# 3D printing/digital fabrication for education and the common good

## Workshop proposal for C&T2017

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## ABSTRACT

3D printing has become an area of intense interest in a variety of disciplines ranging from industry through education, humanitarian and innovation contexts on a research and practice level. At the same time, technologies, materials, usages and appropriation are in constant flux. 3D printing is, however just one of the many facet of digital fabrication, the digitalization of more and more sectors, "Industry 4.0" as well as increasing community-based innovation and (open/commons-oriented) engineering practices. The proposed workshop is intended to illustrate and discuss cases, positions, concepts and experiences related to such developments in digital fabrication, especially in 3D printing. We specifically look for contributions highlighting the role of digital fabrication and 3D printing for the common good and the education sector. This is in line with C&T's socio-technical focus, research suggesting the immense potential in digital fabrication and education as well as growing practices in using digital fabrication/3D printing in humanitarian efforts.

## KEYWORDS

3D printing, common good, education, additive manufacturing, digital fabrication, community innovation, maker, making

## 1 INTRODUCTION

Digital fabrication, community innovation, distributed manufacturing, (open source) modular/DIY hardware and machines as well as related communities in Makerspaces, Fab Labs, Hackspaces, the 'Maker movement, community hubs, industry labs and similar organizations have become an area of intense interest, debate and emerging new practices, methods and possibly even disciplines - or, at the very least, new perspectives on the boundaries of disciplines. See [1, 9, 13, 14] for accessing the field from different perspectives. Said field, however, is vast and of relevance to researchers and practitioners ranging from engineers through educationalists, innovators, humanitarians, critics up to heads of state, activists or social entrepreneurs. However, for the intents and purpose of this contribution – preparing a workshop at the Conference on Communities and Technologies 2017 (C&T) -, we suggest certain perspectives to structure the workshop methodically:

Firstly, on the (socio-)technical level, we suggest focusing on 3D printing as a sub-set of digital fabrication. The rapid market development [6], greater availability, appropriation [16, 19], general public and private interest in the area and a plethora of

publicly available documentation[1] make it a useful starting point into more general aspects of digital fabrication.

Secondly, on the socio(-technical) level, we suggest two topical foci for contributions: Education and the common good, which are both interrelated. Educational aspects as well as cases of digital fabrication and community-oriented approaches in/for educational contexts have already been well-established and feature a corresponding body of theory and practice [2, 5, 10, 21]. The common good is also a domain with substantial prior work in evidence - the existing literature often features undertones or explicit perspectives on values, power distribution, collaboration, international cooperation, humanitarianism and other facets of the common good [8, 12, 18, 25]. Education can also be considered one of the core foundations of common good in that it increases, for example, people's and communities' agency, capabilities, or autonomy [3, 17, 20].

This brings us to the third argument for education and the common good as an intertwined perspective for the workshop and C&T as a venue: Looking at geo-political and geo-economic developments such as regressions to isolationist politics, uneven welfare distribution, migration and sustainability issues, education and the common good seem as important – and as complicated - as ever. Digital fabrication, distributed manufacturing and community approaches seem like promising pieces of this complex puzzle because they not only seem to motivate people and communities to learn and work together [2, 9, 20] but also to take real-world action, to more equally distribute manufacturing capabilities and to facilitate discussion about socio-economic transformation [12, 15, 18, 26]. C&T is, essentially, one of the outlets of a core European stream of Computer-Supported Cooperative Work (CSCW) with very strong roots in workplace democracy [4, 7], grassroots activism [23, 27], action-oriented research practices [22], an awareness of (underlying) infrastructures [11, 24] and a certain amount of political bite. Even if the original instigators and communities behind this stream of CSCW might have become a tad more institutionalized and possibly world-wearier than they once were, those ambitions, values and the spirit still exist – as evidenced by C&T's explicit focus on communities, technologies and the common good. This makes connecting multiple generations of activists, researchers and practitioners at (EU-)CSCW venues such as the proposed workshop at C&T all the more promising regarding grounded theoretical, conceptual as well as community-oriented outcomes.

## 2    WORKSHOP GOALS

The workshop goals can and should also be shaped by the interests and goals of people interested in submission. We propose four initial goals:

- Bring more people from communities such as Makerspaces, social innovation networks and interdisciplinary researchers together with the (European) CSCW and HCI community.
- Illustrate and discuss 3D printing in education and for the common good based on workshop contributions.
- On a more abstract level, illustrate and discuss the role of digital fabrication and social innovation in regards to the common good and education.
- Develop ideas and strategies for new project, funding and action together.

Suggestions for additional goals by interested parties are more than welcome (see also "Publicity and Continuation").

## 3    WORKSHOP ACTIVITIES & STRUCUTRE

We propose a full day workshop, structured as follows:

Morning slots: Socio-technical developments & education

*3D printing: New technologies and their appropriation*

- 3D printing and the Maker movement
- Developments in (desktop / open source) 3D printing
- Appropriation of 3D printing in practice
- Fab Labs, schools, hackspaces, production environments - different contexts, different practices?
- …?

*3D printing and Education:*

- Didactics, pedagogics and 3D printing.
- Innovation and fabrication infrastructures in (educational) organizations.
- Digital fabrication in academic/vocational education.
- User Experience, joy and motivational aspects in lab-based and making-oriented teaching
- 3D printing in informal activities (e.g. after-school sessions, hobbyist communities, …)
- …?

*Extended Break with lunch and enough time for a hands-on session. The organizers will bring at least one 3D printers and lots of demo objects, interactive systems and student projects and the call for contributions should result in more demos/artifacts..*

Afternoon slots:

*Digital fabrication, communities and the common good*

- Between education, activism and economics
- Community engineering for the common good and humanitarian Makers.
- 3D printing and the impaired.
- Open / peer / commons oriented production on local and global scales.

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[1] See e.g. www.youmagine.com, www.thingiverse.com, www.inventables.com, YouTube, local Maker Faires, ...

- (Long-term?) perspectives on (grassroots) activism, ICT and the common good.
- 'ICT4D' and 3D printing.
- …?

*Closing session*

- Recap and discussion.
- Brainstorming project ideas, collaboration options and funding / action strategies.
- Discussion of continuation and publication.
- End of workshop.

# 4 PEOPLE

## Workshop Organizers

Oliver Stickel, Konstantin Aal, Sarah Rüller and Volkmar Pipek are all from the University of Siegen, Germany where they work in practice-oriented research groups in HCI, CSCW and business informatics. Oliver is founder / coordinator of the university's Fab Lab[2], project coordinator for 'FAB101' (see Acknowledgements), general project instigator and lecturer in HCI- and Maker-methods. He has published about digital fabrication, field studies involving 3D printing in Palestine, regional innovation communities and agile methods. Konstantin is probably the most well-travelled operational field-researcher in our research groups, coordinator for the long-term research/integrative project come_IN[3] (intercultural computer clubs). He has published about computer clubs, education migration, gender aspects, change, activism and the ageing society based on a socio-technical perspective. Sarah is a long-term student research assistant, coordinates a come_IN computer club, has done field research (e.g. West Bank and Morocco) and is co-coordinator for project YALLAH[4]. She has published on computer clubs, participation in developmental contexts and ICT use by migrants. Volkmar has been a member of the European CSCW community for a long time, provides valuable long-term perspectives and learnings about socio-technical infrastructures and activism to the workshop, as does Volker Wulf, wo advises the workshop organizers. Both have published extensively in a variety of disciplines. Sarah Dickel and Sarah Lieven, both student research assistants, will help facilitate the workshop organization.

Verena Fuchsberger is a Postdoctoral Research Fellow at the Center for Human-Computer Interaction at the University of Salzburg. She focuses on the agency of human and non-human actors in HCI and interaction design – particularly, she is interested in the materiality of interactions. Verena has published on Interaction Design, the future of work, the ageing society, Materiality in HCI and Interaction Design and more. She also co-organizes scientific and community events centered on fabrication and innovation, whereby she is specifically interested in the intersections of industrial production and hobbyist making.

Manfred Tscheligi is professor for Human-Computer Interaction at the Center for Human-Computer Interaction, University of Salzburg and Head of the Business Unit Technology Experience at the Austrian Institute of Technology GmbH (AIT), Vienna. He has been initiating and managing a broad variety of national and international research and industrial projects. Being a member of various expert, advisory, and conference committees (e.g., CHI conference series, Mobile HCI conference series, Human-Robot Interaction conference series), his work is characterized by interdisciplinary approaches to enrich the interaction between humans and systems.

Victoria Wenzelmann is co-founder of the Global Innovation Gathering (GIG)[5], a vibrant, diverse community of innovation hubs, maker spaces, hacker spaces and other grassroots innovation initiatives as well as individual innovators, makers, technologists and change-makers. She is also a trained anthropologist, agile consultant and member of AricaHackTrip[6]. Vicy will soon be coordinator for the "Learningspaces4Refugees" project at the University of Siegen (as well as preparing her lab-bus for the next Africa trip).

## Contributors

We invite contributors from academia, practice, activism and any other communities interested in workshop goals. We propose three formats for contribution:

- Position Papers outlining positions, stances and perspectives on 3D printing, digital fabrication and education and/or the common good. Position Papers should be 1-3 pages in ACM SigConf format.
- Case studies describing interesting, novel, provocative or otherwise relevant cases of 3D printing and/or digital fabrication and education and/or the common good. Case studies should be 4 pages maximum in ACM extended abstract format.
- Demos and hands-on artifacts/projects for the extended break. We ask for a brief description (2-3 sentences) of what you intend to bring with you and outline any specific requirements (if applicable).

Contributions should address one of the topical slots outlined in section "Workshop activities & structure". A few examples of possible topics for contributions are outlined in this section as well in bullet points.

# 5 SOLICITATION OF CONTRIBUTIONS

We propose the following actions for publicity and the solicitation of contributions:

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[2] See www.fablab-siegen.de
[3] See www.come-in.cc
[4] See www.yallah.exchange

[5] See http://www.globalinnovationgathering.com
[6] See https://africahacktrip.org

- Personal contacts from our networks (the topical suggestions in "Workshop activities & structure" are all inspired by multiple real-world projects and people which we will contact and invite to contribute)
- A workshop website with a Call for Contributions will be created and shared via academic and practice-oriented mailing lists, social media, other community platforms as well as through personal contact.
- We will try to acquire funding to subsidize/cover travel and accommodation costs for contributors without institutional funding (activists, Makers, …) and have specific sponsors in mind. Should this not work out, we will at the very least share our strategies and experiences and debate this issue of integration and accessibility during the workshop.

## 6 PUBLICATION AND CONTINUATION

Contributions will be reviewed by the workshop organizers (as well as at least one reviewer not involved in the workshop in case of possible rejection or another salient occurrence during review).

All contributions will be open-access and published on the workshop website and as a citable International Report on Socio-Informatics - or a journal special issue, depending on contributor interest. This will be discussed at the workshop.

Continuation of the proposed format will also be discussed at the workshop, however, a related workshop on 3D printing, social innovation and small and medium-sized enterprises is already being planned for later in 2017, digital fabrication and education will be discussed at the annual GIG meeting co-located with re:publica 2017 and more concepts for events exist in various stages of implementation.

## ACKNOWLEDGMENTS

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