Why Young Makers Matter

I’m going to be talking today about the Hands-on Imperative and what it can mean for all of us, but particularly young makers and re-inventing the world around us.

American Maker

In 1961, a short industrial film opened in theatres, appearing before the feature film. Its opening shot is of the Pacific Ocean. A closeup follows a large rock outcropping to reveal behind it the beach where two boys in the distance are making a sandcastle. The title appears to great fanfare: American Maker.

The narration begins following closeups of the boys building the elaborate sandcastle: “Of all things Americans are, we are makers. With our strengths of minds and spirit, we gather, we form and we fashion. Makers, shapers, put-it-together-ers. We start young, finding out early in life what’s its like for something to grow and take shape beneath our hands. We start young and stay young, modeling with careful pride the things we expect to endure for ourselves and for others. We build for use and we build in fun, joining eyes and hands and brains.”

This film was created by Chevrolet. It appeared in Detroit drive-in theatres during the run of Alfred Hitchcock’s Psycho. That’s a strange juxtaposition, certainly. I’ve wondered if somehow today’s makers were imprinted at an early age by this unusual combination and the seeds were set for a Psycho-inspired new American making mashup, moving it from something like a Norman Rockwell painting to a punk rock garage band.

Make and Maker Faire

Make is a magazine I created for this new generation of makers. They are largely technology enthusiasts. And what they do is play with technology and there’s a lot of new cool technology to play with. Makers are hobbyists, tinkerers, artists, inventors, engineers, crafters. I saw that computing was moving from the desktop out into the world, embedded in the environment rather than being its own separate environment, carried with us in our phone, embedded in cars and homes, on our bodies as our clothing and backpacks. We have a re-integration of the physical and digital, and a whole new field of interaction becomes possible. In short what I saw was that more and more people were hacking not just computers but hacking the physical world – the world we live in.

As a magazine, Make is like other DIY magazines in categories such as cooking or woodworking. It’s a magazine by and for people who are doing things themselves. It’s meant for you to find inspiration in the projects that other people have done but also to share the details how to start do things yourself. I wanted to focus on what people were doing, how they took hold of technology and personalized or customized it to make it adapt to their own ideas, to create their own applications.

DIY doesn’t mean doing it all by yourself; DIY is social. I’ve called it the DIY paradox. You have to do it with others, and the opportunities for sharing today are so much better than they were fifty years ago. Part of the DIY mindset is to seek out others who are doing similar things.

Make and the name “makers” have become a way to bring together the many diverse projects and people that were already doing things. The term itself helped organize a greater community, made up of creative and technical people who belong to distinct sub-cultures and share different interests. I believed we could bring them together – they would enjoy meeting each other and the public would enjoy meeting them. So I created Maker Faire in 2006 in the Bay Area. Our most recent Maker Faire in the Bay Area attracted about 80,000
people and featured 1000 makers. We have Maker Faires in Detroit at the end of this month at The Henry Ford and in NYC at the end of September at the Hall of Science.

The iMake video from 2008 I think does a terrific job of capturing the enthusiasm and joy expressed by makers and the wide range of projects that people develop and bring to share.

Hackers

As much as Maker Faire is the face of something new, I see it connected to a tradition rooted in hacking and hackers and something called the “Hands-on Imperative.”

In the 1960’s a group of students at MIT first used the term “Hacker” as Steven Levy describes in his book, Hackers. These students were not in a class but in a club, a model railroad club. They had a large train board and the students who played there fell into two groups: one worked above board, building up the terrain and creating a village; the other worked below on the switching system. This latter group soon caught wind of computers -- big machines locked up and guarded by the administration for use only by the administration. They began to feel that there was a good use for computers in their work. The challenge was how literally to get their hands on a computer and by doing so, they would be able to take it apart, look at its components and understand how it worked. Only then would they be able to make it do what they wanted to do. According to Levy, this became part of the Hacker Ethic -- not just an idea but a value -- it was called the Hands-on Imperative. If you couldn’t get your hands on something, then how could you learn about it? How would it be possible to know how to use it?

Hacking from early point on was about personalizing technology, making it do what you want it to do. It didn’t matter whether it was designed to do what you wanted it to do. What mattered was if the system was open enough so that you could make it do what you wanted.

There was another group on the West Coast that were playing with technology. It was the famous Homebrew Computer Club in Menlo Park. Steve Wozniak is probably the best known member and its members wanted to design a computer so each of them were working on building their own. Woz said of his time going to these club meetings: “I just loved going down to the Homebrew Computer Club, showing off my ideas and designing neat computers. I was willing to do that for free for the rest of my life.” Woz is an enthusiast, a hacker, a maker.

So, I’d like to make the connection between those early hackers who created an industry and made computers do things that the people in places like IBM never imagined computers doing. And of course, two young hackers, Bill Gates and Paul Allen, dropped out of Harvard after reading an article in Popular Electronics magazine in 1975 about the Altair computer. They went to New Mexico to meet Ed Roberts and began writing the first programming language for a personal computer. They were young people without formal training. They were enthusiasts who spent unlimited time learning what this technology was all about.

Today’s makers are getting together in places often called hackerspaces. In New York, there’s NYC Resistors and in SF, there’s Noisebridge. Three hackerspaces have open in metro Detroit in the last year. They wanted to play together and they wanted to find other people who liked what they did -- that had the same interests. I see bands of hobbyists forming – my next story in Make is called Kid Robot, and it’s about how a group of hobbyists got together in Detroit to build a robot for a factory.
Design Pattern for Enthusiasts

An enthusiast is an amateur in the sense that they are doing something they love doing. But I believe that enthusiasts do what they do not just to please themselves but to connect to others. In the Twitter sense they seek to create a following by telling people about what they do.

There’s a design pattern for enthusiasts and it applies to garage bands and garage inventors. You set off realizing there’s no existing path to follow but your own. As you create this path, you learn that 1) there is no formal education requirement; you must be willing to learn on your own. 2) you need to find others with a similar level of ability and interest. 3) you have to acquire technical skills -- whether with guitars or machine tools, but you realize that we’re all using the same tools, and developing technical skill is an important advantage, whether it is done by formal or informal means. You can learn from others who have more experience and/or talent than you. 5) To make any progress, you must commit the time to practice and play.

Finally, it’s also important that you get out of the garage and do what you do in public. You need to do it in front of other people because that’s how you get real feedback.

The Elements of Making

The basic unit of making is a project. It’s the basic unit of participation. It’s also by no coincidence the way that Open Source software are organized as projects. It’s what we dream up and its what we have hanging over our heads to complete. A project is a narrative – a story that begins with an idea, however rough or well-formed it may come. One must have a list of ingredients and then proceed through a sequence that’s filled with unexpected challenges and misunderstandings. If you can overcome the obstacles, you might get end up with something. A project is what we can talk about – both a process and a product. We can share that project with others and get others to participate in it.

Here’s what we need to do projects: information; supplies and tools; a physical place. Let me say two contradictory things that are both true: Space doesn’t matter and space matters a great deal. Finding the right space shouldn’t matter – any space will do – a cafeteria, a picnic table, a garage, a shed, a kitchen table. Making happens almost anywhere. On other hand, developing a space over time to create a rich learning environment does matter. A workshop or a studio is a fascinating place – so much more stimulating than the average classroom. A good workspace is organic and it should grow.

We are inspired by workspaces. We can also be inspired by tools and materials as well. There are so many exciting new technologies to explore in personal fabrication such as 3D printers and laser cutters but you don’t need them to get started making things. You can find tools and materials from a variety of sources. They can be really cheap to assemble.

Making is also part of a social environment; we want access to people who know more or can do more than we can; these may be adults or may be our peers. Most kids need to begin by following what others do. This is a role for mentors and if those mentors are enthusiasts, they naturally want to build a following.

A social environment also supports and reflects certain values. For lack of a better term, we want to develop a maker culture in each place – an open culture that supports exploration, permits failure, and fosters creativity and personal development. The Hacker Ethic sets the expectation for openness.

Young Makers
So how could we do more to promote making by young people? Good news. It’s already happening – in schools although there are challenges there; in after school programs which also have challenges and in the home. I hear from teachers, parents and after-school leaders; they come to Maker Faire looking for new ideas. The bad news is that it is hard to aggregate what’s happening and understand what’s working and what isn’t. We don’t have a way to collect best practices and disseminate them broadly. There are a lot of people working alone.

Schools are not the best environment for creative exploration, and yet they need to be. Schools are rigid where we need them to be flexible. Education demands standardization and the right answer where young people pursue individualization and their own distinctive form of expression.

I worry that making in school might simply be another form of busy work, driven by the needs of the institution rather than the adapting to the individual needs of students. Let me give you two examples of how making might be viewed in school.

Making can be seen as another version of hands-on, project-based learning. The hands-on imperative as defined by hackers was not just about doing things with your hands; it was more than that. Hands-on is a metaphor for getting your hands on something so you could take personal control of it. Taking control is the necessary step to personalizing technology. It is a fundamental shift when we move from being told what to do to doing it ourselves, moving from directed to self-directed; from following instructions to creating instructions, from doing what we’re told to do to exploring what might be done. This taking control is part of what is subversive and creative about hacking, and it is also why making can be cool. Kids want to do cool things; they want to create. They don’t want to do what everyone else is doing, and doing it in a boring mindless way.

Making has elements of a vocational education program. I do believe Make can provide a new viable option for kids who need an alternative to traditional textbook learning. However, I don’t think making should be seen as choosing “manual” versus “mental” work. The old voc ed programs undervalued the potential of most kids, and we should think of making as a mode of working that has the real educational value. It’s offers applied learning, and there are kids who really get building applications – whether those are video games, robots or music. We don’t want a narrow voc ed program that focuses on teaching the use of tools and machinery without also encouraging young people to figure out what to do with them. We need to develop programs to engage at-risk kids in making, kids who find little useful or practical in today’s educational curriculum. The goal should be to help them build confidence in their own capabilities, as active learners who have the confidence to learn to do almost anything. That’s the outcome we want to strive for.

Essential to transforming education for the 21st is providing the opportunity for students to take greater control of their own education – to own it, to drive it, and to find their own way. I think of making as alternative form of education for our communities, reaching all kinds of students who are not engaged by education today. So what kind of infrastructure is needed for getting more kids making things?

Clubs

I have mentioned the MIT Model Railroad Club and the Homebrew Computer Club as early examples. Clubs are generally formed around an interest, they offer some reason for getting together and sharing activities or projects, and they encourage peer and community recognition.

A new kind of making club might exist -- and in one form or another already exists – in schools, in after school settings, in libraries, or in community centers. It might be organized in a parents’ garage. It might be a program inside an existing club. Will clubs form the way garage bands form, which is, to say, informally?
Could young makers be motivated to become involved in a club as a physical space that supports the “practice and play” of making and as a social environment that supports what they want to do?

Clubs of all kinds exist in communities around America – Boy’s and Girl’s Clubs, Boy Scouts, Girl Scouts, 4H. They could be partners. Yet, they also are shaped by an older idea of clubs what clubs should be. Like our school system, they aren’t always willing to adapt to new models because they have so much invested in the old model. What if this new kind of club doesn’t need a lot of central organization and administration? What if it has a few simple goals and allows people to adapt to different physical and social environments?

We’re already seeing self-organized adult “maker clubs” in cities; we’re seeing mini maker faires in smaller cities and in school districts. These events are self-organized by volunteers.

Let’s call this kind of maker club a makerspace, a loosely structured physical and social environment bound by simple design goals. It should have tools, materials, and mentors. Its goal is to engage kids in projects. These clubs can be physical and they can connect to each other online – to expand the ability to share.

We should think about a wide variety of projects and how they engage kids of different interests and abilities. For example, one design pattern for a making project for young kids is: build something that get to play with. Making should offer the opportunity for social interaction with others – you play along with others. At the Exploratorium, we had kids build Bristlebots – which use a toothbrush head as a centipede-like body and a cellphone buzzer to give it motion. What Mike and Karen did was build a playfield with an adjustable maze; once the kids built their bristlebot, they went over and tried it out on the playfield. They saw how it worked – or didn’t. They saw how other kids’ bots worked. Most would go back and work on their robot, iterating to modify the Bristlebot’s ability.

Makerspaces should have playfields. They should organize activities for drop-ins but they should also allow young people to develop and sustain their own interests.

A related aspect is to be able to demonstrate your project – to communicate what you did, how you did it and to teach others about it. This is what we have at Maker Faire, and I was encouraged to see in the last year several school districts holding their own maker faire. It is a chance to invite others in the community to participate.

Each of these makerspaces should be connected online. They need to be able to share projects, ideas, mentoring, instruction; each young maker should have a portfolio of their work, which they can share through social media to friends and family.

So how can we create and grow Makerspaces in lot of communities? Like Maker Faire, it’s really a community development project but we want to build a persistent network.

Communities

As I’ve pointed out, making is personal and social. It happens in open communities. Part of what makes Maker Faire exciting is that it reflects so much of what exists in the community but is also hidden in plain sight.

I characterize Maker Faire as a large machine that is assembled for one weekend and taken apart afterwards – and all the parts of the machine come from and and go back to the community. What you see at Maker Faire is that this DIY learning community is thriving all around us – in organizations and in individuals.

I’d like to encourage us to think of the future of education as community-based, not campus-based. I don’t mean to diminish the value or importance of schools, but formal education has its limits. It always has. There is a large, broad informal learning network that we don’t a lot about.
So I’ve come up with an idea for a Smart Grid for Education. I believe we should have a broad community focus for education – thinking of building and supporting alternatives to school in our community. They already exist. They’re just not well connected.

What if the best way to change our system of education is to organize all the resources that are not in the system? Just as we are exploring alternatives sources of energy, we ought to be exploring how to organize alternatives sources of learning.

Educational opportunities are generated everywhere. If we can plug them into a grid, we can make them available where they are needed most. From home or from libraries, learners can connect to the grid as an educational network that allows them to obtain educational services they need. We can assess and monitor participation, and tie it to direct benefits.

The Smart Grid for Education supports the development of new, alternative sources of educational services, particularly in areas of informal education. The Grid can help to utilize more fully many existing alternatives, which are available from many sources. These new sources may deliver services one-on-one, in small groups, in physical or virtual classrooms, in person or online, on the web or on a smartphone.

Think how one can use a service like OpenTable to find out what restaurants are nearby filtered by personal preferences. One can make a reservation based on real-time availability and then share that time/location with friends. The Smart Grid for Education seeks to apply this kind of real-time discovery and registration process for informal learning opportunities. They might discover which workshops were being held and then make a decision to reserve a slot in the workshop. The user would be encouraged to let others know (via Facebook and Twitter) that he or she is going to do that activity.

My goal is to network communities to identify the resources, the needs, and usage for sources of learning.

Make History

One of the concepts discussed in Stewart Brown’s book is the idea of play history. He talks about us recovering moments in our past in which we were at play – how that made us feel and how time seemed to stop while we were engaged. He encourage adults to re-discover play.

I’m often asking makers about their own “make” history. How did they learn to do what they do? Where did they pick it up? Was it a parent, a neighbor or a teacher? Broadening that even more, we can ask about our own learning history. I suspect more creative people have irreproducible learning histories. Each one is a different path with eccentric turns and unusual stopovers. Sometimes the function of formal education was to produce a negative reaction – producing a much more powerful counterforce.

Each of you has a learning history, a make history and a play history. They may be one and the same. Let’s share that history with each other --- they are the unique path each of us has laid down. They intersect with the paths of others as well as diverge from our siblings, our parents and friends. Imagine if we could visualize that network, and if we could see it while it is being made so we could learn from its built-in feedback.

Why Young Makers Matter

Fifty years after the American Maker Video, President Barack Obama in a speech before the National Academy of Science called for us to encourage “kids to become makers of things, not consumers of things.” We can’t tell them what we tell them about a lot of products: “Do Not Open – No user serviceable parts.” We want to show
them how to replace parts, upgrade systems and design new ones. This is the hands-on imperative on even broader terms.

We know there’s so much to do once you get your hands on things. You might want to get your hands on robots or planes or musical instruments. You might also want to get your hands on data, or on 3d printers, or electron microscopes, the Hubble telescope, or on even your own DNA. It’s a great democratic urge, this hands-on imperative.

We can’t change the world unless we are willing to be hands-on. The big systems of education and business and government are like the mainframes of the sixties – designed for centralized control. It’s these very large systems that we want to get our hands on and change for the better. We want to understand how they work, so we can fix them or replace them with something much better. I know this sounds theoretical and idealistic. Yet if you sat in the talk by Bill Gates you saw a man who was once a hacker working with computers and who now is literally looking into hacking education, energy and medicine. He’s a prototype for Young Makers.

Buckminster Fuller asks this fundamental question of all of us:

"If success or failure of this planet and of human beings depended on how I am and what I do ... How would I be? What would I do?"

Making is about knowing and doing and knowing what to do. It’s about doing things that matter. The hands-on imperative applies to each of us – we are in control of a great power, a great technology, which is our own physical and mental being. As makers we become feel fully alive and wholly engaged; we are able to discover our own abilities and decide how to use them.

My hope is that young makers will learn to understand their own power and be able to participate in an open, collaborative and creative culture that makes it possible to re-invent anything and everything. Let’s make this happen

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