SOME
TENTACULAR
PEDAGOGY IN
TROUBLES
ENTANGLEMENT
BOUWKEET
TOOLKIT
THE AGE OF
MAKING
WITH

Shailoh Phillips
Graduation Research Project

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Master of Education in Arts and Design 2017

# Voor de kabouters

**Colofon**

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**Epigraph**

"building fires
requires attention
to the spaces in between,
as much as to the wood.
When we are able to build
open spaces
in the same way
we have learned
to pile on the logs,
then we can come to see how
it is fuel, and absence of the fuel
together, that make fire possible."

*(Brown 2003, 89)*

## Table of content

## How to read this?

This story twists back and forth between practice and theory, expanding horizontally in both directions.

Look left for practice.
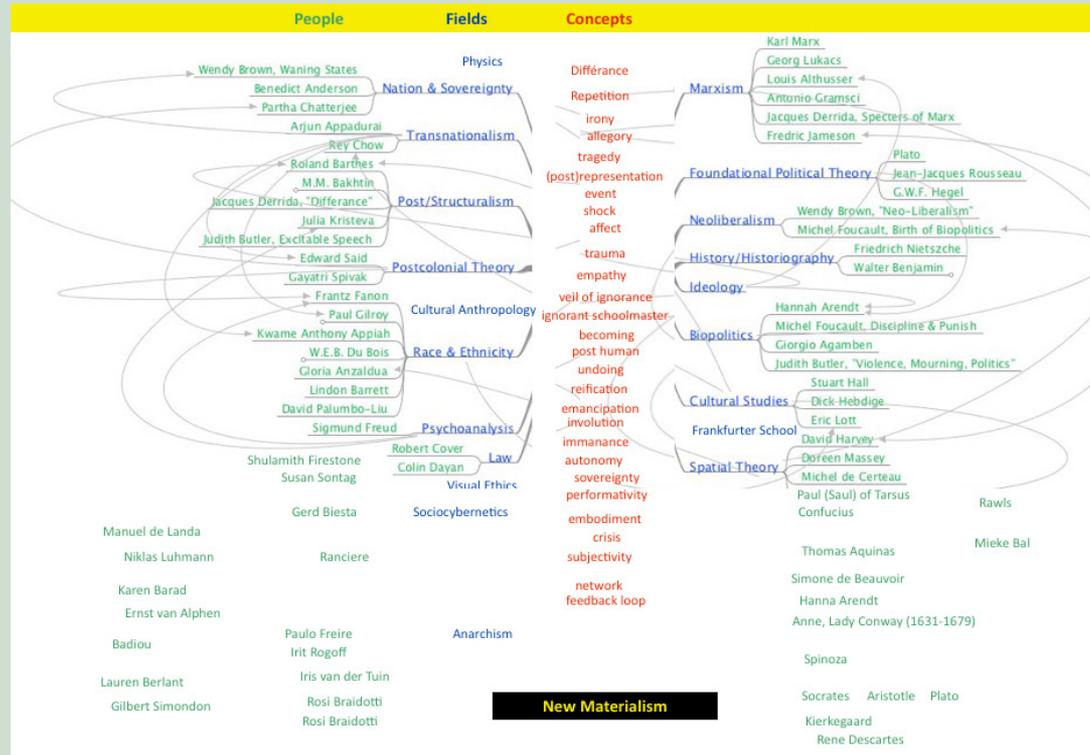More theory is hiding on the right hand side.

Here in the center, there is a story that bridges both sides, weaving together the main points and highlights.

# Theory

Here you can dig deeper into more conceptual underpinnings, philosophical concepts and questions that function on a metalevel.

**People**    **Fields**    **Concepts**

Physics

Wendy Brown, Waning States
Benedict Anderson — Nation & Sovereignty
Partha Chatterjee
Arjun Appadurai — Transnationalism
Rey Chow
Roland Barthes
M.M. Bakhtin
Jacques Derrida, "Differance" — Post/Structuralism
Julia Kristeva
Judith Butler, Excitable Speech
Edward Said
Gayatri Spivak — Postcolonial Theory
Frantz Fanon
Paul Gilroy — Cultural Anthropology
Kwame Anthony Appiah
W.E.B. Du Bois — Race & Ethnicity
Gloria Anzaldua
Lindon Barrett
David Palumbo-Liu
Sigmund Freud — Psychoanalysis
Robert Cover
Shulamith Firestone    Colin Dayan — Law
Susan Sontag    Visual Ethics

Gerd Biesta    Sociocybernetics

Manuel de Landa
Niklas Luhmann    Ranciere

Karen Barad
Ernst van Alphen

Badiou    Paulo Freire    Anarchism
    Irit Rogoff
Lauren Berlant    Iris van der Tuin
Gilbert Simondon    Rosi Braidotti
    Rosi Braidotti

**New Materialism**

Différance
Repetition
irony
allegory
tragedy
(post)representation
event
shock
affect
trauma
empathy
veil of ignorance
ignorant schoolmaster
becoming
post human
undoing
reification
emancipation
involution
immanence
autonomy
sovereignty
performativity
embodiment
crisis
subjectivity
network
feedback loop

Karl Marx
Georg Lukacs
Louis Althusser
Antonio Gramsci — Marxism
Jacques Derrida, Specters of Marx
Fredric Jameson

Plato
Foundational Political Theory — Jean-Jacques Rousseau
G.W.F. Hegel
Wendy Brown, "Neo-Liberalism"
Neoliberalism — Michel Foucault, Birth of Biopolitics
Friedrich Nietzsche
History/Historiography — Walter Benjamin
Ideology

Hannah Arendt
Michel Foucault, Discipline & Punish
Biopolitics — Giorgio Agamben
Judith Butler, "Violence, Mourning, Politics"
Stuart Hall
Cultural Studies — Dick Hebdige
Eric Lott
Frankfurter School — David Harvey
Doreen Massey
Spatial Theory — Michel de Certeau
Paul (Saul) of Tarsus    Rawls
Confucius
    Mieke Bal
Thomas Aquinas
Simone de Beauvoir
Hanna Arendt
Anne, Lady Conway (1631-1679)
Spinoza
Socrates    Aristotle    Plato
Kierkegaard
Rene Descartes

## Practice

With more concrete details drawn from my fieldwork, quotes from interviews, empirical data and situational context related to an extensive case study drawn from the microcosmos from Bouwkeet makerspace in Rotterdam.

# Making sense in times of trouble

This research project operates on multiple layers. First and foremost it is about the specific pedagogical challenges at Bouwkeet, a brand new community Makerspace for youth in Bospolder-Tussendijken in Rotterdam. Within the tremendous variety of Makerspaces popping up across the globe, Bouwkeet is quite unique as a dedicated space for learning by making. It is strategically positioned in a resource-scarce and culturally diverse neighborhood, offering impressive facilities and a custom-designed space of five well-equipped workshops with a solid concrete base, separated by glass walls. Fablab (for digital crafts), metal, wood, ceramics, and textile, each with its own bright color scheme of machines. The Makerspace is also distinctive due to the ample private funding invested, which makes it free of charge for participants and free of constant operational concerns about making ends meet. Without this gift, many participants from this neighborhood would most likely not be able to afford such activities. And from this initial investment, a chain reaction of reciprocity is sparked, as every participant is challenged to think of what they can give back to the community in terms of time and skills.

## Makerspace

So what is this talk about making? What is a Makerspace?

'Making' is one of the latest buzzwords in education. It is a highly malleable a container term that travels between different disciplines in art, design, and engineering. It is used in higher and lower education, formal and informal settings, high and low tech practices—adopting slightly different meanings as it is used in different contexts. The corresponding more narrowly defined Makerspaces (or fablabs), workshops providing digital and analog tools, are booming business, popping up in libraries, schools, and attracting private and public funding.

Let there be no mistake here: indeed, making is primarily an instrument at Bouwkeet. Of course there is plenty to be said about the dangers of instrumentalization, and I will return to this in chapter five. Not that this shift in focus makes it clear that making is not so much about what is being made, but who is being 'made' in this context. In Gerd Biesta's terms: this not only about making objects, but about subject formation. To rephrase it: the type of implicit learning going on is about helping people take responsibility for the place in the world. The makerspace is a functional operation: the input is people who have limited opportunities to 'make it' in life. And the output should be people whose opportunities have increased by learning skills, making friends, finding role models, increasing their options.

# Bouwkeet

On Saturday September 17, 2016, a large crowd gathered on the sidewalk in front of the old Post Office at Schiedamseweg 240 in Rotterdam, which had been completely reconstructed into a community Makerspace, boasting five well-equipped and impressive workshops In the middle, surrounded by a team of volunteers from the neighborhood, the mayor of Rotterdam Ahmed Aboutaleb paid tribute to his engineering background, donning a protective helmet and picking up a metal-cutting powertool.  With sparks flying everywhere, sliced open a metal ribbon, officially opening the doors of Bouwkeet Makerspace. The excitement was palpable. The presence of the mayor, the brand new facilities, the pride and curiosity of the young people—it was a festive and bustling affair. What is this new space? What can you do there? In the weeks that followed, the first block of workshops was launched, including activities, such as basic fashion design, completely refurbishing broken bicycles, tinkering with electronics.

Note that at Bouwkeet, 'making' is not an end in itself. It is not (just) about the final products or the manufacturing process. Nor does the emphasis lay on the technical skills acquired while making—although such developments are certainly welcome, just as the added benefits of language development, cultural integration and other positive side-effects. The learning goals are more about the life skills you can learn. Making is a tool.

MORE ›

‹ LESS

× 

The name already points to what you can do in this space: Bouwkeet is a compound of 'bouwen', meaning to build, and 'keet' which can either be a container (such as those used in shipping and construction), or 'keten' as a verb, which means to play. A place for playing with building, for learning how to construct things. Daniel White, the director of Bouwkeet explains it like this: "for learning sports, you need a gymnasium to practice in. In the same way, Bouwkeet is a gym—a place to practice making things. Here you can learn the skills you need for the future."

The aims are clear from the outset:

Bouwkeet is dedicated to cultivating empowerment, developing soft skills and broadening the horizons for young people (10-15) in the neighborhood of Bospolder-Tussendijken.
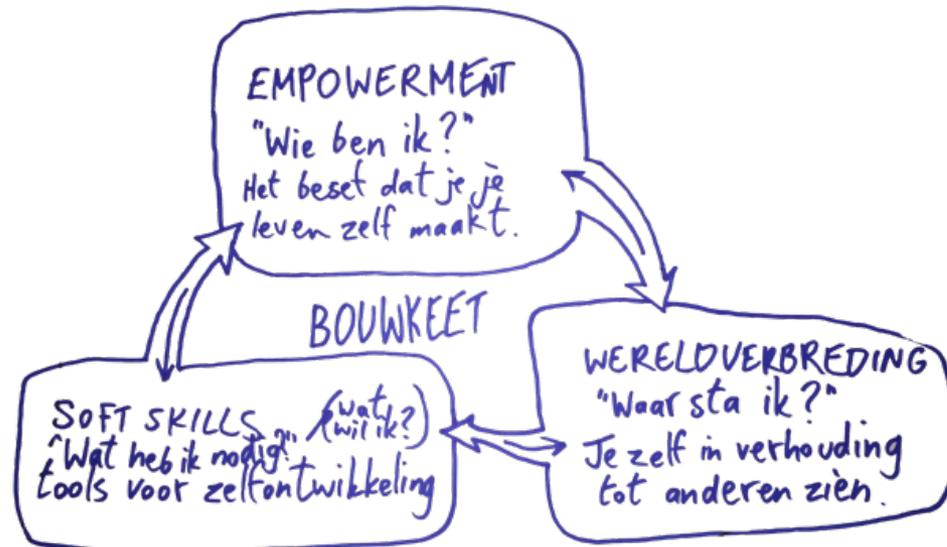
In short, creating brighter future prospects for youth in this neighborhood.
The entire organization revolves around these clear educational aims and a firm
commitment to testing if the envisioned goals are actually being reached. My work
here is not about measuring the impact—it is too early for that. This core of this
project, based on six months as an embedded researcher at Bouwkeet, is dedicated
to developing a practical toolkit and training program for the facilitators working at
Bouwkeet.

Over the past nine months since, the initial launch in the fall of 2017, this well-
equipped Makerspace has grown from offering a few initial workshops and basic
school programs, to a full-fledged and functioning Makerspace with over 25 workshops
per week in the various workshops. The makerspace is a place where people are
motivated to come, with a growing positive reputation in the neighborhood. It is also
attracting quite some attention from the municipality, and national and international
policy makers as a case study on planting a makerspace as a tool for community
empowerment.

The place is bustling with activity on an average afternoon, with full house in all the
workshops, and waiting lists for activities such as building your own computer, your
bicycle, making your own clothes, basic ceramics and woodworking. In short, the
conditions and facilities are extremely felicitous to make this work. The building is in
tip-top condition, boasting state-of-the-art machines, The kids show up and are eager
to learn. So what will they make? And how to help them develop their skills? What
conditions are needed to work towards the deeper learning goals, which principles
to structure the lessons? What incentives can you give people to carry on in face of
a set-back, for failure and frustration is inevitable in the process of making. The
internet is full of lesson plans, construction kits, instructables etc. But none of them are
tailor-made for this specific context.

## Tool

As I will argue below, the fact that there is social engineering going on is not the real issue: all education involves a degree of discipline, manipulation, of shaping people. Of course, we then need to be alert on the ethics of 'empowerment' if the direction is top-down and it becomes unclear what people are being shaped for. Is Bouwkeet a pipeline to the creative industry? Is empowerment defined as employability in the future economy? What then about the freedom of subjects? What about using the skills of making to improve the structural inequality and systems of exploitation that led to this socio-economic deprivation in the first place? Throughout this study, I will explore these questions by taking recourse to scholars such as Paulo Freire, Gerd Biesta, Ivan Illich and Paulo Blikstein in their work on emancipatory pedagogy. More on this in chapter four.

# Workshops

An important not here is that many of the facilitators have no prior pedagogical training whatsoever. This is not actually a disadvantage, I would say, it is also an opportunity. If you have been teaching in the traditional school system for many years, you can fall into a rut, into habits that will probably get in the way of a constructionist way of teaching. Indeed, Bouwkeet is a place for hands-on education, but it operates quite differently than, say, a school. The facilitators are careful not to call themselves 'teachers' and the participants are not 'students', although the kids often default to addressing all grown-ups in the go-to teacher terms of 'juf' and 'meester'.

In theory, the lessons are grounded on an different pedagogical model than traditional schooling. The basis for this kind of learning is not as new as the facilities and the trend of Makerspaces. In fact, there is a very strong international legacy of educators working in the constructionist tradition. In practice, it is easy to lose sight of the underlying educational goals and to figure out what it means for the next lesson.

The first layer of this research project, as I have described it so far, is all about mapping the troubles in the microcosm at Bouwkeet. Based on meticulous fieldwork observations, comparative literature reviews, and testing in practice, I have set out to find some evidence-based didactic tools that can bolster the pedagogical vision and give some practical pointers help align the momentum of this high-potential project with its long-term goals. This part of the research is completely at the service of Bouwkeet, aimed at helping the facilitators in empowering the young people of BoTu.

This analysis is rooted in what Irit Rogoff calls "criticality" (as opposed to fault-finding and analytical "critique" and "criticism"). Criticality means staying with the trouble, inhabiting it. My aim is to make this field stronger: to fortify it, not to tear it down. To align the words and actions in such a way that make space for emancipation, and defend from oppression and exploitation.

## Learning how to educate

How do you empower people, teach them soft skills, such as perseverance, creativity, problem-solving, collaboration, entrepreneurship? How do you expand their horizons? Not in theory, by rote, nor on demand; these are not things you cannot learn second hand, not from YouTube, nor from a book. Such deep-level attitudes and habits are things you can only cultivate by doing. Another word for this is conditioning behavior. The point being, empowerment is thought to be something that emerges from practical hands-on experience. Organizing the conditions for this to happen not an easy task. It requires learning, failing, practicing, taking risks and setting limits. It requires a different kind of pedagogy from what most of us are familiar with from our own upbringing and experience in the current educational system.

It is about connecting this specific instance to broader issues about the maker movement in education, specifically related to the question what potential and risks are at play in developing Makerspaces as a tool for emancipating empowering people. My task has been to construct a web between theory and practice, map and territory, percepts and concept, empirical and analytical knowledge, seen and unseen, becoming and undoing, deconstructing and contructing, analysis and synthesis, grounding and speculation. I am entertaining these lines of tension in order to orchestrate a fruitful interaction between the specific needs at Bouwkeet and the general issues in societies across the globe concerning education. I am convinced that scaling, zooming in and out is a difficult and necessary endeavor in order to understand what is going on and to decide how to act within this context. I do hope that this negotiation will provide a fertile juxtaposition that offers some insights that are practically useful in the context of Bouwkeet as well as conceptually challenging in a broader discourse on the developments the maker movement.

Zooming out from the microcosm and specific challenges at Bouwkeet, I position this educational project in the context of a critical analysis of some fundamental problems at play in the maker movement at large.

Indeed, the other two branches of this research project operate on a different scale, mapping a wider set of troubles at play in maker education, by unpacking some of the assumptions in 'making' as a concept, analyzing this from an ethical and pedagogical point of view. After looking at what people are doing at Bouwkeet, I step back again and engage with what people say they are doing.

On this transversal journey, I have two companion creatures to think with: an octopus and a gnome. The first one is not only has fascinating decentralized nervous system—it has multiple brains and can think with its tentacles—it is a shapeshifter, an escape artist a creature so flexible it can fit itself through the tiniest openings.

The Gnomes in this story live at Bouwkeet. It is what the staff at the makerspace call each other as a half-joke when someone secretly helps the teenage participants by making things for them or helping to do things they are not willing or able to do (in terms of time or difficulty) before.

## Octopus

As the sheer complexity of the issues unfolds, with tentacles reaching into multiple dimensions, we will be looking to the figure of the octopus. It can help us to understand what it entails to teach processes of 'making' in a decentralized way. It can also help us identify the double nature of tools. This is a move towards tentacular pedagogy, looking at what it means to facilitate learning in the age of entanglement. For wherever there are tools, they can be used to build something, or to break them down, to create or destroy—and often both at the same time.



Serving as a warning figure, the Octopus of this is a patch worn by the US Air force maintenance group. Source:

http://www.militaryitems.com/store/images/vpictures/file1/maintenance-ocopus-patch.jpg

# Gnome

The figure of the gnome helps us to understand the hidden mechanisms at work in technology education, to become aware of the quiet forces shaping and helping us. As Paulo Blikstein (one of the key figures in the US-based maker movement) describes the learning benefit of digital fabrication as it 'eliminates manual dexterity as the "middleman" in transforming an idea into a product, so students can focus their attention on improving the design rather than taking care of mundane issues with the materials. (…) the fact that the products generated in the laser cutter and the 3D printer were aesthetically pleasing had a strong impact in students' self-esteem—instead of taking home asymmetric and fragile cardboard prototypes, they were building functional 3D objects with a near-professional finish—it wasn't 'school stuff,' it was the 'real thing.' (Blikstein 2013, 7)

But whether it is a machine or a person helping you, these gnomes of covert assistance are everywhere in maker education. One of the challenges is to employ them in such a way that participants are aware of what is happening and able to find the help when they need it, and choose to shoo away the gnomes and DIY when they want to gain a deeper understanding of how things work. The temptation of the omnipresence of gnomes is that kids will take shortcuts and will not learn to be able to deal with the frustration when there are no gnomes in sight.



Sam Tufnell Gnomes

One of the founders of Maker Education, Seymore Papert, pointed out that if a teacher from 500 years could time-travel into a contemporary classroom, they could take over the class in no time: the basic configuration of a school has not changed in centuries (Blikstein 2013, 1). However, if a factory worker, inventor or craftsman from 100 years ago were to make this trip, and step out into a Makerspace, they would also recognize some elements and perhaps mistake a Makerspace for a little sweatshop or factory (Flusser 1999, 43).

Part of zooming out is putting maker education into historical perspective to understand what is new and what is not. What is new in 'making' compared to the much older traditions of craft? First of all, such a broad container term already says it: making could be (almost) anything. And here's where the trouble starts: with such a fuzzy term as 'making', one that can be stretched to include whatsoever, what are we actually talking about?

# What troubles?

What's the trouble with 'making'? In a world flooded with prefab mass-produced stuff, where so many people escape into the bubbles of online social networks through tiny shiny screens, the return to the messy materiality of DIY—even better, Doing It Together—is a welcome phenomenon. The 'maker movement' celebrates all things handmade, one-off, tinkered toys, the burn marks of a laser and the telltale ridges of a 3D print. As long as there is a personal touch and it did not roll off the conveyor belt of a factory, you can say "I made something".

## (Almost) anything

If Friedrich Fröbel, Maria Montessori or John Dewey were the ones beaming in from the previous century, it is quite likely that they would also understand perfectly well what is going on in a Makerspace—some new equipment, but the constructivist principle of learning by making concrete objects is the same way. For Makerspaces in terms of learning spaces stand in a much longer tradition.
We need to ask ourselves an honest question: is maker education a revolution, or another phase of capitalism? It is very hard to get a grip on this, because making and Makerspaces are popping up everywhere, each with their own particular niche. The irony is, with such a broad and eclectic umbrella term, including so many divergent practices, it becomes impossible to make general statements.

What happened here is not that the fields of science, technology, engineering, arts and mathematics have actually merged into a lump of STEAM. The term 'making' can be seen as a performative call for such interdisciplinary collaboration. It is a new flag under which anyone can unite and convene. Let there be no mistake: I am all for the shift away from mass-capitalism and bringing the tools to ordinary people. This can be incredibly empowering. And even necessary for developing survival skills in a future economy that is more locally produced. I too come from a solid tradition of tinkering, building, of learning by doing. But what if all this making is just a pipeline to the creative industry, creating flex workers for the future?

If you are a hacker or part of the emergent critical making turn, you might already have some preconceptions about the troubles at play. Institutionalized (private) Makerspaces are met with suspicion as start-up incubators who have copped into capitalism; Makerspaces as a pipeline as the creative industry will never live up to the ideals of the grassroots movement of open knowledge networks.

There is never anyone doing anything, there is always someone doing something, somewhere. There is a certain knowhow, the tricks of the trade, that can only be gained in the process of making. In making we become intimately familiar with the qualities, affordances and constraints of the material and digital world, the critique of our peers and the rule of law—the interchangability of bits and atoms, the resistance of the sewing machine, the sensitivity of sensors, the market forces, personality clashes and the vulnerability of other living beings. In making you become aware of the inability to be in full control, and at the same time, find out which buttons you can push.
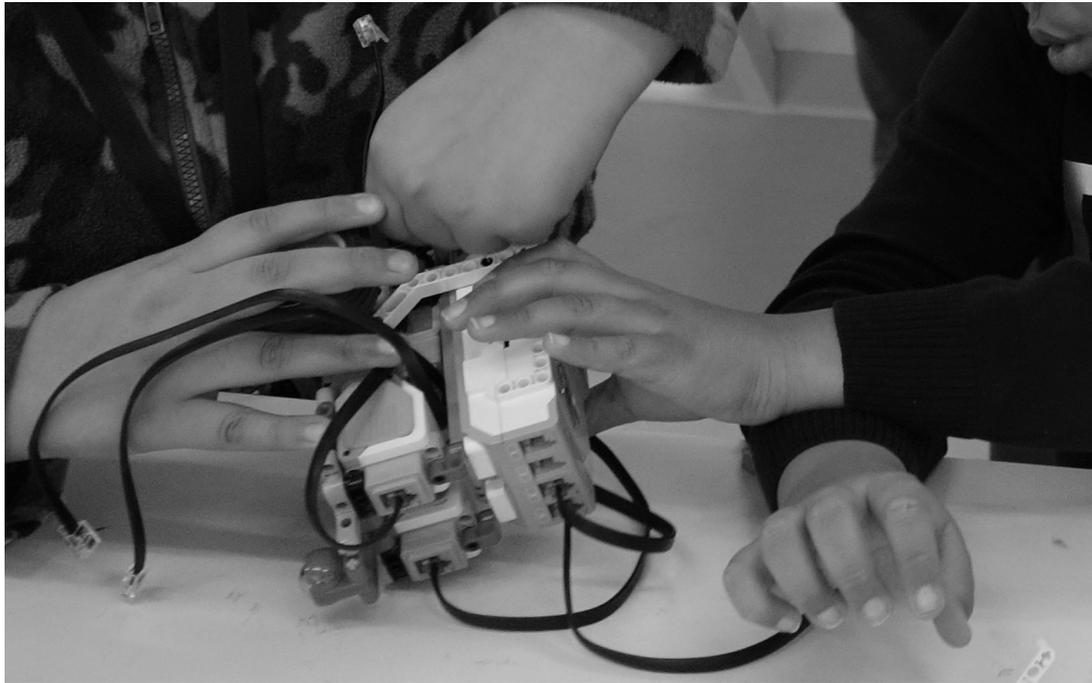
## Buttons you can push

Steve Jobs is well known for his deep-seated fear of buttons (koumpounophobia). And yet as a teenager, he was navigating the world to see where you can press it to make change. This is the embodiment of the maker mentality, even before such a term was coined.

"That's a very limited life. Life can be much broader once you discover one simple fact, and that is – everything around you that you call life, was made up by people that were no smarter than you. And you can change it, you can influence it, you can build your own things that other people can use.
The minute that you understand that you can poke life and actually something will, you know if you push in, something will pop out the other side, that you can change it, you can mold it. That's maybe the most important thing. It's to shake off this erroneous notion that life is there and you're just gonna live in it, versus embrace it, change it, improve it, make your mark upon it.

I think that's very important and however you learn that, once you learn it, you'll want to change life and make it better, cause it's kind of messed up, in a lot of ways. Once you learn that, you'll never be the same again."

*"One Last Thing" documentary, 2011.*
*https://www.youtube.com/watch?v=0Ydp6bR5HXw*

Last stop before we move on to the next chapters. We need to talk a bit more about tools. One of the main points of this thesis is that maker education tends to operate with quite a flat conception of tools and technology. In Chapter Three, I will explore this in greater deal. But for now I would like to point out the simple fact that tools work in multiple directions. As Marschall McLuhan put it "we shape our tools, and then our tools shape us".

We make things. And things make us. This goes both for the tools, that shape us as we use them, and for the final objects, that also by virtue of their material qualities shape our behavior. In design, form may follow function. But in the use of objects, in our confrontation with the material world, functionality is shaped by form. This principle can be formulated in different ways. We can call it the force function of design, material hegemony, the third teacher. All these things are aspects of the same dyanamic: we are born into a given world, and the shape of this world determines how we can navigate through it. We can however influence it to a certain degree – in what we wear and eat, in the interior of our homes, in the assignments at school. In this sense, everyone is a maker: we make a life, somehow, with whatever is available to us. And in turn, the things we make shape us and shape those around us. To understand the learning going on in a makerspace, with so many tools an technologies at hand, it is important to be aware of the nature of tools as teachers and teachers as tools.

## Tools

Digging deeper into tool theory is a fascinating wormhole that almost always ends up pointing to Heidegger's writing on technology, tools and equipment at some point. Heidegger's took the hammer as a starting point to explore how we can deal with tools in two different ways: If we pick it up and use it, it becomes 'ready-to-hand'. Assuming if we know how to use it, of course. In the second case, tools are 'present-at-hand', if we look at them from a distance we are simply confronted with a conglomeration of inert matter. For zero level makers, tools are mostly 'present' and the intimacy gained by making is that they become accessible as ready-mades.

## Humans and Technology

**Basic Information**

| Relationship Status | It's complicated |
|---|---|

The plot thickens in turning to philosophers working with tools in terms of relations between objects, such as Graham Harman, Vilem Flusser. Going more radical, New Materialist concepts of matter, especially in Manuel DeLanda's work, upset conventional distinctions between matter and life, inorganic and organic, passive object and active subject. In Karen Barad's "agential realism", material agency does not privilege the human, just as for Jane Bennett, "thing power" emphasizes the shared material basis and the  kinship of all things, regardless of their status—human, animal, vegetable, or mineral. Open the toolbox far enough, and the entire house of anthropos comes tumbling down.

## Tools

Bouwkeet offers facilities to make all kinds of 3D objects (not 2D). It is not framed as a place of arts and culture, of design and crafts – but as a workshop for 'technique'. Importantly, it is not a school with grades or teachers. Nevertheless, it certainly is a place of learning. A lot of the strategic choices, we see, is based on not overlapping what other people are already doing, instead, collaborating with people who have a certain expertise. For example, in Rotterdam there is already an organization involved with digital technology (animation, film, etc), there is already the SKVR offering a wide range of arts and design courses (in school and free time). There are plenty of other Makerspaces that offer courses for adults and semi-professionals. So Bouwkeet offers none of these things. Looking at the 'making of' Bouwkeet, one of the strong points is that it is not a copy-paste version of Makerspaces in other places. It is really tailor-made for this particular context.

MORE ›

Placing Bouwkeet in BoTu, was a conscious decision on the part of the philanthropist foundation funding it. The question motivating this move is broader than this the success of this project. Inspired by the makerspace movement and socially engaged Makerspaces in the USA, they wondered: can a Makerspace be a tool for improving the conditions for young people growing up in a resource-scarce environment? In the coming years, there will be a scientific study to measure the impact in the neighborhood.

After the initial start-up phase, Bouwkeet will commission an impact analysis to further measure the effect of the makerspace in the neighborhood. Interesting to note is that the project managers from the funding and the management of Bouwkeet already are aware that the impact of the makerspace will likely be quite larger than the stipulated learning aims (empowerment, soft skills, broadening horizons), and will perhaps include things such as social cohesion, developing language skills, cultural integration, democratic citizenship, emancipation of women, as well as technical literacy. This last item is quite a striking omission in the the learning goals. Although bouwkeet is a makerspace, indeed, the main aim is not to develop technical competence (hard skills), such as woodworking, programming etc. Engaging in these types of activities are an instrument for 'deep learning', going a level deeper to develop life skills that transfer into other domains. The supplementary positive spillover effects are bycatch: welcomed, but not the target of the policies.

# Scaling the scope

"In theory there is no difference between theory and practice. In practice there is."

*Exact origins unknown. Quote attributed to Yogi Berra, Einstein, Jan L. A. van de Snepscheut*



We are small.
It is big.
We are big
it is small.

Aha, the problem is one of

## scale.

In order to map, I must learn scalability.
In order to act, I need to learn how to zoom.
In order to act effectively, we must find collective zoom, to upscale and downscale.

The three levels of this research project are inextricably entangled. Nevertheless, they each approach the issues at hand from a different angle, operating with their own particular set of questions. The practical layer focuses on the needs and requirements in the particular situation of Bouwkeet – working with the challenges of 'zero to maker', that is, crafting a toolkit for technology education that is suitable to the 10-15 year olds in the BoTu neighborhood in Rotterdam. This is about matching the current activities with the particular learning goals, as formulated in the policy documents. The result of this is a pedagogical toolkit and a teacher training program. The main story (in the middle) asks some basic questions about the assumptions in maker culture, searching for a pedagogical position in this field, based on a critical understanding of tools and technology. All this takes place in juxtaposition to a more profound philosophical and meta-level exploration in which I turn to critical theories of tools and technology, and the dynamics of wicked problems that serve as a contextual backdrop to the other two levels.

What kind of pedagogy will support people in the slow and complicated work of facing the troubles of technology in society? What kind of pedagogy will shape subjects who are willing and able to take responsibility for living together (people, critters, robots, machines) in the future? In the chapters that follow, I hope to provide a basic framework and position in the context of this emerging field. This study is will never be complete, and yet I hope is that it will provide fertile grounds for future-crafting with the momentum in this complex field called maker education.

## The risk of meta-level

The potential of such a multi-layered cartographic approach is not without risk. The scope of this research is extremely broad and allows for mapping the issues from practice and theory into each other's territory and language. This also has a structural shortcoming regarding the depth and completeness of each layer. Each level is full of rabbit trails and worm holes, and could be infinitely expanded and deepened. Despite the risk of overstretching, this scope is a deliberate choice as I see that many of the challenges that arise in the microlevel cannot ever be solved there. Despite the best intentions of Makerspaces, the solutionist attempts to tackle technology in the microlevel so are not only futile, I will argue, they are counterproductive, as a naive stance on technology is prone to aggravate the wicked problems we are facing. The troubles are here to stay, and what we need is both the continuous effort of critical analysis and a pragmatic approach in finding and creating the space to operate to keep 'making' aligned with a value system of ecological awareness, community empowerment, radical equality.
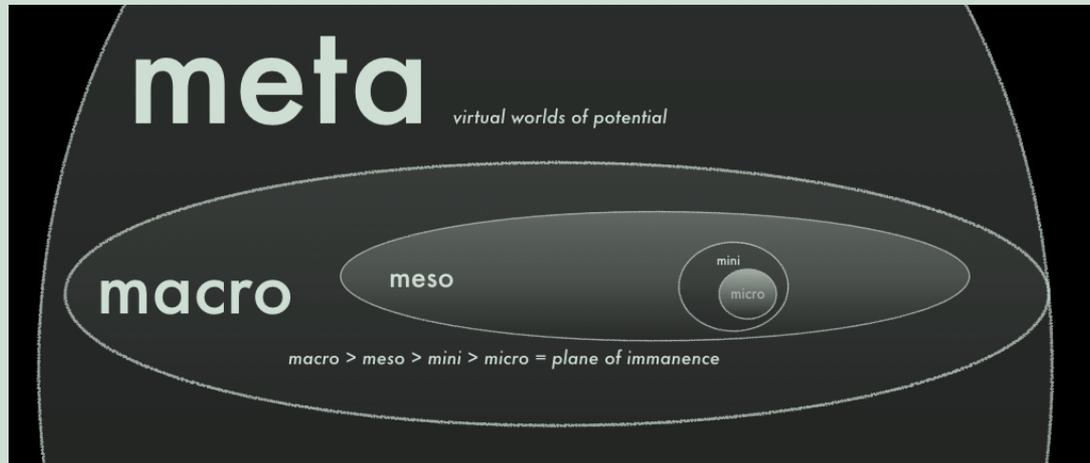
## Position

Before proceeding, a few notes on my position and a brief take on the trajectory that got me here in the middle of things. At Bouwkeet, I am an independent researcher and a freelance facilitator. Over the months of this fieldwork, I have become a part of the team. This gives me an insider-outsider position. When people ask me what I do or what I have studied, the answers can be rather long-winded. The short version is that I work along the cracks between theory and practice. I am an educator, an artist, a researcher and an activist.

"A theorist is one who has been undone by theory"

Rogoff writes in the introduction to her article on criticality. This puts words to my position, which is not the stability of certainty, but rather perpetual curiosity and a commitment to 'stay with the trouble' (Haraway). I am twice undone: by theory and by practice, again and again.  What is left is something in-between—this is the space in which I operate.



My prior training includes cultural anthropology (where I learned the difference between what people say and what they do), physics (where I gained a deep respect for matter), philosophy (where I learned so much from what other people have written), cultural analysis (where I learned to entertain conversations between concepts and objects) and digital media design (where I learned how to make circuits and buttons). From

this academic journey, I learned the skills of analytical thinking and became well-versed in a wide range of theoretical debates. In 2007, I left to found Studio Babel, an interdisciplinary collective, because I realized that the last thing I wanted to do all my life is produce words about the world. To quote Benjamin, quoting Goethe:

> "there is a delicate form of the empirical which identifies itself so intimately with its object that it thereby becomes theory"
>
> *(Benjamin, quoting Goethe 1972, 22).*

From there I have developed a practice of teaching and researching to complement my own artistic work.

I don't study theory from an armchair, I want to get my hands dirty and to learn how to speak the language of machines. To think, to act, to interact. Over the past 10 years, I have been building my practice in theory and my theory in practice. Saying that I am an artist allows me to work with the material world with radical openness, although the things I make are never gallery-based and not for sale. I use visual, material, poetic and messy methods to work through things and experiment with interacting with others in new ways.

The reason I have turned to tentacular pedagogy in the end, is that I am not satisfied with making and thinking; to have an impact on the future of this world, we need to make systemic changes. The resources need for this are already there. We need become fluent in making and breaking connections.

## 1. Educational project: developing a pedagogical toolkit for Bouwkeet
(zoom level: micro)

**FIELDWORK**

How can Bouwkeet create the optimal conditions for young people (age 10-15) to engage in 'learning by making', focused on developing empowerment, soft skills and broadening their horizons'?

# 1. Educational project: developing a pedagogical toolkit for Bouwkeet

(zoom level: micro)

Subquestions:

→ Who are these young people (10-15) that are participating at Bouwkeet? What is their staring position and skill level in the domains of the learning goals? What challenges and opportunities do they bring with them, that are specific to the context in which Bouwkeet operates?

→ What do people say that they are doing in the policy documents and inverviews with staff? What is the current methodology at Bouwkeet? What are the definitions of the learning goals? What assumptions are imbued in these terms? Which mechanisms are employed.

→ What is actually going on during the current programs being offered to young people? What are the mechanisms, activities and pedagogical and didactical tools being used? And how is this working out so far? What troubles (challenges and shortcomings) arise in practice? What tools (opportunities and openings) have the facilitators already found through trial and error? What else is needed?

→ What tips and pedagogical tools can be found in similar case studies and literature on facilitating deep learning processes with young people through maker education?

## 2. Tentacular pedagogy: acting between practice and theory

(zoom level: scaling micro <> meso <> macro)

Main question: What is the pedagogical task for 'maker educators' and what tools are available to support this?

## 2. Tentacular pedagogy: acting between practice and theory

(zoom level: scaling micro <> meso <> macro)

This is a normative question: what should educators be doing in this context? How and why, with what perspective?

Subquestions:

→  What are the opportunities and potential shortcomings of education in the 'maker movement'? What roles and responsibilities do educators have to face these troubles and guide the next generation in technology education? What questions should we be asking in maker education?

→  How can an educator relate to the systemic 'wicked problems' that operate on a global level (i.e. technology, ecological and economic crisis) in the microlevel of maker education?

→  How can we fruitfully connect the troubles of the microlevel and the macrolevel in such a way that it becomes clear how and why an educator can act in relation to the nitty-gritty of pedagogical situations? How can you tell if your teaching is actually empowering?

### 3. A critical inquiry into the tools for making in relation to the wicked problems of technology

(zoom level: meta)

If making is a solution, what were the problems in the first place?
Is making an adequate response to these problems?

### 3. A critical inquiry into the tools for making in relation to the wicked problems of technology
(zoom level: meta)

Subquestions:

→      What do we mean with 'making'? How is the concept used? Why did it emerge, in what context? How does it relate to other concepts (such as design, arts, tinkering, engineering, technology). A very brief geneology of the concept.

→      What is the scope of the field (what are the different sub-genres and subversions of 'making')

→      What are some of the systemic troubles operating on a global level regarding technology and education (the wicked problems)? How do these relate to 'making' and 'makeability'.

→      What are alternative grounds to position making and maker education in a way that is better equipped to faces the troubles of our times?

# The research trajectory 2016-2017

| | Sept. Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | Jun. |
|---|---|---|---|---|---|---|---|---|---|
| 0: preparation | ■ | ■ | | | | | | | |
| 1. Cultivating empathy | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 2. Mapping the context | | | | ■ | ■ | ■ | ■ | ■ | ■ |
| 3. Analyzing the troubles | | | | ■ | ■ | ■ | ■ | ■ | ■ |
| 4. Searching for suitable tools | | | | | | ■ | ■ | ■ | |
| 5. Toolkit design | | | | | | ■ | ■ | ■ | ■ |
| 6. Testing and feedback | | | | | | ■ | ■ | ■ | ■ |

**The research trajectory 2016-2017**

0. Preparation and planning
→       Designing the research methods and questions
→       Gaining access to the makerspace microcosmos
→       Preliminary literature review
→       Preliminary scan of the micro/meso/macro context

2. Mapping the context
→       Literature review: maker education, tool theory, philosophy of making,
        constructionist  pedagogy, learning theories, case studies
→       Discourse analysis: what people say about making / maker education
        (in general and at Bouwkeet)
→       Developing mapping tools to position making (see makerspace strategic map)
→       Developing conceptual toolbox / lexicon (setting the terms)
→       Critical positioning and theoretical framework
→       Scaling the context (BoTu > Rotterdam > Netherlands > Europe > Global)

3. Analyzing the troubles and opportunities (November-June)
→       Analysis of the practical challenges (based on fieldwork of fase 1)
→       Evaluation of current model at Bouwkeet (what works, what is lacking)
→       System analysis of problems (micro/meso/macro)
→       Formulating the core troubles and mapping their interlinkage
→       Questioning the troubles from practice to theory and back again
        (What is the root of the problems? Where can you act and put pressure?)

# The research trajectory 2016-2017

**1. Cultivating empathy in the microlevel**
→ Inventory of current models, concepts, policy, programs at Bouwkeet
→ Observation of current activities (filming, documentation) of 15 workshops
→ User journey: empathy mapping with participants (see empathy map)
→ Participatory observation: what are people doing in the workshops?
→ Interviews with 15 participants (age 10-15)
→ Interviews with 4 staff, 10 volunteers and 2 stakeholders

**4. Searching for suitable tools (March-May)**
→ Observing in practice again to see how people face or avoid the troubles
   at Bouwkeet (sourcing existing tools)
→ Creative sessions with participants and stakeholders (input from basic
   pedagogical training)
→ Gleaning literature and other case studies for useful tools
→ Analyzing the policy documents to align the tools with the aims

**5. Toolkit design and prototyping fase (April-May)**
→ Developing a toolkit for understanding and 'staying with the troubles'
   at Bouwkeet
→ Making it visual, divergent, playful, layered
→ Refining pedagogical vision and models
→ Developing teacher training program (May-June)
→ Making it visible and tangible (for communication)

**6. Testing and feedback (February-June)**
→ Presentation, feedback, refining the models
→ Feedback from stakeholders

# WHAT PEOPLE SAY ≠ WHAT PEOPLE DO

Underlying the design of this research is the simple assumption that there is often a significant difference between what people do and what they say. I am most interested in what they do, because this is the level at which we can act.

By using different tools and constant juxtaposition of methods, I hope to provide insights that, although are not objective, will ring true with the lived reality of the situation and help find a way forward in facing the troubles at hand.

## Rhetoric in action

Central to this research project is always looking at two things: what people say, and what they do. Which is most often quite different from each other. This is my contribution in terms of an anthropological analysis, looking at rhetoric and action. This is relevant in because the pedagogical toolkit I have co-created with the other facilitators is something I want to tailor in such a way that it has a direct impact not on the level of policy (rhetoric), but on the level of how the facilitators act on the microlevel. In other words, it is not something theoretical, but practical.

Which is not to say that language is not important. It is, both performatively (shaping reality) and descriptively. However, this gap between language and action is not specific to my study, it is perhaps a trait of humanity at large— although the width of the fissure can vary, the phenomenon is ubiquitous. No matter how much integrity or sincerity is at play, human beings have a persistent automatic pilot of habits that often go unsaid or are labeled according to desirable behavior. Because the intervention in the toolkit I am offering is meant to operate on the level of action, I focus here on the tension between the said and the done, speech and action.

In closing, some methodological concerns that informs the design of this research. First of all, perhaps informed by my initial training as an anthropologist, I am my own most important research instrument.  The lived experience of the material surroundings in Bouwkeet, the body language of participants, the group dynamics, the moments of tension and hours of making things with people, the small talk and the things that go unsaid—this soft and qualitative data has been just as important for this research project as the answers I received in the interviews. Of course, this means that the data is somewhat skewed towards my personal interests and limitations.

# Mapping makerspace education

"The most critical question which a philosophical analysis of social ontology must answer is the linkage between the micro and the macro (…) [A]n answer to the question of their mutual relations basically determines the kinds of social entities whose existence one is committed to believe."
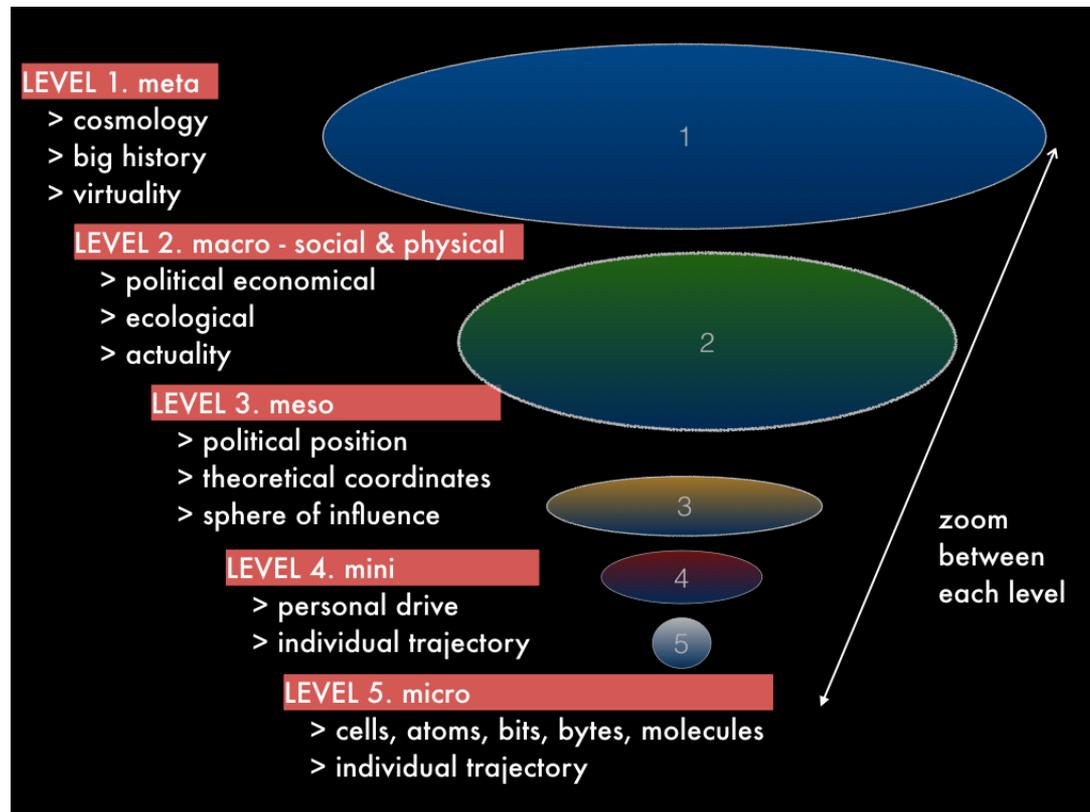
*Fuglsang (2006, 239)*

## Where are we?

I will situate Bouwkeet within two contexts: the physical environment of BoTu, Rotterdam and the Netherlands. I will take a closer look at who is coming to this makerspace and the local and national context in which this particular project is embedded. The questions being addressed are: why here, why now, what else is there, who is there? Secondly, I will map the discourse around maker education by looking at the policy of Bouwkeet in relation to the wider discourse and recourses in Maker education.

What are the current conditions under which participants at Bouwkeet are engaging in 'maker education'? Important for this analysis is looking at the makerspace both within the local and the global context. What are the dynamics at play? How do issues on the different levels scale back and forth and feed into each other? I will respond to this question on three levels: 1) in the microlevel, looking at the tools, the activities the pedagogical framework and context of Bouwkeet 2) analyzing the rhetoric of Makerspaces 3) position both of these in the macroscale of the global dynamics of the 'wicked problems' of technology in education.



LEVEL 1. meta
> cosmology
> big history
> virtuality

LEVEL 2. macro - social & physical
> political economical
> ecological
> actuality

LEVEL 3. meso
> political position
> theoretical coordinates
> sphere of influence

LEVEL 4. mini
> personal drive
> individual trajectory

LEVEL 5. micro
> cells, atoms, bits, bytes, molecules
> individual trajectory

zoom between each level

## Macroscale in the anthropocene

It might sound quite absurd to position the microcosmos of Bouwkeet against the macrocosmos of these complex systemic issues: unsustainable use of resources, network dynamics etc. Of course, no learning space is capable of 'solving' these problems. The very nature of wicked problems defies the idea of pat solutions. The reason that I mention this as the context is that these major global problems manifest themselves in the microcosmos of neighborhoods, schools and Makerspaces in concrete ways, creating troubles.

These huge problems of machines and network dynamics are a given, these are forces that our out of control by any individual human being. It is completely futile to try and combat them at a microlevel. What however is useful, is to identify them as forces at play, as they do manifest themselves on a microlevel. In fact, they manifest themselves in a different way in every microsituation. And seing as there is no global tower from which to observe them other than in the messy human scale, it requires imagination, metaphors, speculation and analytical power to bear these forces in mind. These are things we cannot change or influence, but we must also take care they do not distract us from the areas where we do actually have room to act, to make an impact. This thesis is all about identifying this radius of action.

FIELDWORK

## Microlevel: Bouwkeet

I will start in the middle of things, which is the microlevel grounding this research project. The profile of Bouwkeet is very specific: it is targeted at youth age 10-15 in one of the least affluent neighborhoods of Rotterdam. This makerspace is unique in many ways, because it is a social intervention, with the ambition to transition to being a bottom-up community-lead platform for the inhabitants of the Bospolder-Tussendijken neighborhood.



| GLOBAL | LOCAL | MAKERSPACE | LEARNING COMMUNITY |
|---|---|---|---|
| Network dynamics, (post)industrial capitalism, migration, technology innovation, transportation of goods, multinational corporations. | Neighborhood facilities, roads, buildings,neighbors, parks, urban space. | A situated space, a building, specific and concrete. | The people, both individual and in collective assemblages. |

First, a few things about the area where it is located. The demographics of the neighborhood characteristics related to youth show: 1) high level of people with a migrant background and 2) high levels of economic poverty and unemployment 3) the families with children are often large families with many siblings 4) there is an above average level of youth criminality 5) this is a resource-scarce neighborhood, with few (free) activities for young people to engage in outside of school. What does this look like in practice? And how does this show up in the context of the makerspace?

# Mapping the neighborhood

On paper, it is one of the worst places to grow up in the Netherlands. It is labeled a 'problem neighborhood', with high levels of criminality and hig unemployment. In reality, walking through the streets of BoTu, you see a vibrant neighborhood of people, shops, schools, parks, as bustling market.



The neighborhood was bombed to smithereens in 1944 (accidentally, by the allied forces), and completely rebuilt. In this area, migrants are by far the majority of the population. With about 20% minority of people with roots in the country that go back beyond two or three generations. The neighborhood is a multicultural hustle and bustle. The demographics and economic conditions of the neighborhood are reflected in the kids who come to the makerspace, a superdiverse mix of different backgrounds and a minority of white kids.

The Netherlands still being a social welfare state, the basics needs of children growing up in this area are covered: housing, health care, school, food. And that is it. Families do not have much budget for extracurricular activities, holidays, or unnecessary gadgets.

| TUSSENDIJKEN | BOSPOLDER | ROTTERDAM |
|---|---|---|
| 7.132 bewoners | 7.255 bewoners | 616.319 bewoners |
| 80% allochtoon | 80% allochtoon | 49% allochtoon |
| 52% één persoonshuishoudens | 46% één persoonshuishoudens | 48%éénpersoonshuishoudens |
| 19.294 bewoners per km2 | 20.200 bewoners per km2 | 2.952 bewoners per km2 |
| 18% 0 – 14 jaar | 20% 0 – 14 jaar | 17% 0 – 14 jaar |
| 70% 15 – 64 jaar | 72% 15 – 64 jaar | 69% 15 – 64 jaar |
| 12% 65+ | 8% 65+ | 15% 65+ |
| 20% autochtoon | 20% autochtoon | 51% autochtoon |
| 19% Turken | 22% Turken | 6% Turken |
| 18% Marokkanen | 17% Marokkanen | 5% Marokkanen |
| 11% Surinamers | 12% Surinamers | 9% Surinamers |
| 4% Antilliaans | 3% Antilliaans | 4% Antilliaans |
| 9% Overig westers | 7% Overig westers | 12% Overig westers |
| 65% sociale huurwoningen | 66% sociale huurwoningen | 46% sociale huurwoningen |
| 23% particuliere huurwoningen | 17% particuliere huurwoningen | 19% particuliere huurwoningen |
| 11% koopwoningen | 17% koopwoningen | 35% koopwoningen |
| 1% eengezinswoningen | 7% eengezinswoningen | 24% eengezinswoningen |
| 35% lange woonduur | 39% lange woonduur | 38% lange woonduur |
| 17% mobiliteit | 14% mobiliteit | 14% mobiliteit |
| 51% WOZ-waarde laag | 37% WOZ-waarde laag | 20% WOZ-waarde laag |
| 73% lage inkomens | 66% lage inkomens | 51% lage inkomens |
| 18% uitkeringsontvangers | 16% uitkeringsontvangers | 9% uitkeringsontvangers |

Based on the local context, a design choice in the policy at Bouwkeet is to focus on making practical and functional things, assuming that people with little money will want to make useful things. The assumption is that under conditions of scarcity, the priority will shift to utilitarianism. But is this the case?

What I found in practice does not point in this direction. In fact, many of the things I see kids making (when they have the freedom to decide for themselves) are quite whimsical, playful, more focused on having fun and increasing social status than being particularly useful. The current rage, for example, is to 3D print fidget spinners. The dangers of trivialization in 'zero level' making are also addressed by Blikstein in what he calls the 'keychain syndrome'. When people find out how to make some-thing they like, the next thing the often want to make is more of the same.

## Keychain syndrome

On a macro level, you see this in maker culture in general. The spirit of open design and open source is born out of idealism. But it is also born out of relative economic favorable conditions. It is a luxury to live in abundance, to know that you can give away all your ideas because they will get better. If you only have one idea and you have no idea what other ones are out there, you will cling onto yours for dear life.

The idea of free knowledge exchange is so simple, based on an idea of information as endlessly reproducable. "If you have an apple and I have an apple and we trade, we both have an apple. But If you have an idea and I have an idea, we both have two ideas." (attributed to George Bernard Shaw).



Paulo Blikstein reports on the dangers of trivialization when his digitql fqbrication class became a keychain factory:

"It offered too big reward for a relatively small effort; to produce an object that did not include any computation or complex constructive challenges: Ironically; it is as if students had discovered exactly what manufacturing was about— mass-producing with little effort"

*(Blikstein 2013, 8).*

The thing lacking for kids in the context of Bouwkeet is not just 'useful' things, but the space to make things that one might want, but not actually need. For example: the fidget spinner, which is all the rage at the moment. The other tendencies I see is making unique hand-crafted things to increase one's social status, making things that are connected with the culture of original, one can give as gifts to others or sell. In other words, the things people make are about bolstering or expressing who they are in relation to other people. In this sense, it is worth reflecting with the participants not only on what something is, but why they made it, who it is for and what it means to them.

The scarcity is not only about a lack of resources (stuff), as buying things is cheaper than ever. It is about a lack of influence on the material world. On a second level, one thing I've noticed compared to other Makerspaces with the same age group, is a strong spirit of competition, which results in bullying and reluctance to help one another.

Bouwkeet as such is not a copy of another place, nor can it be used as a model to be copied as such to anther context. The power of this and the lesson to be abstracted is doing the work of mapping the context and seeing what is really needed, where is the added value. In order to open up these choices to other places, I have developed a simple tool for mapping the strategic position of Makerspaces.

## Scarcity

This observation gives me a hunch that would be interesting to focus on in further research: scarcity limits sharing. It's a logical thing really. If you have a whole cake, you are happy to share; if you only have one piece, you may want to keep it for yourself.



Further reading on this can be found in Scarcity: Why Having So Little Means So Much (Mullainathan 2013):

## Competition

The way I see this behavior exhibited in the makerspace is, For example, one week I had a conversation with one of the children (a boy in the open FabLab, age 11) who I showed the basics of the simple programming language Scratch. As an avid gamer, he got it immediately and demonstrated a great natural aptitude. In the next lesson, I offered to teach other kids Scratch as well and asked him to help me do it. He reacted by pouting and protesting:

> "oh no! I don't teach the other people Scratch. I was learning scratch. Then everybody can do it."

I asked him what the problem with that would be and his answer was frank

> "I like it so much, I want to be the only one who can do it. It's no fair if everybody can do it, it's my thing."

Apparently he saw no benefit from creating a community of equals who could learn from each other—perhaps because he had not (yet) experienced that he too could benefit from this. Instead, it was a perceived threat if other kids were able to do the same things. This, I would say, is the consequence of the combination of low self-confidence based on only few skills, and conditions of scarcity: that the idea that everyone would benefit from sharing knowledge is not attractive. This means that he also doesn't trust that it will be good for him if other people also know how to program.

Beneath the surface level of making, technique and technology, there is a more implicit layer of learning that is what Bouwkeet is actually really all about: empowerment, soft skills and expanding your horizons. Ultimately, it is aimed at increasing the life skills people need to 'make it' in life. In other words, it is about working with technology as a medium for transferring skills. It is about shaping subjects (people), while shaping objects (things).

The theory of change in the policy documents at Bouwkeet is clear. They are trying to increase the opportunities of young people (age 10-15). The mechanisms so far were quite general: learning by making, showing what you've made, peer-to-peer learning, role models. The question from the financers is: what will the long-term impact be on the neighborhood? Can you 'uplift' a neighborhood by inserting a makerspace?



Photo by Sander van Wettum

In order to point the activities of the makerspace towards reaching the central learning goals, before opening they doors, the staff developed the so-called 'Bouwkeet method', a policy document with a set of mechanisms and principles intended to achieve these effects. Of course, in every start-up, you run into some unexpected challenges in the beginning. What sounds great on paper doesn't always cover all the challenges in practice. In a process of trial and error, with a set of clear learning objectives and a tremendous dose of enthusiasm and commitment, the team hit the ground running. Since the launch in September, the operational workload of developing a new curriculum, training the staff and finding out what works best for the participants has been a steep learning curve—one that the team has embraced. But they have their hands full, running the entire operation with only a few paid positions and a large group of volunteers. There is little time to philosophize about deep learning processes when you have a group of teenagers in front of you.

Zooming out from Bouwkeet, we can see that this particular place is an instance of a global phenomenon that has been emerging the past 15 years and is still gaining momentum. So now we know about Bouwkeet in specific, what is a makerspace in general? And what do we mean by 'making'?

# The Bouwkeet method 1.0
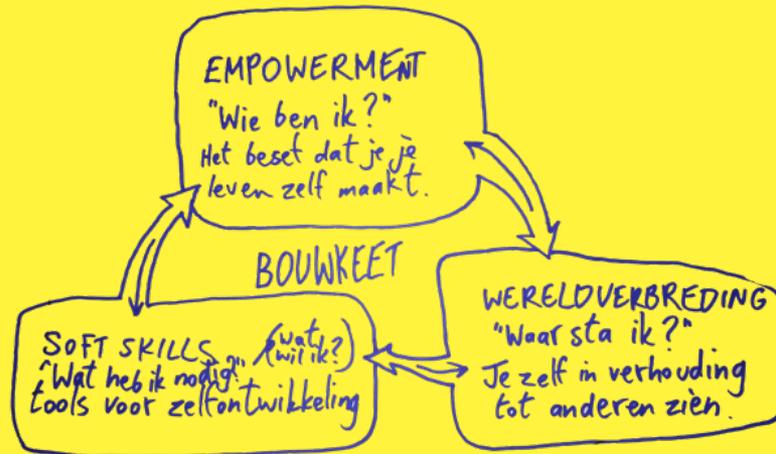


Bouwkeet is based on the implicit premise that offering hands-on opportunities for making will benefit the local population by offering opportunities to practice vital life skills. As mentioned, the aim is threefold: empowerment, developing soft skills  and broadening the horizons of participants (wereldverbreding, literally 'world expansion') by encountering new ways of working, new machines and materials, and new role models.

MORE ›

The current Bouwkeet educational model includes 5 mechanisms, called the 'Bouwkeet method', that contribute to achieve the learning goals:

1. Making starts with a question (start by wondering something)
2. Learning by making (make tangible, useful objects)
3. Learn from others, with others (peer-to-peer)
4. Show the results! (present the results and get feedback)
5. Trainers are also enthusiastic makers (be a role model)

The curriculum mostly consists of blocks that run 8-10 weeks, plus some additional school programs, which are mandatory for participants, unlike the after-school programs. The classes are small, offering intense guidance at a ratio of 2 facilitators to 15 participants (one on a volunteer basis), allowing for a great amount of personal attention. The types of activities are totally different from what the young people are used to getting at school: it is not about gaining knowledge in terms of facts, figures, procedures. It's not about knowing the right answer. It is about learning by doing, hands-on, figuring it out together, making mistakes, taking things apart and fixing them, making things with quite a degree of freedom in what you make and how you make it.

## Meso level: the global rise of makerspaces

Making is one of the latest buzzwords in education. It is often framed as something that is intrinsically progressive. Where does this hype come from? What can we learn from maker education in other contexts for Bouwkeet? 'This time it is different.' Peter Troxler writes in the report on Maker Education[1]. The Maker Education movement is posed as a unique intersection in time and technology – different from the previous waves of innovation in that previously was absent (Illich's dream of the 'web') or instances where technology was used to control people. Although Makerspaces as a particular configurations of networked learning spaces are new—especially at this scale and with this much funding and popularity—the claims to enable an emancipatory revolution in education have a much longer tradition.
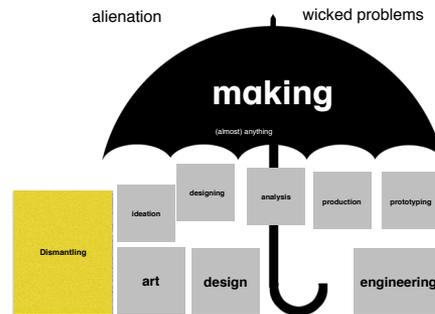


Making in general, and Makerspaces specifically, are umbrella terms that includes what was previously divided into the disciplines of art, design and

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[1] This is a recommended (Dutch) overview of the resources and learning theories associated with the Maker Movement.

## The biggest umbrella is still too small

If you work in a school, a library, or a museum, a school, the buzzword of "making" probably has reached you. "Making" is hot and hyped, it is all the rage in the educational right now. What is new and what is not? What is a fad and what can have a long-lasting and substantial impact for the power of emancipatory education? How can we be tell if this shift to the rhetoric and practices of 'making' is genuinely empowering, and not a new form of control?

If you grow your own food, make your own clothes or beer, shape hats out of felt, build your own furniture, tinker with electronics kids, or spend hours on creative coding projects, you may be part of this movement without ever having called it 'making'. So why is this happening now—why the movement and why is it called 'making'? Where is it headed? Throughout this thesis, I will explore these questions in greater depth, looking at the genealogy of the terms and the scope of makership— the concepts, the spaces, the typologies, the assumptions.

Not only the disciplines are parked under this umbrella, so are the different phases from the process of making (exploration, experimentation, ideation, prototyping, analysis, testing) etc. Whereas in corporate spheres, there are clearly defined roles and collaboration between people in a chain (such as an assembly line), where each human has one small task in which they are specialized, and repeat endlessly. Instead human being are expected to switch between many different roles and use the expertise of the network and the power of computing to make it possible to make things without expert knowledge.

MORE ›

## Types of Makerspaces

**Supported Makerspace**
Makerspace piggybacking on existing (educational) institution

**Embedded Makerspace**
Makerspace physically embedded within an existing infrastructure and institution.

**Independent Makerspace**
Makerspace with its own organisational (community) structure. Often called Hackerspaces.

**Daughter Makerspace**
Makerspace launched using the resources from an existing institution.

‹ Bouwkeet

engineering. So this is convergence culture, a melting pot of disciplines that used to each have their own workshops, materials and methods. So in one workshop, you will now have woodworking, metalworking, textiles, electronics, digital fabrication (3D printers, CNC mill, etc). Makerspace claim to represent the next industrial revolution: the tools and technology to make (almost) any physical object available, so that their use is (re)democratized. So brought back into neighborhoods and made accessible for free to the general public. So instead of being consumers, people are making their own 'stuff' again. This is an idealistic movement of empowering people through giving them the tools that were previously tucked away in factories and professional manufacturing. You could read a classic Marxist dream in this in bringing the means of production to the people.

Compare making with swimming. When you go swimming, there is little confusion: you do one part (moving your limbs, breathing), but it is the interaction with the water and some basic laws of nature that propel you forward, or backwards, or treading water in one place for that matter. But whether you swim, sink or float, you are working with the forces of buoyancy, gravity, resistance, flow.

If you want to learn to swim, you go to a pool or a lake. If you want to learn to make, you can go to a makerspace. But the funny thing about Makerspaces is that it's not always just about making. The aims and ambitions attached to making are much deeper and wider than the stuff being made. What is being practiced in 'making' is not a one way street of mind over matter, a person 'making things by imposing their will on passive materials. Making involves negotiation, collaboration—with people, tools, machines, and with inanimate objects.

## Macrolevel: maker culture and its discontents

Backing up a bit, why do we need maker education? What issues is it supposed to solve? What are the assumptions and the narratives driving this?

When we look around us at the 'made' world of bricks and mortar, steel and concrete, plastic and rubber, the infra-structure of transportation, housing, industry, the stuff we use, the clothes we wear. One of the most salient features of this complex system we call capitalism, is that we don't see how things are made.

# If making is an answer, what was the question?

We need to zoom out even one more layer to the global scale. The problems at hand are not caused by a failing educational system alone, by the inability to keep up with the latest technological developments. Indeed, to have schools speed up and follow the trends of all the latest technologies would in no way solve the problem of preparing the next generation for the future. The problems at hand are much more complex. To understand this, I think it is fruitful to frame the problems in education and the solution of Makerspaces in the context of 'wicked problems'. In the model I have made here, the different arms interact and at any point, new ones can join forces.

## Wicked problems

The success of technology is shadowed by the failure of the educational system: unable and unwilling to respond to the rapid changes in technology. Over the course of my research thus far, I have worked on defining the challenges that I encounter in my practice in technology bring to the field of arts education on a micro level (in classroom situations) as well as in a macro level (network mapping). As suggested by Mischra and Koehler (2007), a "fruitful way of thinking about the complex problem of teaching with technology is to view it as a "wicked problem" (Mischra and Koehler 2007, p. 3). Drawing on earlier theories of Rittel & Webber (1973) the authors argue that wicked problems have incomplete, contradictory and changing require-ments. Empowerment and learning in the digital age is haunted by the "wicked problem" of how to implement technology in education.

It is widely claimed that such collective facilities and hands-on activities for tinkering and experimentation are democratizing technology. Bringing tools to the people, bridging the digital and the analogue, preparing the next generation for the future— nothing short of a 4th industrial revolution, with an emancipatory impulse to match it. But is this a real revolution, or just a new phase of capitalism, bringing new mechanisms of control, and new ways of distracting and alienating people?
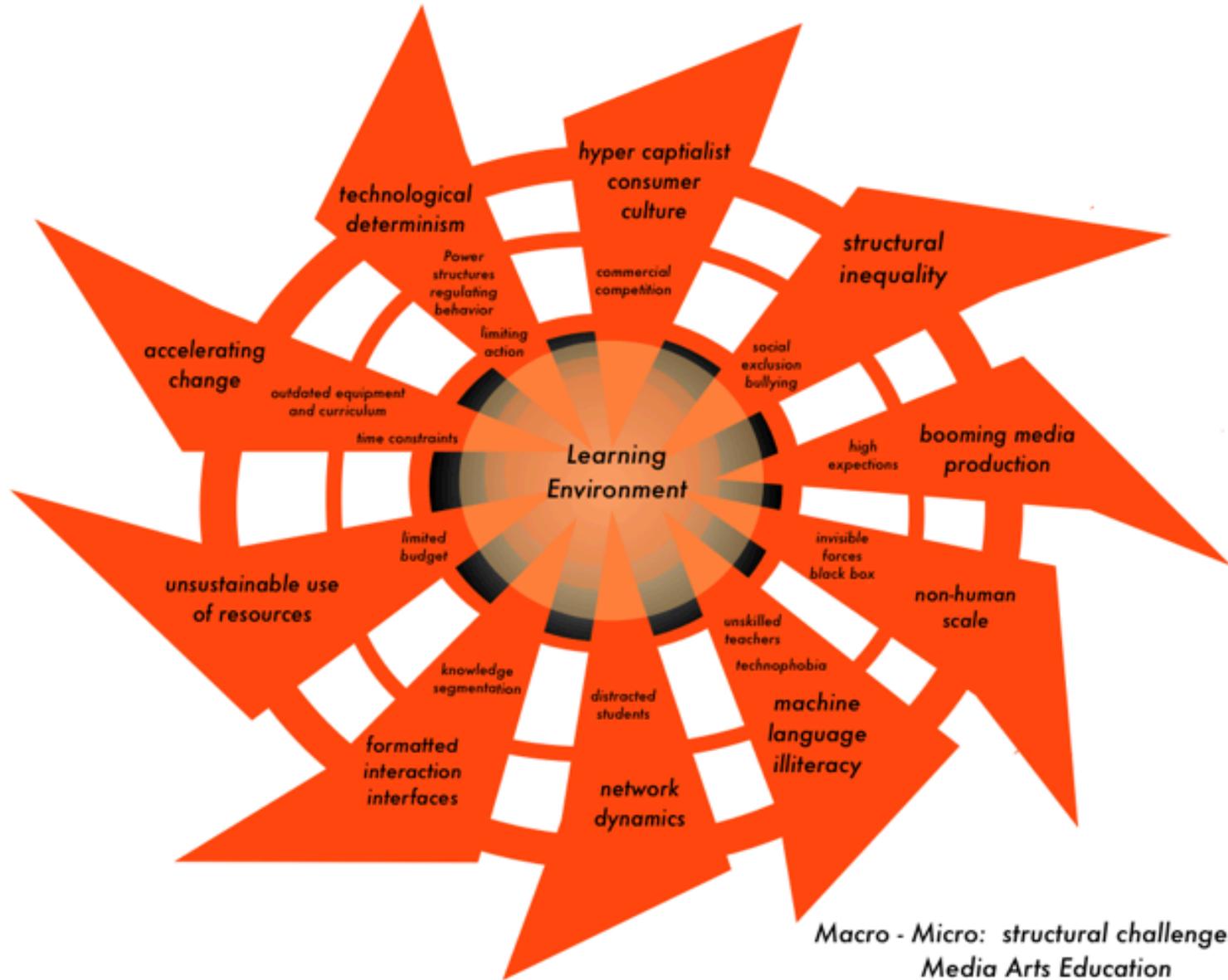
Macro - Micro: structural challenges for Media Arts Education

## What's the trouble 1: failing educational system

One way of looking at this is the idea that the current educational system is not teaching people what they need to learn for the future. This is a crisis of schooling, which is teaching people to become redundant, unable to grapple with the quickly changing world of technology. The jobs of today may not exist in the future. There is a new generation of machines, robots and networked algorithms that make many traditional roles. The problem is that the educational system is not preparing people for the current and future world, and that it cannot be changed quickly enough. Inserting a new kind of educational space that supplements the schools, instead of engaging with the slow process of chainging education from within.

## What's the trouble 2: pillarization of knowledge

Making is a kind of conceptual superglue, serving as the widest umbrella around. Why would we need it? Because in the age of enganglement, the boundaries between disciplines are fading, and at the same time, It can bridge the toddler cutting cardboard and the robot building skyscrapers; artists creating subversive works in the spirit of critical making, or polished commercial work, shipped to package. Collaboration between technology-centered educational institutes and art schools, between amateurs and professionals happens to a certain degree, but the challenge is to understand each other. Making is what comes after the tower of Babel is torn down and people try to put the rubble back together. Everything is connected, but we cannot see the connections. Making is an attempt to bridge this divide by offering a word to performatively conjoin such diverse fields. Of course, there may be resistance for those who have not named themselves or who feel uncomfortable with such conspicuous figures in the same vast container.

## Failing educational system

Not all that much has changed in the basic educational institutions established in the 19th and 20th century: schools, libraries, community centers. Quote: "Our schools were designed to produce the workforce required by 19th-century factories. The desired product was workers who would sit silently at their benches all day, behaving identically, to produce identical products, submitting to punishment if they failed to achieve the requisite standards. Collaboration and critical thinking were just what the factory owners wished to discourage."

## Pillarization of knowledge

The world we live in is a complicated mesh of words, images and things. 'The age of entanglement.' Assemblages of light and flesh, skin touching screen, models becoming 3D objects, buttons and bodies, virtual and actual, databases and archives. The digital world has not come to replace the physical. The exciting and dangerous potential is in the deep craft of that is made possible in our time: bytes and atoms can interact both ways. This is not only to say that humans and machines can collaborate. Technology has developed to the point that it is possible to make (almost) anything that can be imagined.  Out of this practice, a new subjectivity emerges. A subject that is accustomed to switching between modes of making, between the digital and physical realm. The affordances of the emergence have merged with the materiality of the physical world, becoming a vortex of potentiality. The digital age has opened the door of the fantasy of imposing our will on matter. Making as physical engagement runs into the physical resistance of material, bringing us back in contact with the constraints to the freedom of fantasy and a screen-based view of the world.

## What's the trouble 3: alienation

A second answer to the question of 'making' as an answer, is that it answers a much older problem of alienation. As Marx already identified, we have become estranged from the process of making the material world that surrounds us, divided from the value of objects through industrial production. Making, craft would then establish a new kind of intimacy with the material world. This is not a new problem; so why is this solution coming now? Why not earlier, demanded by the workers? Is it really a solution, or is it trying to make people and their labor into flexible consumer goods that you can then exploit again as human resources?

We have gotten ourselves into some serious trouble in this world. Nobody can predict exactly what's going to happen next. What we do know: the centuries of operating with the twofold extractive and oppressive forces of capitalism and colonialism, of exploiting the natural resources of the planet (including human labor) cannot continue in this way. Planet Earth it not a disposable resource, nor can we defend structural exploitation of human labour to keep this system going. Things will have to change, by crisis or by design; slowly or quickly. Things are already changing. This line of thinking, the rhetoric of crisis, is often used to defend new forms of education. How can we teach the next generation to become "makers", when we—now I speak for my generation, and those that came before—have made such a mess of things? To face the future, we must first grapple with the challenges of the present.

## Alienation

The makerspace is a tool, an intervention that is an answer of the human desire to gain some kind of understanding and a degree of influence on the quickly-shifting technological landscape. One of the assumptions, is that 'empowerment' would somehow emerge automatically from the activity of making things. Some of the literature on the return to revalue working with one's hands, running from Sennet on the power of craft, to the rhetoric of the empancipatory impulse of Maker Education, assumes that making an thinking occur simultaneously. That they are interchangeable even. In league with the Critical Making movement (Hertz et al), I would say that this is a contestable assumption. Making is ambiguous and imprecise as a container term. Like 'education' and 'learning', that Illich has taken issue with in Deschooling Society (1967), the term 'making' can hide as much as it shows. Critical thinking about the conditions in which you operate is not something that necessarily emerges form the activity of making. If this were the case, revolution would have already happened. And the type of revolution needed in face of these wicked problems we have set into motion is not another industrial one. We need to generate alternative modes of living together on this planet, with all the material and immaterial forces. 'Making' is extremely elastic, qnd it is concealing; like a closet: you can hide anything in it.

Wicked problems call for tentacular pedagogy (which I will elaborate on further below). This means developing technological fluency and the ability to engage with new machines and materials. It also entails an awareness of where you can put pressure, what you can poke at, which buttons you can push, and which ones are a dead end. This is something you can only figure out by trying. Mapping tools can chart how these huge dynamics manifest themselves in a particular situation. I would argue is that cartography as a tool is a necessary exercise for every makerpace, because you cannot copy the solutions from one place to another. Designing a makerspace and a curriculum requires careful attention to the specific troubles of the particular environment.

# What's the matter with making?

In this chapter I provide the conceptual tools with which I will analyze the findings in chapter 5 and work towards some recommendations for teaching in the microcosm at Bouwkeet (to be found in the appendix). This exploration continues working with the different strands of thought that emerges from the context of the maker movement in the previous chapter.

The core of the argument that is as follows: there are some fundamental troubles with making, oscillating between how people talk about 'making' (the theoretical promises, rhetoric, propaganda) and with how people go about 'making' (the practice, activities, material habits). If we want to use 'making' as a tool for empowerment, these are troubles we need to face. I will start to disentangle these troubles below by a proposing a small shift, with quite some far-flung and radical implications for how we understand maker education.

Making is not about subjects producing objects.

Making is about subjects and objects transforming simultaneously, connecting and disconnecting in different ways.

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## Troubles

These troubles lead to false promises, skewed expectations, and blind spots, as part of an uncritical and disempowered relationship with the material world. In this dynamic, I see 'maker culture' both as a sign of the times (as a symptom) and a contributing factor (a cause)

" Trouble is an interesting word. It derives from a thirteenth- century French verb meaning " to stir up," " to make cloudy," " to disturb." We — all of us on Terra — live in disturbing times, mixed- up times, troubling and turbid times. The task is to become capable, with each other in all of our bumptious kinds, of response.
Mixed- up times are overflowing with both pain and joy — with vastly unjust patterns of pain and joy, with unnecessary killing of ongoingness but also with necessary resurgence. The task is to make kin in lines of inventive connection as a practice of learning to live and die well with each other in a thick present. Our task is to make trouble, to stir up potent response to devastating events, as well as to settle troubled waters and rebuild quiet places. "

*(Haraway 2016, 16)*

## Definition of MAKE

made 🔊 \\'mād\\;   making

### transitive verb

1   **a** *obsolete* : BEHAVE, ACT
    **b** : to begin or seem to begin (an action) • *made* to go

2   **a** : to cause to happen to or be experienced by someone • *made* trouble for us
    **b** : to cause to exist, occur, or appear : CREATE • *make* a disturbance
    **c** : to favor the growth or occurrence of • haste *makes* waste
    **d** : to fit, intend, or destine by or as if by creating • was *made* to be an actor

3   **a** : to bring into being by forming, shaping, or altering material : FASHION • *make* a dress
    **b** : COMPOSE, WRITE • *make* verses
    **c** : to lay out and construct • *make* a road

4   : to frame or formulate in the mind • *make* plans

5   : to put together from components : CONSTITUTE • houses *made* of stone

6   **a** : to compute or estimate to be • I *make* it 23 miles to the border from here.
    **b** : to form and hold in the mind • *make* no doubt of it

7   **a** : to assemble and set alight the materials for (a fire)
    **b** : to set in order • *make* beds
    **c** : PREPARE, FIX • *make* dinner
    **d** : to shuffle (a deck of cards) in preparation for dealing

**8** : to prepare (hay) by cutting, drying, and storing

**9** **a :** to cause to be or become • *made* them happy • *makes* it possible
**b :** APPOINT • *made* him bishop

**10** **a :** ENACT, ESTABLISH • *make* laws
**b :** to execute (see execute 2) in an appropriate manner • *make* a will
**c :** SET, NAME • *make* a price

**11** **a** *chiefly dialectal* : SHUT
• the doors are *made* against you — William Shakespeare
**b :** to cause (an electric circuit) to be completed

**12** **a :** to conclude as to the nature or meaning of something • what do you *make* of this development?
**b :** to regard as being • not the fool some *make* him

**13** **a :** to carry out (an action indicated or implied by the object) • *make* war • *make* a speech • *make* a detour
**b :** to perform with a bodily movement • *make* a sweeping gesture

**14** **a :** to produce as a result of action, effort, or behavior with respect to something • *make* a mess of the job • tried to *make* a thorough job of it
**b** *archaic* : to turn into another language by translation

**15** : to cause to act in a certain way : COMPEL • *make* her give it back

**16** : to cause or assure the success or prosperity of • can either *make* you or break you

**17** **a :** to amount to in significance • *makes* a great difference

**b :** to form the essential being of • clothes *make* the man

**c :** to form by an assembling of individuals • *make* a quorum

**d :** to count as • that *makes* the third time you've said it

**18** **a :** to be or be capable of being changed or fashioned into • rags *make* the best paper

**b :** to develop into • she will *make* a fine judge

**c :** FORM 6b

**19** **a :** REACH, ATTAIN • *made* port before the storm —often used with *it* • you'll never *make* it that far

**b :** to gain the rank of • *make* major

**c :** to gain a place on or in • *make* the team • the story *made* the papers

**d :** to succeed in providing or obtaining • *make* bail

**20** **:** to gain (something, such as money) by working, trading, or dealing • *make* a living

**21** **a :** to act so as to earn or acquire • *makes* friends easily • *makes* poor grades

**b :** to score in a game or sport • *make* a field goal • *make* a birdie

**c :** to convert (a split) into a spare in bowling

**d :** to succeed in holing • *make* a putt

**22** **a :** to fulfill (a contract) in a card game

**b :** to win a trick (see [1]trick 4) with (a card)

**23** **a :** to include in a route or itinerary • *make* New York on the return trip —often used with *it* • *make* it to the party

**b :** CATCH 6b • *made* the bus just in time

**24** **:** to persuade to consent to sexual intercourse : SEDUCE

**25** **:** to provide the most enjoyable or satisfying experience of • meeting the star of the show really *made* our day

YOU WE I

LEARN

TOOLS TEACH

WITH MAKE TO

US
ME THINGS
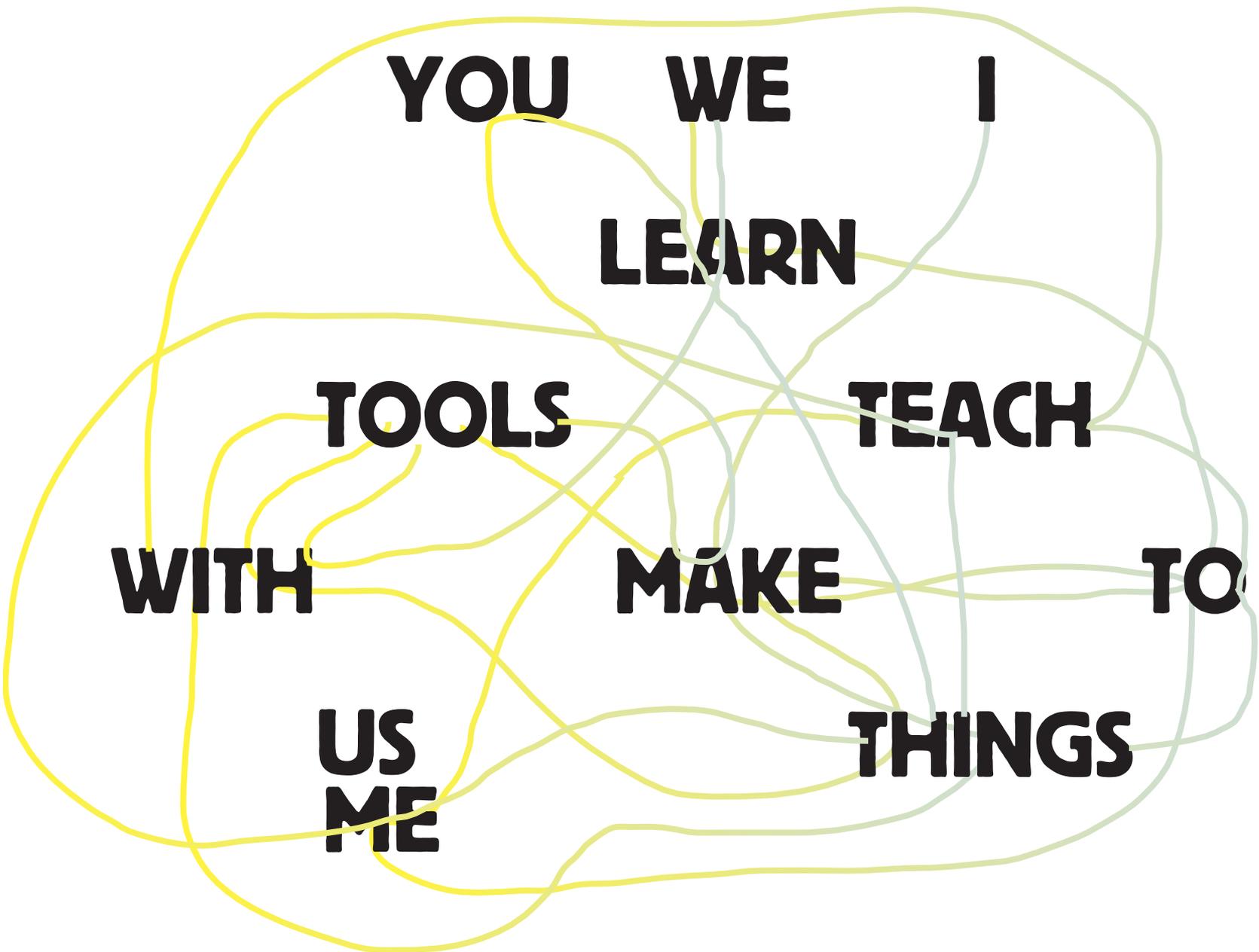
In other words, I suggest that we move from object-centered way of thinking about making, to a relational understanding. Which is not to say that there are now hierarchies or power relations at play, for there certainly are. We can make a mark on this world. In fact, we (humanity) has, it is called the anthropocene.

One thing that is important to mention from the outset: the shift from egocentric to ecocentric is not a new or original idea. Philosophical strands pointing to this go all the way back to antiquity. The only thing that is new is connecting it to maker culture.

## What's the trouble ?

The question, what does it mean to 'make' or to be a 'maker' is a complicated one. I will resist the temptation to provide a full genealogy of 'making' and look into making not only as a practice (making), but as a concept (rhetoric).

Making is posed as a solution, while it points to a number of fundamental problems. I approach these as a mess to be explored, riddle to be deciphered, not a problem to be solved with a definitive answer.

1. De(con)struction is also a creative force. To make things, we must also learn how to dismantle, take apart, destroy.

2. The irreversibility of making. Due to the material nature of connections and the forward-slanted nature of time, we are dealing with a deep-seated irreversibility. As Heraclites already pointed out, the river is not the same twice (Cratylus 402a, DK22A6). Even mechanisms that are flippable by design, such as a swinging door, a zipper: slight molecular shifts take place in every connection made and the undoing does not ever fully erase the doing.

## 1. De(con)struction is also a creative force.

There is a generative bias to making; making as manufacturing is only half the story. It is about making stuff, about creativity as manufacturing. Makers tend to emphasize the productive capacity of making, with the forward-slanted move towards invention and innovation, geared towards the end result of some kind of product or artifact. While making claims to be the polar opposite of consumerism, the activity of crafting some tangible object still puts constructing stuff at the center (with people ruling over the process of assembly, with the aid of machines). In practice, this process of making involves constant switchback between construction and deconstruction. By only emphasizing the concrete outcome, and not the learning, the failure, the undoing and redoing, making is made to seem easier than it looks. Implied in this, is that it is not making if you do not end up making anything at all. With the exception of the emergence of critical making, the rhetoric of making requires an outcome, a tangible result.

Making tends to privilege emergent phenomena – printing, welding, building, budding, waxing, growing. To dismantle the technological hegemony, to stop ecological exploitation and counterbalance structural inequality of the given world we need more destructive and disruptive habits and tools to force open a future that is not the direct extrapolation of the course we are on.

MORE ›

## 2. The irreversibility of making

A major difference between the digital and the physical realm is quite a simple one: we don't have an undo or a delete button for the material world. Materiality of made things, once made, or once actualized into this world, forged into a material form tend to become lasting things. The energy to produce it cannot be unspent. Of course, these artifacts are not everlasting things, but nevertheless, once put together, things can only be dissembled, recycled, reconfigured with effort and energy. Attached to this are both concerns about the ecological impact of making, and the limitations of making as a one-way track creating more and more stuff. Some things, once forged together, cannot be dissected without doing structural damage.
Note that connecting and disconnecting are not simply reversals. Connections function both as conduits, linking separate units, and blockages, dividing lines. The same mechanisms that divide, bind together. And the logic of undoing is another movement, a continuation of the assembling machines. This is already a vast force field of potentiality, and including not only the connections, but the disconnections exponentially increases. The relation between doing and undoing, making and destroying, connecting and disconnecting, is not one of a pendulum, or even a spiral, or a zig zag, swaying back and forth in a Hegelian dialectic. The difference between connection and disconnection is a false dichotomy. Connection persists in disconnection, leaving a trace.

3. We don't really make (anything). There is a misunderstanding about who (or what) does the making in the making of. We want so badly to be makers, to be the ones in control. This is based in a fundamental misconception about tools and technology, that have been designed to do some work for us. We are not in control. There are secret helpers everywhere, in the material properties of glue (we do not make it stick), in the weight of metal, in the calculating machines and the screens that show us in virtual 3D on a flat surface what will soon slowly push through the hot nozzle of a 3D printer. In making, we stand on the shoulders of gnomes. These take the shape of tools, machines, instructables, material list, construction kits. Making is really only ever assembling—pushing around bits and atoms from one temporary configuration to another.



4. Making could be (almost) anything. The bluntness and mediocrity of making as a concept is striking. As an umbrella term that swallows up arts, sciences, design, engineering etc, it empties out centuries of meticulous research, disciplinary libraries, practices of critical thinking. It is a gross simplification.

### 3. We don't really make (anything)

The awkward bias is revealed in language if we turn the language of making object to the parallel track of making subjects. A teacher cannot say of a child: I made you. Neither can a parent. Even the natality of birth is predicated on these wonderous biological mechanisms. Making is something that God could say: I made the world. I said, let there be light, and there was. Perhaps this is the basis of the fantasy of making, that through giving commands, immaterial things come into being.



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MAIN TEXT

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## 4. Making could be (almost) anything

Yes, we need collaboration and common grounds between these islands. And yes to democratizing the tools of arts and science to children. Yes to open source and the creative commons. But data travels fast and stuff travels slow. Human beings have such a short life span. Lumping things together is such a way of preventing a deeper collaboration between these fields that can not only make things, but shape the conditions of making.

## Making makers: three thought experiments

This story is about some troubles with 'making'. You may still think "what trouble"? How could there possibly be any harm in knitting, in woodworking, in learning how to program, in 3D printing and soldering circuits? Before starting this investigation, I'd like to invite you to engage in three brief thought experiments. Let's assume for a moment that you have never heard of this 'maker movement'. This may in fact be the case for some readers, but this exercise is also useful for the most zealous 'makers'.

# Experiment 1: Who made this?

# Experiment 2: How did you get to making this?

# Experiment 3: (How) were you made?

**Making makers: three thought experiments**

Think of something you have made (it can be anything). Make a little sketch and describe what it is (the object) and how it was made (the process, the raw materials, the tools and machines involved). What are the different parts? What is it made of? Then try saying the sentence: "I made this"?

What does it mean to say you 'made' something?

→ Jot down a definition of what it meant to make that particular thing (not making in general, the specific act of making in this case).



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Experiment 2: How did you get to making this?



my mom showed me Sawing

the idea came from YouTube tutorials

hot glue gun

screws from a teaching I guess

wood

from the hardware store

3D printed base from Thingiverse

took this off a broken chair

recycled
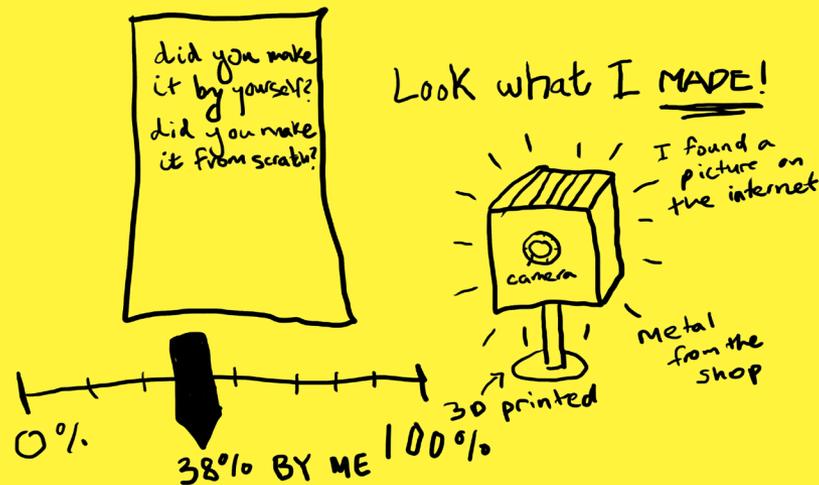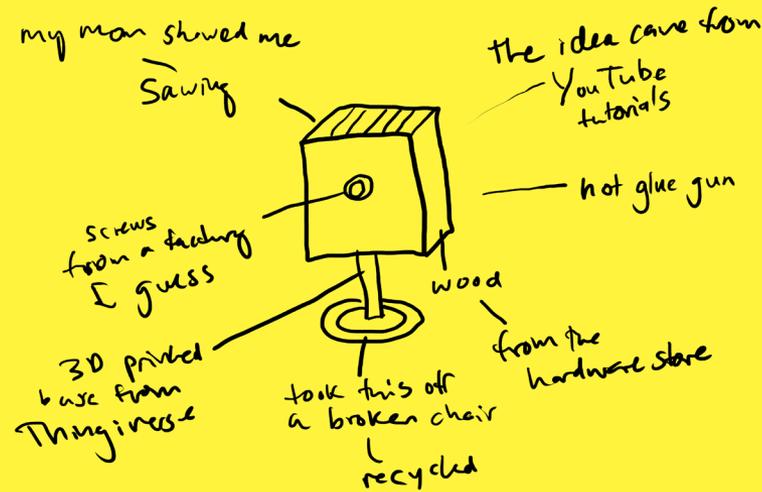
→ Make a word cloud around the sketch of the object with all the skills, tools and materials you needed to make this and where they came from.

Experiment 3: (How) were you made?

Who or what made you? Where did you come from? Were you born like this? How did you develop into this person? Who shaped you? Would you say that you were 'made'? If you were not made, how did you get here? What forces, things, people shaped you into who you are today? To what extent are you self-made? Could you say of another person: I made you? If you look around this room, which things were made and which were born (or combinations of the two)? What difference does this make?

In the sequence of these three experiments, the last one may seem quite odd. Who made me? Are we made, or are we born? If you think we were 'made', there are a range of different possible answers to this question, such as: God, evolution or your parents—in each of these vastly differing traditions of creation or matters of origin. Not matter where you find the answer to this question, or if you have no answer at all, there is a common way of looking at the world as divided into things that were made (culture, technology, objects, tools) and things that were born (people, subjects, nature, critters, algorithmic creatures).

Over the past centuries and still now, there are huge philosophical debates regarding the (in)distinction between nature and culture, between subjects and objects, between people and machines. Of course, I'm not going to solve any of these in this thesis.

What is striking to me, however, is that the rhetoric of 'making' and 'maker culture' quite elegantly circumvents the deep-seated troubles in many of these fundamental debates. When we say "I made this" or "I am a maker", it instates whole set of assumptions about just how much we human beings are in control at this particular moment in time and space. Not as much as we would like to think we are (on an individual level) and much more than we would like to admit as an entire system called civilization, this extractive crust mining the planet and metabolizing its resourses.

Many of the troubles I will address with 'maker education' and the discourse around 'makers' emerge from a basic misunderstanding the complex relationships between subjects and objects, which I will argue, rests on a flat conception of technology and tools. There is this great divide between people who get their hands dirty and people who think about technology, between the doers and the thinkers, between the craftsman and the philosophers. And I think to move towards a meaningful pedagogy that works with tools and technology, we need knowledge that comes from both sides, from theory and from practice. Such an interchange between discourses and practices is what I hope to spark with this project.

For we can comfortably say of objects 'I made this' even though there are many contributing factors in the making of. Whereas for subjects, no matter how much influence or control is exercised, to say that we 'make' someone implies a level of force that goes against the very heart of emancipatory education, which is about liberating and shaping subjects to take responsibility for their (limited) degree of freedom in relation to the world they are born into.

So what then is needed to get out of this conundrum?

The groundwork for a shift has been going on in various domains for quite a while. But all the books on this topic are so far removed from the lived experience and vocabulary of people operating at the level of tools and machines, the educators, the tinkers. To change, we don't need more theory, to make things more complicated or to oversimplify them.

# What we need to do is connect the theories that matter to the problems in practice.
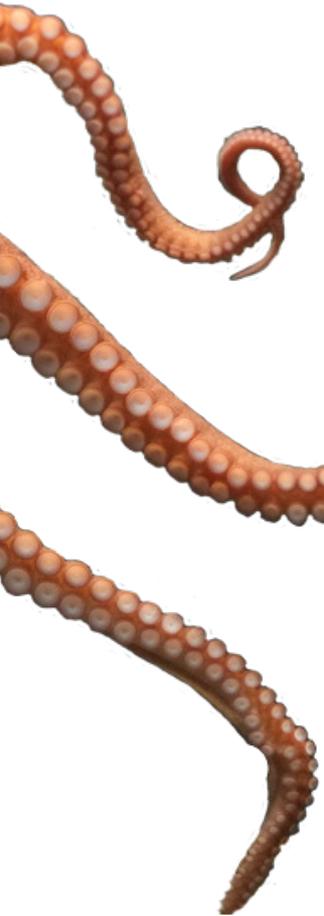
## Connectology

There is a growing force of philosophies and practices that point to a subtle and fundamental paradigm shift that I think can offer a simple yet powerful way of keeping the force and momentum of this maker movement, without succumbing to the forces that flatten it, skew it, harness it to productivity. It involves a paradigm shift away from an anthropocentric, individualistic view on 'making', towards an immanant and connected view. It looks at creation and making as generative forces in their own right, the forces of connection and disconnection that weave the entire universe together. This entails reframing making as co-creation—not only between humans, but between people, things, machines, materials, creatures. The chapter of genesis is not over yet. Every moment is a beginning and an ending.

The universe is a vast, intricate, vibrant, constantly changing field of connections. Everything interacts, as force fields in flux, creating ripples with longstanding and sweeping, great and small. Such an immanent, material ontology of constant change and chaos at the heart of the universe has a long conceptual lineage, with a trajectory running crisscross from Heraclites to Deleuze. The relationships between such philoso-phers are perhaps more like constellations of stars than fibers in a rope, forming a theoretical assemblage. It is time to draw a figure connecting these dots, pointing to the centrality of connections, relations (instead of separate objects and subjects).

## Tools: shaping objects, shaping subjects

We need to talk for a moment about tools and technology. It is a misunderstanding to say about tools that they are instruments that we can simply use and wield at will to impose our ideas on passive material. Making is a discursive process. One of the first things you will notice when you start 'making', that is, working with materials and tools, is that you will encounter the 'forced function' of tools, that are designed in such a way that induce certain kinds of behavior.

Tools work in both directions: they shape objects (the made world around us), and shape subjects. Marschall McLuhan says this poignantly by noting: "We shape our tools, and our tools shape us" (REF).

Technology is no longer under human domination. "We like to think that we are in control of our offspring. But just like children grow up, so do our systems. Human technologies have become so complex that they now behave like independent ecologies." (Van Mensvoort, 2016). The theory of Next Nature provides a speculative model of how technology (culture) becomes nature, through a process of being integrated in society. The evolution of technology, as it progresses from starting from the first imagination to the operational level, then accepted as part of the technological landscape, becoming vital for the functioning of society. And in the last stage, there is a process of concealment, integrating technology so that it becomes invisible to human perception, unnoticeable and fully integrated. And lastly, technology becomes naturalized, as an integral part of the world.

## Next Nature

This framework is not specific to digital technology, but serves as a model of the steps every "made" invention goes on, travelling up the pyramid. As it moves beyond the border of vital to invisible, it also escapes human reach and control. Seeping into society at all levels, this process blurs the distinction between what is 'made and born', between nature and technology (Van Mensfoort 2014). "Like the fish that doesn't know it is wet, we are submerged by technology, yet we are relatively oblivious to its omnipresence" (Mensvoort 2014). Although I disagree with many of van Mensvoort's presupposition, this pyramid model provides a conceptual tool that we can hack to provide a staircase for a pedogogy for the age of entanglement. I will return to this below at the end of this section.

As Mensvoort puts it, "truly successful technology becomes invisible. It is no longer recognized as technology at all. Rather, it is woven into the fabric of everyday life to such an extent that it becomes indistinguishable from it (Weisser, 1991, van Mensvoort 2014). The force of technology itself is not aligned with any specific value system; it has a strong dynamic of proliferation and can be used for good or evil, to empower or imprison. Often the impact of technology is obfuscated, complicated and ambiguous, especially in the context of education where the stakes are high, in an attempt to future-proof the next generation, in spite of constantly shifting prognoses.
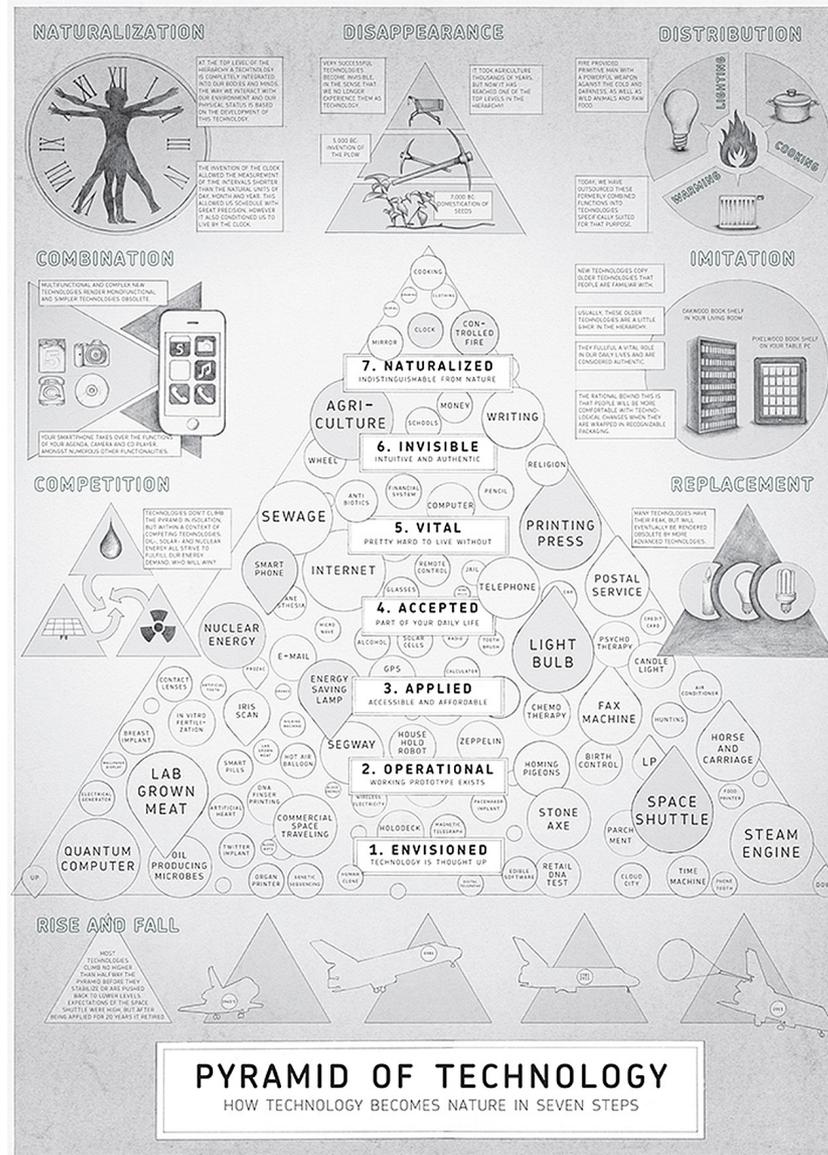
Image Pyramid of Technology, Koert van Mensvoort 2014

# The maker mentality and subject formation

Human beings are not 100% prefab. We have at least a certain degree of freedom. Indeed, as an educator, it would be very strange to say: I make my students. We shape, we form, inform, guide and teach. But we don't 'make' people. The pedagogical framework I will develop here runs along a line of tension that are not binary opposites, but two reactions to the same issue.
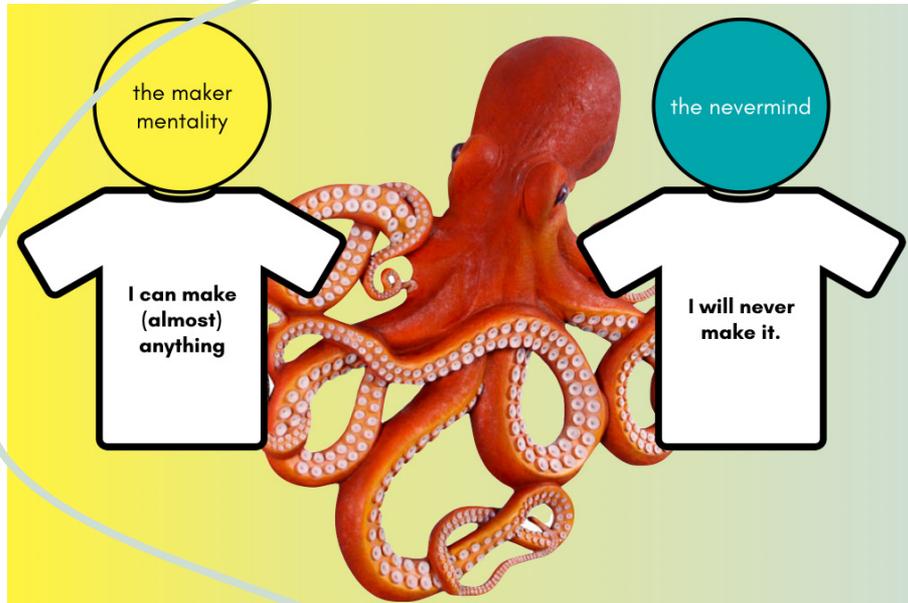
On the one hand, there is the 'maker mentality'. The course title which is at the birthplace of the maker movement says it all: How to make (almost) anything. This confidence is based on the idea that you can impose your will on the world, that with a certain set of machines and skills you can shape material in any way.

## The egocentric maker mentality

This is the practical knowhow derived from trial and error. This is comparable to literacy: the maker mentality is based on the ability to both understand technology and to make it. The problem is, however, that this gravely underestimates the complexity at play in making. Within the force field of wicked problems, as manifest in the incredible complexity of technology that is tucked away in 'black boxes', incomprehensible to any human mind, it is naive to say that any human being can achieve the a full embodiment of being a maker. Not only is this the case, in many ways the problems at play in the complexity of wicked problems feeds precisely on this type of attitude: makers are at the service of the global, extrationist, colonial, neoliberal machinery.

This complex evolving system needs hordes of people to maintain and further it. The risk of constructivism and the maker mentality is that you give a false message, that everything is possible. This is out of touch with reality, in which we constantly have to negotiate with the resistance of materials, limited resources, other people. In this context Biesta points to Freud's principle of reality. Growing up entails finding out that you are not the center of the universe, that there is indeed a world 'out there'. For this reason, I find it problematic to say that the aim of Makerspaces is to foster this maker mentaility, as this is part of what got is into trouble in the first place.

On the flip side, there is what I will call 'the nevermind'. The speed at which a teenager can go from an optimistic "oh, that's easy, let me do it" to "I can't do this" is astounding. There seems to be hardly any space between "I can make (almost) anything" and giving up, saying "never mind". One must navigate between these two. From the report on Maker Education it becomes clear what it is that kids are learning by making:

> "the students grow stronger. Stonger in their actions, in their problem-solving and more confidant about what they are able to do"
>
> *https://waag.org/sites/waag/files/public/media/publicaties/pme-onderzoek-kennis-maker-education.pdf*

I think the problems with 'self-destruction' are clear: unmotivated, uninspired and incapable students is the last thing the world needs and the last thing we want for young people growing up. They will not participate fully in society because they don't know what they can do and lack the confidence to find out. Education, especially at Bouwkeet, is all about empowering people who have heard all their lives: you can't, you won't, you shouldn't. Who have limited opportunities for the future.

The pedagogy I propose is more than a bland "centrism" or "third way"  or middle ground that is simply parasitical off the two supposed extremes. It involves what the philosopher Merieu calls: being in the world, but not putting yourself in the center if it.

## The nevermind

Paradoxically perhaps, a certain dose of this self-confidence in the maker mentality is necessary to pull people out of the slump of self-destruction. And yet now we need to tread cautiously, as offering 'making' as a solution could completely ignore the question of the root problems of how and why this person is disempowered in the first place, as if their attitude was the cause of the problem at hand instead of a quite logical consequence thereof. It could even imply that a disempowered person is to blame for their position. Indeed, giving extra opportunities in order to cultivate an optimistic maker-attitude while doing nothing to improve the socio-economic conditions that created the disempowerment in the first place is extremely delicate matter. Which is not to say that making cannot be a tool to empower people, giving them the tools to take responsibility for their position in the world, giving opportunities to improve the socio-economic conditions. But is remains social engineering, tinkering with people—as all education is, no shame in that as such. Yet the question still remains: what kind of people are we shaping? And how to go about that, without falling into the extremes?

Perhaps the dangers on the left side require a bit more explanation. There are several problems:

1) It is not true that you can make (almost) anything. Not only is it difficult, it is impossible. having such an attitude that is not based on actual abilities makes for sloppy, arrogant work. Moreover there is a strange effect at play. There is a certain

MORE ›

level of confidence that beginning makers can display (before getting started), that is not based on any actual ability or skills. This type of confidence is easily shattered by the first encounter with resistance or failure.

2) And the temptation of people in this attitude is to copy cool projects that other people have already done.

3) such an attitude in making leaves out crucial ethical, ecological and community concerns and
4)        giving people who are in the 'nevermind' mode the tools to grow stronger has a danger: it is very well possible to use the vulnerability of such a person to control and discipline them in ways that are not actually empowering on the long run. In short, the maker mentality it is out of touch with reality, fed by a anthropocentric exploitative and individualistic view of the world, unaware of the constraints and consequences of living in a MATERIAL world.

# Maker education: moving beyond constructivism

Although Makerspaces are a new phenomenon, learning by doing is not. As Blikstein (2013) points out, a pedagogy of experience was already advocated by John Dewey, Seymour Papert, and Paulo Freire.

Constructionism

Connectivism

Electracy

Tentacular pedagogy
You only know what you want, when you know what is possible. And this is the task of broadening horizons: showing what is possible and that here are endless possibilities. Which is not to be confused with the idea that everything is possible. The task of tentacular pedagogy is to hold open the space forging new relationships with the material world and with each other.

## Maker education: moving beyond constructivism

Makerspace pedagogy is grounded in a student-centered theory of learning called 'constructionism', which relates the construction of knowledge to students' physical construction of an object (Papert, 1987; Blikstein 2013). This theoretical framework builds upon student-centred approaches to education stretching back more than a century (Dewey, 1902; Freudenthal, 1973; Montessori, 1964). In constructionist terms, participants in makerspaces learn through producing an external object or "public entity" that can be "shown, discussed, examined, probed, and admired" (Papert, 1993:142), using a range of low to high technological tools and supplies (Blickstein & Worsley, 2016). This making happens in a collaborative atmosphere in which individuals help one another to take risks and solve complex problems (Ananiadou & Claro, 2009; Dougherty, 2013; Jenson et. al., 2010). This is opposed to instructionism, where the teacher is seen as the hub of knowledge. The constructionist way of teaching has a strong link with Feire's radical pedagogy, which looks to people as actively producing knowledge together (Freire 1967; Papert 1996).

Although I entirely agree with the co-produciton of knowledge central to constructivism, I would argue that the makeability of things is a flimy basis for a pedagogy of making. It points to a passive idea of materiality and tools (which is naieve) and an egocentric model of making. Moreover, it ignores the shared aspect of knowledge and the assistance of people, machines, instructables etc that make this making possible in the first place

MORE ›

## Connectivism

The theory of connectivism first appeared on the stage of educational research in an article by Siemens entitled Connectivism: a learning theory for the digital age (2004). Analyzing the impact of technology on how people learn, Siemen calls for rethinking how humans construct, obtain and share knowledge, shifting the focus from the content (the constantly shifting facts), to the infrastructure of connections (Siemens, 2004). Advanced over the past 12 years by George Siemens (2004) and Stephen Downes (2006), connectivism is often framed as a revolutionary educational model, rising to the challenges of the 21st century networked learning ecosystem.

Drawing on chaos theory, complex systems theory (Rocha, 1998; Barabási, 2002) and actor-network theory (Bell, 2011) the connectivist model approaches learning as a process that occurs through connecting nodes in networks (Siemens, 2004). Referencing Gonzalez (2004), Siemens stresses the "shrinking half-life of knowledge" as the main obstacle to learning in a networked age, as knowledge swiftly becomes obsolete, replaced by new facts and new connections (2004).

Since its launch, the framework has gained momentum, alongside earlier theories of behaviorism, cognitivism, and constructivism (Cooper, 1993; Siemens 2004) as a viable alternative to one these other established ways of approaching learning. It has however also been the target of considerable critique regarding its (lack of)

theoretical underpinnings. Shortly following its publication, Verhagen (2006) questioned the "unsubstantiated philosophizing" and claims of novelty. Kerr picks up this line of criticism, postulating that connectivism is an unnecessary theory, arguing that existing theories are sufficient in addressing "the needs of learning in this technologically, connected age" (Kerr 2007).

Instead of psychology, then connectivism turns to network and systems theory for answers on the dynamics of distributed knowledge. Curtis Bonk (Siemens, 2009, p.2) questions whether connectivism is best seen as a learning theory in the traditional sense of a "psycholog[ical] learning theory lineage", or belongs in a sociological, or anthropological, conception of learning. The claim here is that connectivism does not so much qualify as a theory of learning, instead is more of a "pedagogical framework" for creating instructional environments. In other words, more about how to teach and design a learning environment, rather than providing an explanation of the (internal) psychology of learning itself – which remains black box, shrouded in mystery. This critique is particularly salient, because indeed, connectivism explicitly entails a move away from individual psychological processes and includes non-human actors. The matter of psychology is perhaps not fully answered, but the point in connectivism is indeed that learning is not an internal phenomenon, but a connected one. Such a move perhaps raises just as many new questions as answers regarding what "learning" then is, in such a network.

Connectivism claims to break with the central tenet of pedagogy: "that learning takes place inside a person" (Siemens, 2007) Indeed, "connectivism presents a model of learning that acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity […] The field of education has been slow to recognize both the impact of new learning tools and the environmental changes in what it means to learn." (Siemen, 2004, p.7). The basic premise in this theory is that learning is distributed over multiple people and non-human technological devices. "I store my knowledge in my friends" is a one way to summarize the entire paradigm (Stephenson, n.d., p. 1], in which such 'friendships' can include hard drives, cameras servers and social network platforms. In other words, even though experience remains the best teacher, we don't have to experience things first-hand to learn from them.

Knowledge is not acquired in a linear way, by individuals, but takes place in connection with other people and artifacts (Siemens, 2014, 2008). Bell and Winn (2000) explore not only how this happens naturally in learning, but also how it can be used as an instructional strategy, for designing distributed learning environments. In this direction, Siemens builds four metaphors for the educator: "master artist, network administrator, concierge, and curator" (2008, p.3). By being connected to people who have, and technology that can process and store information, we can learn faster and share experiences (Stephenson, n.d.). Learning occurs outside of people, is stored, processed and transmitted through technology. In a connectivist framework, technology performs some of the tasks previously required of students (such as in a calculator, or using search engines for fact checking).

## Electracy

Electracy is the ability humans have to morph and merge with technology, to connect in superhuman ways. The concept of 'electracy' was coined by Gregory Ulmer (2003) only a year before the launch of connectivism. The similarities between the two frameworks are striking, both drawing on a networks and participatory culture. However, connectivism remains related to a "pedagogy of verification", whereas electracy emphasizes the creative potential of "discovery" (Ulmer 2003). "What literacy is to the analytical mind, electracy is to the affective body: a prosthesis that enhances and augments a natural or organic human potential." The term 'electracy' is a neologism, combining "electric" with a Derridean "trace". As James Inman writes, "It is important to distinguish electracy from other terms, such as computer-based literacy, Internet literacy, digital literacy, electronic literacies, metamedia literacy, and even cyber-punk literacy. None of these other terms have the breadth electracy does as a concept, and none of them draw their ontology from electronic media exclusively" (Inman, p.52). The theory of connectivism draws a more passive picture of human capabilities, looking at learning as more receptive mode: recognizing patterns and forging links in dynamic field of distributed knowledge (Siemens, 2004). Whereas connectivism is more a mode of learning and designing learning environments, electracy points to the ability of both connecting and disconnecting. Furthermore, Ulmer includes a more critical philosophical perspective in the shift to 'electrate metaphysics', as a shift "from nature (physis) to

second nature (genius, that is, human creativity, cultural productivity)". Included in the update - and this is where Ulmer again turns to Derrida - is "the relationship between first and second nature, that is, between nature and culture: what happens in the encounter between nature and human creativity? The event that reveals most about this encounter is disaster, catastrophe (tragedy)" (Ulmer, 2003).

Striking in the framework of connectivism, as well as in its strongest critique, is the lack of such a critical note on the catastrophical implications of a network society infused with capitalism and increased energy consumption. A pedagogy of connections without this perspective remains disconnected from concerned and critical analysis of network culture.

## Tentacular pedagogy

But there is a deeper and more radical opportunity in empowering pedagogy here. And this is to give people the tools, the skills and the knowledge needed to shape the future, not only to be agents in it, but to take responsibility for the circumstances they are in. Guiding people step by step in such a trajectory means abandoning the role of a teacher as the hub of knowledge, the person who sets the aims, to a field guide who is able to identify the situation and point out the optionsn people have along the way. This means accepting the freedom of the subjects.

**MAIN TEXT**

**DIGGING DEEPER**

The task of makerspace pedagogy is introducing both the possibilities and the impossibilities, the affordances and the constraints. It is gaining a clear picture of the freedom that is possible. It is seeing yourself in relation to others and developing the stamina to engage in a life-long sustained dialog with this made world. Yes, it is about developing the patience to try again, not giving up too soon, not expecting too much or too little about yourself. About working with the material constraints and affordances of tools.

This means looking at the technical skills as dealing with resistance, grappling with the materiality. So making it tangible. A makerspace is a place to practice dealing with resistance and being in the world in a new way – not as consumers of knowledge, but as people who are able to grapple with their freedom.
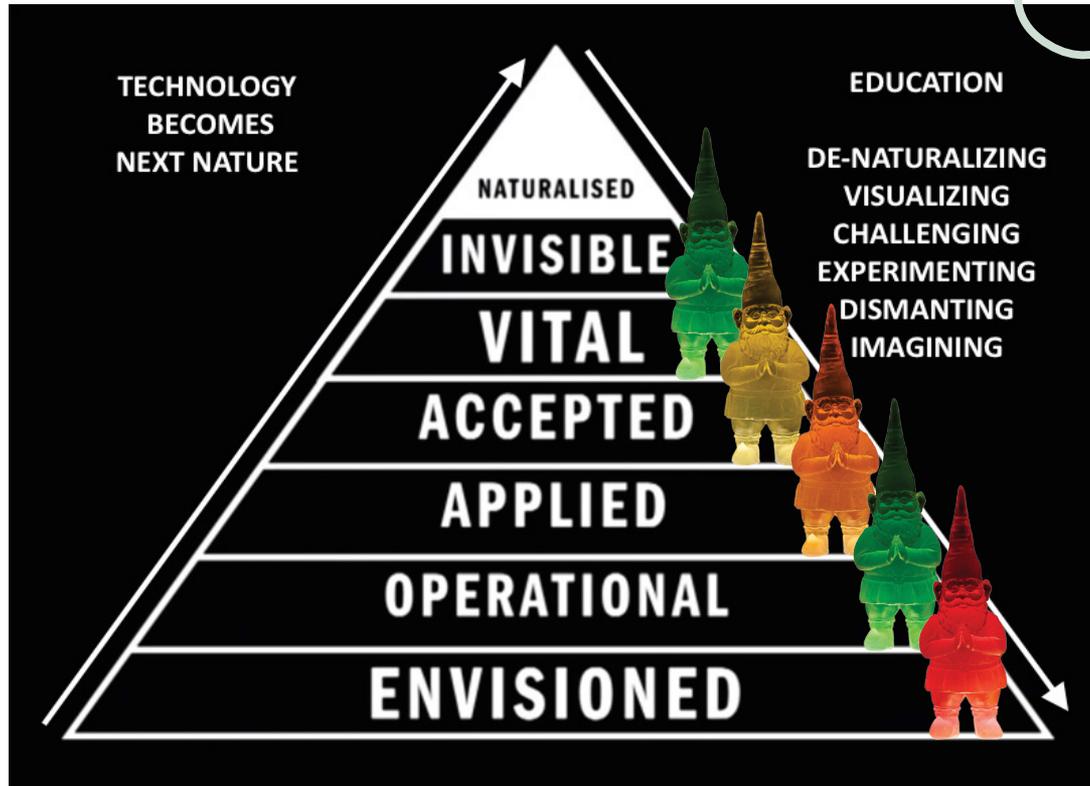
## The pyramid as a staircase

In light of these challenges, I have modified the model of the Pyramid of Technology (van Mensfoort, 2016), proposing that technology education can benefit from not only attempting to climb the pyramid, implementing more and more technology, making it vital and invisible, but as a counter-movement. Looking at learning from a connectivst point of view (Downes, 2006; Mattar 2010), learning takes places by making and breaking connection. This means two-way traffic on this pyramid, that is, finding ways to de-naturalize technology, to take it apart, to visualize and imagine it, to play with it and take it not only as an instrument, but the material and topic of creative activities. Whereas the task of designers is to make technology work by rendering it invisible, the task of educators goes against the grain: to show how technology works by revealing and discovering the very mechanisms that hide it from sight.

What might this look like? What do students learn from it? How does this differ from current digital arts practices? Turning around the pyramid of technology entails a hackers ethic: tinkering, making, undoing, peer-to-peer learning. Figuring out how things work by trial and error. Learning how to troubleshoot when things go wrong, and make trouble when structures of domination encroach on humanity. Makerspaces respond to the issues of Next Nature by providing an environment for taking things apart, tinkering, playing with technology.

The flipped Next Nature model of how technology becomes nature provides a pedagogical route for reverse engineering, turning nature back into culture again,

MORE ›

and a pliable field where technology is moved back into an embryonic phase and can be reinvented again and again. Progress travels up the pyramid, whereas education is a two-way street, scaling the pyramid and using it as a staircase to tinker with the very heart of where technology is born: in the imagination. Important for opening up technology-based education is the way teachers offer such programs with what the MIT researcher Resnick calls "wide walls" (you can try many different things) and "high ceiling" (you can get very complex with what you try), while still keeping the "low threshold" that means almost anyone can play with it (Resnick 2013).

Attempts to mimic the technological process of becoming second nature, starting by imagining, developing, applying and accepting technology in the classrooms follows the lead of technology in society at large, with a significant lag. At the moment, digital arts education – that is educational programs that either make use of networked technology as a tool, or address new media as a topic - is a fragmented field, patchy, often superficial, quickly outdated, underfunded and plagued by limited budgets, lack of expertise, outdated technology and powerful commercial forces dominating the educational marketplace. In fact, digital arts education can scarcely be called a field: despite attempts such as 21st century skills and the STEAM movement in the USA (where science, technology, engineering, arts and math are bundled together), art and technology are mostly taught separately (Piro 2010). Museums working with digital technology use it mostly to facilitate a smooth and pleasant interactive user experience, which indeed can enhance learning on-site or

**MAIN TEXT**

**DIGGING DEEPER**

online. In this case technology is instrumental: it should just work, and not draw too much attention to itself.

A camera is used to expose, but is also an instrument of surveillance. GPS is used to navigate, but also to track your location. Social media is a vehicle of democratic publishing, but also a platform of intimidation. The tools that are used to empower people are also used to control them. The instruments of freedom and expression are also agents of capitalist ideology, breeding ignorance, addiction, dependence and increasing blindness to the mechanisms at work in shaping society.

# Tentacular pedagogy in practice

"You have to keep writing this particular story. Not some story in general, but this story. You have to do this. You have to be here, not everywhere. You have to be attached to some things, not everything".

*Donna Haraway: Story Telling for Earthly Survival / Trailer / Fabrizio Terranova / 2016*

So far, I have positioned 'making' in age of entanglement, running from makerspace politics to the the context of wicked problems. In the previous chapter, building on the learning paradigm of connectivism and the pedagogy of Freire, Biesta and Oosterling, I have started to develop tentacular pedagogy as mode of co-creative facilitating particularly geared towards Maker Education. It is not a method or a formula, it is a way approaching the world as a web of relations, finding tools, making connections. This means learning directly from and with the world, seeing ourselves as part of the stuff of this world instead of the ones who 'make it'. And importantly, the role of a facilitator is offering resistance and teaching not only how to make, but also how to take apart and put things back together again. This entails is the facilitator putting their knowledge and skills at the service of the learning process of participants by creating a catalytic environment, where connections can be both forged and broken.

The teacher becomes a supertool, capable of sensing where there are disconnections, of customizing the input, of providing feedback and demonstrations. In an age where machines and humans are so intertwined, the task of pedagogy becomes one of finding the open spaces where there is room to co-create, not only to copy and follow the instructions of an instructable, reducing the human to a machine that is executing code.

What then is our job as educators in this field of 'maker education'? And what does all this mean for the facilitators working at Bouwkeet? How can this exercise of zooming out and positioning 'making' as a material practice of connecting and disconnecting come back to the microlevel? How then to act in light of the troubles?

There are no quick and easy solutions in this emancipatory mode of making that I have called tentacular pedagogy, as we are dealing with a dynamic force field of freedom and limits. Empowerment is people work: messy, pneumatic, unpredictable, full of twists and turns. I chose for tools instead of for methods and solutions, because they are flexible, situational and adaptable.  Assuming the predicament is both lasting and everchanging: the task is 'staying with the trouble' (Haraway). Staying curious. Staying put and showing the next step when people get stuck. Questioning and interrupting. And helping people shift to a mode of making that is relational, aware of the limitations and of the possibilities. Putting pressure where you can and approaching the process of learning as a process of making. We are in the business of shaping subjects, with respect and attentive humility. Here are some practical suggestions for interventions and priorities on the micro level:

One of the biggest challenges for Bouwkeet is reaching the kids who get stuck in the nevermind. To do this, we need to organize a whole army of gnomes, while at the same time making the participants aware of this small window of opportunity that is

between the 'maker mentality' and the 'nevermind'. This is the realm of practice, of discipline, of learning skills to such a level that you can then deviate from them.

A symptom of the nevermind is that facilitators become 'kabouters', doing the work for the participants. Instead of doing this, tentacular pedagogy can work to connect with the despair of the person who is stuck and search together for ways to get out— learning from each other and from the material world at hand that is already full of potentiality. Nothing will work as well as experiencing success, the victory of self-efficacy where you are able to do what you set out to. Tentacular pedagogy is about creating the conditions in which someone in the 'nevermind' state will physically experience that they are able to make something, that is, that they will encounter the wonder of co-creation by direct contact with shaping and being shaped by the material world. Give space for kids to vent their frustration if things don't work right away.

The aim of maker education is not to make people into makers, to give them false promises to change the world. This is not realistic and will be met with resistance that will ship them straight back into the nevermind. It is not about learning to make things, but about learning to act and interact with others.

These others include people, technology, materials. It is not only about shaping other things, but being shaped in our confrontation with the world. It is about discovering other people as your peers, unlocking the mysteries of technology as familiar and accessibly. In this sense, it is not about opening up knowledge, but about opening yourself up to the material knowledge in reciprocal relationships of giving and taking. What then can we make? A generation of people who practice making together, a generation equipped for futurecrafting and troublemaking. Note that the aim is not 'learning to make', but learning by making.
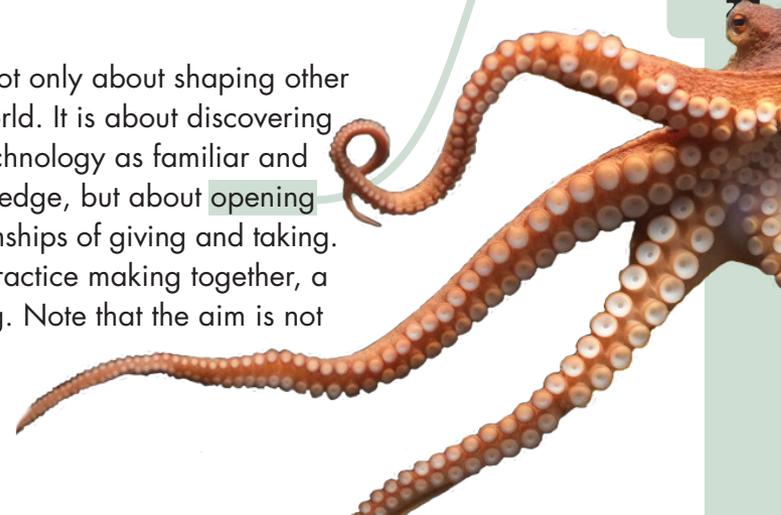
## The paradox of freedom and constraints

The very first mechanism mentioned in the document the policy documents at Bouwkeet is "making starts with a question". Of course the teenagers who come to the space are wondering all kinds of things. But when we ask them: "so what do you want to make?" they almost always draw a blank, or the mention something they have seen someone else make. Especially when they first get started, they need to gain their bearings, to see some examples, and to gain the confidence to try new things. However, you can let someone play with clay and paint, in a way you cannot let them play with lasers and saws. There need to be clear rules and guidelines for the sake of safety. Before you can freewheel, you must first learn the basic skills of how to operate the machines.

Besides the issue of safety, there is a pedagogical paradox at play when it comes to creativity. When the scope of what you are allowed to do is too wide, participants don't know what is expected of them. Too many possibilities actually block creativity. The temptation in solving this issue is to give construction kits and set assignments. This is fine for the first phase (level 0 and 1) of making. But after that, setting limits on what to make and how to make starts to work adversely. After the orientation phase and gaining some basic skills, it is time to give assignments that have multiple solutions. So setting the limits that are not completely wide open, but giving a design challenge that people are able to do. I will return to the tools available for these kinds of issues in the toolkit.

MORE ›

A kid in the 'nevermind' mentality will scoff at the optimism of makeability. Such confidence is simply not possible for most of the kids at Bouwkeet. Many of them start off lacking self-assurance; willing to learn, but easily crushed. Linked to this is the inability to deal with resistance and failure. This can manifest itself in different ways: rebellion, apathy, being timid, sloppy work, cutting corners. Such students seem unmotivated, lacking the inner drive and curiosity to make things – which is of course incredibly challenging for the one responsible for facilitating such a workshop. Enthusiasm and positivity coming from a facilitator can help a bit, but will not remedy the core of this problem, which is rooted in the repeated lived experience of power-lessness: the inability to control one's life, constantly being overruled by parents, teachers and peers. One small failure, and a person dwelling in the nevermind will again be confirmed in the message: I can't make anything. They may stomp off, give up, withdraw. Or maybe buckle down to the work and do the assignment as soon as possible. Deep down, it looks like they simply don't care. And this comes from having experienced that their point of view doesn't matter.

Turning to the book 'inventing the future' as a postcapitalist view on futurecrafting, taking a skeptical stance on technology. So not saying that giving technology and tools to people will empower them, but it can be used either way. The pedagogical task is then to make people aware of the force fields at play, and guide them in the choices they are making. Ultimately, leaving the question of what they will make, under what conditions, for whom, as an issue that people are very well able to make

themselves. "technology is neither good nor bad; nor is it neutral" (Kranzberg 1986, 545).

"So far as a mind is disciplined, control of method in a given subject has been attained so that the mind is able to manage itself independently without external tutelage. The aim of education is precisely to develop intelligence of this independent and effective type—a disciplined mind. Discipline is positive and constructive." Dewey (1910, 12). In discussing the relationship between doubt and judgment, on what ideas are, Dewey "Taken merely as a doubt, an idea would paralyze inquiry. Taken merely as a certainty, it would arrest inquiry. Taken as a doubtful possibility, it affords a standpoint, a platform, a method of inquiry." He then goes on to say "Ideas are not then genuine ideas unless they are tools in a reflective examination." (108)

Obviously, to make the shift to a new system, we can't keep on teaching the old way. However, as Gerd Bieta rightly points out, this rhetorical device is only half-true (2015). Yes, there are troubles, yes we need to change. But what does this mean for education? Biesta takes a stand against the trends and fads of education, stepping back to think again: what is the pedagogical task in light of the developments above? Not to become a slave to the culture industry, to technoregulation, to the cult of the new, rather to reinstate the heart of education as forming subjects by working with resistance, interruption, questioning and guiding.

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On a fundamental level, I side with Biesta. My aim is to connect a strong pedagogical vision with the practicalities of maker education. Making anything or everything is not good enough. We need to keep on asking not only what or how to make things, but why, and who will benefit from it, or who could be harmed. We have no time for uncritical making. Nor is criticality something that can be reserved for artists and philosophers. It is not an elitist practice. What however is elitist is the assumption that people in impoverished socio-economic circumstances not able to think for themselves. Or that the maker movement has exhausted its emancipatory beginning. To make an impact on the world, we need to connect and disentangle the different fields, instead of placing them in a competitive mode to see which one will win.

## Learning to fail

At Bouwkeet making things is a way of creating the conditions to learn. It's more about the learning than the making. Indeed, it's ultimately not really about making beautiful or useful things – it's about shaping people in such a way that they grow stronger, more capable, about cultivating habits and gaining confidence. An essential part of learning by making, is learning how to fail and increasing the material knowledge of connections and tools that will provide a way to face the troubles and make it work without knowing in advance exactly how.

Instructionalism
From literature and from practice one thing is clear. Without instructions kids have neither the knowhow, nor the confidence to embark in making without some instructions. And the workspaces are filled with machines that are either a) so dangerous that they are not allowed to use them independently (band saws, laser cutters b) so complicated that they cannot use them or c) so delicate that they cannot be used by the kids with the risk of them breaking. In other words, the material environment is not particularly conducive for free play and experimentation because of real threat of danger for the people or the machines, or a simple lack of experience or confidence to try them out. In order to overcome this initial threshold, a certain amount of introduction and instructionalism is necessary. You simply will never get the most out of a 3D printer, if you are not shown how it works and what is possible.

The choice between 'program or be programmed' (Rushkoff) is a false distinction. To learn how to program is to be programmed and reformatted, and this kind of shaping of subjects is the very nature of learning. Tentacular pedagogy requires this sharp awareness of the multi-directionality of tools. This means learning from materials and tools, as we enter into temporary configurations with devices and things, that we are being shaped as subjects as we shape objects. To do this, we can use the pyramid of technology with a hackers ethic: tinkering, making, undoing, peer-to-peer learning. Figuring out how things work by trial and error. Learning how to troubleshoot when things go wrong, and make trouble when structures of domination encroach on forms in this world that we think are worth taking care of.

## In-formation: how objects learn

The media philosopher Flusser develops an interesting idea of 'information' and fabrication as learning in the most literal sense of the word: to in-form is to give a form to something, which then in turn has an imprint on other things. Such a view of learning points to a reconceptualization of the factory as an "applied school for the acquisition of information. And at this point, the term homo faber comes into its own for the first time (…) The factory will have to be the place in which human beings altogether will learn by means of robots: what, why and how to turn things to use. (…) The only crucial thing is that the factory of the future will have to be the place where homo faber becomes homo sapiens sapiens because he has realized that manufacturing means the same thing as learning i.e. acquiring, producing and passing on information." (1991, 12). We have taken material and turned it into what Flusser describes as an immutable idea—namely a knowable, definable, and workable unit. We have built our environment out of such units in the form of boards, bricks, shingles, etc. A quick survey of the building blocks of our human-made environment reveals very little in the way of organic form. Instead our built environment, up until now, has been one of immutability in the form of rectan¬gular units.

"These are places in which human beings become less and less natural and more and more artificial, for the reason that the things turned into other things, the manufactures, strike back at the human being: A shoemaker not only makes leather shoes; he also makes a shoemaker out of himself. To make the same point a bit differently: Factories are places in which new kinds of human beings are places in which new kinds of human beings are always being produced: First the hand-man, then the tool-man, then the machine-man, and finally the robot-man." (Flusser 1991, 11)

# Powertools for futurecrafting

The main challenge of the scope and the scale of this research has been dealing with the complexity of so many lines and questions intersecting at so many levels at the same time. In this process, searching for practical tools for the facilitators at Bouwkeet is the only thing that has kept me grounded.

Theories unravel when juxtaposed with practice in such close proximity. I have tried to let that happen, to face the troubles and remain committed to drawing them out in such a way that there is still room for action. If anything, I have learned that the gap between theory and the lived experience on a microlevel is even larger than I thought is was. That theory has just as much to learn from material practice as the other way around. In the end, there is a difference between what we say and what we do, but both coexist and interact on the same plane along with all the forces of natureculture, cultivating nature and naturalizing culture.

Staying with the trouble means constantly going between these discourses and allowing for things to morph and be informed by each other along the way.

Now it is time wrap things up by returning to the initial questions, working backwards from the meta and ending where we started at Bouwkeet

## If making is a solution, what were the problems in the first place? Is making an adequate response to these problems?

Making contributes to the problems that it claims to solve. In this way, it is part of a wicked problem. The problems of sectarian disciplines, of alienation, of black boxes and failing education systems are in no way solved by 'making'. In fact, making is a whole new can of worms. Digging deeper into the rhetoric shows that making reinstates an anthropocentric paradigm of manufacturing as imposing human will over matter—with the aid of machines.

In response to this, I suggest that making would benefit from connecting to a paradigm shift already taking place in theory and in practice. This shift moves away from the separation of subjects and objects as more or less fixed objects, that can inflect on each other, yet are always dismembered. If you pay close attention to what is going on in practice, the boundaries are already deeply blurred.

There are gnomes in the making, and humans on the networks. There are algorithms in our pockets and our voice travels through the sky. The network is not an abstraction, it is the material reality of forces of energy and resistance that shape the world in temporary nodes, along which information travels at ever-increasing speeds. Tremendous creative and critical potential can be released if we shift the focus away from making objects and towards futurecrafting in terms of making and breaking connections. Connectology opens up a vast material realm of resources for critical materialism. This means that we don't only think about making objects, but about changing the operating system. If we stay in the paradigm of makeability, tinkering

with technology is a mere distraction and will have little material impact on the conditions needed for a future of living together on spaceship earth. Making is not a substitute for figuring out how to collaborate between the institutional divides and to counteract the material hegemony that got us here in the first place. Making needs a firmware update.

And then zooming down one more level, closer to lived reality and the practicalities at hand, the second question was:

What is the pedagogical task for 'maker educators' and what tools are available to support this?

The key to opening up maker education is developing a better understanding of tools, technology and the material world as a force field of connections. The learning going on in 'making' is not a transfer of skills from the teacher to a student, from instructions to the production. Such a pedagogy views human beings as the machines that perform prescribed algorithms—good for creating flexible labour, but insufficient if the aim of education is empowerment. Maker education requires tentacular pedagogy

How can Bouwkeet create the optimal conditions for young people (age 10-15) to engage in 'learning by making', focused on developing empowerment, soft skills and broadening their horizons'?

The tools I have developed for Bouwkeet can be found in the appendix. When it comes to the question of the optimal conditions, I think I need to rephrase the question. The conditions for creating are never optimal in a general sense. There is no one-fits-all solution. What is needed most of all is that the facilitator positions themselves as a connector and a catalyst, helping to create the conditions for making that is filled with curiosity and possibility of the potential of materials to be transformed into something else. Tentacular pedogogy is focused on making connections that open options for people to make choices; which are not grounded in the paradigmm of egocentric making. Working with both connections and disconnections, making and taking things apart both as part of the creative process.

Secondly, it means looking at empowerment not as a hollow shift to the maker mentaility (I can do anything), but a fluency in learning how not only to learn by making (as a product), but learn from the materials you are working with.

Thirdly, it requires the facilitator to be aware and reflect on the connections and disconnections in the group, transforming themselves to a position where they can meet the participant where they are at. From this connection you can forge a bond of knowledge, skills, discoveries where everyone is learning. The task is to not generate things, but possibilities. And to teach people what to make, and why to make, but to engage in a constant conversation about the made world around us and what is worthwhile to add to it, and what might need to be dismantled.

# Bouwkeet Toolkit Voor begeleiders

**FIELDWORK**

# 1. Leerdoelen Bouwkeet

BouwKeet zet in op drie gebieden:
  empowerment
  wereldverbreding
  soft skills
Deze drie gebieden voeden elkaar en vullen elkaar aan. Ze kunnen moeilijk los van elkaar gezien worden.

## 1.1 Empowerment

Empowerment gaat over het ontdekken van jezelf. "Wat kan ik? Wie ben ik?" Weten wat je wilt en ervaren dat het uiteindelijk ook lukt. Kiezen uit de mogelijkheden die binnen je bereik liggen. Voor Bouwkeet betekent dit dat een deelnemer zijn/haar leven zelf maakt. Dat je grip krijgt op je wereld. Je neemt verantwoordelijkheid voor wie je bent, wat je doet en wat je maakt. Je ervaart dat je invloed hebt, dat jouw bijdrage echt uitmaakt. Het betekent ook: deelnemers de mogelijkheden geven om talenten te ontdekken, zelfvertrouwen te ontwikkelen, te beseffen waar je goed in bent en dat je trots mag zijn op jezelf. Naar binnen gericht, individuele ontwikkeling.

## 1.2 Wereldverbreding

Wereldverbreding gaat over het ontdekken van je eigen positie in de wereld. "Waar sta ik?" Over jezelf in relatie tot anderen zien en positie bepalen. Het vergroten van de leefwereld en ontwikkeling van technische vaardigheden van individuele gebruikers om een open attitude te bewerkstelligen. Open staan voor nieuwe ervaringen door het

MORE ›

op een positieve manier in aanraking komen met (nieuwe) mensen, machines, materialen en technieken. Ontdekken wat er nog meer in de wereld is. Dat kan door nieuwsgierig te zijn en durven vragen "Waarom?". Je gaat steeds meer mogelijkheden ontdekken. Dit betekent dat je je beseft dat je niet alleen bent. Dat je rekening houdt met anderen. Kennis delen en open staan voor de buitenwereld. Je leert van anderen en geeft jouw kennis ook door. Samen zijn we sterker. Naar buiten gericht.

### 1.3 Soft skills

Naast de hard skills ontwikkelen deelnemers ook soft skills. Soft skills zijn vaardigheden voor zelfontwikkeling. Deze zijn nodig om te functioneren in de hedendaagse maatschappij. "Wat wil ik?" en "Wat heb ik nodig?" Het werken aan soft skills draagt bij aan empowerment en wereldverbreding van deelnemers.
De soft skills zijn een brede set vaardigheden. We focussen met name op:
- Creativiteit (nieuwsgierig zijn, verbeeldingskracht, ideeën produceren)
- Samenwerken (in groepsverband iets creëren, kennis delen, communiceren, elkaar helpen, van elkaar leren)
- Probleemoplossend vermogen (doorzettingsvermogen, oplossingsgericht denken, geduld)
- Ondernemerschap (proactief, zelf doen, handelen, kansen zien)
Er is ook aandacht voor: planmatig werken, verantwoordelijkheid (krijgen en nemen), zelfsturing, digitale vaardigheden en duurzaam denken.

## 2. Leren door te maken: in vijf fases

Fase 0: Kennismaking: ontdekken wat je kunt maken

→ nieuw in Bouwkeet (10-15 jaar)
→ succeservaring
→ tastbaar resultaat om mee naar huis te nemen en laten zien

Bouwkeet nodigt je uit om te maken. Je gaat eerst verkennen: wat kun je hier allemaal doen? In de activiteiten voor beginners krijg je opdrachten en materialen van de begeleider. Het begint met simpele dingen maken die in één keer lukken. Dat geeft een 'wow' effect, waardoor je de moed verzamelt om de volgende uitdaging aan te gaan.
De volgende opdrachten volgen het goudlokje principe: niet te moeilijk, niet te makkelijk. Om dit goed in te schatten is de begeleider alert op wie er in de groep zit, wat ze leuk vinden en waar ze toe in staat zijn. Ben je een keer eerder klaar? Dan ligt er een hele bak aan simpele opdrachten waar je mee verder kunt gaan. Zo blijf je bezig met ontdekken wat er allemaal kan en hoef je nooit lang te wachten omdat je niet weet wat je moet doen. Door steeds nieuwe dingen te maken stap je uit je 'comfort zone' en in de 'zone van naaste ontwikkeling'.
Om dit te kunnen doen heb je een veilige omgeving nodig waar je jezelf kan zijn. Het moet helder zijn wat er van je verwacht wordt en waar de grenzen liggen. Iedereen die zich aan de spelregels houdt is welkom. Je voelt je gezien en gesteund door de begeleider. Je krijgt bevestiging van de begeleider als je goed bezig bent.

Op een gegeven moment wordt het moeilijker. Omgaan met tegenslag en beperkingen is minder makkelijk, maar ook dat hoort erbij. En dan merken dat wat je je hebt voorgenomen toch gaat lukken. Dat geeft een kick. Je leert dat het niet erg is als iets niet meteen lukt. Oh, je hebt de plus en de min omgedraaid? Niet opgeven, maar leren van je fouten en vieren als het gelukt is!

Je leert in deze wat technische basisvaardigheden en de mogelijkheden van ver-shillende gereedschappen, materialen en machines. Je leert ook de basishouding die hoort bij de eerste fases van maken: het lef om iets te nieuws te proberen, zonder te weten of het gaat lukken. Want hoe kun je goed inschatten wat je kunt en wat je wilt, als je nog niet weet wat allemaal kan?

Je krijg in deze fase gerichte opdrachten met stap-voor-stap instructies en beperkte vrijheid. Bij de uitleg laat je zien wat de stappen zijn en doe je elke handeling een keer voor. Zodra een deelnemer het goed doet, kun je hem/haar inzetten om het ook anderen te laten zien.  Zorg er wel voor dat het niet te schools wordt door af en toe een spelletje, een proef je of een challenge in te zetten. En een beetje ruimte geef je wel om binnen de kaders verschillende opties te kiezen zodat de eindresultaten niet allemaal op elkaar lijken. Je mag bijvoorbeeld zelf de kleuren kiezen, de grootte.

Als iets af is, laat je het altijd zien. Dan vier je samen dat het is gelukt. Je krijgt nuttige feedback met tips en tops. Input van de begeleider is gericht op motiveren en inspireren.

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Fase 1: Het maakproces ontdekken

→     enige ervaring bij Bouwkeet
→     10-15 jaar
→     samenwerken
→     stap-voor-stap
→     steeds meer vrijheid
→     intensieve begeleiding

Plezier in het maken zorgt ervoor dat de je door wilt gaan en je grenzen verlegt.

Je staat er nooit alleen voor. Maken doe je samen met anderen en met behulp van allemaal gereedschappen en machines. De begeleiders helpen jou steeds weer verder. Je leert met je handen en met je hoofd, daardoor begrijp je dingen beter. Gaandeweg snap je steeds beter wat er allemaal bij komt kijken als je iets wilt maken.

Fase 2: Ervaren waar je (samen) toe in staat bent

→     verschillende activiteiten al gedaan
→     je interesses en talenten ontdekken
→     complexe projecten
→     zelfstandig met input en begeleiding waar nodig

MAIN TEXT

FIELDWORK

Nu gaat het niet meer alleen over wat er allemaal kan. Maar wat kun jij eigenlijk? En wat vind je leuk om te doen? Je leert hoe dingen in elkaar zitten door te maken, maar ook door spullen uit elkaar te halen. Je ontdekt je interesses en talenten. Kapotte dingen kun je repareren en hergebruiken. Inspiratie put je uit de verschillende voorbeelden die je krijgt aangereikt. Je gaat op onderzoek uit in de wijde wereld van wat anderen al gemaakt hebben en hoe ze het hebben aangepakt. Doordat je ziet wat er allemaal mogelijk is, kom je ook verder met je eigen ideeën ontwikkelen. Het blijft niet bij de eerste ingeving, je ontwikkeld steeds meer om opties om uit te kiezen. Je gaat je eigen nieuwsgierigheid volgen en uitzoeken hoe dingen zitten. Je ontwikkeld een fascinatie voor materialen en technieken. Kom je problemen tegen? Dan kijk je goed wat er aan de hand is en los je die (samen) op.

Fase 3: Oefenen met maken: zelfstandig en samen

→ semi-zelfstandig aan de slag
→ bedenken wat je wilt en wat je kunt
→ de vaardigheden beheersen om zelf te kunnen kizen
→ begeleiders bevragen en reflecteren vooral op het proces
→ technische begeleiding

In deze fase kun je vragen: wat wil je maken? Je geeft veel vrijheid in hoe de deelnemers het willen aanpakken. Je stelt je op als coach en geeft tools om het proces goed te begeleiden.
Als je opdrachten geeft, zijn deze gekoppeld aan echte vraagstukken uit de wereld.

Maar nog beter is als de deelnemers zelf met vragen of problemen komen waar ze mee aan de slag willen.

Je gaat ook als maker anders kijken naar de wereld om je heen. Je afvragen waarom dingen zo zijn en of het niet anders kan. Dingen maken die impact hebben op je omgeving. Slimme oplossingen voor alledaagse problemen of wilde ideeën voor iets nieuws. Gaandeweg wordt je steeds handiger met allerlei nieuwe gereedschappen en kun je zoeken wat je nodig hebt om je ideeën te realiseren.

Je leert kiezen welk ontwerp het beste past bij wat er nodig is in je omgeving. Steeds beter kun je inschatten wat haalbaar is voor je. Je krijgt het lef om te experimenteren en nieuwe dingen te proberen.

Je leert van elkaar, met elkaar. Advies kun je geven en accepteren. Je ontdekt daarmee uiteindelijk de beste oplossingen. Je gaat maken wat je echt de moeite waard vindt, ook al is het anders dan je de anderen. Je leert kritisch kijken en testen of iets echt goed werkt. Soms moet je toegeven dat het niet zo'n succes is. Geeft niet, je kunt je prototype doorontwikkelen. Of desnoods opnieuw beginnen.

Fase 4: Open werkplaats

→ mix van jong en oud, experts en amateurs
→ jongeren (10-15) kunnen al (semi)zelfstandig werken aan projecten
→ begeleiders bieden technisch en procesmatige ondersteuning (op verzoek)

FIELDWORK

MAIN TEXT

Intussen kun je zelfstandig werken met de verschillende machines en ben je in staat om veilig en verstandig om te gaan met de aanwezige middelen. Uiteindelijk ben je in staat om het hele maakproces met anderen aan te gaan: van idee tot uitvoering. Goed bedenken: wat is de moeite waard om te maken? Brainstormen, vooraf inschatten of iets haalbaar is, proefjes doen, risico's nemen in de uitvoering. De stappen in het proces ken je inmiddels zo goed dat je weet hoe je iets moet aanpakken. Je bent niet uit het veld geslagen als iets niet meteen lukt. Je probeert steeds opnieuw en volgt hierbij je eigen interesses.

Je bent in staat om een team samen te stellen met de nodige expertise en taken te verdelen. Je regelt zelf de materialen die je daarbij allemaal nodig hebt. En je zoekt (online) hulp waar nodig, dat hoort er ook bij. Missie geslaagd. Nu mag je eindeloos verder gaan met maken. Bouwkeet biedt je de kans om dit te doen op jouw manier.

Fase 5: Begeleider worden

Dit is zo cool, je skills wil je met anderen blijven delen.

voor zelfontwikkeling. "Wat wil ik?" en "Wat heb ik nodig?"

Door het 'maken' doen de deelnemers vaardigheden op

MAIN TEXT

FIELDWORK

## Tools

De mens als een supertool
In de verschillende werkplaatsen heb je allemaal verschillende machines en gereed-
schappen. Maar geen enkele is zo goed geschikt voor het begeleiden van leren door
te maken als een ander mens. En dat ben jij. Als begeleider is het jouw voornaamste
taak om al je skills in te zetten om de deelnemers te ondersteunen bij het maken. Een
mens heeft namelijk voelsprieten om in te schatten hoe anderen eraan toe zijn. Als
mens ben je ook in staat om alle andere gereedschappen in de werkplaatsen te leren
bedienen.

Hier zit ook een mogelijke valkuil in: dat ze afhankelijk worden van jou, waardoor ze het uiteindelijk niet zelf kunnen. Dit kun je voorkomen door alert te blijven op hoeveel je voor mensen doet. Je mag soms best een "kabouter" zijn en mensen helpen die het echt zelf niet kunnen. Bijvoorbeeld als ze de fysieke kracht niet hebben. Of nog niet zelfstandig met een machine kunnen omgaan.
Je bent als mens de enige 'tool' in de werkplaats met pedagogisch inzicht. Dit betekent dat je kunt inschatten wat mensen al kunnen, wat ze nodig hebben. Verbindingen leggen. Voordoen, laten zien wat mogelijk is. Als deelnemers zich met jou verbinden leren ze het snelste. Om dit te doen moet je een band opbouwen. Ze moeten goed weten wat ze aan je hebben. Dat ze op je kunnen rekenen voor steun en advies. Voor feedback en opdrachten. Voor inspiratie en uitleg.
Maak jezelf niet al te belangrijk. Zodra het kan, laat de deelnemers van elkaar leren. Want zoals je zelf kunt ervaren als je voor een groep staat: het is heel leerzaam om andere mensen iets uit te leggen. Hierdoor snap je het zelf ook beter. Sterker nog, je snapt het pas echt als je je kennis kunt doorgeven.
Om dit te kunnen, heb is het nodig om je je als begeleider ook te blijven ontwikkelen op dezelfde terreinen als waar we op inzetten voor de deelnemers: empowerment (weten wat je kunt), wereldverbreding (weten wat mogelijk is) en soft skills (de vaardigheden om het te kunnen realiseren).Want in tegenstelling tot een hamer, of een naaimachine, ben jij in staat om te leren en om andere mensen iets bij te brengen.

Hoe kunnen we onszelf blijven ontwikkelen als 'tool' voor de deelnemers? Daar heb je twee manieren voor

a)      je dus ook weer andere mensen voor nodig. Dat zijn je collega's. Je kunt elkaar helpen, door elkaar vaak feedback te geven.

b)      Zelf ook dingen blijven maken. Want dan blijf je geloofwaardig als rolmodel, leer je steeds nieuwe dingen die je

En het liefst dan ook deze twee samen: dingen blijven maken met je collega's.

## Didaktische handvatten

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We leven weliswaar in het tijdperk dat sommige machines (robots, computers etc) zelf kunnen denken en leren. Maar andere mensen iets leren? Dat blijft echt mensenwerk.

1.      Drempel laag, ambitie hoog: iedereen welkom, iedereen uitgedaagd
2.      Educatieve programma's steeds testen, monitoren, evalueren en blijven doorontwikkelen
3.      Stel (weder)vragen
4.      Gebruik toegankelijke taal
5.      Maak persoonlijk contact
6.      Verdiep je en leef je in! Sluit aan bij de belevingswereld van deelnemers.
7.      Gebruik inspirerende voorbeelden en laat mogelijkheden zien.
8.      Laat mensen zelf ontdekken! Eerst voordoen, dan laten nadoen, dan mensen

## 2. Hoe werken wij?

Of, hoe maken wij? Want in BouwKeet wordt vooral gemaakt en is iedereen een 'maker' BouwKeet is het technisch clubhuis van de wijk. Dit vraagt een goed balans tussen voldoende structuur, vrijheid om te ontdekken en inspiratie voor ideeën. Op elke werkplaats is een instructeur en vrijwilliger aanwezig die deelnemers kunnen begeleiden. Beide zullen in dit stuk begeleiders genoemd worden. In de vroege avonduren kan er vrij gewerkt worden in de FreeSpace. BouwKeet biedt ook speciale eigen programma's aan. Overdag zijn er speciale programma's voor scholen.

De BouwKeet methodiek bestaat uit 10 ingredienten:

→     Leren door te maken
→     Leren van anderen, met anderen
→     Laat het zien!
→     Begeleiders zijn enthousiaste makers
→     Zelfstandigheid stimuleren
→     Verbindingen leggen tussen mensen, machines, ideeen
→     Wederkerigheid: halen en brengen
→     Zinvolle dingen maken
→     Vrijheid ontwikkelen met beperkingen
→     Respect voor verschillen

Leren door te maken

In Bouwkeet wordt gemaakt. Door iets fysiek te doen onthoud je meer dan door er alleen over te horen. Dat betekent dat de uitleg voor deelnemers zo kort mogelijk blijft en stap voor stap wordt aangeboden.

Van 'vragen' naar 'maken' kan op verschillende manieren in BouwKeet. We hebben een grote verzameling voorbeeldprojecten, van BouwKeet deelnemers en de eindeloze mogelijkheden van uit boeken bij de koffietafel en van internet. Bijvoorbeeld door de vele instructables samen op te zoeken tijdens programma's. Iedereen in BouwKeet deelt zijn project, door dit delen wordt de verzameling van mogelijkheden steeds groter. Deelnemers worden zo gestimuleerd om vooral verder te kijken dan hun eerste idee en zien wat er allemaal mogelijk is.

In de langere programma's zit altijd een aspect van deconstructie – constructie. Zo halen we eerst een trui uit elkaar om vervolgens een unieke persoonlijke versie van te maken. Door iets uit elkaar te halen leer je hoe iets in elkaar zit. Door het zelf weer in elkaar te zetten, kun je dit geleerde meteen toepassen.

BouwKeet is een plek voor de praktijk. Het begint met een vraag, daarna maakt de deelnemer een prototype en dan kijkt ie of dit antwoord geeft op de vraag. Deelnemers gaan vooral uitproberen als ze willen weten of hun project werkt. Door zelf fouten te maken en vervolgens samen naar die fouten te kijken en zo een nieuwe stap te zetten.

Vaak volgt dan een nieuwe vraag.

→ Wil je meer weten? Zoek op: Learning by Doing, Embodied Learning, Creatief Vakmanschap, Design Thinking, Makersmovement

MAIN TEXT
FIELDWORK

Leren van anderen, met anderen

Bouwkeet kan alleen bestaan omdat we allemaal plezier hebben in maken, en we dit graag delen met anderen. Door het enthousiasme dat je zelf iets kan maken, wordt elkaar helpen vanzelfsprekend en delen wat je doet ook. Vaak heb je vier handen nodig als je iets maakt. BouwKeet werkt met wederkerigheid, deelnemers betalen niet met geld maar met uren, op basis van wederkerigheid. Kan jij een computer in elkaar zetten? Leer het anderen ook. Dat kan door een vriend te helpen. Door uit te leggen aan een ander leer je het zelf nog beter. Als je samen aan het maken bent, geef je elkaar vaak spontaan commentaar en dat helpt de ander weer verder. In de FreeSpace werken allerlei leeftijden, achtergronden en genders door elkaar heen, iedereen is een BouwKeet-gebruiker. Allen met een gedeelde interesse, de één beginneling, ander met praktijkervaring en jij, als begeleider en full-practioner. Stapt iemand voor het eerst binnen in BouwKeet? Dan heeft ie waarschijnlijk veel begeleiding nodig, na een tijd doet hij het zelf en helpt ook anderen. Als een groep goed samen maakt, wordt er meer kennis gedeeld. Sfeer en gelijkheid zijn belangrijk.

Laat het zien!

Laat deelnemers trots zijn op wat ze hebben gemaakt. Het mag gezien worden! Laat deelnemers hun producten zien aan hun vrienden en familie. Dat kan in de shop, of met foto's on- en offline. Aan het eind van het programma kunnen deelnemers altijd laten zien wat ze hebben gedaan, dat kan een tentoonstelling, fietsoptocht, mode-show, feest of wedstrijd zijn. Ze vieren hun successen. In BouwKeet is het geven en

nemen, dus alle deelnemers werken samen aan de organisatie en uitvoering van dit moment.

Is Bouwkeet voor deelnemers te klein geworden? Dan kunnen we samen op zoek naar uitdagingen voor het maken in de buurt. Bijvoorbeeld door een bijbaan bij de fietsenmaker, of stagelopen bij een ontwerper in de buurt.

Begeleiders zijn enthousiaste makers

Klussers in het technisch clubhuis van de wijk, dat zijn o.a. de begeleiders van Bouwkeet. Het grootste gedeelte van het team van BouwKeet zijn werkplaats-begeleiders. Een begeleider helpt en leert deelnemers om te maken, bewaakt mede de veiligheid en bouwt aan de sfeer. Een begeleider zorgt dat er veilig gewerkt kan worden. Hij/zij is de vraagbaak in de werkplaats en koppelt deelnemers op kennis en kunde. Hij is een enthousiaste specialist in de werkplaats waar hij/zij staat en gaat open een gesprek aan, advies, geeft veiligheidsinstructies (veiligheid) en hulp. Voor de veiligheid is er hiërarchie in verantwoordelijkheid. Als er een veiligheids-procedure van start gaat zijn de baliemedewerker en coördinator (BHV'ers) de centrale punten van BouwKeet. Andere begeleiders volgen de veiligheidsinstructies op.

Voor begeleiders zullen er ook EHBO en conflictmanagement trainingen zijn. Het team van de BouwKeet bestaat uit verschillende mensen, zodat er voor alle deelnemers iemand is in wie ze zich herkennen. Samen iets maken met mensen in wie je je herkent is een van de meest stimulerende manieren om te leren. De drijfveer

van begeleiders komt vaak van de passie voor 'maken', materiaal of een techniek, maar ze nemen ook hun levenservaring mee. We proberen zoveel mogelijk inspirerende rolmodellen een begeleidende rol te geven in BouwKeet. Begeleiders zorgen ervoor dat de deelnemers zelf kunnen maken en uitwisseling tussen deelnemers mogelijk is. Bijvoorbeeld door rekening te houden met verschillende persoonlijkheden en leerstijlen. Voor begeleiders die voor een lange termijn zijn verbonden aan BouwKeet is het wenselijk om een BouwKeet Training te volgen. Zie Bijlage 1 Bouw-Keet Training.

→ Wil je meer weten? Zoek op: Zone van naaste ontwikkeling, Leerstijlen Kolb, Supervisie, Presentietheorie, Gentle teaching

### Zelfstandigheid stimuleren

Bouwkeet is vooral voor na school, na werk en buiten thuis. Het is het technisch clubhuis van de wijk, een plek voor je vrije tijd. Door te maken, kreeg je steeds meer vragen. Je wil zelf iets. Dat kan klein beginnen "ik wil mijn lamp repareren" tot groter; "ik wil een bedrijf starten dat zelf sleutelhangers 3d-print". Deelnemers worden gestimuleerd en gecoacht om zelf die vraag te stellen, een plan te maken en actie te nemen. Dat begint dichtbij, vanuit iets dat je graag wilt of op youtube hebt gezien. En zo groeit het steeds groter of verder, van de wereld die je kende naar die nieuwe wereld van het zelf maken. In Bouwkeet zijn veel machines aanwezig en iemand om uitleg te geven. Zo krijgen jij en ook deelnemers stap voor stap de verantwoordelijkheid over de machines en de gehele werkplaats.

Een startshot voor zelf-sturend maken kan zijn een vraag vanuit:
→        Materiaal, bijvoorbeeld 'Wat is het verschil tussen houtsoorten?',
→        Techniek of machine, bijvoorbeeld 'Hoe werkt een 3d printer?'
→        Functie, bijvoorbeeld 'Kan ik zelf een fiets maken?'
→        Probleem, bijvoorbeeld 'Hoe zorg ik dat mijn jas weer dicht kan?'
→        Bestaand product, bijvoorbeeld 'Wat kan ik nog met een oude computer?'

→ Wil je meer weten? Zoek op: Zelfsturend leren, Authentiek leren, Pragmatic paradigm (Dewey), Strategisch leren

MAIN TEXT

FIELDWORK

<u>Grenzen en lastig gedrag</u>

Leer deze drie soorten van lastig gedrag herkennen:

1)      frustratie (ik) onmacht, schreeuwen, huilen, vloeken, schelden. De frustratie blijft bij iemand zelf. Het wordt niet ingezet om iemand anders te kwetsen.
        Wat is er dan nodig?
        Begrip, luisteren, samenvatten, doorvragen, opties geven
2)      witteboordenagressie (jij, jullie, men in het algemeen). Manipulatie, ondermijnend, uit de discussie stappen, arrogant.
        Wat is er nodig? De 4 Gs.
3)      Agressie op persoon (jou): intimiderend, dreigend, beledigen, discriminatie (culturele achtergrond, geloof, leeftijd, man/vrouw, seksuele intimidatie, grensoverschrijdend gedrag)

Lastig gedrag en agressie pak je stevig aan met de vier Gs:

Gedrag: Benoem wat je ziet met een feitelijke omschrijving ("ik zie... gebeuren", "ik hoor je zeggen dat..")
Gevoel: aangeven wat het met je doet ("dit vind ik niet fijn", "daar schrik ik van")
Gevolg: duidelijk maken wat de consequenties is ("als we zo doorgaan dan krijgen we het niet af")
Gewenst: Wat wil je graag zien?
→       Bron: Lia.. Training grenzen en gedrag

Knelpunten en valkuilen

1. Dingen afmaken (kabouterplaag)
2. Te vroeg teveel vrijheid geven
3. Te weinig stimulans voor creativiteit
4. Te lang teveel instructies geven (schooltje spelen)
5. False verwachtingen scheppen (maken is niet makkelijk)
6. Product boven leerproces stellen
7. Kopieergedrag stimuleren
8. Onduidelijke grenzen

Competentieontwikkeling begeleiders Bouwkeet

Als begeleider ben je er trots op voor Bouwkeet te werken. Je levert een wezenlijke bijdrage aan de empowerment van anderen. Je steekt graag de handen uit de mouwen. De begeleider wil vanuit zijn/haar eigen empowerment anderen graag verder helpen. Om dit zo goed mogelijk te doen, blijf je jezelf ook ontwikkelen. Deze competenties ontwikkel je door een combinatie van praktijkervaring, training en coaching. Begeleiders zijn supertools de helpen om mensen te vormen tot zelfstandige makers

Begeleiders zijn zelf ook enthousiaste makers

Je kunt laten zien hoe je dingen maakt, omdat je dat zelf ook graag doet. Je maakt dingen waar je best trots op mag zijn. Hierdoor ken je de materie en verken je steeds ook nieuwe mogelijkheden. Je beheerst een breed scala aan praktische vaardigheden en ontdekt ook steeds nieuwe dingen, onder andere van je collega's. Je bent persoonlijk geïnteresseerd in maken met verschillende technieken en betrokken bij trends en ontwikkelingen in de wereld. Je belichaamt waar Bouwkeet voor staat: leren door te maken.

Empowered rolmodellen

Begeleiders zijn rolmodellen voor deelnemers. Je weet wie je bent en waar je voor staat. Je kent je competenties en vaardigheden en straalt vertrouwen uit. Op je eigen authentieke manier ben je betrokken en aanwezig. Je bent het visitekaartje voor Bouwkeet.

Inlevingsvermogen

Als begeleider kun je je inleven in anderen, zowel in de voorbereiding als in het moment van contact. Je hebt interesse in mensen met verschillende achtergronden. Je bent open en nieuwsgierig naar verschillen en staat garant voor respect en gelijkwaardigheid. Je ziet de meerwaarde van diversiteit in de breedste zin en weet dit in te zetten in groepsprocessen.

MAIN TEXT FIELDWORK

### Vertrouwen en veiligheid

Begeleiders hebben scherp oog voor de veiligheid van deelnemers. Dit geldt zowel voor de fysieke veiligheid als de sociale veiligheid. Je weet een veilige sfeer te scheppen door grenzen te stellen. Je hebt een goed inschattingsvermogen en bent niet bang om gecontroleerde risio's te nemen. Je kunnen snel en adequaat handelen bij crisissituaties en stellen hierbij de veiligheid van anderen en zichzelf central. Je bent alert op begrenzen van agressie en (sociaal) onveilige situaties

### Improviserend vermogen

De begeleider is flexibel en in staat om een activiteit aan te passen aan de groep qua stijl, inhoud en tempo. De begeleider heeft een rugzak vol ervaring en kan makkelijk schakelen tussen verschillende voorbeelden en didaktische methodes. Wanneer zich onverwachte situaties voordoen kan de begeleider het soepel over een andere boeg gooien. De begeleider observeert de verschillende leerstijlen in een groep en kan hier op inspelen.

### Regisserend en overstijgend vermogen

Je bent in staat om een activiteit binnen de afgesproken tijd vorm te geven, kan een groep aansturen en motiveren. Je kunt vlot dwarsverbanden leggen tussen wat er binnen Bouwkeet gebeurt, de belevingswereld van deelnemers en de buitenwereld. Je bent in staat tot kritische (zelf)reflectie op het proces zonder de regie te verliezen.

DO:

→ Check in/check out: start together, end together with feedback & reflection
→ Show respect for people, machines, material and the environment
→ Set clear rules, boundaries and expectations (see rules)
→ Guard the safety of the group (physical and social)
→ Demonstrate how to use machines / materials
→ Keep instructions as short as possible
→ Give clear explanation of the possibilities and expectations
→ Get to know the participants / adopt the workshop to their needs
→ Encourage experimentation & creativity
→ Give feedback on the process and attitude
→ Organize the conditions in which people can experience success. Celebrate this!
→ Let people make mistakes. Celebrate this too! Then analayse what went wrong.
→ Have a plan b, c and d for people who are done earlier
→ Be a role model: demonstrate the kind of behavior you'd like to see
→ Listen and ask questions
→ End each course with a presentation (show) & certificate
→ Be prepared for a lesson (prep materials and machines)
→ Know the names of the participants
→ Design assignments that leave space for creative and alternative solutions (not only one way of doing it)
→ Make the rules together
→ Revisit the rules every lesson

MAIN TEXT

FIELDWORK

→  Be prepared to improvise
→  Give inspiring examples (from your own work)
→  Educate yourself on pop culture / youth trends
→  Educate yourself on the culturally diverse backgrounds of the participants

NOT RECOMMENDED:

→  Repeating the same lesson every time, without looking at the group
→  Giving step-by-step instructions for the whole group to do the same thing
   at the same time
→  Being preoccupied with organizing materials during a workshop
→  Calling yourself a 'teacher' or adopting an authoritarian role of the hub
   of knowledge
→  Organizing yourself like a school
→  Do work for people
   (unless you have explicit consent or it is a matter of safety)
→  Punish people who are in the 'nevermind' state
→  Create false expectations (making is easy, it should work out in the first try).
→  Putting on pressure to perform perfectly

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# Acknowledgements

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