

FabLab10

Celebrating the 10th Anniversary of
WetLab, TextileLab and FabLab Amsterdam



waag
technology
& society

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A FabLab is a physical space, but is by definition also a hub in a network. To optimize impact and output it is an important requirement to create maximum dialogue with the surroundings. The relationship with the environment around the lab needs to be as open and explicit as possible.

The FabLab is not just a tool but central to our work. Its facilities, mindset and knowledge network inspire so many different facets of daily life.

Adapted from "FabLab Space and Inventory" and "Amsterdam Craftsmanship Revisited" by Karen van der Moolen (@karendmoolen on medium.com)



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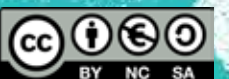
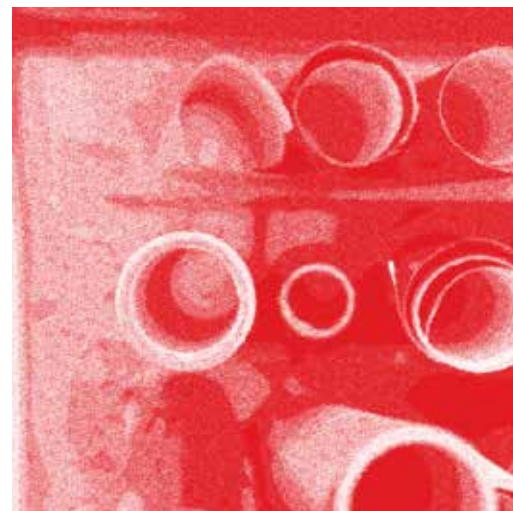
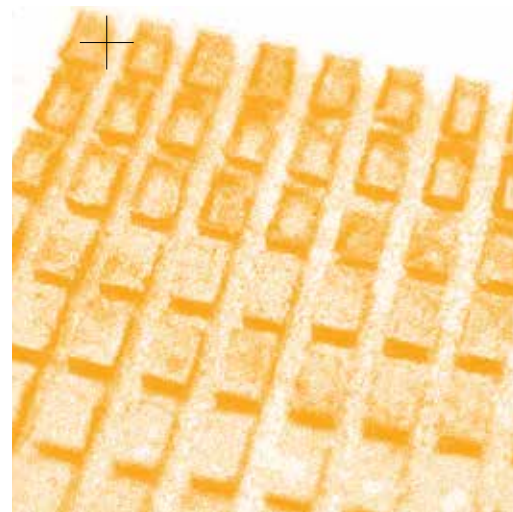
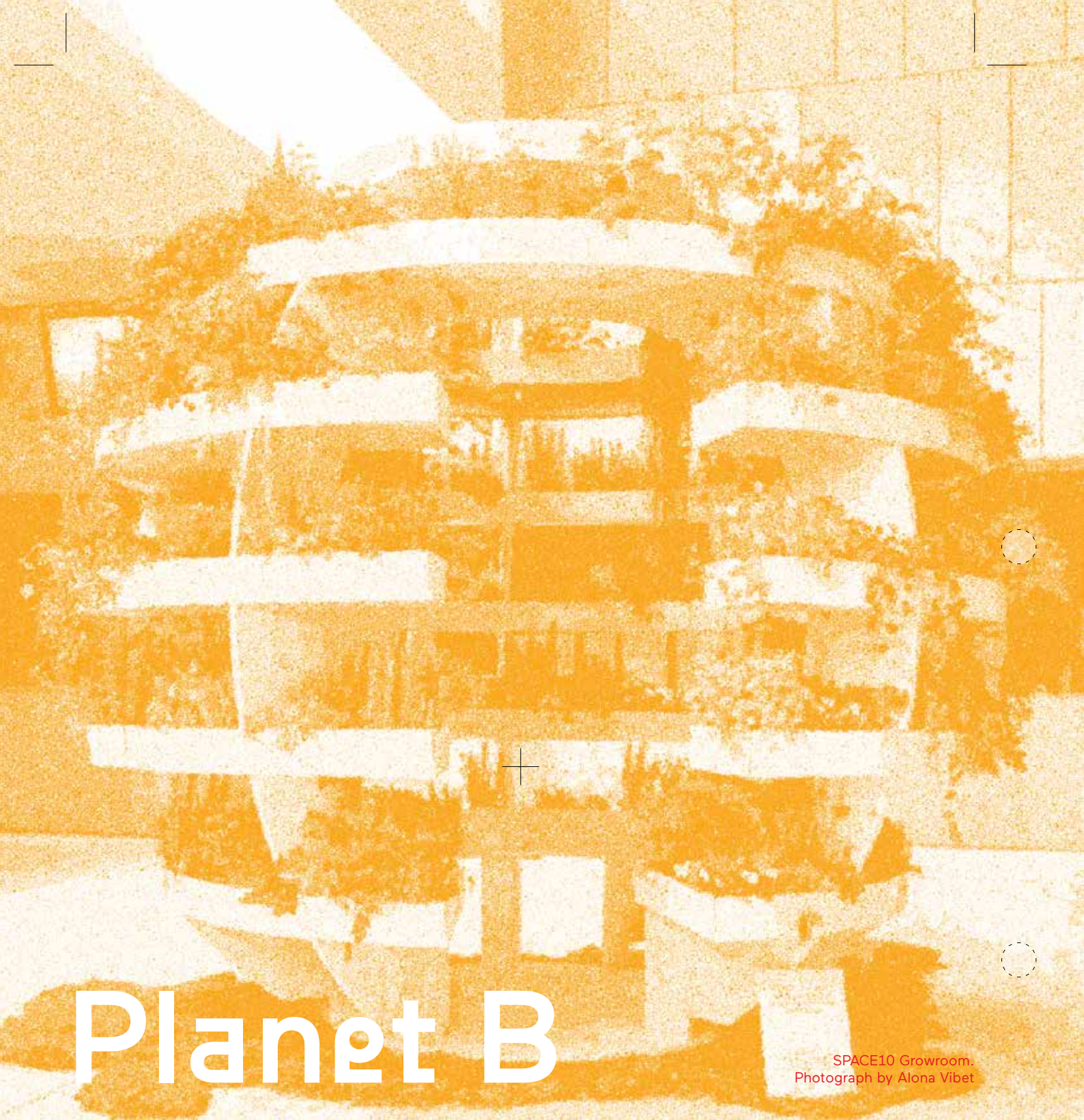


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Planet B

SPACE10 Growroom.
Photograph by Alona Vibet

How doughnuts and mushrooms may save the world.

By **Marleen Stikker**
Director of Waag

With **Thijs van Himbergen**

Imagine a planet that's a lot like Earth. We'll call it Planet B. The atmosphere is rich with oxygen and carbon-based life forms happily hop and run and hang around. There are oceans teeming with life and pristine beaches that turn into lush jungles; gently sloping fields of green stretch out in every direction. Planet B is a place of natural beauty—unspoiled by pollution, unmonitored by satellites, untouched by the hand of human endeavour.

Now imagine that, at some point in the future, our descendants discover Planet B. Shortly afterward a

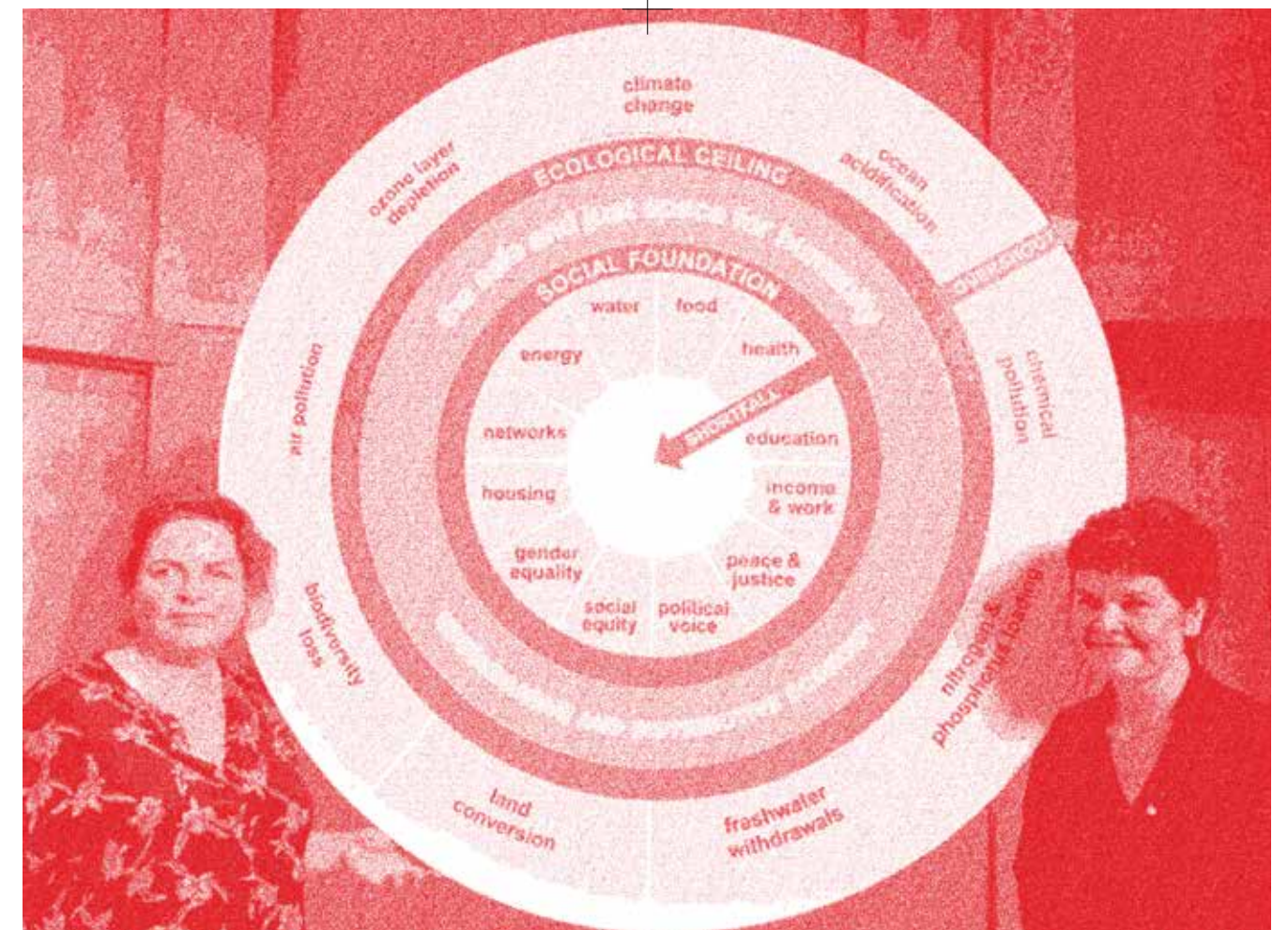
flurry of activity will take place: scientists investigate the planet's accessibility, space agencies race to ready their quantum rocket ships, and government officials quibble over who gets to plant the first flag. The colonisation of Planet B is underway.

But as the frenzied preparations unfold, a unique set of ideas takes hold of the public imagination. Given this unprecedented new opportunity, what if they could do better? What if they could learn from past mistakes made on Earth and create an open society on Planet B that is fair to all? What would that society look like, and what will it take to actually make it happen?

These types of questions about improving the underlying systems of society have as much relevance to us right now as they do to the future colonisers of Planet B, and arguably even more. Planet Earth is all we have at the moment and—this will hardly be news to anyone—we've been slightly negligent in its upkeep. While it's very possible to imagine green fields of possibility on which we may build a new society from the ground up, it is much harder to provide solutions that fix the tarnished 'brown fields' we currently inhabit. But imagining a new start, like the one on Planet B, could help us identify values that will move us in the right direction here on Earth today.

Some of those values can already be found in earthly systems. Consider, for example, the 'commons'—communities formed around the idea that all private ownership should be foregone for the benefit of the collective. All resources, whether material (such as air and water) or non-material (such as knowledge), are held in common by the group and managed with a set of informal norms and practices that are established by iteration and evolve over time. A commons operates on principles of democracy, openness, transparency and sharing, and provides a different way of thinking from the one on which our traditional economic models are based.

What a commons-like model might look like for a global society is eloquently described in the work of Kate Raworth and her book 'Doughnut Economics'. The doughnut, in this case, is a 'safe and just space for humanity', and it exists between a set of common-sensical human rights and needs, the 'societal foundation', and the limitations of the planet we inhabit, the 'ecological ceiling'. Fall short in the former department, which contains facets such as water, food, health and education, and you end up in the doughnut's hole. Fail to take into account the latter, which is made up of topics like climate change, loss of biodiversity and ocean acidification, and you fall outside the doughnut's outer fringe. As such,



Marleen Stikker (l) and Kate Raworth

Photograph by William de Bruin

Raworth's doughnut provides an economic guideline that encompasses the needs of all within the means of the planet. Between the two demarcations—on the doughnut—is where any responsible society should want to be if it values a long lifespan. Sadly, the overwhelming majority of present-day companies do not inhabit that space.

A glimmer of hope comes by way of the so-called maker movement, which strives to make this way of thinking—the way of the commons—more prevalent, most notably by creating and running the shared maker spaces and FabLabs. But as the means of digital fabrication—3D printers, laser cutters, wood milling machines—become mainstream and FabLabs pop up all over the world, the challenge of the maker movement lies in defining its values of sustainability, openness and critical making more visibly, and at the same time adopting a more focussed agenda to promote them.

The core adage of the maker movement—"If you can't open it, you don't own it"—is part of a philosophy that has already sparked numerous projects aiming to improve our world. The realisation, for example, that a typical smartphone cannot be opened and studied, let alone tweaked or have its components replaced,

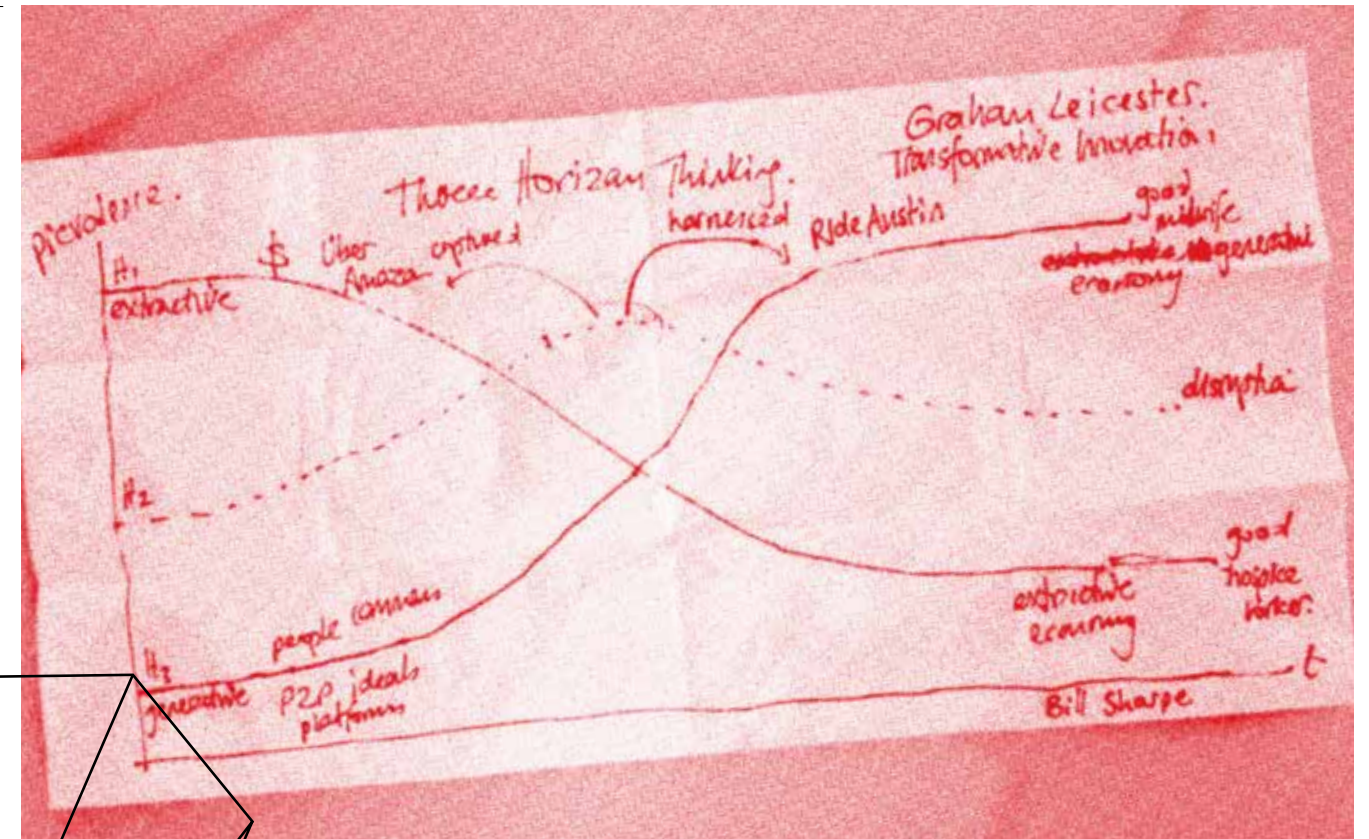
lead to the foundation of Fairphone a number of years ago. What started as a project at Waag's FabLab is now a company that empowers the user by taking away the mystery, striving for social justice and operating within the boundaries of our planet—in other words: right inside the doughnut.

Fairphone is an inspiring example of how things may be done differently, and an argument for investigating how we

may all start to move away from traditional consumerism and help construct a new economic reality. Of course, for any initiative to stay within doughnut boundaries, certain responsibilities will have to be innate to its operating principles. Sustainability is key among them. The maker movement, potential front-runners of this paradigm shift, can play a pivotal role in the process—and should. Sourcing materials critically seems a logical step towards a healthier planet, but it still happens too often that plastics and other unrecyclable materials are used in FabLabs, without a clear enough idea about where they came from or where they will end up eventually.

In addition, the movement would benefit from an unambiguous phrasing and propagation of its core principles. It is no longer good enough to simply say: let's open up access to the tools and make stuff together.

"It is no longer good enough to simply say: let's open up access to the tools and make stuff together."



Kate Raworth — "Three Horizon Thinking". Fineliner on layered tissue paper, 2017.

While fun and play are vital to the maker movement's dynamics, it's time to start wondering more proactively how we can funnel this dynamic towards transformative innovation. The corporates of our world (ie. those not subscribed to the ways of the doughnut) are already adopting the maker movement rhetoric as a marketing approach, conveniently forgetting to adopt its values as well. The maker movement, and by extension the FabLabs, stands to lose ideological ground in the confusion.

When I met Kate Raworth at Waag in October 2017, she grabbed a napkin and a pen and plotted three lines on a graph, calling them horizons. The first horizon represents the old economic model, or 'extractive economy', named such for its parasitic approach to our resources. On this hopeful napkin, this model's prevalence decreases over time. The second horizon, representing the 'generative economy' (which consists of initiatives that operate on the doughnut and have a symbiotic relationship with the planet, its people, and its resources), is a rising line. The third horizon, that of disruption—the one that represents our ability to critically innovate, to surprise ourselves, to make things better for all of us—runs down the middle of the graph. About halfway it spikes upwards, indicating that the benefits of this horizon are up for grabs. In such, it runs the risk

of being captured by the old, extractive model, as much as it holds the possibility of being harnessed by the new, generative one. In this sense the graph, which is based on Graham Leicester's work 'Transformative Innovation', contains as much a warning as it does a hopeful direction for our future. Lest we let the extractors kidnap the language and ways of the maker movement without adopting its values of openness and inclusivity, we should claim those values visibly, incorporating and promoting them in everything we do.

Which, and please bear with me here, brings me to mushrooms. Mushrooms and other fungi can form underground networks which link the roots of trees and other plants. This boosts the plants' immune systems and even allows for the exchange of nutrients—a type of communication that has prompted the term 'Earth's Natural Internet'. The point here is that we, the critical thinkers, the disruptors, the makers and movers: we are all part of a similar underground root structure, a network intent on sharing knowledge and resources, and on spreading the wealth our planet has to offer, without scaling it upward for the sole profit of a select few. FabLabs and Fairphones and other initiatives may sprout from the soil we inhabit, each propagating the values of the common good. It is the realisation that we are part of this bigger alliance, this wonderful movement of the like-minded, that empowers us to grow in the right direction together, creating a society along the way that we can proudly pass on to our future descendants. You know, just in case there is no Planet B.

Maakplaats 021

An interview with Karien Vermeulen

By Dick van Dijk

Photography by Waag Society



Karien Vermeulen is the head of the Creative Learning Lab at Waag Society. Over a good cup of coffee, Karien was interviewed by her colleague Dick van Dijk, head of Future Heritage Lab and Creative Director at Waag Society. Both research labs use the FabLab and try to connect to the education and museum domains respectively.

You first came in contact with FabLab Amsterdam seven years ago when you started working at Waag Society. What was your impression after this introduction to the FabLab?

"I got a tour of FabLab Amsterdam during one of my first weeks at Waag. The impression I got was that of a very experimental place. I remember this crazy artist who was going to test the laser cutter on a pig's bladder to see if he could use it to tattoo himself."

You are not a maker per se, but what does FabLab mean to you? How do you connect with it?

"I think it has broadened my view regarding the importance of these types of physical, networked spaces, and how individual passion can manifest itself through such a place. And I see new opportunities for learning that are more interdisciplinary and intergenerational and come from a place of experimental, intrinsic motivation.

I see my own role as looking for opportunities, establishing connections, building strategic programmes and setting up projects. The question of whether or not someone is a maker is always a bit difficult: how deep do you have to be involved? Personally, I'm very much invested in our activities, I'm present at many events, but professionally some distance is necessary. Otherwise, I will not be able to set up and develop programmes."

From the FabLab and projects like Fabschool, the project Maakplaats 021 was created. This project is a continuation of Waag Society's commitment to the Maker Movement, Maker Education and our focus on 21st century skills. It creates a physical infrastructure for teaching and learning and links between different organisations, such as libraries, schools, the makers of Waag Society, programmers of Pakhuis de Zwijger and researchers at the Amsterdam University. What is the importance of these local maker spaces for you?

"The greater importance of distributed spaces is 'maker access for all'. All children need to come into contact with maker education, creativity and technol-

ogy. It's important because they need to learn that our whole environment is manmade, that they have choices in making and using technology, and that we all are capable of understanding technology. The 'Maakplaatsen' - or maker spaces - form the physical infrastructure that make this possible."

The goal of Maakplaats 021 is the empowerment of 'agents of change'. Professionals from Amsterdam libraries are being trained and hosted by the Creative Learning Lab team. What was your role in the project and how has it changed?

"My role is based both on my own experiences and earlier experiences of colleagues. Actually, the pieces of the puzzle are coming together. FabSchool, a weekly after-school programme with pupils, was our testing ground for the programme. During Teacher Maker Camp, we gained experience in training and supervising teachers. And Waag Society has previous experience with setting up both our own FabLab and other FabLabs. All this experience comes together at Maakplaats 021. And

we've gained a lot of new expertise, which we will start sharing. The partnership also broadens our expertise and scale. As a relatively small organisation, we simply can not reach thousands of children with our programmes.

For Waag Society, Maakplaats 021 is a continuation and scaling up of our many years of pioneering activities. We can now build a relationship between makers and schools in different neighbourhoods. I myself am really invested in this relationship with schools. Pakhuis de Zwijger offers connections to public programmes in the city. The Hogeschool van Amsterdam focuses on demonstrating that the approach works.



As the project is about transforming libraries into maker spaces, we are talking about a structural change that requires attention and guidance. What makes this process easier is that the people at the OBA (Amsterdam Public Library) are willing to learn new things, make the most of themselves and develop very interesting initiatives both on their own and with children.

What makes things hard is that when so many different organisations come together, everyone involved wants to define their own specific role. Striking the balance between striving for impact, making the project successful as partners, and maintaining your own visibility as individual players can be difficult. But if you see what has been achieved in just one year, we can only be proud."

How do you see the role of Waag Society in these maker spaces in the near future? One of the things you and I have already started together is, of course, linking the programme to the museum practice, but what other things do you anticipate?

"We have been bringing maker education into neighbourhoods for almost a year now. There are currently three 'Maakplaatsen' opened in the OBA offices and, in four years, there will be ten. We see these sites as a permanent extension of our themes and programmes. Therefore, it should not be limited to 'just' a project: it is a programme that applies to all Waag Society research groups. Think of a programme about the circular city, or the impact of self-driving cars on the design of a neighbourhood, or the connection you mentioned to museums."

How do you see the future of the 'Maakplaatsen'? Are your nephews and nieces going to join?

(Laughs) "My nephew and niece are 3 and 2, which is a bit too young, but soon I hope to get started working with them with LED lights and copper tape. I often do try to help older children of friends with, for example, Scratch, the Fabschoolino or I send them some cool Instructables."

More importantly, I hope the 'Maakplaatsen' will develop into a bustling hub in a neighbourhood, an active place where teachers and children feel at home. And that these hubs develop their own identity in relation to their respective community, like most FabLabs have their own focus and profile."

Next year, the Amsterdam Maakplaatsen will be connected to DOIT's international network. DOIT is a European funded project focusing on entrepreneur-

ship in young people, using open innovation methods, pilots, digital tools and collaborative skills, in order to address social issues. What does the connection with DOIT add to the current setup?

"It allows us to involve more artists, and especially those artists from the neighbourhoods where the hubs are, so they can stay involved, come back, and possibly even make the Maak-

plaatsen their own workshop. The international context brings a lot of new interesting content and work, as input for the Maakplaats coaches."

Sounds like a lot of new inspiration for the hubs! But what or who serve as inspiration for you?

"I have a lot of admiration for the teachers who work here, often on their own initiative and on their own time, because they are passionate about education. Also someone like Sylvia Martinez, who gave us the ingredients for the development of the Teacher Maker Camp. Her handbook makes things very practical and tangible. And others such as Paulo Blikstein, Seymour Papert, and Eric Rosenbaum. And my own colleagues, who truly invest heart and soul in pro-

jects like Fabschool. In a European context, FabLab @ School in Denmark is a great example: they have started FabLabs in three cities and in more than 50 schools, and have already trained more than 1000 teachers in maker education."

What is your advice for the generation makers?

"Have patience, take time, move on, go to maker spaces often—and the world is open to you. Making requires an open attitude. I notice that I often have little patience myself, but I know that having a craftsmanship attitude towards new techniques means you will be able to advance more quickly. We're so used to instant gratification, but you need to train and develop skills to see if it's a good fit. Maybe it's not for everyone, but you have to investigate that first. And make things together with a friend over a cup of tea or a beer. That makes it a lot more fun."

What's the best thing you've seen in a FabLab or a Maakplaats?

"For me it's not so much about what has been made, but about what happens to the children and teachers. When people are so concentrated that they forget to go to the toilet. The twinkle you see in their eyes, the little dance they do when something that failed at first succeeds later on, the advancements

"Make things together with a friend over a cup of tea or a beer. That makes it a lot more fun."



you see. For example, there is a girl at FabSchool, maybe 11 years old, who enthusiastically takes over the presentation of the whole programme. She sometimes has a lot of trouble, but at Fabschool she is the entertainer and the presenter. We often hear from parents that their children, who might not perform that well in school, learn well in this setting and with these types of projects. That's a huge compliment to the team."

Last question. FabLab Amsterdam has been around for ten years. What do you wish for the birthday-boy/girl over the next ten years?

"I really hope we can affect more people and transfer the lessons and methods we have learned in the FabLab to other settings. We're already doing this, for example, with museums and botanical gardens, who we help to innovate using Fab-related principles."

I wish our own FabLab even greater accessibility, especially to the 'agents of change'. While we are now moving activities to the Maakplaatsen, we still need the interaction with users and to be users ourselves. We can't just be a laboratory. We must also give our own people the freedom to create and experiment."

Makers of FabLab

Interviewed by **Ista Boszhard**



Victor Brangoleau

Interned in 2013

Victor made a book showcasing the variety of designs and projects that were developed in five years of FabLab Amsterdam. He wondered why there was no printer in the FabLab and brought in a Risograph printer, a low-tech printer with a very manual and unique way of printing which he used for the actual book.

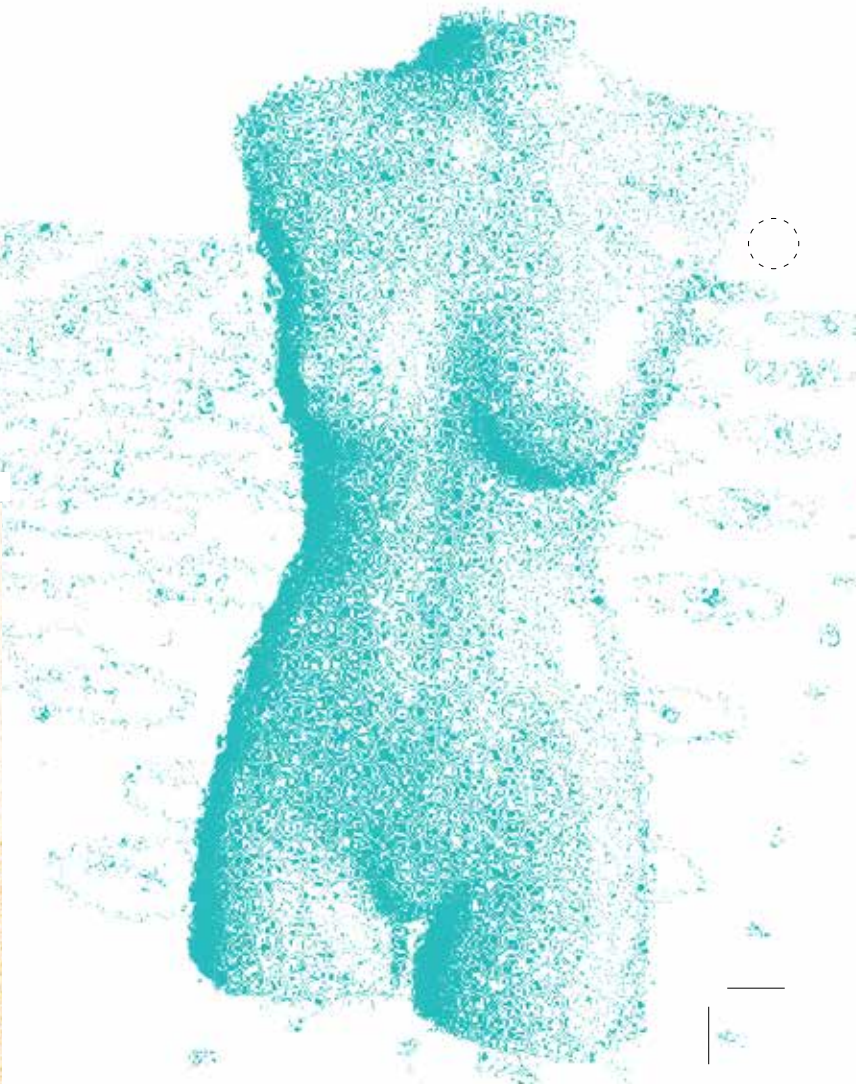
"I found a gathering of people with a common will to make things and learn from each other's own design worlds, by bringing new approaches to design in general."

Nina Papakonstantinou

Intern & assistant from 2015 - 2017

Nina combined parametric design tools together with the digital fabrication tools to create customised (real) human figures as an assignment for the participants of the Textile Academy.

"Working in FabLab Amsterdam was a mindbending experience. In such a stimulating environment everybody is both an amateur and an expert, a student and a teacher, ready to transfer or to take in new knowledge that will enable them and the community to envision, find alternatives and shape the future."



Yolanda Rendón Guerrero

Interned in 2014

With other makers and FabLabs, Yolanda designed a prosthetic and experimented with the prototypes of 3D models. The idea was to make a low cost prosthetic that people could hack.

"In FabLab Amsterdam anything can happen. To the point where you become a master of oneironautics. I would recommend everybody to spend a day in FabLab Amsterdam to experience how to teleport ideas, prototype and make products."



Ismael Velo

Interned in 2015

Through a very personal project, Ismael explored the boundaries of digital fabrication and the aesthetics of FabLab-made products. The result is a set of irresistible miniatures that represent some of the most iconic buildings of Amsterdam, from the Golden Age to our modern time.

"My time at FabLab Amsterdam was decisive for the development of my professional and personal profile. It turned me into a maker when I was only a designer."



Angelo Chiacchio

Interned from 2010 - 2011

Angelo explored how to use *fabbing* for communication. 'Leaves of Grass' was a research project on the laser-engraving poetry on dry leaves. He also worked on a camera replay design and physical score display system for the FabFoos project.



"FabLab Amsterdam allowed me to do all the research and experimentation I needed for my master degree. I spent only 4 months of my life at the Waag castle, but that short period definitely helped shape the designer I am today."

Alessandro Iadarola

Interned from 2013 - 2014

Alessandro investigated the potential of maker spaces and FabLabs as atelier for new crafters where tradition and technology meet to create sustainable products.



"FabLabs play an important role in bringing manufacturing from the outskirts into the city. I witnessed the positive impact of FabLab Amsterdam on cities, communities and people's lives. This influenced my way of looking at society and helped me develop a more systems-oriented thinking mentality."

Alice Mela

Interned in 2011

One of her research projects focussed on digital fabrication leftovers and the possibility of putting them back in the process as new materials in order to make the lab more sustainable whilst innovating. Together with Alex Schaub, Carsten Lemme and Thomas van Werff, Alice made a bass guitar, the first ever milled in a FabLab.

"At FabLab Amsterdam I found a family, an ambition and a craft. FabLabs are great mines for social innovation and Amsterdam's is no exception."



Maria Viftrup

Interned in 2017

Maria created an open-source material archive in order to share information and inspiration amongst researchers, designers and other material nerds.

"At FabLab Amsterdam there is room for experimentation, learning and failure. There is an understanding and valuing of the making process and the physical interaction with materials and machines. And there is warmth, openness and creativity everywhere."

Veit Penzenstadler

Interned in 2015

Veit built a bio safety cabinet that allows the user to work with biological samples or other sensitive materials without contaminating them. An airflow is going through the cabinet and a HEPA filter makes the cabinet sterile inside. It is reproduceable by using the facilities and machines of a typical FabLab.

"The FabLab community is a very good example of radical collaboration; highly needed to tackle the complex problems of our globalised world."





María Boto Ordóñez

Interned from 2014 - 2015

María worked on a project that focused on our relationship with other organisms: Pet Shop and PET'IT considered microorganisms as pets that we can actually care for and spoil.

"During my internship I was in touch with artists, designers, scientists, biohackers and makers. The Pet Shop and PET'IT came out of this interaction with people whose approach to microbiology was totally different than mine. The FabLab/WetLab facilitated the interaction between people with different backgrounds and skills in working and learning on the intersection of different disciplines."



Takuma Oami

Interned in 2013

Takuma made a toaster that can print, or actually bake, 8x8 pixels patterns on bread to share information while having breakfast.

"When I was an intern, it was so hard to explain how to use machines to different people since everyone uses the same machine in a different way and for another purpose. But later I realised that working together in the FabLab, with a big variety of people and ideas, the best ideas and prototypes come out. It's a form of active collaboration that goes beyond many fields."



Roland van Dierendonck & Christian Schulz

Interned in 2016

"When science meets games, it makes everyone's eyes sparkle!" Roland and Christian worked on the Euglena Spaceships kit that includes building instructions for a webcam microscope setup that lets the user interact with light-sensitive organisms, and build digital games with them.

"Organising a Hacksprint to get coders, biologists and makers together was a great experience. We just met the coolest people with the craziest ideas there. Tinkering with biology was such big fun!"



Lucas Perret

Interned in 2016 - 2017

Lucas designed and manufactured an open source tweakable vacuum former that is simple to build and can be made by anybody with access to a FabLab.

"Being an intern at the FabLab and the TextileLab has been one of the greatest experiences of my life. It's not only a place for making, it's much more: a place to laugh, to share, to learn, to discover and to experience that everything can be done as long as you work together."

The Can Do Spirit

At FabLab Amsterdam (which includes a TextileLab, a WetLab, and an Open Design research programme), we have spent the last ten years questioning and exploring technologies we believe will have great impact on the social, ecological, and industrial landscape of the future: digital and biological fabrication. Our journey so far has been one of inspiration, experimentation, and curiosity. It has also been one in which we encountered resistance and frustration both internally and externally. While there is a general acknowledgment of the need to change our ways as a species, this does not mean that we can easily adapt or even agree upon what is needed. As Enrico Bassi from Open Dot Lab in Milan put it: "We need the right gravitational kicks to get things to move."

So what are these "gravitational kicks"? How do we come to a common understanding of what is needed? How do we overcome the resistance to change within ourselves, others and organisations? These are not easy questions. Because I firmly believe in the value of appreciative inquiry and open dialogue, I have been in many engaging conversations with colleagues, peers, and industries on this specific topic over the past years. The richness of these conversations has given me enough fuel to write a book on the topic. But, in this article, I would like to focus on the value of a core tenet of the maker mindset: the "can-do" spirit.

From the world of today into the world of tomorrow
Industrial systems have been built up over the course of decades. Many organisations work in silos with

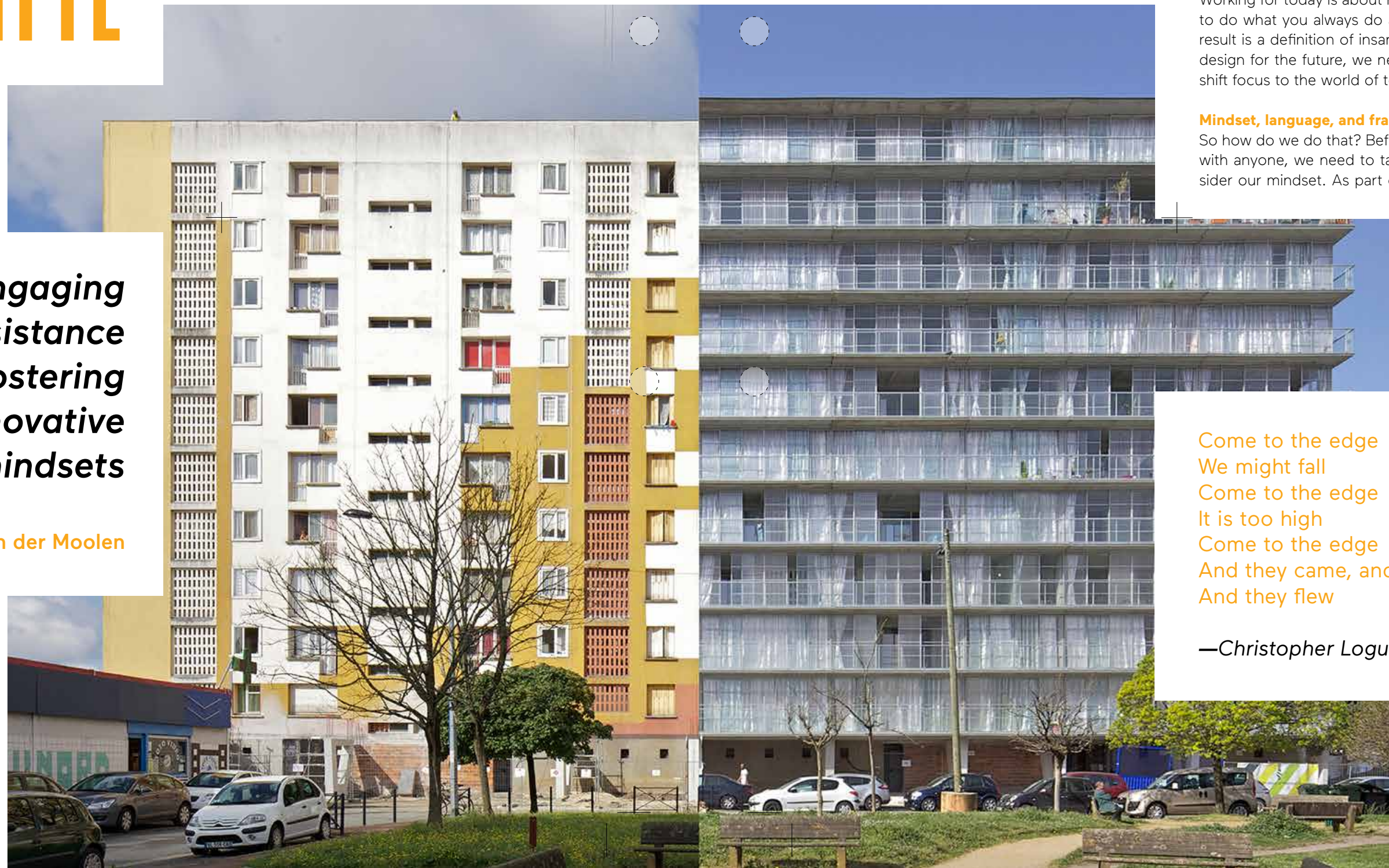
separate R&D departments, with linear innovation trajectories, often separated from customer or sales departments, and grids of suppliers so complex that they themselves do not always know where their resources come from. They certainly don't have any clue of the circumstances under which raw materials were made or mined. Such a modus operandi embodies the opposite of what we believe Open Design is about. As my FabLab Amsterdam colleague and teacher at Amsterdam Fashion Institute, Ista Boszhard, talks about her experience with the textile industry, she describes how there is a lot of fear and resistance to change. The majority of textile industry tends to focus on producing cheaper and faster. Like many other industries, the textile industry thrives under an operational mindset. The focus is on getting the job done and maximising profit. As Jonne Ceserani described it, they operate in the world of today. Working for today is about repetition. But continuing to do what you always do and expecting a different result is a definition of insanity, she says. In order to design for the future, we need to allow ourselves to shift focus to the world of tomorrow.

Mindset, language, and frames

So how do we do that? Before we discuss the future with anyone, we need to take a step back and consider our mindset. As part of Waag Society, FabLab

Engaging resistance and fostering innovative mindsets

By Karen van der Moolen



Come to the edge
We might fall
Come to the edge
It is too high
Come to the edge
And they came, and he pushed
And they flew

—Christopher Logue, 1968

Photograph by:
Philippe Ruault.

Amsterdam's dominant focus is on the world of tomorrow. Our eyes are on the future. This is both our strength and our biggest weakness when it comes to impact and societal transformation. In engaging with anyone (industry in particular), one can easily forget what it means to live in the world of today.

Although our primary impulse is to start conversations with the like-minded, we certainly should not disengage from those who resist. In the words of Simon Kavanagh from the renowned creative business school, Kaospilot, in Aarhus, Denmark: "one needs to start from the premise that every person is naturally resourceful, creative and whole." If an individual seems unable to engage, chances are high that there are internal and/or external restrictions limiting them. It is in this resistance that we can find a tremendous amount of energy and opportunity. Resistance is golden. Sometimes we might feel that it slows us down, but no one ever said change was quick or easy.

Engaging with this mindset is essential to creating common ground through frameworks and language, which help establish the mental and physical space that allows for exploration. After all, Albert Einstein noted that "problems cannot be solved by thinking

within the framework in which the problems were first created". For example, FabLab Amsterdam is part of an EU funded project working to build a network of experimental textile business labs within the textile industry. The aim of the business labs is to research and experiment with new forms of design, new tools and technologies, and new ways of collaborating. The collective challenge was to come to a shared understanding of

a new textile industry culture, that we will practice in the project and through the labs. In this new culture, ambassadorship plays an important role. However, in the first stages of the project it appeared quite difficult to cultivate this concept. The partners all came from very different backgrounds and were dealing with different problems and questions. Also there was a tendency to translate new concepts to existing structures. Discussions quickly become an operational instead of philosophical or strategic. Through a persistent, co-creative and iterative process and a lot of divergent thinking, the consortium came to convergence. The result was a framework of what makes a textile business lab and how to showcase the outputs. This framework created a next level of commitment from its members. Instead of operating in their own local silos, members were enabled to operate in a broader context, and their local effort

"Although our primary impulse is to start conversations with the like-minded, we certainly should not disengage from those who resist."



IKEA's innovation hub, SPACE10, in Copenhagen.

Photograph by Alastair Wiper.

became relevant to a much wider audience.

Revolution happens through collaboration

When we take a closer look into specific businesses, we see huge differences in mindset. There is resistance, yes, but also a tremendous amount of curiosity for the work makers do and their view of the world. Yet this does not mean that a sudden transformation will go smoothly. Resistance can be found in many parts of the chain. Recently, I had an insightful talk with Guillaume Charny-Brunet, Director of Innovation at SPACE10, IKEA's innovation hub, in Copenhagen. While SPACE10 is funded by IKEA, it operates independently, searching for sustainable future visions, systems and models. Like FabLab Amsterdam, SPACE10 is part of the Fab City Initiative, a global project to develop locally productive and globally connected self-sufficient cities. It comprises an international think tank of civic leaders, makers, urbanists and innovators working on shifting the paradigm of the current industrial economy, in which the city operates on a linear model of importing products and producing waste, towards a circular city model.

Guillaume explains how digital fabrication has enormous potential to fill the gap between craftsmanship and modern day mass production. To reach scale in local personalised production, he suggests we may need to add micro-factories for digital fabrication to our cities' ecosystems. However, Fab City is not about machines and access to knowledge alone. For Guillaume, the maker movement and its accompanying can-do mindset could prove a tremendous asset during such a transformation. They are critical minded citizens. I could not agree more. At the same time, we need to be aware that makers are still a relatively small group compared to the vast numbers of customers shopping in IKEA stores on a daily basis. For the paradigm shift to happen, we need to support a wider uptake of that maker mindset.

We also have to convince the customers. However common it was in the 16th and 17th century, when guilds dominated the cultural and economic landscapes, customers today are not used to personalised, handcrafted products using local or recycled resources. We have learned to seek "perfect homogeneity" at minimal costs. While there is a growing consciousness about the impact of our personal habits on the social and ecological sustainability of our planet, we still resist changing our ways. To open up dialogue with customers and engage with the resistance from the other side of the cash register, Guillaume suggests industry should certainly not impose and demand, but listen and empower. Revolution does not happen through competition, but through collaboration, he says. And if you type "IKEA hacks" into Google, you'll see that IKEA is already embracing these ideas. At the same time, IKEA increasingly



Photograph by John Simitopoulos

asks its designers to aim towards longer lasting products, so customers will have the incentive to reuse, resell or repair old items instead of tossing them into the bin.

Concluding remarks

We will come to distinguish different roles for each of the growing number of makerspaces in the cities of tomorrow. Some of these will focus on future research, while others will focus on product innovation, education, or small scale production. Through our principles of open design, FabLab Amsterdam will remain a safe space for research, learning, and experimenting. However, we also need to recognise that changing entire systems does not happen overnight. We must engage with resistance and take the time to establish the right frameworks and mindsets to make sure everyone is onboard for the ride—no matter how fast we'd like to go.

Riverbank FabLab

Jens Dyvik and a group of makers are setting up a FabLab in Oslo.

By Thijs van Himbergen

The Akerselva is a ruggedly beautiful river that runs through the Norwegian capital of Oslo. For over 150 years, Akerselva's numerous frothy waterfalls powered the factories that dotted its banks; nowadays most of those buildings have been repurposed as upscale apartments and offices, coffee places where the barista draws cat faces in your girlfriend's capuccino, and shopping malls so all-encompassing they would cause Santa to change his business model. The Akerselva now runs through an area designed for consumption; an entirely gentrified reminder of Oslo's industrial heritage. Well, entirely? One small group of indomitable Norwegians holds out. At the Støperiet ('foundry'), they are hard at work getting Fellesverkstedet

"It is about taking part in something bigger than yourself, by tapping into an internet-fuelled collective global brain."

('communal workshop') off the ground. An initiative by makers, for makers, Fellesverkstedet aims to be a FabLab devoted to providing equipment and knowledge to anyone with a good idea and a wish to turn that idea into reality. And while running a space full of expensive equipment costs money—quite a lot of it—Fellesverkstedet will pool together both private and public resources in order to offer its services at a fraction of the actual cost.

At the time of writing, in October 2017, the building is still being renovated for a planned opening in February 2018. Once a place where iron was smelted to

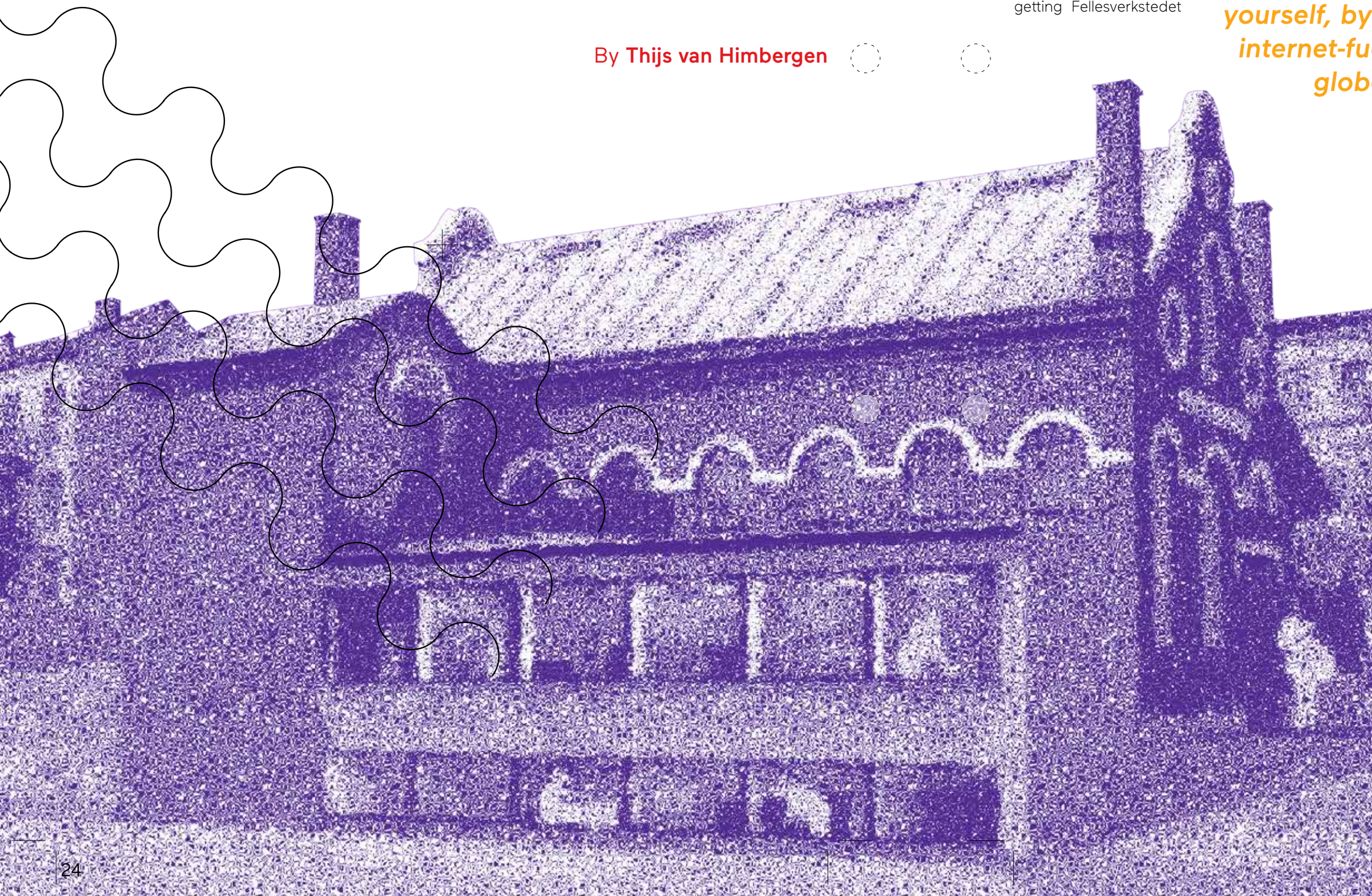
cast padlocks, the structure is now the stage to a bustling scene of doers and makers pouring concrete, laying bricks, repairing the facade, the roof, and constructing the annex. After the renovation of the interior, which will start in November

and take four months, Fellesverkstedet will open its doors to the public.

Jens Dyvik is one of the minds behind the initiative. In 2009, he graduated from the Design Academy Eindhoven with the projects Ref, a wearable that helps the wearer improve their emotional skills, and GreenCube, a device that helps inhabitants of cities recycle organic waste into nutrition-rich worm compost with which they can fertilize their urban vegetable gardens. During his studies, he interned at the Waag's FabLab in Amsterdam, where he received mentorship from Dick van Dijk and Bas van Abel.

About that time, he writes in an e-mail: "I am very grateful for my time at the Waag in autumn 2008, making prototypes in the freshly started FabLab. Working together with former FabLab manager Alex Schaub was a great inspiration. The people at Waag have been the biggest contributor in opening my eyes to the potential of open design and social fabrication. [...] The digital fabrication and electronics skills I developed during my internship helped me take my graduation projects to a higher level. It was great fun to have a project prototyped with 3D printing, laser cutting and an Arduino brain, and receive a cum laude title and numerous awards from the traditionally technophobic Design Academy Eindhoven."

After graduating, Jens travelled the world for two years, going from FabLab to FabLab. He documented his travels in the film 'Making Living Sharing - a FabLab world tour documentary', and gathered the knowledge and insights that helped him and his fellow makers conceptualise Fellesverkstedet.





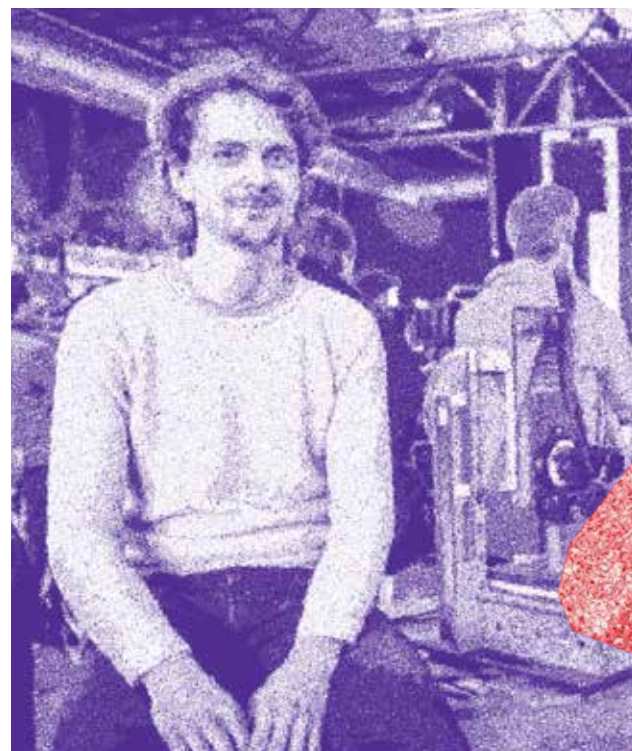
An artist's rendering of Fellesverkstedet's interior.

Jens and his partners are part of the so-called 'maker movement'—a loosely associated international group of people who operate on the philosophy that inventing, making and sharing designs is a positive way forward for humanity. The FabLab plays a vital role in the movement, where it functions at once as a laboratory, clubhouse and production centre. As Jens puts it in an interview with Elementa.no, "it is about taking part in something bigger than yourself, by tapping into an internet-fuelled collective global brain." This 'global brain' acquires more and more information over time since the ideal participant of the maker movement contributes to it "by adding and sharing components of [their] creation with humanity." It's an ideological model that promotes sharing and learning within the global community, all the while improving the agency of the individuals within it.

But in practice, the maker movement seems to risk being too loosely defined to keep all of its ideologically motivated constituents on board. "We are now at a point of dilution," Jens notes, "where making stuff in new ways has been embraced by such a diverse set of people and organisations that the movement fades into the infrastructural background, becoming more anonymous, yet widespread." The contradiction seems clear: as 3D printers and other digital production methods become more widely available, an increase will take place in the number of people using these methods to produce DIY action figures and other fun-yet-disposable knick-knacks. And while having fun can be a great driving force behind inventiveness, this phenomenon is blurring the principles

of the maker movement as they were once intended. "There is a lot of confusion between the general evolution of digital fabrication and the social side of making. There is no doubt that more and more physical stuff will be produced digitally and locally, but hopefully we can use this technology to connect people to each other, to the machines that make the stuff, and to the stories of why we make things."

"Intellectual property is a bizarre concept."



Jens Dyvik

Of course, FabLabs like Fellesverkstedet won't be flooded by people who want to print Darth Vader helmets for their kids. Jens: "The idea of making stuff together, in open and informal ways, definitely has a universal appeal. But not everybody likes to make. Some people love to consume, or support those who make the stuff they love. Everybody has a relationship with music, but that doesn't mean that everybody should be a musician. Consider the way YouTube has uncovered hidden musical talent; the same can happen with open workspaces and online knowledge-sharing platforms for making."

It is precisely this sharing of knowledge, and the underlying principles of open design, that form the backbone of the maker movement's philosophy. Within this context, Jens distinguishes both a rational and an emotional aspect:

"On the rational side, it is about eliminating artificial scarcity. Instead of holding human progress back by artificially limiting who gets to learn or make, we can openly share and support each other by making our knowledge and tools available to everyone. On the emotional side, it is about acknowledging that creativity does not come from inside one person, but is synthesised from the thoughts and actions of millions of people throughout the ages. Intellectual property is a bizarre concept: Where did you get

your inspiration from? Where did you learn the mechanic principles, or how did you shape the language behind your creation? What happens when multiple people take in input from the world, and come up with the same idea at the same time? Should only one lucky lottery winner be allowed to do business with this idea?"

It's a convincing point. Some systems are so ingrained in society and our way of thinking, so taken for granted, that we fail to ask critical questions about their nature and use. Jens:

"Instead of spending resources on defensive strategies, I think it is better to invest in positive developments and collaborations. For me, knowledge sharing is about diversifying and multiplying your creative activity, instead of hedging your bets."

Positive developments are certainly taking place on the banks of the Akerselva. The non-profit organisation under which Fellesverkstedet was founded now actually legally owns the old lock-making foundry they're renovating. Jens: "It is unprecedented that an independent FabLab owns real estate of such scale. This is the result of more than five years of hard teamwork, and we hope it will ensure great stability and a very long-lived FabLab for our city."

That seems to be a perfectly safe bet.



This article was partly based on an interview with Jens on Elementa.no: (<http://www.elementa.no/archive/2016/12/14/making-living-sharing-with-jens-dyvik>)

Facing Global Challenges Together

An interview with David Ott, co-founder of the Global Humanitarian Lab

By Jurre Ongerling

Over the last 10 years, the FabLab and the concept of digital fabrication have offered endless opportunities for individual makers. At the same time, the FabLabs have also influenced the boundaries and strategies of organisations. One of these organisations is the Red Cross. The connection between the Amsterdam FabLab and the Red Cross came about through David Ott around two and a half years ago.

David's curious mind combined with a personal interest in technology meant that he was easy prey to the 'maker virus'. He began exploring how digital fabrication could be meaningful for the International Committee of the Red Cross (ICRC). He envisioned creating a Red Cross specific FabLab in the field, which he called: "The Red Lab". That's where it all started.

At the beginning, David was somewhat of a lonely digital fabrication ambassador in ICRC. To help make his colleagues aware of the potential impact of Red Lab, David organised a week-long trip to FabLab Amsterdam with a broad delegation of the ICRC. The goal of this workweek was to share with others what David himself already envisioned as opportunities. This week featured 'learning by doing' so that everyone could better understand what FabLabs and the maker mindset could mean for the ICRC. This was a valuable first step towards what has now become the Global Humanitarian Lab. David's reflection on this journey offers several relevant insights and demonstrates FabLab challenges of the future.



What happened to the initial Red Lab concept?

The Red Lab idea was further developed after Amsterdam. During its implementation however, the Red Cross concluded that it would be more effective to further explore digital fabrication related possibilities by doing this together with others. A cross-sector partnership of leading humanitarian organisations was therefore envisioned. This idea led David to write a proposal on how to do so. Peter Maurer (President ICRC) embraced this concept and the first partner to join was Olivier Delarue of the United Nation High Commission for Refugees. David explains: "Together with Olivier we refined and further developed the concept. As the project snowballed, more and more partners and several national governments also committed to the idea. On the 24th of May in 2016, the Global Humanitarian Lab (GHL) was officially launched as a project under the United Nations Office for Project Services (UNOPS)." The goal of this lab is to accelerate innovation in the humanitarian sector. This includes exploring the possibilities of FabLabs, but the GHL also focusses on topics like new financing models for the humanitarian sector, foresight, and development of cooperation between humanitarian partners.

David's personal focus is greatly on FabLabs in a humanitarian context. "The most specific example of this is the deployment of a mini FabLab in a community centre for refugees in the city of Ioannina, Greece. More of such enabling spaces are to be developed in the near future."

How has contact with Waag influenced this development?

There are two things worth mentioning here. Firstly, David explains: "I recall some fierce discussions about balancing high tech and the reality of humanitarian work. Finding links between new technology and the reality and needs of our operational work is not always easy for people in the field who demand the very best. The workshops really enabled us to start a more informed and much needed dialogue about this within the ICRC."

The second thing worth mentioning is a shift in the application of the FabLab idea. David: "I must say that, at that time, my mindset was on the FabLab as a new way to support operations through offering a new way of making things. In retrospect, a very important discussion with Marleen Stikker helped me to realise that we needed to change our perspective and empower affected communities instead. I slowly realised that, instead of focussing on our own practical work, we should focus on what these communities can do with FabLabs. That might seem totally natural from what we do now, but it really took us a



while to move from the idea of focussing on 'making things' for our operations to offering a community the tools to solve its problems." This more inclusive and community-central approach also allows for so much more than just product creation. It provides opportunities for informal education, appropriating new technologies, and learning new approaches to challenges. "So today when we talk FabLab, we talk about models to cooperate and to problem solve with communities. You can definitely say that Marleen put us on the right track there", David says.

According to David, the best example of deploying FabLabs for humanitarian causes, is the aforementioned FabLab in Greece. This sprouted from a proposal made to Terre des hommes. David explains: "They were looking for ways to deal with unaccompanied minors. Teenagers are notoriously difficult to interest and attract. We were looking for ways to provide something to interest and attract them, enabling humanitarian colleagues to identify challenges like abuse, depression, etc. Now the FabLab has been created and it is attracting these kids. At the same time it also attracts single refugee mothers with children and local communities. It's a place that not only offers protection, but also social cohesion, learning, collaboration and integration."

“It’s a place that not only offers protection, but also social cohesion, learning, collaboration and integration.”

What do you offer to attract these people to the FabLab?

“That’s actually less of a challenge than you might imagine. Just put yourself in the refugees shoes,” David explains, “Imagine the hardships of a trip taking you away from home, through Turkey, and ending up in a refugee setting in Greece—a new place that doesn’t offer you much besides a safer environment. You have very few social connections, and you are basically just waiting to move on to something else while not being allowed to work or participate. In such a situation, the FabLab offers a place where people can re-take control over their daily efforts and routines. They become able to learn and be productive in this new setting.” The FabLab also offers a place that doesn’t push a specific agenda. It’s not about ‘you must’ but about ‘you can’. People can develop things that align with their own interests. They just have to find the right personal focus to do so. The FabLab facilitator tries to encourage this development, which makes it a very important role.

What projects do people embrace in these FabLabs?

“In Greece, there was a teenage guy spending his days smoking, playing ‘Clash of Clans’ on his mobile device, and drawing cars. As soon as the FabLab opened he came in to learn about 3D modelling and printing. Embracing his car drawing passion, he managed to start printing models quite quickly. After a few weeks, he decided he wanted his models to move. This led him to explore electronics like Arduinos. Now he has a fully automatic little model, and has accumulated a ton of knowledge to boot. There are many other examples of people having a personal interest that triggers similar learning experiences.”

Before getting the chance to ask for more examples, David interrupts me. “But wait, the potential is so much bigger, it really gives me goosebumps,” he says, as he shows me his arm on the Skype webcam. “This car guy is gone now. He has moved to a new home somewhere in Western Europe. Unfortunately, he has gone to a place without a FabLab, but imagine what would have happened if he had gone to Berlin, Paris, or Amsterdam? There are great facilities there. What if he could have continued his development there? We should explore what he could mean

for such a new place and vice versa.”

Where do humanitarian labs stand now?

When talking about digital fabrication, the focus is often on the products first. However, the work we have done so far have made us realise that the people involved should be our main focus. I see a role for FabLab managers to not only focus on project development and documentation of work, but also to better manage the individuals in the communities by establishing a humanitarian layer over the network that already exists. Imagine FabLab facilitators being in contact with each other about the community. What if one facilitator calls the other and says: ‘There is a Syrian guy heading your way and he could take his project to the next level in your FabLab!’ Or maybe this facilitator could give his colleague a heads up saying: ‘There is a great Iranian designer coming your way and he can teach a thing or two about the basics of 3D modelling.’ There is so much unused potential there now. We have to tap into this. We must leverage the mobility of makers and enrich initiatives like VULCA (European Mobility project for FabLabs and Makers) by doing so. That way all labs can become a bit more ‘humanitarian’.”

What do you personally strive for right now?

“I am personally a ‘techie’. I believe that technology is a problem solving tool. It has the potential to solve so many problems. I want to make sure that we embrace the transformative power of technology for humanity in general, but I have learned that the social or human aspect should never go overlooked. I now see how these subjects should go hand in hand when implementing any FabLab approach. We will continue to do so ourselves. From that direction, we are now looking at opening a FabLab in Burkina Faso to address the problem of child labour in gold mines. We are also going to Palestine to see how we can offer an alternative programme for delinquent youth through FabLabs. We are also looking into creating FabLabs in refugee camps in Rwanda and Kenya. I see a great number of ways to do even more and better things. I also hope that next year we can create and involve more local FabLabs through which we can create a bigger and more connected community to deal with the global challenges of today.”

Spotlight: Emma Pareschi Fab Academy

Interview by **Ista Boszhard**

In 2014 Emma was a Fab Academy student. A year later she started teaching and now she is the local coordinator and lecturer and part of the team of global evaluators.

What is Fab Academy?

“Fab Academy is the most complete, six-month course about digital fabrication and best practices within digital fabrication laboratories that you can find. Not only do students learn about machines, but also about the mindset, project management, application and implication, the documentation of the process and a spiral, iterative development of the work.”

What makes it special?

“The fact that it’s global distributed network, all connecting at the same time world wide, every week! We overcome distance and space. Students are going through an intense process together and they share the made efforts and the results. This weekly sharing of work and process is very important because students can not only build upon each others work and knowledge, they also see how people from different places approach assignments completely different.”

Who’d you recommend the academy to?

“It’s all about changing the rules. So to everyone that would like to have a different approach to her or his work or the world. Or to people that have a concrete idea and want to develop a prototype that can be the start of something bigger. During the academy students can do almost anything!”

Website: fabacademy.org

“Life is one big design challenge...”

An interview with Sacha van Tongeren

By Gijs Boerwinkel



Sacha van Tongeren, who worked at Waag Society for four years, was involved in the early steps of the FabLab, the Fairphone and many other ‘maker’ related projects. Nowadays, she’s working for the public library in Amsterdam, opening new Maker-spaces (Maakplaats 021) all across the city. She’s also involved in the Fairphone Foundation.

What do you see as core values in a Fablab and the Maker Movement?

For me, FabLabs represent open access, demystification and curiosity. Everything around us, from product to complex systems, is designed and made by people. This means I can design and make something even better than the existing product. That is a very empowering idea. It means I can change things for the better, nothing is fixed and life is one big design challenge where everybody can be involved in designing and making.

What inspired you to join this Maker Movement?

Back in 2010, when I started working for Waag Society, it was the curious and innovative mindset that attracted me. The ‘maker attitude’ quickly got me infected as well. ‘If you can’t open it, you don’t own it’. Why are things designed the way they are and

can we change or influence that? Closed systems and exclusive business models will be consigned to the past. We’re not there yet, but a lot of things are changing for the better.

Did FabLabs change the world? And if so, how?

It’s hard to say if FabLabs have changed the world. In the beginning they were just physical workshop places for ‘geeks’ and ‘nerds’. But these days I see that FabLabs are ‘hot’. We’re all looking for ways to get a grip on the rapidly changing world. I think these places offer a really concrete alternative for people to realise action and change. The place is intended for discovery and collaboration.

How did the FabLab contribute to the idea and development of Fairphone?

FabLab Amsterdam is the birthplace of Fairphone. It all started with the question: ‘Why can we have fair chocolate, but not a fair smartphone?’ and ‘Would it be possible to create a fair, open and sustainable smartphone?’ This initiated an extensive research phase where we looked at all the aspects of producing smart devices, from resources, intermediate goods and finished products. We looked at which chains of this production process we could change to make a smartphone more social, sustainable and



A jolly man atop numerous phones, simultaneously calling two friends.

Photograph by Fairphone

fair. This idea fit within the FabLab mindset of (re) connecting with the products we use every day. You shouldn’t have to choose between a great product and a fair society / sustainable environment. It should be both. A FabLab can help drive the experimentation behind that idea.

How do you see the future of FabLabs and the Maker Movement?

I see small makerspaces in every corner of society, in shops, schools and public libraries. These places, where people learn how to make stuff, empower them to take a different stance on consumption. The

next step is to make FabLabs more accessible and keep making the connection with sustainability and social innovation. We have to move beyond ‘the fun and new way of making’ towards a social and critical approach towards closed production schemes.

What advice can you give to the next generations of labs and makers?

We’re just getting started changing the way things are made. Terminology like open access, open knowledge, open sharing still sounds like ‘gibberish’ to most people. So there are still a lot of new people to engage with!

...and everybody can be involved.”

Spotlight: Cecilia Raspanti Fabricademy

What is Fabricademy?

"Fabricademy is a transdisciplinary course that focuses on the development of new technologies applied in the textile industry. The scope of this program is to train a new generation of professionals who develop more sustainable processes with the help of digital fabrication, synthetic biology and global knowledge networks."

What makes it special?

"I'm always wondering why there are almost no fashion designers in FabLabs since it's a perfect place to explore infinite possibilities and to get in touch with the maker mindset and a worldwide network of all kinds of experts! Fabricademy puts people in unfamiliar places for the magic to happen."

Who'd you recommend the academy to?

"We see an industry that is trying to innovate, but what's missing still is the application of new technologies in unexpected ways. So we train students to explore digital and new technologies without fear and to combine it with craftsmanship and traditional knowledge to discover the valuable unexplored!"

Websites:
textile-academy.org

waag.org/nl/event/fabricademy-new-textile-academy

Interview by **Ista Boszhard**

Fabricademy is everything Cecilia always wished for when she was studying. It didn't exist yet, so she co-founded it with Anastasia Pistofidou and Fiore Basile. She already dreamed about this programme for some years. When the

European project TCBL came along, Cecilia had the opportunity to set up the Textile Academy that was executed in Amsterdam in 2016/2017. In the meantime the worldwide programme was developed and in September 2016 Fabricademy it took off!

DIY Phone Charger

What if there is a power failure and you have to charge your cell phone? With these instructions, you can build your own charger that works with a bicycle dynamo. This way, you can produce electricity by using your muscles!

What is electricity?

Electricity originates from the Greek word for amber: elektron. This was the material where electric charge was discovered by rubbing it against fur.

Electricity (or current) is a stream of very small particles with a negative charge (called electrons) that are able to move through a solid material. If one place contains less electrons than another, they will move to the place with the least electrons until levels become equal again. This movement of the electrons (the current) is what we call electricity. To produce electricity, there has to be a difference in the amount of electrons between two places. This difference is called voltage. The strength of the current, called ampère, is the quantity of electrons that pass a certain place per second.

AC and DC

With direct current (DC), electricity flows in one direction, while with alternating current (AC) the flow direction of the electrons changes very, very rapidly. High voltage cables and your wall socket use AC, whereas many small devices in your home use DC. That's why your computer and telephone need a power adapter. With these instructions you will make an adapter that can transform the AC of the dynamo into DC for your telephone or tablet.



Tip: No bicycle? Put your charger on a buggy or wheelbarrow wheel.

First Things First: How to Solder

Attention: Soldering tin may contain lead, which is poisonous. Some may get on your skin — always wash your hands afterwards.



Turn on the soldering iron. Heat the metal you are going to solder with the iron.



Add some soldering tin underneath the soldering iron.



Form a small pyramid around the soldered leg with the iron. First take away the soldering tin and next the iron.



What Do You Need?


Now that you're a master of soldery, here's a list of what you need to make the phone charger.

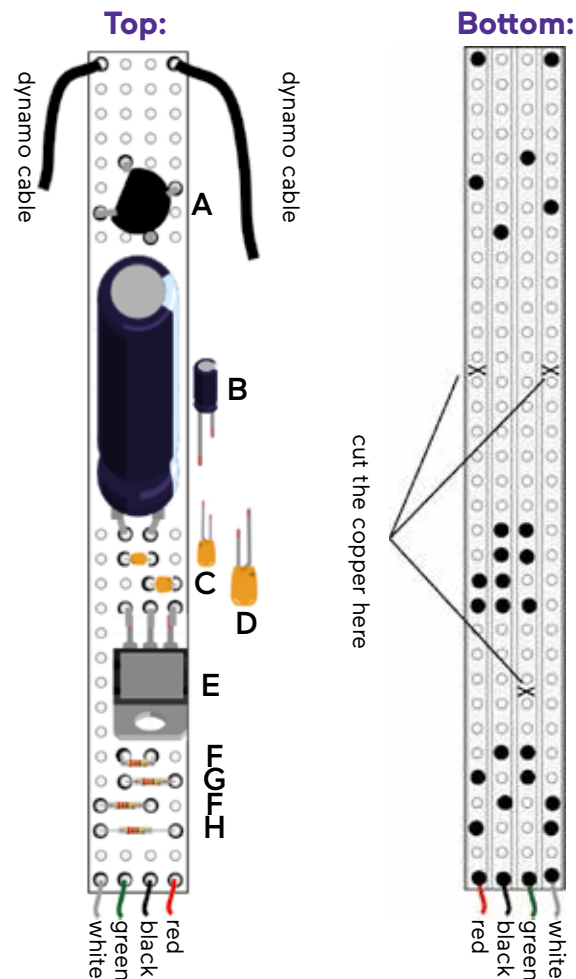
Tools:

- Soldering iron
- Soldering tin
- Stripping pliers
- Flat nose pliers
- Cutting pliers
- Stanley knife
- Metal ruler
- Handsaw
- PVC glue
- Multimeter

Parts:

- Dynamo
- Stripper board (hard paper)
- USB extension cable
- Twin-core wire to put between dynamo and charger
- 12 cm PVC tube, min. ø25mm
- PVC cap
- PVC cap with screw cap
- A = Bridge-rectifier (converts DC into AC)
- B = Capacitor 1
- C = Capacitor 2
- D = Capacitor 3
- E = 5 Volt regulator (converts 6V into 5V)
- F = 2 Resistors 51 kOhm
- G = Resistor 43 kOhm
- H = Resistor 75 kOhm

Note: Part F, G and H look like this: 



Alright, Let's Go!

Got everything? Put on some nice tunes and make that charger happen!



1 Cut the stripper board to the right size: 4 holes wide by 34 holes long.

Do this by carefully cutting into the board and subsequently breaking it with flat nose pliers.



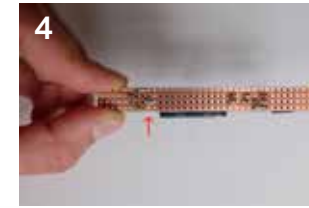
2 Put all the parts on the matte side of the board using the detailed top and bottom views on the left.

Attention: the long leg of all parts is always the plus side (+), place this on the plus line of the board Reading downwards, the board has a +, -, + and a - line.

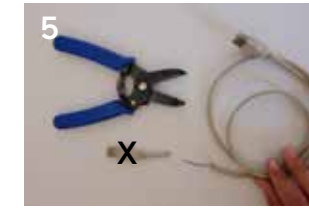


3 Solder the parts to the shiny, copper side of the board (see the soldering instructions on page 35).

Attention: the copper side of the board is conductive. Do not connect the copper strips to each other! Cut off the long legs.



4 Scrape some of the copper away from the bottom with a stanley knife on 3 points. See the previous page for a detailed view of which points. By doing so, there will be no contact between the leg of the rectifier and the rest of the line on the board.



5 Cut off the USB connector (male) from the USB extension cable.

Strip all 4 wires to attach them to the board. On the previous page you'll find a detailed view for the exact locations on the board.



6 Drill a hole in the screw cap and cut a smaller hole in the rubber inside of the cap. Next, glue both ends to the pvc tube.



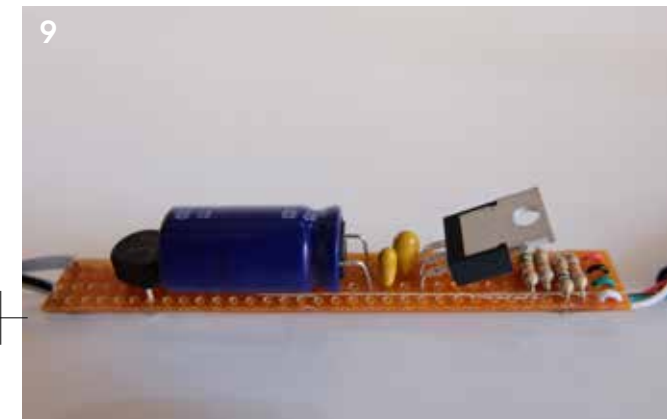
7 Pull the wires (USB + the wires that lead to the dynamo) through the hole in the screw cap.

Solder the wires to the USB as pictured above. Place the red wire on the top (+) line, followed by the black, green and white wire on the lines below.



8 Now solder the wires that run to the dynamo as pictured above. In this case the way of wiring does not matter.

Attention: solder the wires to the shiny, copper side of the board.



This is what the top of your board should look like after populating it.



10 Place your device in the PVC tube and connect the wires to the dynamo.

Attention: before you connect your phone, first test if your device works properly with a multimeter.



You did it! You are a maker!



This instructable was adapted from the DITOs project, funded by the European Union's Horizon 2020 research and innovation programme. Please visit togetherscience.eu



Spotlight: Xiamyra Daal

BioHack Academy

Interview by Ista Boszhard

In 2016 Xiamyra wrote an open application to former colleague Pieter van Boheemen, who started the BioHack Academy in 2015, after which she started as an academy assistant. Now she is a local instructor and the global and local coordinator.

What makes it special?

"It gives individuals from hackers to biologists and from chemists to designers the opportunity to do their own research and by doing so, demystify biology laboratories. There are still misconceptions when it comes to labs and research. You don't need to be a professor to do important research for example! We all have different qualities and we can all add to relevant research by doing it ourselves and sharing our results. The course makes future, interdisciplinary research possible and much more available."

What is BioHack Academy?

"A ten week course in which participants learn to design, build, use and share their own biology lab."

Who'd you recommend the academy to?

"To people that want to have a different approach to the work they are already doing or that want to have a different view on the world. During the academy we give students the tools, we plant seeds and within an open, informal and safe environment they get the chance to explore, make mistakes, formulate statements and develop projects."

Websites:
waag.org/nl/project/biohack-academy-biofactory

biohackacademy.github.io



Colophon FabLab10

Editorial Board
Lotte Kleijssen
Thijs van Himbergen
Laurie Skelton
Linda Inpijn

Photography
Jimena Gauna

Design
Thijs van Himbergen

Concept & Production
Lotte Kleijssen
Thijs van Himbergen

Authors
Marleen Stikker
Dick van Dijk
Ista Boszhard
Karen van der Moolen
Thijs van Himbergen
Jurje Ongering
Gijs Boerwinkel
Pieter van Boheemen

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**Waag Society /
FabLab Amsterdam**

Nieuwmarkt 4
1012 CR Amsterdam

Telephone: 020-5579989
Internet: www.waag.org
Email: info@waag.org
Twitter: @waag
Facebook: @waagsociety