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Makerspaces and Teaching Artists

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ABSTRACT

A librarian and scholar discusses the burgeoning makerspace movement as a new context for teaching artist work.

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Makerspaces and Teaching Artists

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Shannon Crawford Barniskis

Collaborative creative spaces are blooming nationwide, and teaching artists have the opportunity to join them, teach in them, partner with them, and benefit from them. Sometimes called makerspaces, hackerspaces, fab labs, or medialabs, or sometimes housed in coworking spaces (my preferred term: "library"—many public libraries are adding makerspaces), these creative spaces vary widely in what they offer and to whom.

Many factors lead to the recent eruption of makerspaces. Expiring patents on equipment such as 3D printers puts tools in the price range of hobbyists. *Make* magazine—a key periodical for teaching artists to peruse—discovered an astonishing surprising groundswell of support, especially for its Maker Faires, or festivals celebrating creativity. The social networks enabled by the Internet bred a culture of collaboration, and many more people now understand coding and electronics with the dominance of electronic gadgetry in our lives. Most fundamentally, in my opinion, the very ubiquity of those gadgets has spawned a tide of tinkering as people seek to understand, personalize, and cash in on the electronics/information revolution, while increasing sensations of distance and alienation called people to create supportive and playful communities. Also, we just want to make things with our hands.

What ARE These Things?

Wikipedia calls a hackerspace or makerspace a place "where people with common interests, often in computers, technology, science, digital or electronic art (but also in many other realms) can meet, socialize and/or collaborate." Often funded as cooperatives, these makerspaces thrive in cities and, increasingly, more rural and suburban communities. When they hear the term "makerspace," many people think of digitally mediated production using rapid, small-scale prototyping equipment. 3D printers, CNC routers and

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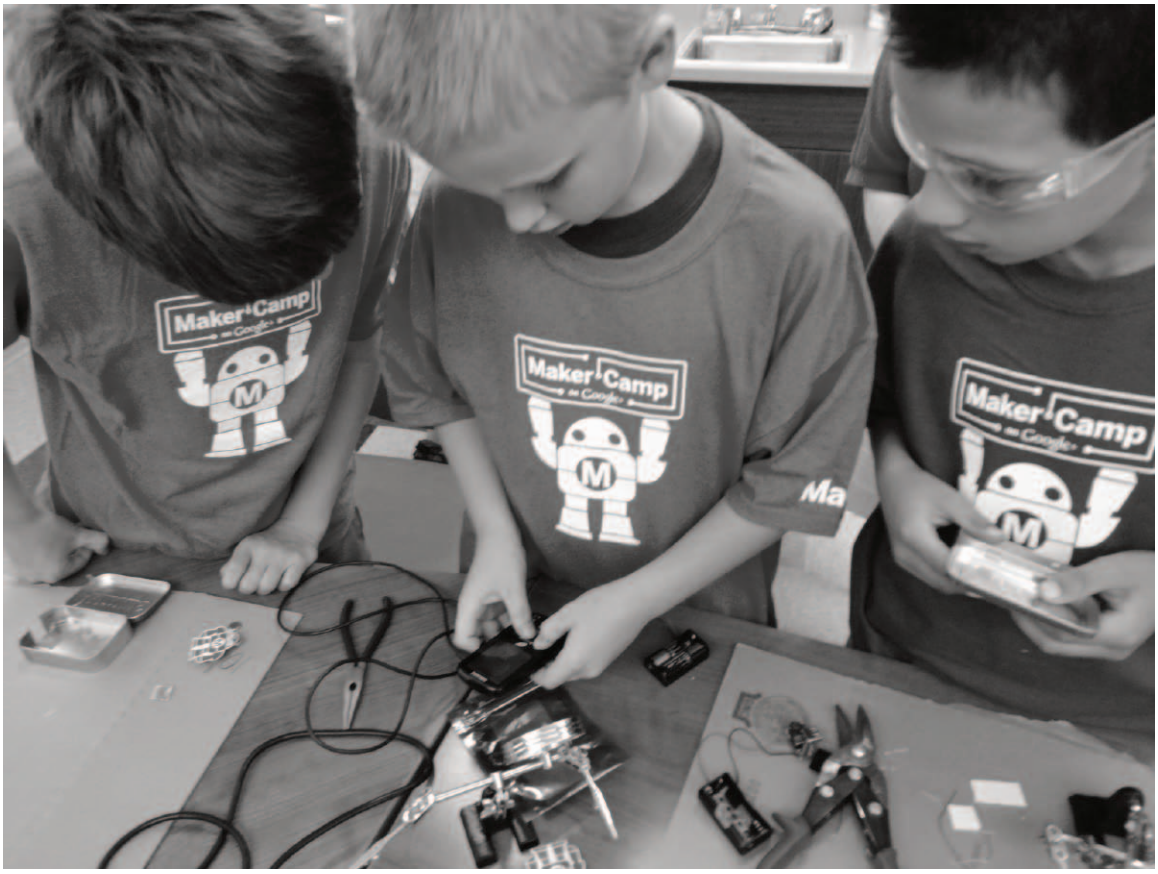

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Makerspace minty boost: Boys create battery-powered USB portable chargers from mint tins.

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laser cutters, and electronics equipment are de rigueur for many makerspaces. However, a wide variety of activities occur in these spaces. For example, the Milwaukee Makerspace offers tools, mills, kilns, sewing and embroidery machines, and welding equipment, all in a large space with an industrial-sized crane. Some of the recent activities there include sewing one's own craft apron, creating an no-rules pinewood derby track and cars similar to the ones Boy Scouts use, and sharing all sorts of projects with the public on the "builders' night out" weekly events.

While many people who are not members of a space like this may focus on the tools, makers generally emphasize the impact of the knowledge shared in a makerspace. In fact, one of the best-known makerspaces in the country, NYC Resistor, has a mission saying, "We Learn, Share, and Make Things." The emphasis on learning and sharing means that, while the tools and equipment are important, a participatory culture of community building is vital to a strong makerspace. *Make* magazine editor-in-chief Mark Frauenfelder called the maker community of "the killer app" of the maker movement, indicating that the tools and equipment are less important than the pool of knowledge held within the community.

That said, the tools and equipment do

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Makerspace 3D Printer: Tweens watch the 3D printer creating one of their projects and using interactive lights they built.

offer astounding opportunities to make new things, hack existing objects, and be creative, especially the Computer-Aided Design equipment. The additive production equipment, namely, 3D printers, allow users to quickly and cheaply build everything from sculpture to gadgets, using simple software. These printers can work with biodegradable plastic, the plastic used in LEGOs, wood composite, or nylon, depending on the printer. Some printers can print concrete. The subtractive equipment, such as computer-directed mills or laser cutters, allow users to cut wood, Lucite, cork, or plastic film, and to etch wood, aluminum, and glass. It can cut or engrave in intricate lace-like ways that is nearly impossible to do with non-computer-aided tools.

Makerspaces that offer industrial sewing machines, kilns, and soldering or welding equipment allow users to dabble in art forms they may have never considered before,

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or to focus their energies using equipment they could not afford on their own. Since most makerspaces are collectives, in which users pool their economic resources to purchase equipment, a makerspace can support any type of creative endeavor, depending on the people who belong to the space. Unfortunately, many makerspaces are expensive to join. Member fees are often $40 to $100 each month. Many spaces offer free programs or tours, and sometimes classes, so those who cannot afford a regular membership may still be able to try the equipment out. And the makers themselves are overwhelmingly generous with their time and skills, in my experience.

Library Makerspaces

In libraries, makerspaces are popping up to offer free access to the means of production to everyone, whether they can afford the membership fees of a collective makerspace or not. Creative librarians are translating public libraries' mission of ensuring access to information into more tools and hands-on classes, as well as books and videos. Some library makerspaces are digital media labs, with little or no prototyping equipment. Others are geared to a particular art form that is in high demand. One library is adding a fiber arts makerspace that developed from its popular knitting classes; it includes looms, a spinning wheel, ball-winders, and swifts for yarn enthusiasts to share. Users of this space largely use computers in this space to share patterns and blog about their projects, though pattern-creation software would be a welcome addition. This library offers regular classes on dyeing, spinning, and other fiber arts.

In my small rural library, where I am the director, a pop-up makerspace allows community members to 3D print, make jewelry, paint, or be creative in a wide variety of ways. These tools are available for casual, drop-in use as well as through classes on everything from cooking to soldering. In larger communities, community centers or museums may host similar activities, tools, and spaces.

If teaching artists partner with the shop teachers, home education teachers, and computer science educators in schools, a multifaceted makerspace can emerge.

Makerspaces Matter

Artists already understand the delights and skirmishes inherent in creative interactions with the world, but many children and adults do not consider themselves artists. They may struggle with particular art forms, or feel they haven't the talent to create. Others create regularly as hobbyists but may not be connected to a wider community of makers, and may not consider themselves artists. Makerspaces offer ways for the most art-challenged people to craft immediately beautiful and often useful objects. The most reluctant artist has access to the recipe for success in a makerspace—easy to use tools and plentiful help. These spaces offer opportunities for creators to connect and share their craft. Like communal studio spaces and classrooms, makerspaces allow students to teach one another. Most makerspaces offer many outreach opportunities to grow a larger community of makers.

In the background of every makerspace runs an undercurrent of hacking—the act of adapting an existing object, code, or activity to fit one's needs. This hacker attitude encourages people to tinker, to fail, to experiment, to make things better. Many of the projects filling the metal shelves ubiquitous to makerspaces are old electronics, gadgets, or tools that makers are changing to do things they were never intended to do before.

The makers in these spaces often prefer open source software both for its modifiability and for the community assistance that accompanies it. Makers often avoid purchasing electronics that they cannot modify. In fact, *Make* magazine says the maker's manifesto is, "If you can't open it, you don't own it." This philosophy suggests a desire for agency and control

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over the electronics that beep to tell us what to do, where to turn, how to like something (thumbs-up?), and control the way we can accomplish goals. In a makerspace, if too much computer gaming has given a member carpal tunnel syndrome, she can create an individualized controller from anything conductive—her dog or some bananas will do—and a MakeyMakey microprocessor. Or she may hack a Wii nunchuck controller. The knowledge and tools shared in a makerspace allow members to solve problems in innovative ways.

"The impact on our culture could be revolutionary," says *Wired* magazine editor Chris Anderson in *Makers: The New Industrial Revolution* (18). He predicts that the democratization of production will revolutionize our relationship with things and with each other just as access to information technologies (computers, printers, the Internet) did. The maker movement is rooted in the DIY punk ethos of a generation ago, but Anderson believes that the maker subculture will expand to simply become our culture.

Not everyone is sanguine about the impact of makerspaces or maker culture. Some critics worry that the creativity and artistry of many of the things that makers are currently producing in makerspaces, such as whimsical robots, may transition to more workaday customization and household production. In short, they believe makerspaces engender consumerism, just in a new location or with revenues generated in different ways, such as through selling the digital plans for an object. Other critics argue that the items created in makerspaces or by equipment such as 3D printers are trivial—such as toys. This line of reasoning is largely uninformed. My maker acquaintances are creating tools, fixing equipment, and creating art, not "just" toys. They are also learning while making toys, and having a wonderful time doing so. Other critics fret about issues of intellectual property. Since copyright does not cover objects, and patent covers processes, what rights do creators hold over the physical manifestation of an object when anyone with a smartphone and 123D Catch can create a digital file for printing or cutting? How will the rights of the creators be balanced against the rights of the users? This is one of the many lacunae in the intellectual property laws that are apparent due to increased access to digital media.

Art Partnerships and Media Interactions

Legalities aside, for a teaching artist, the maker movement is nothing new—artists have been making for eons—yet it offers fresh opportunities to join forces on projects and education with people who may never have considered themselves artists, or with tools artists rarely use. An artist may be already experimenting at the forefront of the field of digital production, or might be using two-thousand-year-old techniques to cast paper sculptures. In either case, makerspaces are seeking creators of all stripes to teach classes, to join as members, or to perhaps to partner with in teaching students.

Even if the makerspace in a community is highly tech-centric and the artist uses low-tech materials and processes to create, there are opportunities for cooperation. The artist could add interactive LEDs to those cast-paper sculptures, for instance, which respond to shadows cast by clouds or passersby. One of my maker friends is creating a musical instrument by shooting water from a pump at varying rates, programmed with an Arduino microprocessor, which hits different chimes to play tunes. Another is creating ecological art using wind-activated lights released into the "wild" of a local park, collaborating with the yarnbombing project already installed. My library's group of maker teens is creating 3D printed sculptures using a video game engine called Spore. These sculptures look like plastic toys when printed, so we are modifying them further by drilling, painting, sewing, and otherwise changing the printed object. Some artists are using the new scanning and printing technology to reconstruct broken objects in fascinating ways, while others are constructing new objects from printed connectors and found items in a tinker-toy-like fashion.

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Art can become more participatory and collaborative for students using makerspace tools and ideas. For example, an art teacher could install a dead drop—a mounted USB flash stick that anyone can plug into and add or take files from—in a school hallway (see deaddrops.com). Students could upload their own files, download those created by others, and remix them into unique compositions, combining different forms of digital media. A collective piece could include music, photography, scanned art images, and coding to make the piece change when connected to a microprocessor and controller. Those concerned with the potential for unsavory additions of expletives or other undesirable files could consider anything students add to the dead drop as an offering, upon which excellent art could be scaffolded. Teachers could install a series of dead drops throughout either an urban or natural environment, to encourage students to work with the wider community, and to connect their art with a sense of place. The makerspace in this instance is as small as a USB flash stick.

Getting Involved

These are sparse examples of the rich art that teachers can demonstrate and create in makerspaces or with makers. I encourage teaching artists interested in integrating maker-style projects into their toolkit to check out sites aimed at children, such as Sylvia's Super-Awesome Maker Show, created by a maker when she was nine years old, at sylviashow.com, or youngmakers.org and the *Make* magazine/Google+ collaboration Maker Camp at makezine.com/maker-camp to get a sense of the possibilities. Teachers can check out Instructables.com, otherlab.com, *Make* and *Nuts and Volts* magazines, and look at online catalogs from the Inventables hardware store, or Adafruit Industries. To see a case of how one art medium can inform another, one teacher has brought chairmaking as an activity to a creative writing class (www.iftf.org/future-now/article-detail/maker-education-and-the-wikiseat-project/).

The teaching artist's next step is to join a makerspace or group by searching Make meetups (www.meetup.com/makermeetup) for groups that may not yet have a makerspace, or makerspace.com/makerspace-directory for a list of spaces. Teachers may not wish to become paying members of the group but to sample the open nights or meetings that most groups regularly hold. Dozens of local Maker Faires, such as those in Detroit or Rome (makerfaire.com) offer outstanding opportunities to experience the range of creative activities makers are up to. The maker community is supportive and often willing to do far more than one might expect in collaborating on new projects. Many of these groups are seeking educational opportunities to spread their knowledge and support community needs.

Teaching artists working in schools may have the opportunity to create a makerspace. President Obama called for one thousand new makerspaces in high schools in the next four years, and the Defense Advanced Research Projects Agency is teaming up with makers to facilitate these spaces, in order to promote science, technology, engineering, and math (STEM) learning, innovation, and technical skills in a new generation of workers. At the White House Science Fair in 2013, Obama called for students "to be makers of things, not just consumers of things" in his speech on his Educate to Innovate campaign.

If teaching artists partner with the shop teachers, home education teachers, and computer science educators in schools, a multifaceted makerspace can emerge. I recommend the Makerspace Playbook for those interested in creating their own spaces (makerspace.com/wp-content/uploads/2013/02/MakerspacePlaybook-Feb2013.pdf). One issue to consider when creating a new makerspace is the fact that much of the makerspace magic is bound in the community that creates it, and the wide variety of ages and skill levels found in that community. The tools do not make the space; integrating makers from outside the school environment will likely be critical to success. In the controlled environment of a school, building regular interactions with non-school-based creators may be challenging. For this reason, I recommend

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Makerspace spinbot: A girl creates a spinbot, which draws spiral art with markers affixed to its legs.

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creating new makerspaces in other environments that more people can access, such as libraries and community centers.

Heads Up, Teachers

Many teachers are used to teaching a large group of children to work on one project at a time. However, in a makerspace environment, each student may be working with different tools and processes. The teacher needs to be comfortable with a considerable quantity of chaos in such an environment, as well as skilled with all of the tools and able to switch gears quickly. In addition, safety hazards abound in these spaces, if students are not trained in cleaning up, using equipment properly, and safety equipment.

A large part of the maker movement involves documentation, or sharing the process of making. Not only is this necessary for the community as each person strives to stand on the shoulders of those before them, but it is one of the unique thrills of the makerspace. Creating a time-lapse film of the 3D print is just as interesting as the print itself, and sharing that film on social media both allows students to demonstrate what they've made and how, and teaches others of the potential applications of the tools and methods. The process is as important as the product. Teachers will need to provide notebooks or handheld video cameras or other recording equipment. They will need to instill a culture of documentation for their students.

Planning sessions are another important step in the creative life of the makerspace. The group should plan regular sessions on how to create, how to document the process, emerging road blocks, and the triumphant (or dismal) results. This is one of the main ways the makerspace community is engaged and promulgated, through intentional sharing opportunities.

As for those potential dismal results, failure-rebounding is a fundamental activity in makerspaces. For example, I recently learned to solder a printed circuit board kit that makes an interactive light display (an Octolively, from evilmadscientist.com). I made it with the support of a local maker group at a Hackathon, in which each person made their own thing while we shared ideas, knowledge, food, and great music. I tested the kit with those makers, one of whom loaned me an electrical supply to power it temporarily. I fixed the lousy soldering with the use of his voltmeter and advice, and replaced a defective LED once we ascertained that it wasn't my soldering that was causing the problem. Back at my library makerspace, I didn't have an appropriate electrical supply yet—it was backordered. I was teaching a pack of library makers how to solder their own Octolivelys. So I decided to try different electrical supplies I had in the library, to see if I could show the kids how the Octolively worked. I knew this was probably not going to work, that too much current could blow the circuit board, and I also knew (or was informed by an electrician-maker friend) that it wasn't particularly dangerous to try it. I ended up frying the microprocessor with too many watts. The kids watched this failure, saw that I was calm, and heard how I would fix the problem—I would have to order a new microprocessor and figure out how to program it. They have referenced this failure several times since then. For them, failure is just something you figure out how to work around. Of all the lessons in a makerspace environment the lesson that failure is no big deal is probably the most valuable, along with the lesson that you can rely on friends to help with your failure if you offer them pizza.

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Conclusion

The benefits of STEM have been hyped in education, but STEAM (just add Art) is the new catchphrase. As digital technology becomes cheaper and more ubiquitous, the arts are increasingly in conversation with science. Teaching artists who expand their creative horizons in makerspaces, partner with makers, and teach using digital tools may find a wider audience of students eager to create who may turn their noses up at more traditional arts. Funders of STEM may be convinced to support STEAM. Integration of the arts in science or math classrooms, or shop classes, may become more common.

The teaching artist's goal to create and facilitate great art with students can obviously occur with tools no more technologically advanced than the human body. Nevertheless, the digital and creative tools and, more important, the community that makerspaces collocate, offer new ways to create great art and to teach.

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