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The Story of MIT-Fablab Norway: A Narrative on Infrastructuring Peer Production

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ABSTRACT:

MIT-Fablab Norway was one of the first Fab Labs ever established, in northern Norway in 2002. Despite this auspicious beginning to a network that is rapidly growing and attracting ever more attention, surprisingly little has been written about the genesis of the network or the Fab Lab itself. We therefore aim to contribute to this knowledge gap with a narrative account of our independent research visits to the Fab Lab, conducted as ethnographic research and presented here as first steps towards grounding theory and under guiding umbrellas of Design Research and Science and Technology Studies. In this narrative we present both descriptive and interpretative accounts in our attempt to lay bare the social world of MIT-Fablab Norway and its charismatic founder, Haakon Karlsen jr. Our themes emerged from the data but are also guided by our research interests; they present the stories and ideologies by which the Norway Fab Lab community represents itself and transmits its culture to others. It is but one Lab in a network, but through our narrative we aim to illustrate its unique profile: as a socially shaped entity and a product of a particular time and place.

Keywords: Fab Lab, ethnography, MIT-Fablab Norway, material peer production

1. INTRODUCTION

High up on the 69th parallel, in the far north of Norway, a pleasant road winds its way south of the town of Lyngseidet through a landscape of fells and farms. A rather undistinguished turn-off is marked by a more distinguished sign reading "MIT-Fablab Norway". The lane ends at a large, traditional Lapp log building that looks like a community centre or a rural dance hall. Inside, indeed, a community centre is brought to mind, as the centre of the space is filled with chairs and tables set up as for either meeting or dining. Only when one looks closer and begins to explore the sides and the back of the room does one see the tell-tale signs of a Fab Lab: a laser cutter, electronic components stored in neatly labelled bins, and a few prototypes and odd objects.

While reports or studies that examine fabbing and making, whether conceptual or commercial, tend to cover Fab Labs as well as makerspaces (and often hackerspaces) (e.g. (Bauwens et al., 2012), in this paper we focus particularly on Fab Labs with their distinct network and identity. Fab Labs were established by Neil Gershenfeld and MIT's Center for

Bits and Atoms with a will to "empower" people, as a way to lead people around the world "to become technological protagonists rather than just spectators" (Gershenfeld, 2006). As a network it is now rapidly growing and attracting increasing interest, from policymakers, educators and technology developers alike. The literature tends to be informal: 'grey literature' reports, essays and journalistic articles, on, for example, bringing Fab Labs into schools or Higher Education Institutes (e.g. Tiala, 2011). In the English language, surveys and overviews are beginning to appear (e.g. Eychenne, 2012) and academic studies increasingly published, exploring a range of topics from business models (e.g. Troxler and Wolf, 2010) to cultural and media studies (e.g. Walter-Herrmann and Büching, 2013). Fab Lab Amsterdam has been the target for a user survey (Maldini, 2013) and an ethnographic study (Ghalim, 2013). Despite being one of the first Fab Labs to be established, little has been written about MIT-Fablab Norway or the birth of the network (a key exception is Gershenfeld, 2006). The Norway Lab was the subject of an innovation-focused conference paper that examined its role in its regional industrial community (Gjengedal, 2006). In spite of the growing literature, there is still a certain mystique that surrounds Fab Labs, their objectives and their activities. Our role in this paper is to disperse some of this mystique by providing an ethnographic narrative: an account that aims to convey the particular story created by a place, time, a charismatic lead character, and a particular set of circumstances.

As researchers, our story began independently, as we visited the Norwegian Fab Lab separately, pursuing our own doctoral research and conducting our own fieldwork. In both cases Lab founder Haakon Karlsen Jr. hosted us and spoke extensively with us. We wrote about our experiences informally in weblogs, which we shared in our social media circles. Bosqué's account (in French) (Bosqué, 2013b) was similar to Kohtala's experience (Kohtala, 2012a; 2012b) in a sufficiently compelling way that Kohtala translated Bosqué's text in another blog entry (Kohtala, 2013b); this led to an invitation by this Special Issue's editors to compile our accounts in a joint paper. This narrative is thus an exploration of Karlsen's social world, the story of MIT-Fablab Norway as related to us by a community leader and known personality in the Fab Lab network. Before we embark on Karlsen's story, however, the following section will review the methods for conducting the fieldwork, analysing the data and compiling this narrative.

2. METHODS

Both Bosqué and Kohtala have been conducting ethnographic research in makerspaces, with slightly differing knowledge-gathering objectives, but both involving semi-structured interviews and conversations and recording observations in fieldnotes. The semi-structured interviews allowed the subject to dictate what he felt was important while certain topics were anchored according to our respective research interests – as true to ethnographic research tradition (e.g. Van Maanen, 1988). The Lab's profile regarding typical activities, users, relationships in the local community as well as with the global network were important to both of us, while Kohtala probed especially environmental sustainability issues and Bosqué wished to delve into the very roots of MIT-Fablab Norway and thus the origins of the network itself. The interview topics were hence not derived from or strictly tied to topics from the literature or any theoretical background as an attempt to confirm theory. Moreover the informal conversations and latent details were equally important: Bosqué was particularly sensitive to peripheral activities, taboos, social interactions around the machines and the like, while Kohtala especially noted the language and rhetoric employed to convey ideology and shape community culture.

Kohtala's data set consists of nine audio recordings with transcriptions, three video

recordings, 200 photographs, fieldnotes and four field reports. The videos and photographs were not analysed but serve to supplement the fieldnotes; qualitative data analysis was conducted on the fieldnotes and transcriptions (according to Strauss and Corbin, 1998). Bosqué's data consists of eight hours of interview (split in five audio recordings), 400 photographs, fieldnotes and numerous drawings and sketches made during informal conversations or observation. Some parts of Bosqué's field reports have been published on her blog in ten posts (Bosqué 2013a).

What was somewhat problematic from the perspective of ethnographic research (and something we regard as a 'finding', as we will soon see) is that there was surprisingly little activity ongoing in the lab during our visits that we could observe. Visitors came in and out and there was much coffee consumed, but it was not the type of traffic nor amount of fabricating activity we were accustomed to from other Fab Labs. Moreover, our visits were short: Kohtala visited the lab in September-October 2012 for nearly four days and Bosqué for ten days at the end of June 2013. These circumstances necessitate heavy reliance on Karlsen's own discourse and problematise useful comparisons between, for instance, what he and others said and what they actually did. This had to be taken into account in the data analysis and constructing this narrative. For Kohtala, this was done through the categories generated through axial coding (or 'themes', for the purposes of this narrative), contrasting ideology and value statements with actions that instantiated these values. For Bosqué, this similarly meant contrasting 'myth' and 'reality', or stakeholders' representations of reality from each other, and 'conventional' with 'unconventional' situations. For reasons of space we have greatly condensed these themes.

Independently we identified the main themes in our own data sets that were most salient (i.e. most highlighted by the subjects as well as most prevalent in the data) and noted issues that seemed contradictory or surprising. Evidence from the data (e.g. portions of the transcript) was compiled in a tabular format individually, which could be easily shared if the other researcher requested more details on a particular theme. We each expanded upon our respective themes in writing and then proceeded to merge and combine the texts, a conversation which also involved ranking not only what was most salient but what we regarded as most important for future theory building as well as our own particular research interests. Our story – of Karlsen's story – follows.

3. THE ROOTS OF MIT-FABLAB NORWAY

In his book Fab, Neil Gershenfeld uses the expression "growing inventors" to present "community leaders around the world, who are embracing emerging technology to help with the growth of not only the food and the business in their communities but also the people" (Gershenfeld, 2006: 77). These "technological protagonists" are Mel King in Boston, Nana Kyei in Ghana and Anil in India. From personal fabrication to grassroots community development, a few selected persons are described throughout the book as local "inventors", raising opportunities through technologies for the people around them.

In the book's 'Network' chapter, Gershenfeld presents several examples of "innovators in telecommunications infrastructure" (Gershenfeld, 2006: 181). Haakon Karlsen jr is one of them; two pages elaborate on how, despite the fact this farmer and herder in the Lyngen Alps is "less interested in hearing from satellites in space than from his animals in the mountains", one day he comes up with the idea of tracking his sheep with the help of radio signals (Gershenfeld, 2006: 187). In this text, Karlsen is presented as a down-to-earth person with relatively prosaic interests: to simply find his animals in the mountains at the end of the summer and protect them from danger. Helped by Bjorn Thorstensen and Tore Syversen from

Telenor's Tromsø office, Norway's national telecom operator, Karlsen developed a kind of GPS receiver that was quickly able to report locations. During Bosqué's research visit, she took one specific sentence from Fab and asked Karlsen to give more details: "Telenor initially put these together, then in 2003 a Fab Lab opened on Haakon's farm to continue development and production of the radios and antennas there" (Gershenfeld, 2006: 189). This prompt served to shed more light on the truly compelling Electronic Shepherd's story, in which everything started a little before the year 2000.

According to Karlsen, at that time livestock populations were suffering due to rampant disease. In 1994 the Norwegian government was asked to establish a laboratory for artificial insemination of sheep and goats. In the Lyngen region, however, Karlsen in collaboration with several farmers and shepherds were seeing surprising success rates of up to 94% instead of the usual 10%. Karlsen quickly realised this was due to two farmers he was working with, who knew their animals so well they knew how to inseminate at the exact moment of ovulation. "To succeed, it was necessary to know when the females were in heat. I suggested that we imagine for ourselves a technical tool to measure hormones," Karlsen recounted.

They then tried to detect different hormones to see what could be learned. Eventually they developed a small temperature-sensing device that sent a message to warn the farmer that ovulation was impending, based on the female's brain activity. They even went on to create a program to train shepherds how to use the tool. Later, with the farmers, they thought about possible use for the device for the rest of the year: "So we put an accelerometer in our little machine to capture the movements of the sheep. To test this feature, we created a system that calls home after fifteen minutes of inactivity for the sheep, saying, 'I'm dead'. We then put in a GPS, which allowed us to get the geographical coordinates of the sheep sent to the farmers." The flocks of sheep could thereby be easily located in the mountains and protected from wolves or unstable ground. The original "sheep phone" – later called Electronic Shepherd – was born, in a "strange" laboratory on a farm on top of the world. In order to improve the GPS reception from the fells to the farms, Karlsen and his colleagues worked with Telenor for one year.

When the Center for Bits and Atoms won the National Science Foundation Grant in 2003, MIT engineers began to look for local communities around the world they could help via digital fabrication: "Instead of bringing information technology to the masses, the fab labs bring information technology development to the masses," explained Gershenfeld, in the official press release published on the National Science Foundation website (NSF, 2004). Karlsen had a slightly more colourful version:

> There was an innovation competition launched by MIT globally to develop local projects. MIT sent some of its best teachers to Norway to find a suitable cooperation project. They found us through Telenor, who told them: 'There is this crazy guy lost in the fjord who devised sensors for his animals.' We enjoyed a great year of cooperation with MIT in 2001 and we were invited to Boston to present and develop this project.

When asked about the very start of the Fab Lab, Karlsen immediately referred to "we":

> It was fantastic, but after years of collaboration we had to terminate the project. We had a discussion at MIT in Boston and we decided to do something to further enable this kind of adventure, something we would call … a Fab Lab. A Fabrication Laboratory. The decision was taken on 18 October 2002, I remember. We first decided to launch three Fab Labs. One in Pune with a man named Kalbag, from Vigyan Ashram, south of Mumbai, and another in a poor neighbourhood of Boston

called South End Technology Center, with Mel King. And the third here in Norway.

In conversations with Kohtala, these three labs also formed the constellation of the first Labs, the story of the inception so often repeated it has become almost a mantra. At one point, Karlsen hesitated for a moment, remembering: "No, Ghana also came. And Costa Rica also has some strange story about that." To be sure, this is confirmed in NSF's official press release:

> The first international fab lab was established in Cartago, Costa Rica, in July 2002 at the Costa Rica Institute of Technology. (...) This was followed in June 2003 by a fab lab far above the Arctic Circle in Solvik Gård near Tromsø, Norway. In cooperation with engineers from Norway's Telenor and Finland's UPM-Kymmene, that lab is developing wireless networks and animal radio collars to aid nomadic herding. (NSF, 2004)

The birth of the Fab Lab network is thus challenging to trace, with each contributor shaping it according to their own perspective and vested interests. In another extract of Bosqué's interview with Karlsen, he is asked if he remembers when the word Fab Lab was spoken for the first time. He replied:

> In my memory there was Gershenfeld, Kalbag, Mel King and me. Mel King is an old fellow who was a professor at MIT and Kalbag was an old Indian who had many projects in the community. He came into contact with MIT through links with the Indian government. A bit like here, he had created a local system for watering different plantations and was spotted by MIT.

In the 'official' version, MIT-Fablab Norway is one (excellent) example among many others; in Karlsen's version, the team consists of the "growing inventors" that Gershenfeld presents in Fab, and he ensconces himself comfortably at the same table, at the centre of the story. During Bosqué's visit Karlsen also presented a sheet of paper he called a "contract", where he and Gershenfeld had signed a kind of agreement in an informal way, both signatures appearing among many muddled drawings and diagrams.

At FAB9 – the large annual meeting of Fab Labs which in 2013 was held in Tokyo – Bosqué was able to interview Sherry Lassiter, Director of the Fab Foundation, a body that supports development of the network, who neatly summarised: "How did it start in Norway? Well, I think at one point, after seeing what we did in Ghana and Costa Rica, Haakon must have come to us to ask if we could do the same at his place... Haakon is a great storyteller; what he says is not false but he surely has his own way of presenting things." The Fab Labs, in the narrative of their genealogy, appear as objects with multiple versions and multiple interpretations, in which the heroes are not necessarily the same. What remains somewhat shrouded, however, is the devil in the details: the story is not linear by any means, but it reveals in mere hints what must have been fascinating moments of discovery, as well as rejection and failure, that led not only to the Electronic Shepherd, as designed and developed by 'a bunch of farmers', but also the advent of a rather remarkable network.

4. THE STORY(IES) OF FAB LABS

As we see, how the main characters in these Labs and in the network choose to tell and share these stories, and with whom, reveals much about how they see their local conditions, what they esteem, how they view their own rights to shared commons, and where boundaries, borders and access points may lie. For example, Karlsen is skilled at building up tension: at

'gearing up' his listener for an exciting outcome. "What is this?" he asked Kohtala, as they sat at the table on a chilly September evening, tantalising hints of the Northern Lights glimmering outside. The stories always started this way, the presentation of the problem, the context, the heroes, the struggles... and eventually the result, whether it was the artificial insemination device, developed as part of the Electronic Shepherd process, the "sheep phone", or a solar-powered LED lamp developed in Africa. The effect is not to emphasise the object or the invention however; the intention is always to stress the need the invention caters to – which is always local, always developed in collaboration, and always something that combines previous, even ancient, ideas in new ways. Moreover, Karlsen has been a teacher, and this may account for how he communicates, especially through repetition.

There are therefore many of these repeated 'in vivo' codes. The most common is Karlsen's definition of a Fab Lab: <u>a global network of people who want to cooperate and share knowledge</u>. Fab Labs must also be <u>free and open</u>: one must not close the door to anyone nor have a "taxi metre" at the door. Fab Labs may charge for their services if needed, but they should do so "in a room beside". We should concentrate on what <u>people really need</u>, not on useless things. People need to solve their own problems, there <u>where they live</u>.

This last phrase is also stressed by Gershenfeld, in Fab, news articles and documentaries: do not send technology to the people, send them the means to develop their own. Karlsen showed Kohtala a CNN-produced video which introduced Gershenfeld and the Fab Lab concept, focusing especially on the Norway Lab. Gershenfeld speaks: "What we find is that people don't just need information on a screen, they need it out in the world <u>where they live</u> … for health care, for jobs, for education..." (CNN, 2008; emphasis added). He reaffirms Karlsen's underscoring of the local, or perhaps vice versa. In fact Karlsen's and Gershenfeld's discourses diverge and converge like a DNA strand: they converge on concepts such as 'community', i.e. community empowerment and betterment, meeting needs, and <u>where they live</u>, but Haakon plays down the role of the actual equipment and the technologies. "I would see the absolutely most important success criteria for a Fab Lab [is] the people." 3D printers are especially useless – except when learning how to make them. In contrast, Gershenfeld defines Fab Labs as "high tech, low cost workshops, equipped with the tools to make almost everything..." (CNN, 2008). It is possible that Karlsen, given the increasing amount of media interest in all things related to personal fabrication, feels increasing pressure (or responsibility) to put the people, not the technologies, at the centre of the story.

Given Karlsen's position in his small, largely agrarian, community, his take on Fab Labs has surely had a profound impact on how it came to be: not only Karlsen but all community members, whether farmers, school pupils or company representatives, have helped shaped MIT-Fablab Norway – and have plausibly been shaped by it. In the following section we provide a richer description of this unique Lab itself and our memorable research visits.

5. THE FAB LAB AS COMMUNITY CENTRE

Getting to MIT-Fablab Norway, from Paris (for Bosqué) or Helsinki (for Kohtala), requires a long journey to Oslo to Tromsø and finally Lyngen. In the end, it is a great, long chalet, on a large plot whose entrance is flanked by two flags: that of the region and an American flag. It is surrounded by smaller buildings for accommodation, where both researchers stayed. Each year about 600 people pass through the door of the Fab Lab. For Bosqué, the arrival is marked in her fieldnotes as a special discovery that anticipates an even more special routine to come:

> June 25th 2013: When I arrived today, it was raining outside. I was not even sure that Haakon was remembering my arrival tonight and was hoping I would not be stuck

outside with my backpack. But he was there, with two ladies who were cooking fish caught this morning in the fjord, in the oven. Without asking anything and without taking time to show me around, he told me to sit, offered a big glass of water and declared that we were going to have dinner.

The vast vault of the Fab Lab gives the effect of a strange chapel, in which we spoke softly, silence was allowed, and the wind was heard blowing gently outside – where the light in summer never fades. Karlsen is in his early sixties. He was born here and, after training as an engineer, spent his youth working with sheep insemination on the family farm, which is located "just down from the Fab Lab". He's an unmissable figure in the region; he has also been successively a teacher and farmer. He owns several houses and land at the edge of the fjord.

For ten years, he has also been a pillar of the Fab Lab movement, whose contours he has contributed to drawing in collaboration with MIT. What was made clear to both Bosqué and Kohtala is that Karlsen now believes his Fab Lab is more of a "community centre" than a place for prototyping: "It has even held a wedding celebration!"

[insert Figure 1 about here]

Figure 1: MIT-Fablab Norway, extract from Camille Bosqué's sketchbook (30 June 2013).

There is a clear layout of machines, tables and workstations in the main room of the chalet. All technology is now in the periphery: on the sides, along the walls. In the centre, a large meeting table and videoconferencing set-up, a huge fireplace, several dining tables and chairs occupy the space. The open kitchen is itself important. Karlsen joked about it: "When Neil Gershenfeld of MIT came to see the finished chalet and saw the kitchen, he told me that it was useless, that I had made a mistake, that it was not planned! The result proved that I was right. A Fab Lab is people, not just machines." Gershenfeld apparently also exclaimed about the number of beds here and there, near workstations, where one can remove shoes and have a quick nap, possibly in the company of Junior the dog. Next to the kitchen, coffee, various teas, muesli, biscuits – and Aquavit – are available. There are plenty of tables, some of which are there to accommodate any visitors who want to stay in the area for a few days to go hiking or skiing. The Fab Lab is thus a tourist facility as well as a place for prototyping and manufacturing, a function that guarantees a good part of its funding. Karlsen even said that skiers sometimes get curious and use the Lab.

Moreover, the video-conferencing facility is used for more than simply observing and communicating with other Fab Labs around the world. Professionals such as nurses come here to attend distance education courses conducted in Oslo or Trondheim. A local group – initiated from the grassroots as a peer-to-peer support group for anything from mental health issues to alcoholism – started meeting in the Lab before finding another meeting place; the group grew but it also sparked a 'meme' such that similar groups soon started sprouting up throughout the country. The mayor of the municipality drops in from time to time to discuss local problems, such as the number of school drop-outs in the region and what can be done about them. Others pop in for coffee to find out about the impending birth of the most recent foal.

Such unconventional activities for a Fab Lab also meant unconventional roles for researchers.

We helped cook, we went for walks in the stunning terrain, and we worked long hours – either talking with Karlsen and his colleagues or working alone on our notes, bathed in the strange pine-yellow light. The equipment was usually silent but sometimes people would come by to vaguely fix something or work on a prototype. When we dined, we sat on dramatic high-backed wooden chairs, each named after a local fell and each physically profiled according to its namesake's actual elevations (see DyvikDesign, 2013). Karlsen told Kohtala the idea for the chairs (the "design" – when prompted) had "come" to him on an African savannah.

Designer Jens Dyvik helped realise the chairs on the ShopBot, a milling machine that was strangely conspicuous by its absence. Bosqué began to ask about it often enough that finally – despite his reticence to have any focus at all on the technologies – Karlsen agreed to take her to the farm where the milling machine was housed. It was hidden behind a door in a small shed at the end of a cluttered barn, where a wooden kayak was suspended from the ceiling. It was dusty and likely not recently or regularly used. Moreover access was difficult and the room narrow. During winter, when sheep come back from the fells, they are herded in with the ShopBot. This 'co-housing' arrangement was also evident.

To be fair, considering the population of the region, perhaps the amount of personal fabrication that took place during our visits was proportional, and there was certainly evidence in abundance. Bosqué asked directly for an inventory of the projects and was treated to the storytelling ritual to which we were becoming accustomed, and enjoyed. As we saw earlier, each object was always presented first with the question: "What is this?" Then would come a brief presentation of the author or creator or the context, then the first ideas and prototypes, an interpretation of the project, and finally the "conclusion". The first object Karlsen put on the table was a cardboard box and many small plastic pieces, presented as prototypes for chocolates. "One day, in 2007, a woman came to the door and said: I want to make a chocolate factory, I need some chocolate moulds. And we said: OK, no problem, we can make it, we can help you. So we started to make moulds." The woman was described as "very shy" and not particularly interested in the machines and the process. "She was only interested in the production," said Karlsen. "I designed everything, she paid for that. She also needed a brochure, we made it."

"What is this? It's a house for a dogs' race." The next object was placed on the table, as simply sheets of lasercut cardboard. The organisers of a large dog race had come to meet Karlsen and explained their problem: they had hundreds of dogs racing over an entire fortnight and sleeping in hay outside. A proper shelter system was needed so each dog could have security and rest. "I said we can do it flat-packed," explained Karlsen, "and we made the first prototypes." Minutes later, the story moved to small wooden pieces described as "an earthquake house". The little bits, called a GIK (Grace Innovation Kit), can be put together randomly and were first imagined by Eli and Grace, Gershenfeld's twins, in order to build a dollhouse. Eventually, the pieces grew to a size able to create a human-sized house for the local kindergarten, and a doctor passing through the Lab fantasised it as an earthquake house or even a "surgery room" for emergency systems in Gaza. The story ended there: "it has not been tested," Karlsen explained.

Where the power lay in the stories, in the almost confrontational "What is this?", was the latent message "What could this be?", thereby projecting much potential and many exciting discovery routes on what were essentially basic prototypes. Moreover links were constantly drawn between people and ideas, during planning and fabrication. When Bosqué asked Karlsen why he likes these stories, he answered: "You must not have the feeling that I have made that alone, all of this is the result of a global network of people who want to cooperate and share knowledge: two kids from Boston, a shy woman from northern Norway...." Who

had the idea, who did the design, who contributed – sometimes these were remembered and important and sometimes not.

Design was a topic we were particularly sensitised to, as design researchers with our own emic, insider perspective as well as the etic, outsider view: Kohtala having been involved in local maker communities and Bosqué active in many makerspaces' activities. The design and prototyping is furthermore where the links to the global network become more visible: during Kohtala's visit Knut Klo was working on the design of a drone, a 'helicopter' that can carry a camera, whose plans were to be made available to the Fab Lab community on the Wiki. The drone had first been developed by Klo, Karlsen and Dyvik, who by that point was in Indonesia working on the inter-lab "low-cost prosthesis project" with Fablab Amsterdam's Alex Schaub (lowcostprosthesis.org, 2012). In the early hectic years, the Norway Fab Lab hosted several well-attended Boot Camps as well as FAB2.5; in one video (fablabbcn, 2009) posted on YouTube, Gershenfeld can be seen perched on the mezzanine, slumped on a bench working with his computer on his stomach. Schaub is also there, as is Tomas Diez from Fab Lab Barcelona.

Karlsen seemed to equate "inventor" with designer and maker. Bosqué asked him to clarify the distinction between designers, makers and entrepreneurs. "A businessman is not interested in how things are made. I can guarantee I haven't seen one single person in the world being both designer and entrepreneur." In Nordic languages, the word 'design' is cognate with the term 'form-giving' and many other words equally serve, such as 'planning' or 'developing'. Karlsen tended to favour these other verbs, and during a pause Kohtala asked him directly for his definition of design. He hesitated and laughed at the same time: "No…." "Because these [objects you are showing me] are designed," she countered. "So all the boats, all things people really have needed during millions of years, have been developed by people where they are, ... for their use, scaled for the way they really need it," he replied.

If Karlsen himself wears many hats – as inventor, businessman, teacher, therapist, social worker, consultant, designer, farmer, and historian – the Fab Lab carries as many roles: community centre, school, college, business incubator, science lab, R&D facility, museum, hostel, ski lodge…. In the end it all served to drive home the point that the Fab Lab should be free and open, people should not be categorised when they come in the door, and knowledge should be shared. The real answer to Kohtala's question actually came at the end of the day, at the end of a different, unrelated story: "Back to your answer, what is design, and who has the decision on what is design, nobody."

6. DEFINING SUSTAINABILITY

When speaking of distributed production, a still moot but pervasive issue is sustainability: will we build a nicer, lighter, greener and less consumerist society via material peer production or will fabbing simply add to existing material flow? For Kohtala it was especially important to probe how or if environmental sustainability is taken into account in daily activities in the Lab, how sustainability is understood by the key players, and what potentially impactful issues are clearly ignored or neglected. Environmentally relevant topics came up fairly regularly, and without prompting on Kohtala's part. All unprompted instances were descriptions of Fab Lab projects involving renewable energy, in the Lyngen area as well as Karlsen's cooperation in the Kenyan Fab Lab, with energy referring to heating and transport as well as electricity generation.

Near the end of the visit, Kohtala asked about a Boot Camp schedule where a discussion topic was titled "Business, Entrepreneurship and Sustainability". Karlsen confirmed that

"sustainability" in that case was financial, as funding for Fab Labs becomes increasingly problematic as they develop beyond the first few years. He explained that in Fab Labs, sustainability could also concern things like climate change and being "against the nature", but economic sustainability must now be the priority for Labs: it is "the most important thing". Even so, "if you are a pig in the environment they don't want to support you": environmentally unsustainable actions will lead to economic unsustainability. Later we came back to this, the impracticality and impossibility to differentiate environmental from social and economic sustainability dimensions. Karlsen was in agreement: "Absolutely. It is impossible to separate them. And they are so tied up in so many ways, if you say sustainability, that gives the whole project a very wide responsibility, for other people, for friends, for enemies, for the economy, for local communities, counties, countries, for the global network."

This statement (which avoids talk of, for example, natural landscapes or biodiversity) reaffirms Karlsen's emphasis on people and the social fabric, and it confirms that socio-economic sustainability does tend to be prioritised as a concern. Environmental responsibility seems to need special attention if it is not to be lost in the shuffle of other considerations, as preliminary results from other fieldwork suggest (e.g. Kohtala, 2013a). Perhaps, however, it can be more integral to each Lab's identity. Perhaps we can leverage values of openness and sharing knowledge, pride in the place <u>where you live</u>, respect for all its resources and cultural assets, and an interest in past inventions: this is where the 'enduring' connotations in the definition of sustainability become relevant. On numerous occasions Karlsen referred to the Lyngen locale as a socio-historical place of importance: the Viking heritage with its special artefacts and significant places as well as less ancient traditions of the region he clearly regarded valuable. These were not to be lost and forgotten; it was also the role (and interest) of the Fab Lab not only to record and document them, but in the case of 'old' technologies, for example, a 200-year-old windmill formerly used to grind flour, to revive and update them, adapting them to today's circumstances. In the case of the windmill, Karlsen was working with Siemens on a generator specifically for the ancient windmill design, which could be developed and employed today to generate distributed electricity. In the CNN video, Gershenfeld called this locale- and culture-sensitive type of invention "appropriate technology" (CNN, 2008); Karlsen might call it alive, not dead knowledge that sits alone "in a library".

As for environmental issues that were not addressed despite their importance, Kohtala, for instance, prompted discussion on activities around DIYBio in Fab Labs, where the potential impacts on people and the environment are simply not known. This was misunderstood as "computer viruses", whether because of a simple language barrier or unfamiliarity with the topic. Concern with e.g. the toxicity of materials used in Fab Labs is also growing (e.g. Huang et al., 2013), but conversations regarding material toxicity, e-waste, or other material waste did not arise, nor did topics around supply chains or logistics that imply transport emissions and are central to the concept of distributed production. With such emphasis on empowerment and the information commons, it remains uncertain where Fab Labs will take a stand on the public commons of natural resources.

7. GROWING KNOWLEDGE

Perhaps because MIT-Fablab Norway was so unlike any other fieldwork site we had visited, we became hyper-aware of how the Fab Lab network – as a community as well as a collection of communities – differs from how we understand and relate to institutionalised societal structures such as formal education or industrial mass production. Unlike many other labs, it

was 'normal' for anyone to walk into the Norway Fab Lab, from the town mayor to farmers to the neighbour renovating his house; this almost domestication of fabbing (especially considering the kitchen and the beds in the Lab) began to render the outside world as almost abnormal, or at least uncomfortable, even unnatural. This was compounded by our own experiences of immersion and suspension in the Lab's environment, as we explained in Section 5, as well as Karlsen's own discourse which heaped scorn on traditional institutions (especially universities during Kohtala's visit) while praising openness and reciprocity. Such a 'normalising' process was obviously enabled by Karlsen's charisma and role in his community; we have no doubt he would have had an equally influential role in Lyngen if the MIT connection and Fab Lab germination had not occurred. As it did, Karlsen was the conduit to make the otherwise opaque construct of a Fab Lab acceptable and everyday in its small, rural local community. Moreover, since entering the Fab Lab world promises skills and knowledge, a way to meet one's own needs and other espoused benefits, even a new badge of 'cool' (which is actually a threat rather than an opportunity to Karlsen), we may consider not just desirable but inevitable the transition to a network-based society – or the non-hierarchical, non-judgmental society Karlsen wishes to promote.

For example, for all his criticisms of universities – in Kohtala's paraphrasing this meant their hierarchies and the power granted to professors, their ability to dominate innovation support systems as well as knowledge transmission, and their tyranny over science, all examples Kohtala coded as 'university hegemony' – Karlsen would provide numerous inspiring stories about individuals reaching their own potential: where people of all ages and abilities were granted access to knowledge sharing and teaching at the Fab Lab. Moreover, where the "magic" happened was not merely through open access for the marginalised but when different types of people were able to mix together: "During many years we have had so many strange people here in the Lab. (...) [W]hen you can find many different people, where they have this cross-over, then you have something. How can you put all these things in rules, it's impossible." For Karlsen, "strange" was a relatively neutral adjective used to describe nearly everything, from the diverse, unconventional or surprising to the unfamiliar and unknown. These strange people are not allowed into universities because of "rules" – which also bar them from jobs, entrepreneurial support or simply opportunities to explore their own ideas and inventions.

[insert Figure 2 about here]

Figure 2: Extract from Camille Bosqué's sketchbook (26 June 2013).

This does not mean a network-oriented, heterarchical social world does not have rules: the Fab Lab network has a Fab Charter, a set of principles that should be displayed in every Lab and embody the values of openness, access and reciprocity. There are no sanctions for not following the Fab Charter, if one does not include having to endure Karlsen's heated chastisements. Instead, in true p2p fashion, the conformity ranking is made transparent: an ongoing chart that documents each Lab's compliance with the Charter principles – open access for the public, having a basic inventory of the same equipment that eases inter-lab project work, and giving something back to the network (NMÍ Kvikan, 2012).

Nevertheless, for Karlsen rules are like categories: they protect people, which serves to keep

some in and others out. And it is not only the people who should not be categorised – the Fab Lab should not and cannot be. In the first years the 'network' existed, those first few labs scattered among various continents, Karlsen said the Americans did not know how to take it: was it a development project, an aid project or an innovation project? On research projects and surveys that try to make sense of the current network, Karlsen scoffed:

> ...there are so many people who see that the Fab Lab network is super cool, and then they try to make a description, to put the Fab Lab into a form, into a matrix, and it never fits. The Fab Lab here is one thing, the Fab Lab in Africa is another, the Fab Lab in the United States is a third one. There is no sense to make all the labs exactly the same. The diversity, that's the good thing with the Fab Lab.

Such diversity allows each Lab to cater to <u>local needs</u>, <u>where people live</u>. Ah, but does this not problematise 'normal' support one could influence or access, such as government innovation policy and funding? "That's a super problem for all the Labs. We don't fit into any policy. ... [T]hey don't know how to handle us. When they put us in the state budget. Yes or no, we are there, we are not that."

Karlsen's speech is peppered with these kinds of references, to how Fab Labs fall into the gaps – neither concerned with education, innovation, agriculture, industry, technology development nor social development – but all of these and none of them simultaneously. However, if indeed the Fab Lab world does become normalised (and note that we use both normalisation and domestication as descriptive, exploratory terms and not as definitive interpretations at this point), what may happen to its self-conception as an alternative: as <u>not</u> institutionalised or at least consciously avoiding the hierarchic structures of mainstream institutions and their concomitant rules and categories? Perhaps there are some clues in how Karlsen understands and conveys the very idea of the Fab Lab network.
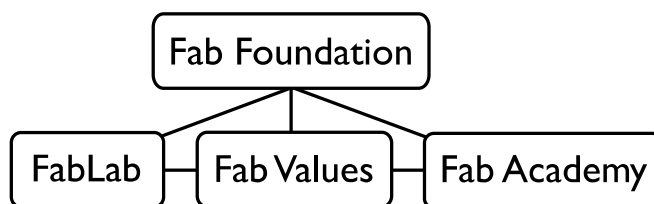
[insert Figure 3 about here]

Figure 3: "The normal way to organise a structure" (adapted from a Karlsen original document).

Let us examine a diagram, a typical organisation chart with boxes and rows. Karlsen explains:

> Normally an organisation should be like this, you have the Fab Foundation at the top, you have Fab Labs, you have business creation here in the middle, and you have the Academy thing here on the side. This will be a normal way to organise a structure. (…) This is how you would learn it in Sloan or in the business school. Then you report, and then everything works well. But here, in the Fab Lab structure, all the arrows are changing upside down. (...) The top is only a result of

what is happening in the grassroots. It's not some people who sit at the top and give orders and make a structure down through the organisation down to the labs growing up all around the world. Here you seed something and coming up is a strange thing, and you have the upstream all the time, the grassroots stream all the time, so all the arrows in a Fab Lab organisation are upside down. Or downside up.

This is the first and about the only time Karlsen pointedly used the word "grassroots" in the conversations with Kohtala; the previous day we had heard it several times in Gershenfeld's commentary in the CNN video. How Karlsen describes the process of "seeding" is particularly apt: one may plant a seed, but what comes up will take on its own character based on the soil, the sun and the nutrients available. The best way to develop, or grow, solutions for a particular community is to enable it to meet its own <u>local needs</u>, <u>where people live</u>. A Fab Lab is a seed, or a container for one.

And what then is the role of the Fab Lab network? For Karlsen, the network is a global coming together of "many small brains" that become a "big brain" when they cooperate and work together according to the same values or "with the same approach". When describing the 'helicopter' project, Karlsen suddenly veered to talking about the material chosen for the propellers and how their milled birch propellers do not break. Superior to the carbon fibre common in such projects, birch is described as "fantastic", a "living material" that has "computers in every cell". This way of portraying wood – and plants by implication – as almost a distribution of intelligence is so akin to how he describes the Fab Lab network, i.e. as a "network of brains", that one sits up and takes notice. This is why Karlsen wants us to focus on the people and not on the "nice things" or the technologies: it is the people and their individual strengths and curiosities that have formed the Fab Lab movement and will continue its trajectory. Again we hear the definition of a Fab Lab: "A house like this, that's only a facility and all the things you have around here, the tools, software, a Fab Lab you have to remember absolutely all the time, a Fab Lab is <u>a global network of people</u>. It's not a global network of houses or other dead things, it's <u>a global network of people that want to cooperate and share knowledge</u>." Not only the material is living; the knowledge is living knowledge and the network is alive and organic, growing, evolving and changing. Technologies in themselves do not better communities; the "remarkable story" is contained within the "combination of brains who push all of us a little bit forward". Karlsen asks us to consider "how did all these brains stimulate each other to make remarkable things, and you [will] see that nothing is impossible". Through Karlsen's storytelling, people become the heroes of a collective adventure, where doing one's best and doing it for everyone's betterment is paramount.

8. CONCLUSIONS

The description for this Special Issue Call for Papers pointed out how the incorporation of Fab Labs into libraries and museums may indicate an escape route from a "subcultural ghetto"; in this narrative we describe another alternative adopted by a tightly knit rural community whose peripheral, Arctic identity necessitates cooperation across a broad range of interests and a Fab Lab is thus much more than a space for personal fabrication. Subsequent explorations may now address the literature and reflect upon certain nuances of this story: exploring the data anew with lenses focused even more on how the community provides infrastructure and shares and protects its commons (as in Star and Ruhleder, 1996; Ostrom, 1990. We are grateful to the co-p2p group for providing the inspiration for our paper title [co-p2p, 2013]). This narrative aims to provide a foundation for this future work.

Moreover, such a rich, thick description as we have provided here serves several purposes: for one, it clearly shows that not all Fab Labs are alike, despite their surface similarity, and that each Lab becomes an entity shaped by – and over time also shaping – its founders, funders, fabbers and followers. It also unpacks the role that certain seminal or keystone Fab Labs and individuals may play in communicating and even steering the image, goals, strategies, visions and ambitions of the Fab Lab network – both within the network itself as well as to outsiders. Finally, a rich narrative can capture a moment of time in an otherwise quickly changing phenomenon, which can shed light on what came before and – for the researchers that come after us – what develops in future. We find this particularly relevant in the case of Fab Labs, as they serve as a visible, observable representation of what happens when a group of people decide to formalise material peer production in terms of a designated space and provide a certain infrastructure for 'making'. How each Lab develops over time and – moreover – how the entire network chooses to evolve is surely of keen interest to anyone studying peer production or aiming to reap its benefits.

Works Cited

Bauwens, M., Mendoza, N., Iacomella, F. (2012) A Synthetic Overview of the Collaborative Economy. [report] Orange Labs and P2P Foundation.
<http://p2p.coop/files/reports/collaborative-economy-2012.pdf>

Bosqué, C. (2013a) 'Sur la route au niveau du FabLab, un panneau...'. Make Hack Fab [blog] 25 June.
<http://makehackfab.tumblr.com/post/54619312525/sur-la-route-au-niveau-du-fablab-un-panneau>

Bosqué, C. (2013b) 'Fablab MIT Norway: Là où tout a commencé'. Strabic.fr, [online magazine] 3 September. <http://www.strabic.fr/FabLab-MIT-Norway-la-ou-tout-a.html>

CNN (2008) 'Principal Voices: Neil Gershenfeld'. [video] CNN International, 28 March. Edited version:
<http://edition.cnn.com/video/#/video/international/2008/03/28/pv.neil.gershenfeld.cnn>

co-p2p (2013) 'Seminar 2013 | Infrastructuring the Commons'. [seminar announcement, co-p2p Special Interest Group] Aalto University. <http://co-p2p.mlog.taik.fi/seminar-2013/>

DyvikDesign (2013) 'Making Living Sharing - a FabLab worldtour documentary' [user video]. 25 Sept. <https://www.youtube.com/watch?v=PNr1yBIgQCY>

Eychenne, F. (2012) Fab Labs Overview. [report] The Fing (Fondation internet nouvelle génération). <http://www.slideshare.net/slidesharefing/fab-labs-overview>

fablabbcn (2009) 'What are you doing? Fab Lab Norway' [user video]. 9 Jan.
<http://www.youtube.com/watch?v=jQ5-XLH3FwY>

Gershenfeld, N. (2005) FAB: The Coming Revolution on Your Desktop – From Personal Computers to Personal Fabrication. New York: Basic Books.

Ghalim, A. (2013) Fabbing Practices: An Ethnography in Fab Lab Amsterdam (Master's

Thesis). Universiteit van Amsterdam (New Media and Culture Studies), Amsterdam, The Netherlands. <http://www.scribd.com/doc/127598717/FABBING-PRACTICES-AN-ETHNOGRAPHY-IN-FAB-LAB-AMSTERDAM>

Gjengedal, A. (2006) 'Industrial clusters and establishment of MIT FabLab at Furuflaten, Norway.' Presented at the INEER (International Network for Engineering Education and Research) 9th International Conference on Engineering Education, INEER, San Juan, Puerto Rico. <http://icee.usm.edu/icee/conferences/icee2006/papers/3600.pdf>

Huang, S.H., Liu, P., Mokasdar, A., Hou, L. (2013) 'Additive manufacturing and its societal impact: a literature review'. Int. J. Adv. Manuf. Technol. 67: 1191–1203.

Kohtala, C. (2012a) 'Grassroots innovation in Fab Labs' Aalto Talk [blog] 16 October. <https://blogs.aalto.fi/cindykohtala/2012/10/16/grassroots-innovation-in-fab-labs/>

Kohtala, C. (2012b) 'What are Fab Labs anyway?' Aalto Talk [blog] 27 October. <https://blogs.aalto.fi/cindykohtala/2012/10/27/what-are-fab-labs-anyway/>

Kohtala, C. (2013a) 'Shaping Sustainability in Fab Labs', in: Melkäs, H., Buur, J. (Eds.), Proceedings of the Participatory Innovation Conference PIN-C 2013, Lahti, Finland, LUT Scientific and Expertise Publications, Tutkimusraportit – Research Reports No. 6. Lappeenranta University of Technology, pp. 287–290. <http://www.lut.fi/documents/27578/292022/PIN-C+2013_Proceedings_HQ.pdf/17fa385b-cc30-4ae4-82a6-59308a80d503>

Kohtala, C. (2013b) 'More on MIT-Fablab Norway' Maker Culture [blog] 2 October. <https://blogs.aalto.fi/makerculture/2013/10/02/mit-fablab-norway/>

lowcostprosthesis.org (2012) 'The Low Cost Prosthesis'. [website] <http://www.lowcostprosthesis.org>

Maldini, I. (2013) The FabLab Amsterdam user: a survey on their profile and activity (Study within "Object-user relationships in open design dynamics" project). Vrije Universiteit Amsterdam and Waag Society, Amsterdam, The Netherlands. <http://waag.org/sites/waag/files/public/Publicaties/fablabusersreport.pdf>

NMÍ Kvikan (2012) 'Fab Lab conformity rating'. FABWiki, last modified 12 December 2012. <http://wiki.fablab.is/wiki/Fab_Lab_conformity_rating>

NSF (National Science Foundation) (2004) 'MIT Fab Labs Bring "Personal Fabrication" to People Around the World'. Press Release 04-112, National Science Foundation, 2 August. <http://www.nsf.gov/news/news_summ.jsp?cntn_id=100425>

Ostrom, E. (1990) Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge, MA: Cambridge University Press.

Star, S.L., Ruhleder, K. (1996) 'Steps Toward an Ecology of Infrastructure: Design and

Access for Large Information Spaces'. Information Systems Research 7(1): 111–134.

Strauss, A., Corbin, J. (1998) Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Thousand Oaks, CA: Sage Publications.

Tiala, S. (2011) Fab Labs: Re-envisioning Innovation and "Entrepreneering". ASQ Higher Education Brief 4(5).
<http://rube.asq.org/edu/2011/10/innovation/fab-labs-re-envisioning-innovation-and-entrepreneering-.pdf>

Troxler, P., Wolf, P. (2010) 'Bending the Rules: The Fab Lab Innovation Ecology'. Presented at the 11th International CINet Conference, Zurich, Switzerland.
<http://square-1.eu/site/wp-content/uploads/2010/09/TroxlerWolf2010_BendingTheRules_FablabInnovationEcology_pub.pdf>

Van Maanen, J., 1988. Tales of the Field: On Writing Ethnography. Chicago: University of Chicago Press.

Walter-Herrmann, J., Büching, C. (Eds.) (2013) Fab Lab: Of Machines, Makers and Inventors, Cultural and Media Studies. Bielefeld, Germany: Transcript Verlag.