Inclusive Making in the Neighborhood

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Abstract
The Maker movement and maker spaces are supposed to be open and accessible spaces to explore digital fabrication technologies. But experiences from a series of making activities show, how there are still boundaries to Maker technologies, and how the social structure of local computer clubs can help to include users that usually get left out, as well.

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Introduction
In the last years Fabrication Laboratories, maker and open spaces equipped with digital fabrication technologies (e.g. 3D-Printer, Laser cutter) opened all over the world. The spaces are seen as places to democratize these “professional” technologies and make them available for end users and hobbyists. However, in practice, these spaces still tend to be appropriated by a minority of technology-savvy users. We seek to understand how new ways of fabrication and industrial innovations, such as 3D printers, can be made accessible for all.

State of the Art
Scholarly discussions of maker culture have contextualized the hacker space ethos as one of democratic access and support for individuation through the manufacture of epistemic artifacts on a grander scale than that of loose aggregates of hobbyists and amateurs [1]. These notions are not limited to U.S. contexts that are supported by publications such as Make magazine [1]; instead this speaks to larger cultural constructs that in turn

reimagine sociotechnical environments as ones that promote new types of industrial fabrication. Lindtner et al. [1] argue that "Our particular interest is in the ways in which DIY making has extended beyond tinkering and hobbyist practice and become a site of industrial innovation" (p. 2). However, this ideology has been challenged by scholars such as Sun and Hart-Davidson [6], who in their study of social affordances and the subtle power dynamics at work in these innovations, have asked " How might design features that aim to improve efficiency and effectiveness end up hurting a user's feelings and morale, distancing him from his own community, isolating her from other users, and/or labeling him as "other"?" (p. 3534). The performative elements of identity work that occur in maker spaces, in terms of artifacts as boundary objects [1] that mediate both how social actors understand their own expertise as well as the collaborative aspects of the communities they join, resist oversimplification. These oversimplifications include utopian maker discourses that insist upon progress that links to industrial makers as emergent hackers and innovators on a grand societal scale [1, 2] as well as overtly critical paradigms that seek to undermine even the possibility of collaboration and communities of practice [6].

We propose that the realities are more complex. Our work also seeks to understand how maker technologies act as epistemic objects [3] that in turn mediate how the members of communities of practice view themselves in terms of group dynamics and collaboration. Against the backdrop of empowering local minorities and representing places for neighborhood inhabitants from most diverse backgrounds to meet and exchange, come_IN computer clubs have shown to positively affect their participants and surrounding neighborhoods [7].When in the clubs' initial years computers per se constituted a factor that attracted participants to attend computer club sessions [4], we may today ascribe a similar effect to new maker technologies, such as 3D printing [5]. Just the opportunity to see these new ways of digital fabrication 'in action' draws participants to the clubs. In our work in local computer clubs, we seek to understand, how we might link industrial innovations such as 3D printers to local communities that would then be able to engage in making for sheer enjoyment, rather than profit.

Methods & Research Setting

Our Computer Clubs

The come_IN computer clubs are located in intercultural neighborhoods in Germany. They have a low barrier to entry for children and adults, and their collaborative project work with computers and modern media contributes to cross-cultural understanding and respect in the local setting. At the same time the club's project work serves to bridge the so called "digital divide" [8], the unequal access of migrants groups and societal majority to computer infrastructure and related skills. In the computer club, children and adults find themselves in equal positions as learners. Acting as mentors, tutors and teachers offer guidance as needed. Our case study took place in one of these clubs in a large city in the Ruhr area in Germany. The neighborhood stands out in the city not only because of its high population density, comparatively young age structure, cultural diversity, and large number of families, but also because of high levels of unemployment, low wages, and a high crime rate. Access to higher education is often difficult.

Figure 1 Car Brand logo with a LED

Every club session starts at the round table, where the children and adults come together to talk about their current and potential future projects. During such an assembly, the project activities were conceptualized together with the children and the teacher of the computer club.Two of the authors of this paper conducted both of the subsequently described activities, with 10 to 12 children, and acted as tutors on the one side but also observed the children and collected field notes on the other side. This allowed them to establish both, sufficient access to the participants and hence, in situ experience of their activities and interactions, as well as to build an intricate rapport with the children, to better understand their worldviews and values, over an extended period of time.

Project Activity I: E-Textiles

Light-up pins were crafted from felt and fabric to explore and employ electronics basics. Each was designed in an individual shape and contained a circuit made of conductive thread, battery holder with coin cell battery, and at least one LED. Completed projects included light-up pins in the shape of animals, hearts, cars and car brand logos (see **Figure 1**).

Project Activity II: 3D Printing

Participants explored 3-dimensional designing of an object of their choice, using the software 3D-slash[1]. These objects were 3D-printed. Completed projects included a labyrinth, smileys, flowers, and buildings.

[1] https://www.3dslash.net/index.php

Findings

Evidence from the two making activities suggests that there is a general openness and curiosity for maker technologies and related skills. It was the first time that the children and adults in the clubs got in touch with maker technologies and they were eager to learn what the proposed activities were all about. They expressed their curiosity for the unknown technology, and their astonishment when materials were used in unexpected or unfamiliar ways. This was seen during the 3D-printing activity, when children would bring their parents to the club to show them, how they had designed their objects at the computer, and how these had then been printed out with the 3D-printer. Another evidence was that children were not able to focus on their project work anymore, as soon as the 3D-printing process was started (see **Figure 2**). Instead they would gather around the printer and watch as their finished designs slowly unfolded three-dimensionally in printed plastic. Some would even take out their mobile phones and capture the process filming. These printed artifacts motivated the club participants to create more sophisticated models and children, who experienced troubles while using the software, were inspired to give the project a second chance after seeing the results.

Astonishment about unexpected use of materials was observed in the e-textiles activity. Club participants were not short on ideas on what to create. But it showed in the process of making, that the combination of fabric and felt with electronics was unfamiliar, as frequently children were seen to struggle with the 'translation' of their idea to the materials. This was the case, e.g. when one of the boys wanted to create the brand logo of his favorite car, but could not envision how to design the layout in a way that was compatible

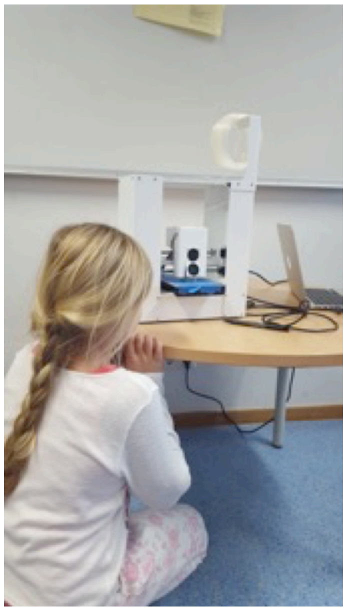

Figure 2 Participant observing the 3D printing process

with 1) the material properties of fabric, and 2) the structural necessities of a circuit (no crossing of conductive thread to avoid short-cutting the circuit).

It was through the mentoring guidance of tutors and teacher in the club that children and adults were able to make sense of the two making activities individually, and to experience the making as an opportunity to express themselves and their identity. Children and adults chose their designs according to their liking, e.g. by designing their favorite animal from fabric, and also picked their favorite colors, shapes and materials. Contrary to the e-textiles, sewing activity, the 3D-printing was bound to the computer club: it was here, where the participants were able to design and print their objects, as they did not have access to the needed technology and software at home. With regard to the sewing, field notes report how children – while sewing and laying out circuits – were making plans for further objects that they wanted to create at home.

Discussion

During our study, we experienced two major boundaries to making and to maker-technologies. The first one is of material nature. Maker technology, such as 3D-printers are expensive and complex, and as such not accessible to everyone. In the computer club, this technology can become accessible to a local neighborhood community. Children and adults alike can participate and learn about this technology and the skills needed. The second boundary is of a social nature. Children and adults did not only need to acquire the technical skills needed to handle the given technologies, but they needed to make sense of them individually. The club setting offered individual mentoring and technical guidance, and thus the opportunity to experience making as a means for individual self-expression. As a result, it fostered the development of maker identities among deprived groups of society who otherwise would not have easy access to the required expertise or technology.

Conclusion

Our work study shows, how the sociotechnical structure of local computer clubs may help to open up emerging fabrication practices to diverse local communities, empowering children and adult members of societal groups that otherwise might find themselves marginalized in maker culture. Following Lindtner's view on DIY making [2], extending beyond tinkering and hobbyist practice to all parts of society, our vision of the future of fabrication includes socio-technical institutions like the computer club. These are able not only to provide the skills and technical knowledge needed, but also to facilitate action and dialogue among local people, thus providing a means to provide (early) access to maker technologies and maker culture, and to support making that is truly for all.

References

1. Fuchsberger, V., Murer, M., Tscheligi, M., Lindtner, S., Reiter, A., Bardzell, S., ... & Bjørn, P. (2015). The Future of Making: Where Industrial and Personal Fabrication Meet. *Aarhus Series on Human Centered Computing*, *1*(1), 4.
2. Lindtner, S., Hertz, G. D., & Dourish, P. (2014). Emerging sites of HCI innovation: hackerspaces, hardware startups & incubators. In *Proc. of CHI*. ACM.
3. Star, S. L. (2010). This is not a boundary object: Reflections on the origin of a concept. *Science, Technology & Human Values*, *35*(5), 601-617.

4. Stevens, G., Veith, M., & Wulf, V. (2003). Come_IN: Using computers to foster the integration of migrant communities. *ACM Siggroup Bulletin*, *24*(3), 66-72.
5. Stickel, O., Hornung, D., Aal, K., Rohde, M., & Wulf, V. (2015). 3D Printing with Marginalized Children—An Exploration in a Palestinian Refugee Camp. In *Proc. of ECSCW*. Springer.
6. Sun, H., & Hart-Davidson, W. F. (2014). Binding the material and the discursive with a relational approach of affordances. In *Proc. of CHI*. ACM.
7. Weibert, A., & Wulf, V. (2010). All of a sudden we had this dialogue...: intercultural computer clubs' contribution to sustainable integration. In *Proc. of ICIC*. ACM.
8. Witte, J. C., & Mannon, S. E. (2010). *The internet and social inequalitites*. Routledge.