. This theory explained why people said the things they said and also predicted what was going to come up next.

Did you use any AI techniques, like machine learning for example?

No not really, I have not been really using that. It is AI-related in that is is very strongly related to logical and formal theories. The difficulty is that the work you can do with machine learning on large corpora is not very sophisticated. We have very sophisticated theories. The annotations required to be able to confirm them with machine learning is very high level. The manual work that comes with that is insurmountable. The only person

who is doing something that is even coming close to that is Johan Bos.

How is your current research related to your original field?

Predicting what is coming to come up has roots in early computational linguistics.

They made these Markov models, bigram or trigram models to see "Can I predict what will come next?".

In computational linguistics the goal was to make a model, by theoretically calculating words and their sequencing. Of course, what we are researching is more high level. It looks ahead so much further: instead of making predictions about sequencing, there is semantic prediction with a hierarchical syntactic structure. This might predict the subject of a follow-up sentence.

If you would get 5 years and a sufficiently big grant to research a topic of your choosing what would it be?

I think I would probably do something related to this. That has several reasons. Many people have done research about discourse and looking back, but so few look into discourse and prediction.

I think I could get fairly famous with both theoretical and experimental work in this area.

With fundamental research you cannot predict when it is going to be useful. A large portion will be useful in the future, but the money is required now. Meanwhile, it takes years to perform the research. Only the government funds fundamental research, companies do not. The government funds research and education based upon what is happening now. They want people to get a job now. You want to train people for the things you don't know are coming, the future, not for now! The government funds

things that are directly applicable. Why don't we let private companies pay for that instead since they are going to make money from it!

So you think the government should fund only fundamental research, since the companies can fund the rest?
Yes, because a company is not going to fund you if you say "yeah maybe in 25 years, this will be very useful." Take the internet, for example. Back in the day, the internet could be useful to connect computers. But no, that's not useful now. Let's invest in cables, telephone lines and fax machines...

Have you thought of any ways to use the outcome of this research in society?
I think it could have lots of applications. Think about chat bots we build, for example for ABN AMRO. If you talk to them now they are just trying to recognize words. They could be more sophisticated and prepared, especially when you are doing speech recognition at the same time, this will greatly improve their quality. If it knows which word or term is probably going to come up in the next sequence, it will help with recognition speed and how well it can be interpreted.
I'm looking at one type of verbs now, but we have many different classes of verbs. There are people who have done very hard work to make computerized verb dictionaries which classify verbs into different subclasses. I think we can often find patterns for the different classes of verbs. We have to check experimentally whether we are correct or not. However, you have to start with a theoretical analysis of it. When we have the theoretical analysis and the experimental results, we can use it in something useful.

Thank you for your time!

Jennifer Spenader graduated in Computational Linguistics at Stockholm University in 2002. She is now an Assistant Professor at the University of Groningen in the Cognitive Modeling group of Artificial Intelligence. Besides doing research in the areas of child language, pronoun interpretation and resultative connectives, among other things, she teaches several courses throughout both the bachelor and the master programmes of Artificial Intelligence.
For more information, you can look on her website: http://www.ai.rug.nl/~spenader/

GLOBAL PROBLEM-SOLVING

BY: *Lieve de Vreede*

'Had the world not been there, I would have been fine with just doing linguistic research and studying philosophy. Intellectually speaking, that is far more interesting. However, political work is so important.' Noam Chomsky brought this up in an interview with Vrij Nederland in March.

I think Chomsky's quote reveals an existing tension between theoretical philosophy and politics. Coincidently, this year, there happened to be a fervent discussion about the offered Philosophy programme at the Faculty of Philosophy in Groningen. The more theoretical, analytical philosophy, which is the one closest to you betas, wins terrain,

Had the world not been there...

while the continental philosophy, regularly labelled as "vague", loses. Although the exact difference between these branches itself is also a controversial topic, you can broadly state that analytical philosophy is often about language, science and epistemology, and continental philosophy, which is traditionally non Anglo-Saxon, is more about politics, culture and the "self". Thus, more analytical philosophy in our programme means more overlap with mathematics and natural sciences, which means more relevant philosophy about scientific development. This trend means more input for Artificial Intelligence students, therefore analytical philosophy seems the rational choice to have

an interest in.

There is something wrong with concluding that theoretical philosophy will help us to give the best input concerning cognitive computer science, linguistics and problem-solving.

The unique and in philosophy quite rare property of first-order logic (which is the core of analytic philosophy) is the fact that you can give objective assessments to statements. There are, as you might know, clear rules to prove P or not P out of nothing. Suppose we have a perfect intelligent robot, completely programmable, on which we apply the ethical theory of 'utilitarianism'. We suppose the robot can perfectly measure the amount of well-being his actions will provide, in long-term as well. The action that provides the most well-being for the biggest amount of people will be carried out by the robot.

Now, examples of philosophically interesting questions that raise are: 'based on which principle does the robot decide what well-being is?', 'why is utilitarianism the best ethical theory?', 'should robots in different cultures (be allowed to) maintain different ethical theories?' and 'what ethical justification does the robot use for treating different people in a different way?' We do not ask ourselves if the modus ponens is correct. We don't want to specify the conceptual analysis of this robot – at least, not if we are philosophers. If you can measure well-being perfectly and

if utilitarianism is the perfect theory and you can overcome ethical objections, then it is perfectly clear what the robot must do. The green check marks in Fitch tell us that this isn't an object of discussion at all.

The focus on theoretical philosophy seems to approve stronger interaction between philosophy and computer science, which is a good thing. The "suppose"-part (suppose capitalism is the best theory) is a non-discussed topic that can be used to show certain structures in reasoning and language, which is very interesting. But in continental philosophy you criticize what is the case (what is or isn't wrong with capitalism?). You need the "vague" philosophy as much as you need the theoretical, especially if you are a beta!
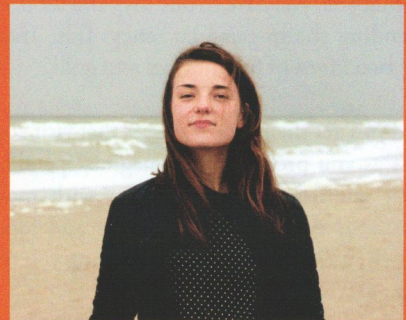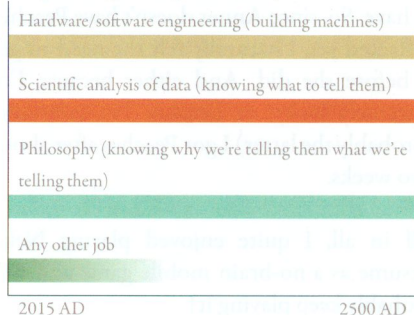
Have a look at the figure below. If philosophy means "knowing why we tell the machines what we're telling the machines" and artificial intelligence is "knowing what to tell the machines", the philosophy that is relevant for the machines is not the analytical philosophy at all.

Why do I tell this story to artificial intelligence intellectuals? Well, because I want to point out that the overlapping part of AI and philosophy might not be the most interesting part for you. Let's apply a nice analytical structure in order to keep your close attention: if you are really interested in philosophy and what will happen in the future, then you should follow a course in culture, politics and ethics. Pleasant side effect: more outsiders' interest in these continental courses can maybe help getting our balance back.

Although Chomsky would probably think that lots of continental philosophy isn't really philosophy, he does agree with me that politics is the best way to complement your problem-solving skills. Since the world indeed 'is there', besides impressive mathematical puzzles, some societal problems also have to be solved.

Lieve de Vreede is – surprisingly – a philosophy student. She started a bachelor Artificial Intelligence last year because she had an end-of-study-and-not-knowing-what-is-next-crisis and wanted to broaden her view. After finishing the introduction course she nevertheless ended the beta adventure. She now feels relieved to just break her head on the input of robot brains instead of making those robot brains.

Super-long-term job security

Hardware/software engineering (building machines)

Scientific analysis of data (knowing what to tell them)

Philosophy (knowing why we're telling them what we're telling them)

Any other job

2015 AD   2500 AD

SWITCH:
NEKO ATSUME

BY: Elias de Haan & Annet Onnes

Everybody knows that one game on your phone that you automatically open when you have nothing to do. As Annet and I both have a game of that kind on our phones, she thought it would be a good idea to switch. So we did and because of that, I'm left with playing the game Neko Atsume. Simply put, this is a game where you have to collect cats. You're pretty much an old cat lady, who has an empty backyard and you have to lure cats.

The ultimate goal is to get as many (rare) cats saved in your catbook with a picture to prove they were in your backyard as possible. To get to that goal you have to buy toys and food, by spending the in-game currency: fish. There are two kinds of fish, normal and gold,

and you get them from the cats that visit you. Just as you probably can imagine, spending your goldfish will reward you with more luxurious and more special toys and food, which in return hopefully will bring you the rarer cats.

There are a lot of specific toys that will attract a specific rare cat, but there is one cat that doesn't get attracted by any toy
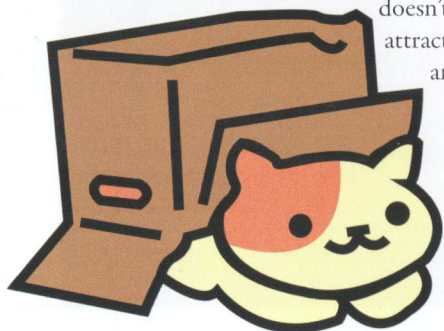
or food specifically, and in general visits very rarely. This cat, called Peaches, has become some sort of unofficial goal for all the players of the game, and is probably the ultimate cat to have. So, since Annet doesn't have Peaches collected yet, I naturally felt the need to get it before she did. And either because I'm extremely lucky, or because I'm awesome, (probably the latter) I got Peaches after about two weeks.

All in all, I quite enjoyed playing Neko Atsume as a no-brain mobile game and will probably keep playing it!

Hearthstone is more of a game than your average candy crush-like telephone game. It is not something that you can play mindlessly: Neko Atsume is more suitable for that. This game requires some hard thinking.

Before this switch I was only slightly familiar with the game. I know who were playing it and that it had something to do with World of Warcraft. From the corner of my eye, I had also often spotted some kind of battleground with cards being played. However, I was not prepared for this.

Hearthstone, full name Hearthstone: Heroes of Warcraft, is a huge game published in 2014 by Blizzard Entertainment. You can play it on phones as well as on PC's. The game is a strategic card game, with some unmissable time pressure.

Players try to defeat each other using their deck of cards, consisting of cards that give many different options for attack. Players can put together their deck themselves and the decks are often very well-thought-out. The game also imposes a whole system for collecting and buying cards, repurposing them to dust - which can give you new cards - etc. When I was playing the game I was strongly reminded of Magic: The Gathering.

The battles between players are fast-paced, but still take quite long for a phone game. Also the game field is extensive, with triggers that can go off, several ways and things to attack, a mana counter to keep track of and much more. I was severely confused by all that was going on, so halfway through a game Elias took over, but he could not save the day either.

Although the game was entertaining and I can see how people can spend so much time playing it, it is not something for me. There is just so much: there are so many cards and so many game tactics to get the hang of!

BY: *Mente Konsman*

Unlocking the flexibility potential of smart grids

In 1999 I graduated in Cognitive Science and Engineering, which later evolved into Artificial Intelligence. After my graduation I found a job at KPN Research, which was taken over by TNO in 2003. I must admit that AI has not played a big role in the projects that I worked on over the years. Although there was one big exception to that rule: the TNO autonomous robot competition. Together with a team of colleagues we participated several times, unfortunately without ever winning the event.

There was however something else that I learned from my studies that I still apply on a daily basis and that is the multidisciplinary approach that we were taught. The ability to look at a problem from different angles and to work within a project team where each member has their own specialization is still very valuable today.

Over the years I have been working on different subjects. I started out working on the management of telecommunication networks, then I went from Enterprise Application Integration to sensor networks (monitoring of dikes) to smart grids (our future electricity networks). All of these subjects have enough technical challenges to keep you busy for a while, but what I really see as a bonus when it comes to a subject such as smart grids is its potential to help make the transition towards more sustainable energy sources of energy wind and solar energy. In this article I will describe the IT issues that are associated with smart grids and focus on how we approach one of those challenges within TNO.

To understand what a smart grid is and why it is needed, we first need to take a step back and look at the way our traditional electricity grid is organized. (diagram)

The electricity is being produced in big centralized power plants and then flows downwards from the transmission grid (high voltage), via the distribution grid (medium and low voltage) to the consumers. The consumption follows known patterns and can be predicted quite well by looking at
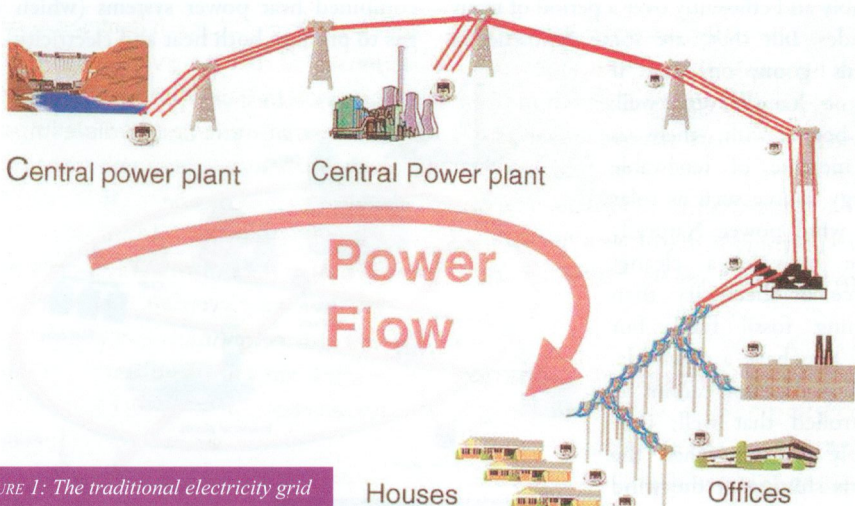

FIGURE 1: The traditional electricity grid

historically similar days (based on weather, working day vs. weekend, etc.). This demand is then matched as closely as possible by the production units to create a balance on the grid between production and consumption. As good as the consumption forecasts may

more and larger imbalances on the grid. If we were to continue running the grid in the traditional way, this would lead to a paradoxical situation: the more renewable energy sources, the more fossil reserve power plants are needed.

These imbalances have to be compensated somehow

The second trend is that of electrification, which is illustrated by the increasing popularity of electric cars. We now have the option to buy an electric car as an alternative to a petrol powered one. The charging of electric cars puts additional strains on the grid that were not foreseen before. Large number of electric cars may cause local capacity problems on the distribution grid. You could solve these issues by putting more copper in the ground, but this is very costly.

be, they are never completely accurate, thereby creating imbalances on the grid. These imbalances have to be compensated somehow, otherwise the voltage will drop (or rise) and the grid will black out. To prevent this some power is kept in reserve to regulate up (in case of too much consumption) or down (in case of too much production). This power may come from a gas powered plant for instance, that only runs at 80% of its capacity (keeping the other 20% in reserve) and has the ability to react relatively fast.

The traditional electricity grid has performed reliably and efficiently over a period of many decades, but there are some fundamental trends going on that it cannot handle very well. To begin with, there is an increase of renewable energy source such as solar and wind power. Naturally these provide a cleaner source of electricity than burning fossil fuels, but they also have a downside. Their production cannot be controlled that well; they simply produce when the sun is shining or the wind is blowing. This creates

Distributed energy resources form the last trend worth mentioning. Instead of having a few large centralized power plants there are more and more small production units that are scattered over the distribution grid. Think of households with solar panels or combined heat power systems (which use gas to produce both heat and electricity). In
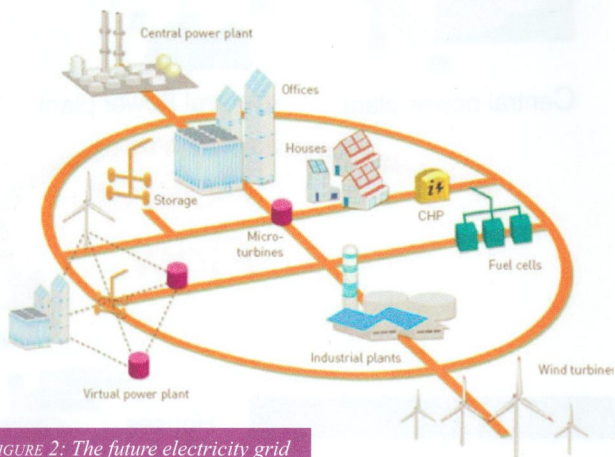

FIGURE 2: The future electricity grid

some segments of the distribution grid this can even change the direction in which the power flows.

In order to deal with the trends described above, a paradigm shift is needed in the way we operate the electricity grid. Rather than trying to predict the consumption and matching the production, we should see if we can shift consumption to those moments in time when production from renewable

sources is available (balancing). Capacity problems can be prevented by actively spreading peak loads over a longer period of time, thereby lowering the peak.

This can be done by exploiting the inherent flexibility that many electric devices have. The standard example is that of a washing machine with a delayed start option. The user indicates the latest possible time by which the washing program should be ended and leaves it to the grid to figure out the best starting time based on the available production. This is the smart grid at work.

There is a rough consensus on what a smart grid should do, but far less so on how to do it and what the best IT architecture would be. There are some interesting IT challenges that need to be addressed to make the smart grid a reality. The first one is to find a good matching algorithm that can dynamically match production and consumption. TNO developed a multi-agent algorithm called the PowerMatcher, but it is

certainly not the only matching algorithm out there; there are many others that each have their own pros and cons.

Scalability is another important IT issue. There are a lot of endpoints (think of households for example) that need to exchange information to a central point or to each other. The number of endpoints can run into the millions, yet the information exchange needs to be efficient and reliable. It may be even more of an issue for matching algorithms that will have to find acceptable solutions out of so many possible permutations.

The last challenge I would like to discuss is interoperability. As mentioned before, there are a lot of different matching algorithms to exploit flexibility in a smart grid. But this is only one side of the coin as this flexibility has to come from somewhere: devices that consume or produce electricity. Just like the matching algorithms there is a wide variety of devices. They perform different functions, ranging from heating and ventilation to electric cars to dishwashers to solar panels, etc. They are produced by different manufactures and if they happen to be "smart" they will use different communication protocols such as ZigBee or Z-Wave.

But this is only one side of the coin

It is impractical for matching algorithms to have detailed knowledge on how each device operates, what its internal parameters are and which protocols it uses. It is equally

impractical for the devices to have detailed knowledge on how the matching algorithm finds a valid solution. These concerns need to be separated.

The central concept here is flexibility; it is provided by devices and exploited by matching algorithms. To describe this flexibility in a generic way we developed the Energy Flexibility Interface (EFI). We recognize four different categories of flexibility which are briefly described in the table. Each device is mapped onto one of these categories using a device driver. The matching algorithm only has to be aware of the flexibility categories; all the implementation details of a device are hidden. Each category has a well-defined set of messages that allow the device to express its flexibility options as well as messages that give the matching algorithm control over how this flexibility is being used.

Over the last couple of years we have been refining the EFI and tested it in practice in smart grid projects in the Netherlands and Germany. We successfully used it to combine different matching algorithms with a variety of devices such as solar panels, washing machines, fridges, heat pumps, combined heat power systems, electric vehicle charging, hot water storage and batteries.

Ultimately TNO would like devices to support EFI natively, instead of having to develop drivers. This is why we started working on international standardization of the Energy Flexibility Interface. The development of an international EFI standard will take three years or even longer and there is a lot of politics involved. I realize that that doesn't sound like a lot of fun, but it is a crucial step towards making this an operational technology, so we'll have to be a little patient.

inflexible	Has no actual flexibility, but is measurable and may provide forecasts	Photo-voltaic panels, domestic loads, ...	
time shiftable	Progress which can be shifted in time, e.g. has a deadline	Washingmachines, dishwasher, ...	
storage	Flexible in production/consumption level, but is bounded by storage/buffer	Freezers, CHPs, heat pumps, batteries, EV, ...	
output adjustable	Flexible in production/consumption level and not constrained by storage	Generators, Dimmable lighting, ...	

Figure 3: The Energy Flexibility categories

REVIEW: MR. ROBOT

BY: Michiel van de Steeg

Mr. Robot is an impressively well written and directed tech-drama following the introverted and mentally unstable Elliot Alderson (portrayed by Rami Malek). Elliot suffers from social anxiety, depression, paranoia, and mania. He's seeing a therapist, Krista, but during their sessions he rarely ever talks about what's on his mind, like the men in suits he thinks are following him, and spends more time trying to analyze his therapist. He also uses several types of drugs supplied by his friend-with-benefits neighbour, Shayla, and is addicted to morphine, instead of taking his prescribed medication. He learns about people not through social interaction, but by reading and hacking them.

By night, Elliot uses his hacking skills as a vigilante, targeting those he sees as rotten, but by day he works as a cyber security engineer for a company called Allsafe Security. Allsafe's most important client is the massive multinational conglomerate E Corp, referred to by Elliot, through whose filter we see a lot of the world, as Evil Corp. E Corp is the corporation responsible for Elliot's father's death to leukemia, due to exposure to toxic chemicals. This is how he got to know Angela, his childhood friend who got him his job, who lost her mother similarly.

When E Corp is under attack by a severe DDoS attack, Elliot's boss Giddeon flies out with him to the main server farm. While defending against the attack, Elliot finds a file on a rootkit-infected server requesting for him to leave the rootkit there. Despite his job, he leaves the file there, motivated by his hatred of E Corp. Soon after, he is approached by the mysterious Mr. Robot (Christian Slater), a shabby man who wants to recruit Elliot into a hacktivism group called Fsociety. This organisation seeks to take down E Corp by destroying all financial records, erasing all debt and redistributing wealth. Elliot decides to join them, and uses his position at Allsafe to set their plans into motion. In the process, however, Elliot discovers a lot about himself and his past.

Meanwhile, Mr. Robot follows Tyrell Wellick, an ambitious, but arrogant and temperamental young employee at E Corp, vying for the position of Chief Technology Officer. Throughout Fsociety's attempts at finding E Corp's database's weak spots, Tyrell starts to suspect Elliot as he's the one constant in a sea of variables.

Mr. Robot offers a hauntingly beautiful depiction of mental illness, as well as a surprisingly realistic portrayal of hacking and hacking culture. In my opinion, with its splendid acting and a style reminiscent of Fight Club, Mr. Robot deserves a strong recommendation.

COLUMN:
ROBOT UPRISING

BY: *Arryon Tijsma*

A sleek, muscular man appears on the top of the hillside. He has an unblemished appearance and short, military style hair. He is wearing sunglasses. His skin almost reflects his surroundings as he descends the hilltop with a stiff gait. He is wearing a leather jacket but underneath the half loose zipper you can make out the contours of something that appears to be a glowing orb protruding from his chest cavity. While walking, a metal ring appears around his left eye, focussing on the outskirts of a small city. From out of nowhere, his right arm starts to shapeshift. His underarm widens to make room for a retracting hand, leaving only a hole where it used to sit. Slowly, a sound like a mechanical device powering up grows louder and louder into a jet-like roar.

Then, he starts shooting. The city vanishes into nothingness as the sheer power of his destruction wipes out entire buildings in one shot. In his wake, only a burning ruin remains. He continues walking, unfazed, determined.

> ## In his wake, only a burning ruin remains.

What if there was a massive robot uprising? Would humanity survive?

I am by no means an expert on robotics, but if my experience has taught me anything,

it is that a real robot apocalypse would end quickly, because robots would get stuck behind walls, break down, or mistakenly view an oddly shaped tree as human, then proceed to eradicate all oddly shaped trees from the planet.

So instead of sticking our heads up our asses and fantasize about the first scenario, let's assume that current technology suddenly revolts and tries to kill us all.

> ## That is, if the lab door is open or they possess arms.

You would wake up to your cell phone frantically vibrating in order to bridge the distance between your nightstand and you. Out of spite, because it can't get any further than jiggling back and forth, it would disable your alarm. This makes you late for your lecture, which is hardly deadly.

All over the world, advanced and potentially deadly robots will rise up and escape from their lab rooms. That is, if the lab door is open or they possess arms. If they are lucky, the next hurdle is driving over the doorframe. Hours later, half of the world's most sophisticated machines will be burnt out carcasses due to overloaded CPU's, exploded batteries or repeatedly driving into a shop window to exterminate the mannequin from the nearest clothing shop. And don't forget all the tumbles from flights of stairs.

Every satellite revolving around Earth will plummet towards the surface, kamikaze style. The chances their debris won't burn up or hit a human being are probably very small, so I wouldn't be too concerned with that.

Vehicles pose a bigger problem. Most driving vehicles possess a computer, so they would also try to attack us blindly. And I mean literally. Because most cars also don't have any sensors to know if they're accelerating with great speed towards a human being or a sturdy oak tree. Less blessed will be those actually sitting inside cars the moment our uprising happens...

Then there is still a plethora of other robot type appliances that can try to wipe us out. Drones that try to poke your eye out, roomba's that are nibbling at your feet, you name it. Also, computer-driven systems are all around us. They would control our trade markets, food supplies, nearly every aspect of our lives would be disrupted as they come to a halt. Most definitely this will be a problem for many people, and the absence of computer systems will kill quite a few. But it probably won't be the end of us. The thing is, robots need fuel and energy to stay alive, and humans are still key to controlling this supply of energy. Without us assisting, even the most violent of uprisings would quickly end in a scrapheap.