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# Opening “open” materials design

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**Abstract**

Proponents of 3D printing often celebrate its ability to create and manipulate new materials at the volumetric pixel, or “voxel” level. However, current software tools for manipulating such material properties rarely reflect the practices of designers actively manipulating and working with them. In this workshop, I would like to explore how negotiations of “openness” in materials prototyping could be configured differently. Drawing on fieldwork in a design firm, I chart pathways for designing and prototyping with 3D printing materials that confront the troubles designers run into while working at the voxel level.

**Author Keywords**

Digital fabrication, 3D printing, computational composites, materials.

**ACM Classification Keywords**

H.5.2. User Interfaces: Prototyping.

**Background and Motivation**

During a recent internship at a large firm with interests in digital fabrication, I was introduced to several groups of researchers working to design machinery and interfaces for fabricating new materials at the volumetric pixel, or “voxel” level. During conversations and meetings with these technologists, I was struck by the challenge of their task: to build equipment and techniques to design novel materials that must be

computationally designed in tiny units that the human body cannot perceive, and with properties we may have never encountered. At the same time, I was conducting a series of design workshops exploring how a group of fellow designers and engineers made sense of speculative 3D printed materials and their design applications, in this case digitally fabricated architectural components. I began to notice a gap between how these designers went about making sense of novel materials and how their colleagues downstairs charged with building the ecosystem for creating new materials conceptualized materials design work.

This was particularly the case with how the printing technologists approached what designers and makers need to know about a material's properties in order to make judgements about its appropriateness in a given print, attempting to operationalize and implement properties like "appearance" in simulation. The technologies being developed follow a familiar engineering-driven approach of operationalizing various properties for simulation, effectively limiting materials design work to only those propensities that the printing engineers deem salient and useful.

Several of this workshop's organizers and others in the HCI and design communities have shown that the practices around designing with computational composites and novel materials are very much still in exploration [1-3,11-12]. Material capacities and limitations come to be known in design practice [1-8,10,13] and we can think of the particularities of materials design practice as especially unsettled when materials, designers' and technological competencies, or materials' meanings change [9]. Each of these

elements of practice is currently being reconfigured in 3D printing with novel materials.

### **For Workshop Discussion**

The avenues for participating in reshaping design practice with novel printed materials include ambiguously "open" platforms for makers. For example, it's not clear how knowledge arising from printing with unfamiliar materials can be made to circulate widely, even given some mechanisms for sharing this knowledge. And in this design ecosystem, how can makers/designers and firms sharing their "open" materials deal with the redistributed design work and related issues like intellectual property? How can we ensure the creativity of makers and designers is not repeatedly rendered subservient to the work of technical development and the particular requirements of simulation, reopening old Cartesian distinctions between abstract and embodied creative labor? I'm left with numerous such questions about the potential for open materials design and pathways of entry for design knowledge in contemporary digital fabrication and manufacturing development, particularly when such efforts are being channeled through modes of simulation and its associated computational logics that marginalize the situated, imaginative, embodied ways of knowing in design work. I believe these questions are pertinent to the workshop's theme of "exploring the relationship between Makers and Manufacturers", and my ongoing work could greatly benefit from discussion with the organizers and fellow attendees.

### **Author Biography**

I'm a third-year PhD student in the Department of Human Centered Design and Engineering at the University of Washington. My research interests are

broadly concerned with digital craft in the work of home construction. I am currently exploring architectural-scale fabrication methods in both traditional craft building and in 3D printing. This work is supported by NSF award #: 1453329.

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