Makers’ ambitions to do socially valuable things

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Abstract: Neil Gershenfeld called the Maker movement the next digital revolution as it placed the means of fabrication on people's desks. This paper looks at makers' ambition to do socially valuable things and critically reflects on their potential impact, whether makers’ societal impact can be recognised on micro-, meso- or macro-level. Paraphrasing Schumpeter, who explained innovation as a ‘new combination of production factors’, social innovation can be defined as a new combination of social practices. To add an empirical dimension, via qualitative research we have explored the expectations and values of makers. We chose to proceed from the concrete to the abstract by approaching 30 Makers with very specific issues they knew from their day-to-day work and asked them regarding their social ambitions in terms of inclusion, education and environmentalism. Eventually these questions led then to insights on the threads we outlined above.

Keywords: maker movement, maker space, social innovation, openness, maker culture

1. The potential in making

It could be said that the Maker movement represents a return of interest to the physical side of innovation following the almost complete shift to the digital side with the dot-com bubble, the rise of the participatory Web 2.0 and the diffusion of Open Source Software. Neil Gershenfeld (2012) called the Maker movement the next digital revolution as it placed the means of fabrication on people's desks. The boundaries between rapid prototyping and small batch production in smart factories are blurring and if there is any doubt about the commercial viability of Maker products, Etsy (2015), an e-commerce marketplace specializing in crafts and Maker products, reached a turnover of about 2.4 billion USD in 2015.

In addition to these economic perspectives, ‘making’ presents also novel technical and socio-political interpretations. Values in making include a desire to produce things that would never see the light of day due to a perceived lack of demand, to produce more collaboratively by improving design suggestions of others or by simply copying, mashing or personalizing existing design elements. However the potential of making goes beyond single products, offering the possibility to think supply chains and the participation of actors in the design processes differently. In China, there is already a very visible effort to overcome the stigma of 'designed in the west, made in the east'. These efforts
are not mere attempts to catch up but aim to develop networks of design and fabrication facilities, characterised by agility, informality and openness together with a reference to "grassroots anti-establishment heroism" (Avle & Lindtner, 2016). Similarly Hacker- and Makerspaces in Europe are very much locally inspired, but still taking advantage of globally developed technological innovations.

2. Social innovation and making

According to the current state of the academic literature 'social innovation' is still a quasi concept, meaning that no single point of view dominates the discussion. However, paraphrasing Schumpeter, who explained innovation as a ‘new combination of production factors’, social innovation can be defined as a new combination of social practices (Hochgerner, 2012). A hallmark of social innovation is its emphasis on gaining acceptance with the people that should benefit from the innovation; hence having an impact on a societal problem is an expectation all social innovations have to meet (ibid.). Bekkers et al. (Bekkers, Tummers, Stuijfzand, & Voorberg, 2013) distinguish a functionalist understanding of social innovation, referring to solving a known problem, and a transformationalist understanding of social innovation, referring to reframing the underlying problem and possibly identifying new needs. So designing with a social innovation in mind needs awareness of societal problems in the first place and a way to develop a solution that is acceptable to most of the actors involved. Moreover, Bekkers' distinction is very compatible with Dorst's (Dorst, 2010) description of design problems as vague and open to associated with a variety of patterns of reasoning and ways of seeing.

3. Values and expectations within the maker movement

Whereas the previous two paragraphs described makers’ potential to be socially innovative this section adds an empirical dimension by asking makers about the values and expectations they bring to the process of making. In the end, makers, just as designers, need to identify with the people they want to address with their work and need to be emphatic (Nelson & Stolterman, 2003).

We chose to proceed from the concrete to the abstract by approaching 30 makers with specific issues we expected to be of relevance, if makers had an inclination to do socially valuable things - inclusion, education, environmentalism etc. Eventually these questions led to insights on those issues addressed. The participants in the study resembled a wide variety of engagement levels, including Makers who started their own businesses, were running their own makerspace or supported other Makers in more informal ways.

3.1 Maker interviews

To explore the expectations and values of making, we applied qualitative research methods. Unlike quantitative research, which tests already formulated hypotheses and requires certain conditions such as representativeness of the data and validity of test items, qualitative research methods are best used to explore emerging concepts, where statistical data is not yet available (Silverman, 2016). This has also the advantage to be able to go into more depth and follow up on topics that seem rich of interpretations. For this purpose, we developed a semi-structured interview guideline, i.e. a set of
interview questions that can be used in a flexible manner while still preserving coverage of similar topics across multiple interviews. In other words, the interviewer was requested to ask all the questions but was free to change the order or to add additional ones in case a topic should have been explored in more detail. The interviews were all recorded and then transcribed to allow for detailed content analysis (e.g. labelling of text snippets according to a coding scheme). In the coding process the researcher is going through the interview material with pre-defined codes and identifying new topics at the same time (Flick, 2014).

We chose 10 maker initiatives in 9 countries (Austria, Denmark, Spain, Italy, Germany, Croatia, Estonia, UK and the Netherlands), which were very different in nature, from a mini maker fair to Fablabs and maker spaces that were independent or part of a university. We asked the managers of the different maker spaces to point us to 3 makers resulting in 30 interviews in total. Since we wanted to collect the data from as diverse makers as possible in terms of regions and types of makers, we targeted one female maker, one maker with commercial and one maker with social ambitions to get diverse answer patterns, reflecting the conditions of making under different circumstances. The interviews had an explorative character, they were divided in three sections, starting with the organisation of maker spaces, collaboration and sharing between makers and values and impact of making. This paper focuses on the last one, and here specifically on the social dimension.

3.2 Social value and impact of making

In the following the most important findings about social values and possible forms of impact related to making are described on an aggregated level, summarising the essence of the statements of the 30 interviewed makers. However, at certain points direct quotations are given to illustrate a specific finding.

Maker spaces are very community driven, some have more social ambitions while others are keen on becoming the jumping off platform for start-up companies who visit the space to make and test their prototype. Some makers regard the maker spaces as an opportunity for social and economic change. “We have a society filled with consumers and the idea is to tempt these consumers to become something else” (female Maker, Spain). Consumption is linked with a level of ignorance about the object of consumption by accepting black boxes delivering services, without wondering about the interior of the box. Making, taking up the idea of hacking, means opening these boxes, understanding how a device is assembled and interacting with it, changing it in a way that is suitable for the person and making it work in a way different to what it was planned for originally. Many makers saw educating future makers as a main condition for hacking consumption in the future.

Education

Educational ambitions of makers in the interviews included: educating children, changing the relation between consumers and producers and ultimately a mentality shift in respect to consumerism, adding hands-on learning to more formal education, and up-skilling for employability and competitiveness.

Most maker spaces are described by makers as empowering and educating people by offering spaces that allow them to train new skills through learning by doing and in the exchange with other makers but also by offering different workshops. Some are also engaged in the Fab Academy programme which was originally founded by MIT’s Center for Bits and Atoms to teach “How To Make (almost)
Anything” (Gershenfeld, 2012). Moreover, most maker spaces reach out to formal education institutions and sometimes they are part of a university themselves such as the architecture faculty. There is also a strong commitment to address children and schools and kindergartens, and reach out to children even as young as 3 years old. “I am often asked why I approach schools. It is not for money but because I think it adds value to society in the future” (maker, Croatia). The expectation is that engaging children would have an impact on their interest regarding in STEM subjects (Science, Technology Engineering, Math) and eventually motivate them to chose careers in these sectors or becoming interested in higher education in general. This is particularly important for children who grow up in social environments without any contact to universities (Archer u. a., 2012). Thus, maker projects with children are often part of a bigger STEM project. Also, another expectation is to have an impact on their mind-sets regarding consumption versus making and to raise a new generation that is more aware of waste reduction and sustainability: “I don’t want to have a kid who thinks ‘OK, I want this and where can I buy it’, instead of “I want this and how can I make it” (maker, Croatia).

Young children are said to be more creative before they have become consumers already, as one of the makers said. “Today we are in a society of consumerism, so people buy things. It is a change that will take place a bit of time, because you have to start with the new generation and teach them it doesn’t have to be like this, and they can be picky, and they can influence their design and be a designer and I really believe that will change the way society works” (Denmark, maker).

Some of the Maker spaces host workshops for children (and their parents or teachers) or also lend machines to schools once the teachers have received training on the use of the machines (cf. Figure 1). The interest from schools and kindergartens has grown considerably recently, as pointed out by multiple makers.

The educational impact of making consist in contributing to a different kind of learning that is very much based on trial and error and doing something creative with their own hands: “I don’t know if our students are makers. I think that they are having this traditional education that is not preparing them for the real world, to be competitive (...). When one day they have to start working and they are being educated like you just sit and listen and here are 10 pages and then you learn them. Most teachers today are not working this way: they want their pupils to find out for themselves” (maker, Croatia). Although the mentioned forms of learning are not inherently new but ‘making’ allows for this creative exploration and playful learning. Furthermore, learning from others, collaborative learning, project based learning with people with different backgrounds were the learning formats most mentioned by our interviewees.

Makers also stated that they used maker spaces to train skills for their jobs or to further their employability or to better compete with their fellows: “For my design studies, I add a new dimension
by applying electronics to textiles and thus, I am able to do something different and I get acknowledged for that” (maker, Germany).

Inclusion

Statements by interviewed makers that relate to inclusion address either (1) including diverse kinds of makers in the maker space and/or (2) creating something useful and beneficial for diverse communities.

Maker spaces hold strongly to the value of democratised access for all: from every social class, from young to old, from whatever educational background people should be able to access maker spaces and make use of digital fabrication technologies. FabLabs are committed to the Fablab charter, which implies open access for individuals as one of the core values\(^1\). This is realised by lowering the entrance levels economically trough free-of-charge use or low membership fees but also in relation to the available technology by reducing the complexity of operating machineries to a level that can be obtained through workshops or self-regulate learning. Reaching out to diverse communities is also one of the core missions of some maker spaces. For example, some labs are even equipped with mobile versions of a Fablab, so that they can reach communities without an immediate access to a maker spaces.

Makers described workshops that are dedicated to communities that are hard to reach and do rarely engage in maker activities such as refugees. For instance, Fablabs were built in refugee camps to be able to solve immediately necessities or other projects were developed for Doctors Without Borders (Pérez, 2014) or ‘Fieldready.org’\(^2\), which makes humanitarian supplies in the field. Other initiatives addressed unemployed people specifically. For instance, one of the interviewees had been unemployed for several years and got engaged in a maker space. He tried out several things such as making substitute parts for old-timers and ended up producing eatable mushrooms. He was at the starting point of creating his own business by opening a mushroom farm. Still other projects addressed older people with the social ambition to overcome loneliness and isolation. The project ‘Senior-Design-Lab’ (Grefe, 2017), for instance, had a bigger social perspective, i.e. supporting an independent life at a mature age.

Some maker spaces are accessible for people with special needs and offer workshops for people with certain disabilities. One maker space, for instance, organised a makerthon, similarly to a hackathon, to develop a wheelchair that adapts to a growing body. Interviewed makers described their projects that aimed at coming to assistive technologies and designs for people with disabilities such as prostheses, or a customised spoon for people with partial paralysis, or a golf tee for people in wheelchairs. “I printed a two prosthetic covers for a leg and it was a joint operation with me printing and another designing it (…). The social thing about it was that it was 90 times cheaper than what he would gotten his leg made like that in a traditional way and (…) to be able to help someone, and still make some money (…). So I think this is important that you can add more value to whatever you do “ (Maker, Croatia). Maker spaces are also used by parents who seek for technical solutions for their children with special needs, and “they can do this by networking with other parents and supporting each other (e.g. creating special joysticks that can interact with computers and videogames)” (female maker, Italy).

\(^1\) [http://fab.cba.mit.edu/about/charter/](http://fab.cba.mit.edu/about/charter/)
\(^2\) [https://www.fieldready.org/](https://www.fieldready.org/)
Engaging in maker spaces and becoming a member of the maker community means also becoming a part of a collective as one maker expresses: “Ultimately, it is a break with the anonymity and against this permanent trend of individualism. Many people wish for new forms of social engagement” (Germany). “Maker spaces could have a meeting place function as one maker pointed out: “that people in the neighbourhood come together (…) similarly to urban gardening (…) to produce your own material in a group (maker, Germany).

Some sceptical voices doubted the inclusiveness of maker spaces by stating that the maker scene is self-absorbed to some extent, that realistically quite some segments of the population have not a real chance to enter a maker space also because there is nothing to offer to them, because the language is a specific one that attracts a certain type of people.

Environmental awareness

While some makers are very much aware of environmental aspects, others are not worried about sustainability and energy efficiency. Two general concepts mentioned in the interviews were:

*Upcycling and recycling:* „I really like to create things out of junk. This is so cool when you can pick up something from the trash pile and make it into something useful again“ (maker, Estonia), use scrap or discarded materials from different industries or just use what they have around their homes to come up with a clever ecological solution for some appliances. As one maker put it: “How do we manage to bring bits into atoms and how do we manage to exchange bits and not atoms, which can stay in place as they are? (…) Not to move things but to move ideas” (maker, Spain).

The *repair culture and circular economy* was also mentioned as being important in the maker culture: Some maker spaces are repair cafes at the same time, where people can bring their old kettles and televisions and with the help of other makers learn how to fix it. In maker spaces spare parts can easily be built that are no longer available on the market: “3D printing can help to repair more things and extend the lifetime of products (…) There would be production just in time to repair the part, and then you have a more sustainable consumption model because people will repair more” (Maker, Denmark). Thus, many makers see that on a longer prospective the maker movement could help to getting people more involved in recycling and enhancing people’s awareness.

There are makers who look for ecological solutions, make something better or more efficient by consuming fewer resources, e.g. an energy-harvesting flower-pot (maker, Estonia).

Some interviewed makers in Germany were dedicated to developing sustainable materials as a substitute for leather and were very much engaged in the bio-maker scene. They experimented with mushrooms or milk to get a textile with many advantages. Accordingly, the material can be used for various purposes such as insulation of buildings; even bricks can be made of mushrooms as they argued (cf. Figure 2: Mycotecture). They were also in search of materials that would have a decomposing effect on other more conventional materials such as plastics.

Making could contribute to local decentralised production and consumption and lower the environmental footprint and support a carbon free or at least carbon reduced life style: The maker who started his mushroom farm business used waste such as coffee ground, wood waste and straw pallets to make his mushrooms grow. One maker had the idea to add a carbon-footprint to all kinds of products (not only food). Some makers were engaged in hydroponics, i.e. plant growth without soil: “I am focused on hydroponics because I see most use in this area because people are growing
hungry and there are people in the cities who would benefit from having a system where they could grow their own food in their own apartments without soil, without mess...” (maker, Croatia).

In a desirable future scenario, people would thus become aware of 0 km possibilities to produce all they need locally, so that goods do not have to be transported over a long distance. They would have their personal fabricator at home and produce for themselves or others on-demand.

![Figure 2: Mycotecture (architecture grown out of mushrooms), an IAAC project.](http://www.iaacblog.com/programs/mycotecture-building-from-mushrooms-2/)

Another example of a tool that was prototyped in a maker space and that is contributing to solving environmental issues is Wadi (cf. Figure 3). It is used for water purification with solar energy and has the potential to replace the more cost-intensive chloride tablet, which is especially needed in developing countries.

![Figure 3: Water purification tool Wadi by Helioz.](http://www.iaacblog.com/programs/mycotecture-building-from-mushrooms-2/)

In contrast to these very positive attitudes and examples of environmental awareness in the maker movement, we detected also some very sceptical voices among the makers who said that in the maker movement there is a “huge lack of material intelligence” (maker, Spain). ’Making’ creates also a lot of garbage, for instance, 3D printers that operate with non-biodegradable filaments. And even with biodegradable filaments, the question of how long it takes to decompose is not yet fully answered. Also, there are no widely adopted mechanisms for recycling these materials. Furthermore, purchasing truly eco-friendly material is challenging, because the production chain of these materials...
is not completely transparent. According to these voices, the next revolution in making will be materials.

3. Conclusion

Based on the conceptual and empirical analysis presented in this paper, we suggest that there is a considerable potential of social innovation in the maker movement, yet there are also threats along the way that limit this potential. There is some awareness of societal needs among the maker community and maker values such as openness and sharing, environmentalism and inclusion seem highly responsive to societal challenges. In fact, Neil Gershenfield in his keynote at the maker fair in Rome in October 2016 argued that maker spaces would be supportive in solving all 'Sustainable Development Goals'\(^4\) such as sustainable cities and communities, climate action, quality education, clean water, etc. If the maker movement flourished to its full potential as in the visionary future proposed by Gershenfield, the social innovation momentum would be acknowledged on a macro-level.

However, there is a visible risk that the innovative momentum of 'making' gets lost in response to market pressures, lacking awareness of customers and makers not yet able to capitalize on their collective powers, missing the chance of innovating their own ways of collaborating in interdisciplinary teams. Privacy concerns and uncertainty about intellectual property should be protected or not, challenge the Maker movement as a social and political movement which sees itself bereft from the possibility to live its values. Other developments threatening Makers’ possible social innovation power are trivialisation, globalised supply chains and technosolutionism.

Another challenge concerns the economic viability of making. Although maker products are mostly customized and made on demand, the basic building blocks such as sensors, controllers and boards resemble a global race to the bottom situation, where price once again becomes the dominant factor leaving ecological and socio-political considerations such as workers’ rights in producing countries behind. Lastly, a Silicon-Valley style ‘technosolutionism’ threatens our ability to deploy technologies in ways that acknowledge people’s responsibility in changing their behaviours rather than hoping to be socially engineered or persuaded. Fogg (2002) mentions examples such as gadgets that motivate obese people to become physically active or set ups that support you in separating waste.

Thus, opposed to the rather positive perception of makers themselves contributing to social challenges, the questions remains open whether this social innovation currently taking place on a micro-level will be successful in overcoming the above described challenges and scale to meso- or even macro-level (Hochgerner, 2012). In any case, the maker movement offers many inspiring practises.

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Makers’ ambitions to do socially valuable things

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