MEETING REPORT

Additive visioneering

How visions shape 3D printing technologies

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Advocates of additive manufacturing, or 3D printing technology, raise no doubts: it will not only revolutionize the way we produce, but how we work and live together. It is to be found in museums, companies, at the universities and might soon be found at schools. The vivid response to this innovation in all areas of societal life points to its relevance. At the same time, the variety of initiatives and applications of 3D printing poses great challenges: laws and regulations have to be redefined, ways of working re-explored and ethical issues reflected upon anew. In view of these pending changes, the question arises as to how this technology, which seems to convey the most diverse wishes and threats, can be reflected upon on the one hand and how its development can and should be accompanied on the other.

Hosted by the Institute for Technology Assessment and Systems Analysis (ITAS) at Karlsruhe Institute of Technology (KIT) the online symposium *Re-imagining the futures of 3D printing in society* was organized by the Cluster of Excellence 3 DMM20 and took place on March 23 and 24, 2021. The call for papers had invited participants to contribute to an interdisciplinary reflection on the visions of 3D printing, now that the first great hype is over, and to review the paths of research and assess novel scenarios: How can 3D printing be adapted to social needs? What potential chances and risks remain after the great hype? Where do the visions that form around 3D printing lead to?

The organizers and members of the Cluster of Excellence 3 DMM20 opened the symposium: Martin Wegener (Institute

of Applied Physics, KIT) introduced the research on 3D printing within the cluster, where natural scientists from KIT and Heidelberg University work together on 3D printing solutions. Andreas Lösch (ITAS, KIT) introduced the research at ITAS on visions of socio-technical futures. The underlying goal of this research is to reflect on and co-create socio-technical visions. In this way, the research intends to contribute to responsible modes of developing future technologies and to their potentials for social innovations. Christoph Schneider and Max Roßmann (ITAS, KIT) presented how the symposium was one part of a longer scenario process, with the intention to co-shape socio-technical futures by facilitating a dialogue between leading experts on 3D printing in the humanities, social, natural as well as applied sciences.

The symposium was a mix of lectures, the scenario workshop, an artistic intervention by Fabian Hesse and Mitra Wakil (HGB Leipzig) and several poster sessions. Alfred Nordmann's (TU Darmstadt) keynote lecture dealt with the philosophically challenging identity of 'indiscernibles'. To preserve the ability of distinguishing 3D products, when even the original is a copy, he suggested Provenance Assessment as a TA-method to reveal the continuity stemming from the real and visionary histories of previous printing technologies. Connecting the past to the present, to the future and to present futures was one of the common thematic denominators of the symposium. Armin Grunwald (ITAS, KIT) emphasized the intertwined nature of socio-technical futures. He suggested the presence of a temporal asymmetry in socio-technical visions consisting of different expectations, made from past data and projected into possible futures. Visions therefore intervene in the world, creating self-fulfilling prophecies, sometimes accompanied by adverse effects and always entailing relations of power.

Several lectures discussed the notion of temporal interconnectedness. On the one hand, socio-technical visions of 3D printing and its uses may undergo dynamic transformations in relation to shifts in society over time. These shifts can open up avenues for technologies and can be the starting point for projections about future scenarios (Thomas Birtchnell, University of Wollongong). On the other hand, as was stated by Jan-Felix Schrape (University of Stuttgart), those visions de-contextualize emerging technologies, thereby unveiling the contingency in contemporary politics. The re-contextualization of these technologies is needed to reassess the actual limitations on the realization of visions. For the development paths of socio-technical visions about 3D printing, Niki Vermeulen from Edinburgh University suggested that the contingency itself posed questions of what happens after the hype. Carla Alvial-Palavicino from Utrecht University asked: Is 3D printing in the end just another solution looking for a problem or can it initiate a deep transition into a new form of industrial modernity? Moreover, how can a robust regulatory system be achieved when the production is decentralized (Phoebe Li, Sussex University)? 3D printing and digital fabrication imply significant changes for all areas of society, including its economy. According to Kean Birch

(York University), techno-scientific capitalism is characterized by the transformation of things into assets. Assets have virtual character and almost anything can become an asset, from ideas to personalities and design. 3D printing technology contributes to this development by shifting the economic focus from the product to its design.

During a public event as well as in the sessions adjoining the symposium participants discussed their visions of 3D printing for the post Covid-19 world. The discussants envisioned a systemic transformation of the economy, a seemingly shared vision of localized production, decentralized structures and a democratic process. All of it realized in and with the help of additive manufacturing, but with different roadblocks and chal-

port or even substitute conventional means, but these changes call for a socio-cultural shift that involved actors must initiate, undergo, rethink and perpetuate. Regarding the digital conference, more moderation work is required on the part of the organizers and participants are challenged to interact differently with the presenters, for example on a digital platform accompanying the conference.

During the scenario workshop, participants were asked to reflect on the future of 3D printing along four contrasting scenarios: sustainable & exclusive, sustainable & inclusive, unsustainable & exclusive and unsustainable & inclusive. The scenario feedback rounds were created as a mix of online surveys and comment sections, some of them feeding back into the sympo-

Discussants envisioned a systemic transformation of the economy through 3D printing.

lenges to its fruition. While the potential for innovations appears to reside within independent projects, the need for institutionalization seemed prevalent to Joel Cutcher-Gershenfeld from Brandeis University. Some participants treated a local, responsible, sustainable and resilient future as unequivocally possible but emphasized the need for its global distribution (Neil Gershenfeld, MIT) as well as coherent and engaging cultural narratives (Alan Gershenfeld, E-Line Media). During the pandemic 3D printing's potential overtly unveiled the problem in centralized production schemes: The technology hints at the possibility of a localized production that adapts to time-sensitive needs, which arise during a pandemic, circumventing the supply bottlenecks and utilizing the potential of digital networking. Therein lies the potential for resiliency of 3D printing in the context of the pandemic as well as future crises (Ulrich Petschow, Institute for Ecological Economy Research). However, this potential threatens to be hampered by patents on the one side, while possibly being preserved by open source licensing on the other (Angela Daly, Strathclyde University). Concrete 3D printing projects working on solutions for dealing with Covid-19 already face an array of challenges. In particular, tensions between makers and institutions were identified, which are caused by the decentralized way the makers worked (Peter Troxler, Rotterdam University of Applied Sciences).

Beyond the highly relevant nature of the topic of 3D printing, the symposium was an experiment and very much in line with the research agenda of technology assessment. Both the content level and its digital execution were a sign of the social embeddedness of technologies. It was made clear that any form of digital transformation requires an accompanying cultural change. The intertwining of the socio-technical became visible on multiple levels. First, as mentioned in the presentations, the Covid-19 crisis shows that technical solutions can find a niche, if the social context allows for it. Second, digital tools can indeed sup-

sium through the platform, encouraging participants to digitally mold their societal visions of 3D printing. As the threads on the digital platform stayed online for about a month after the symposium, the organizers could follow up on them with feedback on the results as well as with further research on the topics. The experimental character of the event, expressed in its digital format and the co-development of socio-technical alternatives, and the exchange about the potentials and risks in 3D printing development in the current Covid-19 pandemic hit the core of technology assessment. They are the manifestation of a socio-cultural change that is underway.

Further information

https://www.itas.kit.edu/veranstaltungen_2021_re-imagining_futures_of_3d_printing.php

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