



A World Café event held in Copenhagen discussed possibilities for creativity, inclusion and sustainability in FabLabs, Hackerspaces and Makerspaces

Grassroots digital fabrication in makerpaces Report from a World Café

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Around the world there is a flourishing of innovative workshop spaces that allow people to access tools freely and make things in collaborative projects. FabLabs, Hackerspaces and Makerspaces are all examples.

In these spaces people access networked, digital design and fabrication tools and, it is argued, can therefore make almost anything they wish. Ideas, designs, experiences and viewpoints are shared between spaces through on-line social media. Makerspaces are globally connected. Indeed, observers and participants consider makerspaces to connect to and express

materially various broader social movements, such as the maker movement, hacking, and free/open hardware movements, to name just a few.

Some makerspaces receive policy attention and institutional support (e.g. through universities, libraries, skills programmes), often for the potential they seem to offer for promoting creativity, innovation, skills, and revitalising manufacturing entrepreneurship. Other makerspaces are self-organised, rely on their own resources, and value their autonomy. There are various combinations in between. In this report we use the term 'makerspace' as

a general term for community-based workshops, and recognise the wide diversity that exists in terms of organisation, participation, purposes, settings and histories.

Commentators argue that the international burgeoning of makerspaces presents a variety of possibilities. For some, makerspaces suggest new forms of democratic and decentralised production and consumption. Some argue they can close production-consumption loops locally, and develop more sustainable material relationships. The facilities may cultivate grassroots innovation, and even

Makerspaces allow people to experiment with grassroots digital fabrication

post-consumerist practices, including upcycling, re-manufacturing, and different material cultural relations between people and objects. And for others still, makerspaces are part of a third industrial revolution, where digital fabrication opens up new forms of entrepreneurship and personalised manufacturing.

World Café

As designers and social scientists, we see FabLabs, Hackerspaces and other spaces as sites where people are experimenting with grassroots digital fabrication in a wide variety of forms, and where reflections by practitioners provide valuable insights to our developing understanding of making and consuming. We wanted to explore some of the claims being made for these spaces with a mix of practitioners and researchers with either direct experience with makerspaces, or related experience with contrasting sites of public engagement in knowledge production and material experimentation, such as science shops.

So, on Thursday 10th April 2014 we organised a half-day World Café workshop in Copenhagen on the topic of grassroots digital fabrication in makerspaces. It formed one session within a wider conference exploring an 'Innovative Civil Society' and hosted by the international Living Knowledge network of science shops. Here we provide a summary report of participant discussions from our session. Over 30 participants with varied experiences of makerspaces contributed to the discussion.

We divided World Café discussions into the topics of creativity, inclusion and sustainability. Under each topic, participants were asked:

What do you think the issues are for creativity/inclusion/sustainability in makerspaces?

How do making activities in spaces present possibilities and limitations for creativity/inclusion/sustainability?

What are the wider social impacts (now and potentially) of makerspaces for creativity/inclusion/sustainability?

Following the World Café format,

three groups of participants discussed each of our topics in turn. The groups did this by circulating around three tables, where facilitators helped the discussion, and where participants could see notes and comments written up by the previous group visiting that topic/table.

Opening presentations from local practitioners

Importantly, before discussions got underway, practitioners from three local makerspaces gave presentations.

Vanessa Carpenter from Illutron Collaborative Interactive Art Studio in Copenhagen talked about the projects and aims of their space. Illutron uses public art events and projects to engage people in interactions with varied devices, as a means to challenging social norms and encouraging creativity amongst participants. Projects range from a 'barcode beatbox', which scans and converts product barcodes into music, to installations in Copenhagen harbour involving fire, explosions, and provocations to think about its future.

In contrast, Copenhagen FabLab is a more recent space within Valby Cultural House. The new facilities are available for people to get involved in fabrication projects. The Cultural House is committed to engaging various groups in their activities, including schools, unemployed, families, and pensioners, and this extends to aspirations for the FabLab. However, FabLab manager Michael Hviid Nielsen explained how providing facilities had been relatively straightforward compared to building a community with ownership of the space.

The final practitioner presentation was by Oyuki Matsumoto from STPLN Open House Makerspace in Malmö. The Open House was an interesting example because the facilities (which were at first under-used) co-evolved over time with the development of a community. They started off with an exhibition hall, conference space and then expanded their offer, depending on the user interest, to open office spaces, textile department, bicycle kitchen, screen print facilities and a makerspace. At the beginning, the makerspace was mainly used by a specific group of hackers, which intentionally or not tended to discourage involvement by other groups. So STPLN decided to close the space



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**World Café on
GRASSROOTS DIGITAL FABRICATION
in FabLabs, Hackerspaces and Makerspaces**

THURSDAY 10TH APRIL 2014, 09.00-12.30, SCANDIUM

THEME 1 (T1-2): Two-session World Café activity on Grassroots Digital Fabrication, discussing the issues of inclusion, creativity & sustainability

Come and discuss the possibilities for inclusion, creativity and sustainability opening up with the international burgeoning of community-based, open-workshops. In these spaces people access networked, digital design and fabrication tools to make almost anything in collaborative projects. Some argue this presents new forms of democratic and decentralised production and consumption that has sustainability potential.

SPEAKERS:

Adrian Smith SPRU	Johan Søderberg IFRIS and practitioner
Vanessa Carpenter Illutron Collaborative Interactive Art Studio	Ellen van Oost University of Twente
Michael Hviid Nielsen Copenhagen FabLab	Sascha Dicke Technical University Munich
Oyuki Matsumoto STPLN Open House makerspace	Sabine Hielscher SPRU

for a while. They visited a few Fablabs for ideas, and introduced a membership system and opened up the maker-space to families, etc. The idea that they just needed to provide some tools and people would use them proved not to be the case. The municipality has provided resources in support of this development, although the Space is also looking to diversify its funding sources. They want to cultivate an exchange economy where users help others or keep the space tidy in return for free access to some of the facilities.

All presentations emphasised how important it was to cultivate an atmosphere within makerspaces where people felt welcome and accepted, where they could be excited about experimenting with things, especially in playful ways, and could collaboratively create their own activities within the space, and thereby develop a sense of belonging. In this respect, the practitioner presentations provided a vivid introduction to life in three quite different makerspaces and to topics for our World Café.

Creativity

As organisers, we introduced the issue of creativity into the World Café because we were curious about a possible tension in grassroots digital fabrication. Historically, many of the technologies being used, such as computer-aided design software and computer-integrated manufacturing tools, were originally resisted by workers because they were seen as deskilling. We wondered whether there was a darker side to the creativity celebrated in makerspaces. We wondered whether the pa-



Illutron, Copenhagen FabLab and STPN Open House Makerspace Malmö gave presentations

rameters set by design software and code, machine tools, on-line instructions etc, might unwittingly restrict creative possibilities.

However, participants in the discussion did not see this as an issue, or chose not to dwell on it, for a number of reasons.

First, the combinations of tools available in makerspaces, including older craft tools, and all aimed at general purpose flexibility, meant they were not so restrictive overall (compared to shop-floor production lines of old). Makerspaces need to take care to ensure excitement about 'high-tech' tools amongst some does not eclipse the creativity available through more 'low-tech' activities. Not everything needs 3-D printing!

Second, as people gained confidence in one technique or tool, made necessary by an initial project idea, so it spurred ideas for other, more ambitious projects, that led people into learning about other tools and skills. This can involve combinations of digital technologies and more traditional craft techniques. Evidently, creativity and

skill enhancement appear to go hand-in-hand when using tools in the maker-spaces.

Third, people in makerspaces help each other out, see what others are doing, and become curious about trying other things through such socialisation.

Developing this line of discussion, participants considered interaction and collaboration to be important sources for creativity. Interaction and collaboration were seen as something that could be actively encouraged in the design and organisation of makerspace spaces. Fun, laughter, and playfulness were mentioned as powerful means to opening people up to experiment, try things out, think beyond their norms, and yet feel it is OK and safe to transgress, make mistakes.

It was observed how such playfulness is often neglected or even discouraged in adult worlds, and which maker-space activities needed to overcome. However, any intense activities in that vein need to be complemented by more relaxed and reflective periods. Maker-space processes with varied pace, pressure and dynamics contribute to creativity.

Hacking was seen as important to creativity. Taking things apart, seeing how they worked, putting them to work in different ways, all helped people understand new possibilities for devices and materials. Even simple objects, such as products bought from a €1 store, can be sources of inspiration when opened up and experimented. Hands and brain creativity can be encouraged through activities exploring the possibilities using varieties of tools and materials, as well as thinking more conceptually and ana-

Cultivating the right atmosphere and establishing its position in the world is what makes the space





lytically. It was pointed out how the renaissance and scientific revolution involved tinkering and hand-brain activities.

Overall, participants saw few limits to creativity, and where limits did exist, then this was due to organisational, institutional and cultural reasons, rather than features in any particular technologies per se. So rather than dwelling on the skilling and deskilling consequences of digital fabrication, which exist, a more nuanced picture emerged about the conditions under which people have the power to play with these technologies, and have control over them, and how hacking and making things lends itself to the accumulation of skills and flourishing of creativity.

The point about the power to be creative was underscored when participants contrasted the kinds of innovations and activities in the 'free-zones' of makerspace spaces, with the institutionalised provision of everyday needs in the wider world. Probably not all of these needs could be created in local makerspaces. But citizens might consider production systems differently, and engage with them differently, perhaps even critically and politically, following the kind of creative making and demystifying of technologies in makerspaces?

Inclusion

Surveys of hackerspaces have suggested that a majority of users are well-educated, technologically-confident, young(ish), white men: though not exclusively. Indeed some (publically-funded) makerspaces have social inclusion as part of their mission. But, whilst greater diversity can be a good thing, perhaps there are risks or countervailing issues in including too diverse a group of people? The drawbacks of exclusion might need to be considered in the light of trust-building and relationship-building that goes on in more closed communities? We introduced this issue to the World Café to explore who becomes involved in makerspace spaces, and how; and how organisers can bring people in, but also how they manage the inevitable exclusions that are the flip side of inclusion.

Consistent with the observation at the creativity table, discussion of social inclusion noted how the provision of access to tools and facilities alone was insufficient. Makerspaces need to think about how to reach out beyond their doors to specific groups. And then they need to consider how to cultivate a makerspace atmosphere where people feel welcome, comfortable, and confident in sharing their ideas and contributing.

It takes energy to create and sustain such an atmosphere. There can be a

trade-off between the energy and time spent in trying to include whilst attending to the practical running of the makerspace. Ideally, inclusion would involve a sense of belonging in the makerspace that meant all participants helped with its maintenance, or readily document their projects for sharing with others. This does not happen always in practice, and can be impracticable in some cases. So some makerspaces introduce membership fees, rules and processes for the running of the makerspace. Meeting the fees may exclude or deter some people.

Other makerspaces receive grant funding, investment by entrepreneurs, or public funds to help with costs, but in return have to fulfil certain obligations. Such obligations, such as setting the purposes of the makerspace, can sometimes work to exclude certain users and participants (e.g. providing rapid prototyping facilities or educational facilities rules out other users and participants).

A balance might be struck across makerspaces by having a variety with different profiles in the same city. Or, as is the case with some makerspaces, varying the activities over the week. So, for example, makerspaces provide fee-based prototyping services for part of the week, and then free-access for community-based services over weekends.

Tensions between community building and inclusiveness were discussed. Sometimes, building relationships within a community simultaneously sets up barriers for others. Members of a makerspace might not be willing to go out of their way, or break shared norms and expectations, in order to accommodate newcomers. They may have created a close bond, informal rules, trust, collaborations which they want to keep and see threatened. Unless it is recognised that newcomers bring contributions to discussions and activities, or be required to do so, then newcomers risk being perceived as a burden, and inclusion will reach its limits.

Only by institutionalising social inclusion into the constitution of the makerspace space can this tendency be minimised. The STPLN Open House

Makerspace in Malmö is an example where the old community had to be rooted out (to the point of removing old furniture) before establishing an atmosphere where others felt willing and able to join in.

The terms of inclusion can vary. Commercial activities can require the protection of one's ideas and involve particular agreements over collaboration. Entrepreneurially minded people might accept this in a makerspace; but others seeking differently oriented, less commercial, activities and expression in their space may resist it, such as those committed to cultivating a 'knowledge commons' and free and open hardware. Inclusion in makerspaces and projects works differently. Again, having an ecosystem of spaces with different purposes, and where people can fit in differently, may be a solution.

What did not feature so much in discussion were conditions in wider society that affect inclusion issues in makerspaces. So, for example, a highly differentiated, specialized and accelerating social world may complicate the ability of makerspaces to engage wide varieties of people for long periods. Moreover, in societies where structural inequalities make it socially, economically, and culturally easier for some groups to participate than others, then so inclusion in makerspaces becomes part of a wider political debate about whose voice and capabilities count.

Sustainability

It is claimed by some that the relocation of fabrication facilities in communities, with makerspaces pointed to as a potential seed for such a flourishing, could underpin a move to more sustainable, closed-loop production and consumption cycles. Makerspaces could re-manufacture, re-purpose, and upcycle goods and services. Widespread participation in these activities could encourage less materialistic, post-consumerist cultures.

In contrast, grassroots digital fabrication can further deepen the personalisation of products. The relatively easy re-design and re-fabrication possibilities opening up might play further into a throw-away, materially intense culture.

We wanted World Café participants to think about the sustainability possibilities and challenges of makerspace spaces.

As a caveat, it was pointed out in discussion that sustainability is a complex and heterogeneous issue with numerous dimensions that have both global and very local dimensions. These dimensions are not simply environmental, but include economic, social, health, and knowledge dimensions also.

What this means is that it is incredibly difficult to talk robustly about the general sustainability of makerspaces per se. Instead, one has to focus on concrete issues and situations in different makerspace spaces – how 3D printing is used in a makerspace, the economic sustainability of the space, how knowledge is sustained over time through maker networks, the kinds of material culture developing etc.

Many discussants thought environmental sustainability was a low priority issue for makerspaces currently, if it was even considered at all. Questions of resource efficiency and energy demand are rarely addressed. Some inspiring upcycling and re-manufacturing projects do exist – and are highlighted by promoters of sustainability possibilities. However, the majority of makerspace participants were considered to be busy developing their projects, and using whatever materials necessary to do so. Developing these projects, including 3D printing, can include throwing away earlier versions and mistakes before settling on the finished product. Material efficiency is not a priority.

It was pointed out that makerspaces are all about change, experimentation, disruption, and doing new

things. This might create a tension between the creativity-oriented ideals of makers and more conservative or restrictive notions of sustainability. As one participant put it, 'prototyping is not efficient, it's play!' However, a more dynamic notion of sustainability, in which innovative capabilities attend to different sustainability concerns over time and contribute positively to solutions, would not see the same tension in play.

Similarly, it seems to be a misconception to compare the experimental forms of production in makerspaces with industrial production in factories. Makerspaces in their current forms constitute no decentralized alternative to established forms of production. Hence, it might not be appropriate to compare their resource efficiency and energy demand directly with industrial factories. Rather, they can be considered as innovative spaces where new ideas for sustainable production and consumption might emerge.

Some innovations and capabilities were mentioned which could improve environmental performance in makerspaces. For example, in the case of 3D printing, it was pointed out that bioplastics are available, and that old plastics (including the millions of tonnes discarded at sea) could also be converted into new raw materials. In this sense, 3D printed plastic products might even help with environmental clean up! The precision possible with other digital fabrication technologies, and the ability to model and test in design packages before materially making, could also be put to more resource efficient purposes.

However, technical possibilities are dependent upon the social practices that make use of the technologies.



Makerspace participants could be encouraged to follow better environmental practices. They would need to promote awareness for the amount of material used and waste produced. The re-use and re-making of 3D prints should be expected; but also re-use of other fabricated products after use, and drawing from a store of reclaimed objects and materials. Materials could be shared across makerspaces. More broadly, the material cultures in makerspaces will matter here.

Discussion also made the point that so much of this environmental performance is beyond the control of makerspace participants. Decisions taken by technology developers, regulators, investors, materials suppliers, energy utilities, waste infrastructures, and others in the wider social world in which makerspaces interact, are critical in the way they set the parameters for environmental performance downstream in makerspaces. Making within a sustainability-inspired makerspace culture might prompt participants to rethink notions of wellbeing more widely, with potentially broader social consequences.

So, reflecting on the discussions, then some of the sustainability possibilities in makerspaces might actually involve putting pressure on more powerful decision-makers? In turn, this might mean any post-consumerist cultures cultivated in makerspaces would have to include an activist strand willing to agitate for more supportive institutions and infrastructure for green makerspace spaces.

Looking ahead

In thinking about this World Café report, it is important to remember that the views arose through discussion amongst around 30 participants. Some had direct experience in makerspaces. This included an interesting initiative of mobile makerspaces in Flanders. Other participants worked in science shops, or organised citizen science initiatives, and could bring views from analogous activities, and as discussed in the wider Living Knowledge conference. Other World Café participants were educators. And some, like us, were researchers.

Whilst we have tried to reflect the discussions above, and tried to refrain from imposing our own views, we have inevitably had to interpret the discussions in editing the record into this report. Collectively, the variety of viewpoints opened up the topics we brought initially. And, consistent with the purposes of the World Café technique, they have helped elaborate and extend issues of creativity, inclusion and sustainability.

The key message from the World Café, in our view, is that providing facilities, tools, and even technical assistance and training is only one aspect to creating a makerspace. Establishing the culture within and its position in the world is what makes the space. In doing that, there are complex interactions between the people and things involved, and also between the space and the wider social and material world. Were makerspace managers and supporters to choose to pursue goals for creativity, inclusion and sustainability, then they will need to attend to those internal and external relationships, and the deeper and broader processes and forces that underpin and shape those relationships.

As such, the ways makerspaces might contribute to goals of creativity, inclusion and sustainability, will depend upon their material cultures and the political economies that frame and shape making possibilities.

Please get in touch if you wish to learn more or to get involved:

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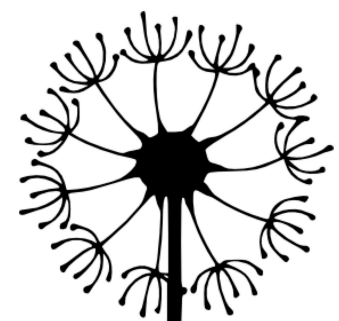
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