

Playful Fabrication: Speculative Game Designs for 3D Printers

Karen Tanenbaum

UC Irvine
Irvine, CA 92697 USA
karen.tanenbaum@uci.edu

Theresa Jean Tanenbaum

UC Irvine
Irvine, CA 92697 USA
ttanen@uci.edu

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The recent proliferation of affordable hobbyist grade 3D printers and laser cutters has led to an explosion of utopian claims about the future of personal fabrication (Mota 2011) and the reconfiguration of manufacturing and industrial infrastructures (D’Aveni 2015). 3D printing is envisioned as the ultimate “disruptive technology”, creating anything from food to cheap electronics and even bioprinted organs. While the transformative potential of this technology is clear, the path to that future requires more than engineering and prototyping new hardware: it requires the development of key literacies around geometric and spatial thinking, more user-friendly interfaces and experiences, and more playful and expressive applications. In the research program we have termed “Playful Fabrication”, we envision and produce aspirational prototypes for a future of personal fabrication technology where expressiveness, playfulness, and communication take precedence over practicality, functionality, and utility. This reframing of personal fabrication technologies allows us to develop applications and contexts for challenging existing orthodoxies about 3D printing. In this talk we present our preliminary investigations into the design of games and playful experiences for networked 3D printers.

Much of the conversation around 3D printers and other devices for small-scale personal fabrication has been mired in functionalist and utilitarian notions of these machines. In this sense, the current state of playful fabrication parallels the early days of the personal computer. When the computer was first introduced, the emphasis was on technical uses for calculations and algorithms. As it became practical to put computers in the home, the driver for a consumer market shifted from the technological and functional to the experiential and creative. It wasn’t until computers could make music, create documents, and play games that there was a compelling narrative for a personal computer in the home. Instrumental in telling this story was Alan Kay, who undertook to envision expressive and playful interfaces long before the advent of what we would now consider “personal computers” (Kay 1972). In the late 60s and early 70s, Kay described a vision for the future of computing that reimaged computers as a communicative medium, rather than calculating devices. Kay outlined a research and invention program built around the creation of aspirational prototypes, intended to illustrate and explore the possibilities of graphical user interfaces, expressive software, and interactive games. Although the technology to fully realize his vision was not yet real, the designs he created inspired a generation of engineers, driving innovation and, more importantly, creating a vision for computing that was accessible to the general public. Thus, Kay’s famous quote, “The best way to predict the future is to invent it”, was proven to be true. The subsequent

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proliferation of personal computers produced a public demand for computers that were more playful and more usable, resulting in economic conditions that rewarded innovations in human-centered computing. The resulting virtuous cycle produced the radical changes in culture and in technology that have characterized the last half-century of human society. Core to this transformation was the shift away from command-line interfaces and applications designed for engineers and programmers, and towards programs that made the technology accessible to everyday computer users. In particular, the development of computer-based games for entertainment and education was a significant driver of adoption within schools and the home. We now have the technological capability to put 3D printers and other small scale CNC machines in our garages, but the vast majority of the use cases for them are utilitarian: creating one-off parts, repairing or replacing broken items, and designing new prototypes for fledgling startups. The technologies that are used to create and communicate instructions to these devices are still geared toward engineers rather than casual and playful end users, and the tasks being imagined for these devices are similarly oriented towards engineers rather than creative and exploratory end users. Design and engineering firms tout their use of 3D printers to rapidly prototype new products in the same way that financial and marketing firms once touted the impact of their new mainframe computers. But there is currently no equivalent of desktop publishing or computer gaming to push fabrication technologies from the business and engineering world into the household and educational market. Home fabrication technologies are still very much in the “command line” phase of their history, often requiring significant engineering expertise to operate successfully. There is therefore a significant opportunity space to reorient the field towards more creative and educational uses. In the same way that games like "Oregon Trail" and "Where in the World is Carmen San Diego" drove adoption of computers in the classroom and then the home, we believe there is an opportunity to develop interactive and entertaining applications for 3D printers that will help drive a virtuous cycle within the consumer market.

In this talk we present several speculative designs and early stage prototypes for playful fabrication systems using 3D printers as platforms for networked gaming. Our current work-in-progress is called *Terraform*, and it draws inspiration from civilization simulations games and the emerging “idle game” genre. Players in *Terraform* take on the role of an AI advisor to a community of simulated space colonists who are developing a new settlement on an alien world. The player sets social, technological, and scientific priorities for the colonists, but does not directly control what they build. Instead, the colony determines a course of action and produces new facilities directly on the build plate of the 3D printer. We also present several farther-future scenarios for playful fabrication that cannot yet be realized with current technology. By developing compelling games and playful interfaces for 3D printers we believe we can create a consumer demand for these technologies that parallels the rise of the personal computer in the 1980s.

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