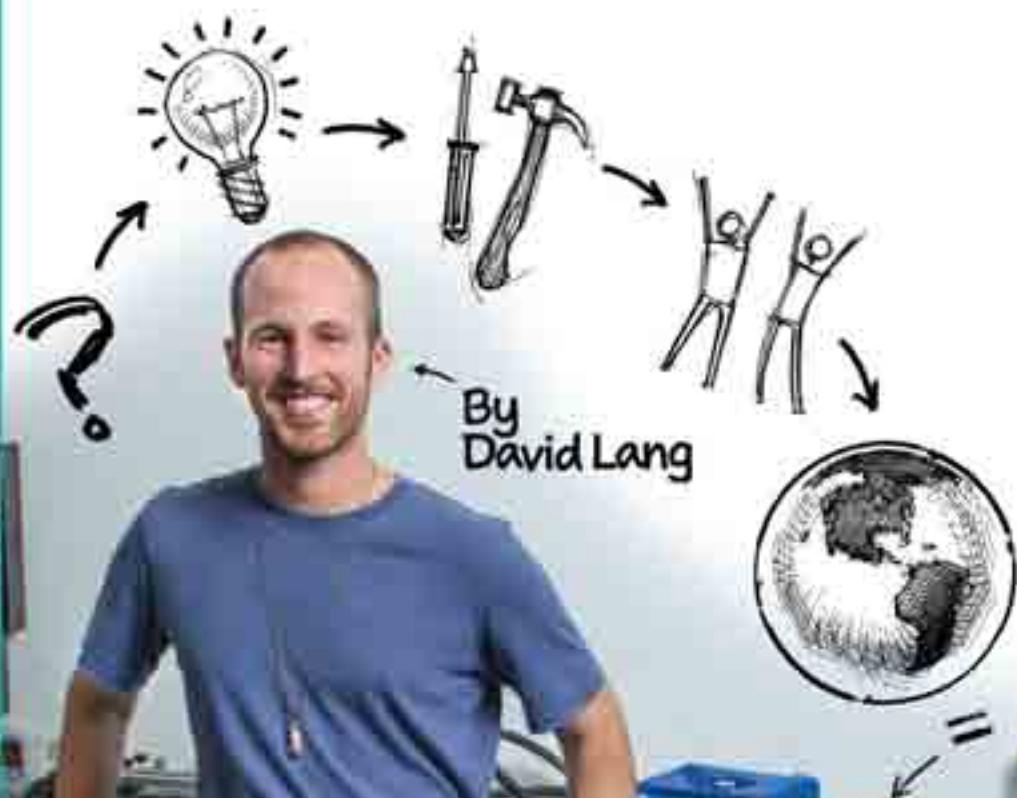


From
Make:
magazine

Zero to Maker

Learn (Just Enough) to Make
(Just About) Anything



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David Lang



ZERO TO MAKER

by David Lang

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Craftsmanship

Craftsmanship was a simple idea. Before I started my maker journey, I thought it was something I could easily identify and define. In fact, it was the lack of craftsmanship in my own life that was the real, underlying motivation for getting involved. I'll never forget the feeling of maker admiration when I attended my first Maker Faire, or the conversation I had with the carpenter in the days after losing my job. These people (both men and women) were craftsman. They had an approach to their work that nobody—not an employer or an angry customer or a turbulent economy—could take away from them. It was deeply personal and, from my perspective, fulfilling in a way that I had never felt about my work.

Strangely enough, the idea that seemed so certain when I began my journey became the most challenging and elusive concept I tried to tame. Initially, the concept of craftsmanship seemed like a title. It was a badge of honor that could be achieved, like being a doctor or scientist. I tied the word to the traditional tools, the ones my grandfather and grandmother used in woodworking, metalworking, or sewing. I tried to spend time with as many craftsman that I could, from an old-school metalworker in the foothills of the Sierra Mountains to a bag maker in the Mission District of San Francisco. I wanted to get a flavor for the analog tools—the skills I missed in shop class—but also soak up as much wisdom as I could from this dying breed (or so I thought) of worker.

It seemed straightforward: meet and learn from experts in a few different trades, take notes, and hopefully walk away with a little more tool knowledge and wisdom. But the further I went down that path, the fuzzier the concept became. I realized that craftsmanship wasn't a title, it was a way of moving through the world. It was as much about learning the techniques as it was about discovering yourself. I also realized that craftsmanship wasn't confined to the classic trades I had originally envisioned, but spanned all types of tools. And the same forces that were shaping the maker movement—the accessibility of new tools, the connectivity of the Web, and the DIT mentality—were forging a new model of a craftsman for the twenty-first century.

The Process of Becoming

In my search, no one embodied this new class of craftsman more than Joel Bukiewicz, a knife maker in Brooklyn. I learned about Joel, as I did many others, after watching a short 10-minute documentary about him, his craft, and his perspective on making. The video was shot as part of the [Made By Hand series](#). It consisted of Joel talking over clips of himself in his gritty workshop in the Gowanus neighborhood of Brooklyn. I was captivated by the visual tone of the film and of Joel's world.

Like for me, making wasn't always a part of Joel's life. It was something he stumbled into during a particularly tough and uncertain time. Joel was living in Brooklyn, having just graduated with a degree in fiction writing from the New School, and was trying to get his writing career off the ground. After a prolonged struggle to sell his first manuscript, fear and doubt began to set in. It became so worrisome that Joel decided to take time off from writing. He let go of the fear by letting go of the hope.

With the hole that writing left, Joel began to fill his time with new "creative offerings" like making bookshelves, canoe paddles, or fixing things around the house. While spending time in Georgia, he began teaching himself how to make knives in a garden shed behind the house. The process resonated with him. The making of knives had the feel and fundamental utility that pushed all the right buttons. He started with sporting and hunting knives, putting thousands of hours into his newfound craft. After coming to the realization that the knives weren't actually being used, and valuing the idea of utility more than art, Joel switched his focus to creating knives for the kitchen. His passion has since turned into a thriving small business in Brooklyn, where Joel still makes every knife by hand.

I've never made a knife. But I'd like to try. I wonder if I'd get that same rush, the internal "click" of something that feels right. That was the dream when I started. I wanted to find something that I could pour myself into. My starting point was the same as Joel's: a creative hole that I needed to fill with something tactile. Joel's search, moving from bookshelves to paddles, mirrored my own quest, which was a sampling of maker aesthetics. Like finding the right pair of jeans, it involved trying on a number of different roles, sitting in them for a moment, and trying to get a feel for whether this was "me." Only after you have something that fits can you start breaking it in.

It wasn't until much later, after I was knee-deep in underwater robotics, that I realized how critical that search had been. I learned that craftsmanship is not a destination, it's a process. And the search—the trying-on process—was the first phase. It's impossible to achieve mastery without starting the search. It feels similar

to unlocking a padlock: twisting to the right, then back to the left, then back to the right. That doesn't work. Back to twisting. Then, just when you're ready to break the damn thing, something clicks. All the frustration and failed attempts are behind you, and were, in fact, part of the unlocking.

A Maker Sampling Quest

You picked up this book for a reason. Something about the idea of creating an actual, physical object spoke to you. Based on my conversations with other reluctant makers, this could be that you had a product you have always wanted to create. Or maybe it's that you read about 3D printing and wanted to see what all the fuss was about. Fundamentally, though, I'm willing to bet that there is a part of you that sees this maker movement as scratching an itch. It seems to me that that itch lives somewhere near this idea of craftsmanship—tactile and meaningful work—that I just described.

If you don't have a specific project in mind already, but you find yourself driven by the same search for authentic creativity, I encourage you to recreate a similar "Maker Sampling Quest" that Joel and I found ourselves on (Joel's writing sabbatical and ensuing "creative offerings" and my Zero to Maker journey). There's something re-humanizing about the process. For me, it became very clear that human beings are tool builders and tool users; it's ingrained in each of us. It creates a connection to the past and a sense of responsibility to the future. Committing myself to the month-long search helped me to crystallize that perspective.

The natural inclination is to rush the craftsmanship process, to squeeze into the first maker aesthetic you find. I think it's worth it, if you can afford it, to designate the first month as a re-skilling exploration.

Here are some ideas and tips:

Include the old-school tools

It's easy to want to jump right into the new tools like the laser cutter and 3D printer, and you should (we'll explore that more in the next chapter). The ease of use and the immediate feedback loops of the digital fabrication tools are great for new makers. But I also think it's important to become familiar with the manual processes, too. Stay curious about classic tools, even if you have no idea how or when you'd use them.

For one, it will give you a greater respect for the newer tools. Learning to make a mold out of wood by hand will help you appreciate the speed of the digital substitute of laser-cut cardboard and Bondo (a two-part putty use for

body filling). It will also give you a better sense of what you're gaining or losing in quality.

More important, though, you're probably going to need to use them. As incredible as a CNC mill machine can be, it's very likely you'll have to do some touch ups and sanding using analog tools afterward. And sometimes a table or miter saw is the fastest and most effective tool for the job. The digital tools aren't replacing the traditional tools, they're enhancing them.

Meet the old-school people

If my grandfather were still alive, and I told him I was getting into "making" he would look at me with a curious and concerned look. Of course you're going to make things. What else would you do?

There is an entire generation that feels uncomfortable *not* making. The wisdom that these makers have accumulated in their hands, through a lifetime of dedicated practice, is something that will never be available through an on-line course. It's a type of knowledge that can only be absorbed by spending time around them, watching the subtleties and doing your best to imitate. Even a day or two with this class of maker can be revelatory.

Make it a phase

Originally, my pitch to the *Make:* editors was "Zero to Maker in 30 Days." I did that for a few reasons. The first was to set a deadline for myself, which was an attempt to stave off procrastination. But it was also because I didn't have that much time. Having just lost my job, I had a short window of time before I burned through all of my savings. I thought it would be a short jaunt and then back to finding a job.

I think this designated exploration period was critical. It kept me from getting overly invested in the first project that I encountered, and it forced me to gain a broader perspective on the possibilities of the maker movement. It also caused me to go outside of my comfort zone and meet makers whom I might not have met otherwise. It's been surprising how often I've resorted to some piece of advice or tool I never thought I'd use.

Setting a distinct period for exploration, say two or three months, is a great way to start.

Note

Now that you've made it this far into the book, I should probably clarify a few things. Mainly, I feel I need to issue you a warning; you deserve an explanation of what this book *isn't*.

As much as I would love this to be a comprehensive guide to every tool and technique in the maker universe, it's just not possible. For one, the idea of making is just too broad (and too important) to fit within one book. It's everything from knitting and wood carving, to waterjet cutting and brewing beer. Makers are everywhere—every person who is out there changing and affecting their world in a physical way is a maker. I could never hope to explain all of it. And I wouldn't want to. In fact, it's the endlessness that makes it so rich.

Nowhere were the limits of my own perspective more obvious than with the craftsmen I met. There's only so much one person can see or do in a year, and unfortunately, I didn't have nearly enough time to dive into the deepest depths of craftsmanship. That takes a lifetime. This book is a small window into a big world.

Admittedly, this chapter is sorely lacking in specifics like how to use a bandsaw or how to make your metal shop from scratch (for that, Google "Dave Gingery"). It was an issue I wrestled with for a long time. Instead of putting down lists and links, I decided to focus on the ideas I discovered around craftsmanship.

If you are looking for more specific details on a tool or technique, refer back to the Ultimate Maker Tool in [Chapter 4](#).

Sometimes It's Simple: Make What You Know

As much as I talk about this being a journey into a new world, don't dismiss the knowledge and materials in your immediate surroundings and past experiences. In fact, after you start looking, it's easy to find the maker spirit everywhere around you. Sometimes you don't have to go far to find the feeling of craftsmanship. Sometimes it's been with you all along. It just might be a new way of approaching what you already know. Susan Hoff taught me that.

Susan makes bags—beautiful, durable bags handcrafted from old sails and horseback riding reins. By grabbing a seat in her small studio in the Mission District in San Francisco, I had an inside look into the entire sourcing, manufacturing, marketing, and accounting departments of Susan Hoff, Inc. A large, sturdy table with a Sailright sewing machine takes up most of the room. Finished bags, about eight in total, adorn the north wall while shelves stuffed with old, folded sails and reins fill the rest of the space.

"I think this is the smallest industrial sewing machine you can get. It's made for sewing sails on board boats," she explains. Clearly, she doesn't need much. The Sailright and an old-school push palm are the only tools she uses.

The bags, the tools, the studio: it all seems to fit together. It's just so unapologetically her own. And the more I learned about her background, the more it came together.

Hoff had a hands-on childhood. When she was in middle school, her family bought an old, condemned farmhouse in northwestern Illinois. They spent the next five years completely renovating and rebuilding. She credits the experience as giving her the confidence to use tools. It was also during those high school years that her mom first taught her how to sew.

In addition to life on the farm, she spent time sailing at summer camps, eventually becoming an instructor at one of them. Her love for boats and the water grew when she spent a semester of college sailing around the Caribbean on the 134-foot schooner *Corwith Cramer*. After college, she spent more than three years leading sailing trips, some of them 3 or 4 weeks long, for *Outward Bound*.

The bag business was almost an accident. While working for *Outward Bound*, someone gave her an old sail that was well beyond its useful sailing days. She loved the texture of the canvas and decided to try and make a bag out of it. The results were great so she made another. Then another. Pretty soon she was getting requests from friends for bags of their own. She told me she had a breakthrough when she realized she could make money selling her bags in a few small retail stores in Maine. The bag business has grown from there. Whenever Susan has traveled or moved to a new city, she's brought along her *Sailright* and set up shop.

She's currently thinking about opening up a retail location in San Francisco, but even as we talk about it, she seems to go back on the idea. It's not that she doesn't think it would succeed—she's confident it would. She's just hesitant about the commitment. She'd rather take two months off and sail across the Atlantic Ocean (which she's done) if the opportunity arises.

It's hard not to be charmed by the life Susan has created for herself. The simplicity is alluring: taking old, undervalued materials and working them into a new, useful life. The value is so tangible. She gets out exactly what she puts in.

I've grown to love that quality of the makers I've met. They create value. It's not an indifference to the grander scheme of things, but a sufficient preoccupation with immediate possibility. They don't seem overly concerned with changing the world. They're content to find a small corner of it—a place that not enough people are paying attention to—and make it beautiful.

It doesn't necessarily take a 3D printer or an Arduino microcontroller to start making things. Sometimes the project you've been searching for—your maker sweet spot—has been a part of you all along. Susan is a perfect example. She didn't

have a blueprint for her maker life and business. She just started making what she knew.

Down the Rabbit Hole: Welding

When you venture into the unknown (and you should) with skills that are unfamiliar, you learn that all of these tools have their own unique histories. Even the latest and greatest have a maker lineage that can be traced back through generations of tool users. Sometimes there is new terminology or slightly different styles and techniques, but there are always people who came before. We're all standing on the shoulders of giants.

Part of learning a craft is learning that history. This became evident to me as I tried my hand at welding.

I actually had no good reason to weld anything. There were no parts of the ROV that needed to be welded together. I didn't have dreams of building my own grill or fixing up an old motorcycle. There was just something about joining two pieces of metal together. For me, it was a romantic idea about welding masks, torches, and flying sparks. I had to try it.

Like any tool in the shop, as soon as you scratch the surface, you quickly realize just how much there is to learn, and how specialized the knowledge becomes, depending on what you want to do.

MIG WELDING

My first experience with welding was taking a metal inert gas (MIG) welding class at TechShop. At this point, I knew there were different types of welds, but I couldn't tell which was which, or what they were used for. MIG welding uses a continuous wire feed (which serves as a filler to adhere the two pieces) as an electrode and an inert gas mixture (argon and carbon dioxide) to protect the weld from contamination. From what I was able to take away, MIG welding is fast and, because of the automatic wire feed, somewhat easier to learn.

Our instructor spent a lot of time on safety and preparation, which are both important aspects of welding. There were a few other students in the course, each with a slightly different grasp of what they were getting themselves into. After he set up the table, each of us were given a chance to handle the arc. Admittedly, my first welds were not very good. I was zigging and zagging all over the sheet metal nowhere near the joint I was trying to weld. It took me a while before I was used to the darkness of the mask and the feel of the torch through the gloves.

The main lesson I took away from my first welding class wasn't a safety tip or technique. It was a quip by our TechShop instructor: it takes about a mile of welding before you're decent. I did the math in my head, adding up the different activities and examples we just did in class. I estimated it was about two feet. I had a *long* way to go.

TIG WELDING

Because MIG welding had an automatic wire feed, it was easy to focus on my welds (even though they weren't very good) and the speed and angle that produced the different results. Tungsten inert gas (TIG) welding was a slightly different process. You have to feed the filler metal into the weld manually while simultaneously controlling the arc (the part of the metal being heated) created by the tungsten electrode. Even though this was a slightly more complex process, my welds were dramatically better—an improvement I credit to the MIG welding experience, and probably only because I had gotten used to seeing through the welding mask at this point. Based on my conversation with the instructor, the TIG weld can be more precise but can take a lot longer and cost more than MIG welding.

GAS WELDING

The general classes at TechShop were informative, but they left a lot to be desired. A Zero to Maker onlooker suggested I check out TM Technologies and its metalworking courses.¹ I followed the suggestion and discovered that TM ran weekend workshops on metalworking fundamentals and a four-day metalworking intensive out of Kent “The Tin Man” White’s workshop in Nevada City (about three hours northeast of San Francisco). I decided to reach out to the Tin Man to see if he could manage a tour of his workshop. I sent him an email explaining what I was doing, and that I’d love to learn more about his work. A few days later I got this response:

“Come on up. I’ll feed the bears first if you call ahead.”

Understandably, I was a little nervous as I drove to the shop on a Sunday morning. But as it turned out, making that trip and spending that morning with Kent was one of the most enlightening experiences of my journey so far. Not only did Kent give me a lesson in gas welding (oxyacetylene welding), but he offered his point of view on the Zero to Maker concept, which was a situation he knew all too well. This was his advice for me as a beginning metalworker:

1. For more information on TM Technologies, check out their [website](#).

My advice for someone getting started is to read some and watch some. Ask questions. Then decide what you want to do. Start simply. Learn to sketch, measure, mark, cut, file, and sand. Learn also to drill, deburr, fold, and bend. Learn to rivet, bolt, and screw. Learn the metals and their applications. Then learn the hot stuff, after your shop skills are developed. Nothing worse than jumping in prematurely and setting your hair alight.

The tone in his voice was unmistakable. He was someone who genuinely cared for the craft, but also full of concern after watching a generational drop-off in metal workers. He's become a world renowned expert in gas welding instruction not only because he's exceptionally great, but also by default—he's one of the few who still use and teach the technique. I asked him why he prefers gas welding to some of the more common methods I'd seen, to which he responded:

Gas welding is simple and portable and needs no electricity. Perfect cleanliness and breeze-free conditions are not required, as they are with MIG and TIG. Persons nearby do not necessarily need to be shielded from it, as they must be from arc rays. It is effective on several types of thin sheet and tubing, such as steel, aluminum, stainless, copper, etc.—and the same equipment is also appropriate for soldering, brazing, annealing, hot working, coloring, and in some cases, cutting—which the marvelous electric machines simply cannot accomplish.

The way the Tin Man talked about gas welding was very different than the way my TechShop instructors had described it. He pulled me around his workshop to show me books and diagrams, special welding glasses he had invented, and work some of his students had created. Metalworking was clearly a part of him. And he was a part of it. He was one link in a long chain of craftsman.

Twenty-First Century Apprenticeship

I enjoyed gas welding with the Tin Man, but it wasn't my "thing" like Joel's knife epiphany or Susan's bag making. It was just a memorable pit stop on my maker journey. But if I ever want to dive deeper into welding or metalworking, I'll know where to go. I would try to create some type of informal apprenticeship under the Tin Man. I would get my mile of welding in while trying to understand what it meant to be that next link in the chain of metalworkers.

Apprenticeships are an old idea, dating back to the Middle Ages, and they're still around today. All over the world, some form of the apprenticeship model has been used for centuries to pass specific crafts to the next generation. Apprenticeships are still a fundamental feature of the education system in many countries, especially Germany. They are still alive in the United States, too, but they've taken on a rather narrow role. Currently, they are used mainly by the trades and labor unions—electricians, painters, plumbers, and others—as a bridge from school to work. It's still an excellent option if you aspire to a career in the trades.²

However, I think there's an opportunity to apply the apprenticeship model in new, more tactile ways than the “momentary apprenticeship” of YouTube and the traditional apprenticeship of the trade associations. This model would be less formal, more broad, and more realistic for the work and life demands of new makers and experienced craftspeople alike. For example, if I decided that I wanted to learn metalworking, it's terribly intimidating for me to think about going back to school with the intention of locking myself into one type of work for the next 30 years. But I also wouldn't trust myself after watching a few YouTube videos.

Instead, I would set about creating my own apprenticeship—not based on a set curriculum or National Institute of Metalworking Standards (NIMS), but based on absorbing the knowledge of the most skilled craftsman I could find. To continue with the metalworking example, I would convince the Tin Man to let me work for him, making sure I was clearly articulating two things:

1. A deep and committed desire to learn the craft.
2. An admission of inexperience and an enthusiastic offering of some tangential form of value, like helping to blog or run social media campaigns to try to increase attendance at the workshops. I would be trading the digital currency I have spent my life accumulating for something more tangible. Or, I would do anything where I could immediately add value, even if that were just answering the phones and brewing coffee.

2. In general, trade schools are an excellent place to augment your maker education. They have programs and certificates that can put you beyond the “enough to be dangerous” level and head-first into a career. They're also a resource for taking classes and learning tools on a one-off basis. Not every hackerspace is going to have a welding setup or advanced CNC machines. Community colleges and trade schools can fill in the gaps.

It's one thing to learn how to make knives in a class at a makerspace, but it would be quite another to shadow Joel and learn how, in addition to making knives, he manages his small artisan business in the digital age; that's an art form in and of itself.

In his book *Mastery* (Profile Books Ltd, 2012), Robert Green emphasizes the essential step of apprenticeship in achieving mastery: "...the goal of an apprenticeship is not money, a good position, a title, or a diploma, but rather the *transformation* of your mind and character—the first transformation on the way to mastery."

That fits with my idea. The notch on the belt isn't as important as actually absorbing knowledge. Greene goes on to outline three phases of this self-learning style of apprenticeship:

Deep observation

Learning the unspoken rules and social dynamics of the new world or skill, watching intently for the factors and details of success.

Skills acquisition

Learning the tools, actions, and movements of the chosen skill. Greene advises keeping it simple at first, avoiding multitasking to focus on building a foundation one skill at a time.

Experimentation

Continually pushing yourself past the point of comfort. Testing your new skills and filling in the knowledge gaps.

Greene also acknowledges the point when it's time to move on, when the learning has reached a point of diminishing returns. The beautiful part about this self-styled apprenticeship is that you can then take your newfound skills to your next endeavor or adventure. You are not locked in to a foregone career path, and you are free to create value elsewhere.

The Future Is Hidden in the Past

Some part of me was always jealous of the craftsman (or what I imagined them to be). More than their manual skill, I felt that they were better prepared for the world than I was. They knew what was valuable. They built their lives on stable ground, whereas I had taken the "promising career in a growing industry" bait.

Somewhere along my path, I had confused the decline in the popularity of a traditional tool or technique with a decline in value. Still steeped in my tool

insecurity, I began to hypothesize that older techniques were not only still valuable, but sometimes actually *more* valuable.

My thinking was based on an omission in one of the basic concepts taught in business schools and marketing classes around the country: the *Innovation Curve*, as shown in [Figure 5-1](#). The Innovation Curve, or the *Diffusion of Innovations Theory*, was developed by Everett Rogers while he was an assistant professor of rural sociology at Ohio State University. He published his ideas in his book, *Diffusions of Innovations* (Free Press, 1962). He theorized that adopters of new innovations (technology, ideas, products, etc.) fell into distinct categories: innovators, early adopters, early majority, late majority, and laggards.

He based his theory on the bell curve, pictured in [Figure 5-1](#).



Figure 5-1. The Innovation Curve (from Wikimedia Commons)

At one point, the theory became the second most cited paper in the social sciences. The idea received a new life of sorts when it was repackaged and sold in the form of a marketing book, *Crossing the Chasm* (HarperBusiness, 2006), by Geoffrey A. Moore. Moore used Rogers' concept to explain why some technology companies fail or succeed based on their ability to attract and persuade "early adopters."

For better or worse, the terminology has stuck with us. When I first saw the Innovation Curve, I thought it was overly simplistic. I still think that's true, but have also decided that it's misleading. Not that I totally disagree with Rogers and Moore's analysis of technological innovation, I just think it only tells half the story;

it focuses solely on the rate of adoption, ignoring both the nature of use and the rate of “un-adoption.”

In the real world, adoption can hardly ever be explained by a simple bell curve. Tools and technologies are continually replaced. The reasons are endless: something shiny and newer, cost barriers, unforeseen market shocks, supply issues, etc. To account for this, I’ve decided to create my own innovation curve, one that takes into account both the rate of adoption as well as un-adoption. The new graph, which I’m calling the *Unnovation Curve* (seen in [Figure 5-2](#)), attempts to tell a more complete story by including the general form of both technological diffusion and dissolution.

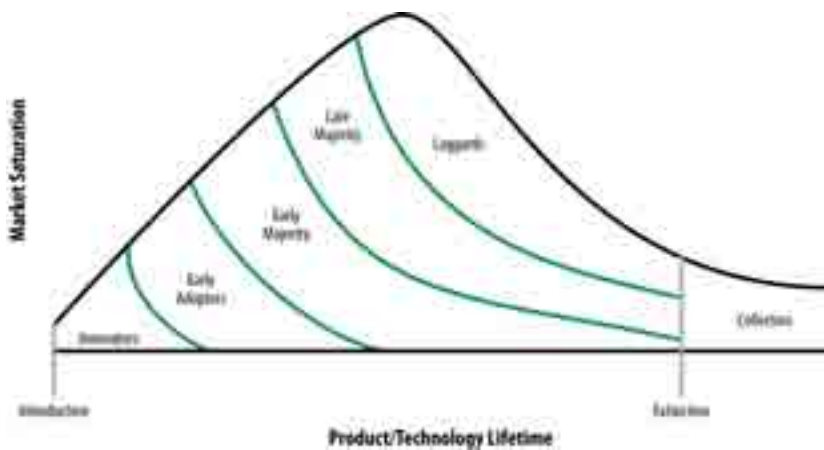


Figure 5-2. The Unnovation Curve

Is it perfect? No way! But the important part of the updated graph is to introduce and emphasize a new category of technology user: the collector. In the Unnovation Curve, a collector can come from any one of the previous groups; late adopters, laggards, early majority, late majority, and (although unlikely) even early adopters. What’s important about the collectors is not when they adopted a tool, but when they refused to reject it. They are the ones left standing in the musical chairs of technological evolution.

My definition of a collector is someone who refuses to reject a technology after it has passed its peak; or in other words, it is no longer recognized as a mainstream technology. For instance, the horse as a means for transportation is no longer considered a mainstream technology for getting around. However, horseback riding

hasn't gone away, it's just evolved into equestrianism. It's not something everyone does anymore, but it's something *some* people still do.

This post by David Frey, in which he interviews farrier Danny Ward for the Tractor Supply blog, is the perfect anecdote:

For about 30 years, Ward has run Danny Ward's Horseshoeing School in Martinsville, [Virginia], continuing a legacy his father Smokey started in 1965.

"He shod horses before World War II, when they were used more for work and transportation," Ward says. "Then the '40s came along, and the '50s. Then the tractor came along. All of a sudden, horses weren't used for work and transportation. He kind of got out of it for a few years."

It was a difficult time for farriers everywhere. "During the industrial era in the country, we lost the basic core of our experts, if you will, who had come over from Europe," Ferguson says. "Basically, the only horses that were getting shod during that time were those of the rich and famous."

When the 1960s rolled around, Ward says, the outlook brightened considerably. Work horses became pleasure horses, and the equestrian industry was starting to explode. "By about 1965, he just couldn't keep up with all the work," Ward says.

His father started the farrier school to train others to help him juggle the workload at a time when many farriers had left the industry. But with the new role of horses in society came new needs for horse-shoeing. When horses were beasts of burden, farmers didn't expect much more than a regular trim of their horses' hooves and a curved piece of metal nailed in to protect the feet.

These days, when most horses are for recreation in sports that have become high-dollar activities, the needs for horseshoes have become much more complicated. Horses may need corrective shoeing or trimming to fix chronic foot problems. A mere millimeter's width in a horseshoe can mean the difference between a horse being sound and being "off." These days, horseshoes are made to fit each individual horse and each individual hoof.

"It's no longer a trade. It's an occupation," Ward says.

The nature and makeup of the collectors is always different, but for every technology or tool that you can imagine, more often than not you'll find a group of die-hard enthusiasts who keep it alive for one reason or another. For me, this is reassuring. I like the idea that there are people out there who are working with tools I've never even imagined. It keeps it interesting.

Take flint knapping, for instance. Flint knapping is the process of shaping stone tools for use in weapons, building, or decorations. It involves using both a hard and soft hammer to slowly remove flakes of stone—flint, chert, obsidian, or something similar—until the desired shape is reached. It's a primitive form of stone carving, and different forms of flint knapping have been used by cultures all over the world. However, after the rise of more modern metalworking technology, the practical uses of flint knapping eroded. Now the technique lives on in the hands of experimental archaeologists and a certain class of outdoorsman scattered around the world. But these modern knappers are insistent. At one point, a handful of researchers and writers even “helped to ignite a small craze in knapping” thanks to their publications.

I learned about flint knapping through the *Make:* blog and, after following a few links, quickly found myself deep inside a foreign microculture. Much of it is centered around flintknappers.com, a site that gives knappers a platform to share knowledge. The man who runs the site, Mike Miller, started it in 2001 as a way for him and a few friends to publicize and sell their work. It has since turned into the central online hub for lithic art. Mike is a lifelong knapper; the hobby stems from his interest in arrowheads as a kid. Now he runs the site in addition to his work as an archaeologist.

From my perspective, Mike Miller is an enviable entrepreneur. It's not a full-time job, but it amplifies his other work (and he explained that others do make a living as full-time knappers). He has a loyal and enthusiastic customer base. The flint knapping market is relatively insulated against market shocks, and there is no chance that a technology will come along and “replace” flint knapping. For all intents and purposes, it's holding its course. And, Mike and his fellow flint knappers are holding onto knowledge that will never expire.

In his book *Antifragile* (Random House, 2012), Nassim Taleb argues that, in fact, the technologies that have survived the longest are most likely to endure. He refers to one of his insights as the Lindy Effect: “the longer a technology lives, the longer it can be expected to live.”

Taleb elucidates his theory by explaining one of his typical evenings:

Tonight I will be meeting friends in a restaurant (tavernas have existed for at least twenty-five centuries). I will be walking there wearing shoes hardly different from those worn 5,300 years ago by the mummified man discovered in a glacier in the Austrian Alps. At the restaurant, I will be using silverware, a Mesopotamian technology, which qualifies as a “killer application” given what it allows me to do to the leg of the lamb, such as tear it apart while sparing my fingers from burns. I will be drinking wine, a liquid that has been in use for at least six millennia. The wine will be poured into glasses, an innovation claimed by my Lebanese compatriots to come from their Phoenician ancestors, and if you disagree about the source, we can say that glass objects have been sold by them as trinkets for at least 2,900 years. After the main course, I will have a somewhat younger technology, artisanal cheese, paying a higher price for those that have not changed in their preparation for several centuries.

This simplified narrative is true for most of us. We’re surrounded by countless technologies of the past, yet we’ve become blind to their provenance and oblivious to the potential of actually making them ourselves. But just because we don’t notice the changes as much as the latest upgrade on our smartphone doesn’t mean there isn’t an opportunity to explore.

Craftsmanship Re-Imagined

Even though the past is still with us (and still valuable), that doesn’t mean that only traditional methods hold the mark of craftsmanship. I came to realize the concept was much broader. It didn’t necessarily equate to age or have to involve a specific method or technique. More than that, it was an ethic, a way of approaching the work.

In the moments of technological transition, when the boundaries between manual and mechanized labor begin to blur or change, an uneasy tension develops. Whenever machines start doing our “jobs,” a group of people revert to a nostalgia for days and ways gone by, while others start tinkering with new opportunities, searching for a new maker aesthetic. The futurist Paul Saffo calls this **the divide between the Druids and the Engineers**. It’s something I’ve struggled with myself as I met the torch bearers of traditional skills while at the same time reveling in the immediate feedback of the newer tools.

And the divide is nothing new. In *American Genesis* (University Of Chicago Press, 2004), Thomas Hughes’ account of technological innovation’s effect on

American culture around the turn of the twentieth century, he describes the dynamic perspectives and outcomes from the previous industrial revolution:

With the rise of factory production and the displacement of human skills by machine, numerous social critics lamented the passing of the era of the craftsman. In England, William Morris celebrated the joy of work and called for the recovery of medieval crafts... But in the industrial era tool users were giving way to machine tenders. Still, in the model rooms, laboratories, and machine shops used by independent inventors, craftsman of a conspicuous skill thrived. Kruesi, with an intuitive grasp of Edison's three-dimensional concepts, presided over the machine shop at Menlo Park. He transformed a quick sketch of Edison's into the first phonograph... Sperry attributed his company's success in manufacturing the precision gyroscopic devices to the skill of his machinists, many of them Swiss.

My nostalgic sympathizing with the Tin Man (and many others) about the decline in skilled machinists and my own lack of manual literacy seemed eerily similar to the tone of William Morris. But looking back, even the skilled machinists once seemed a distasteful transition from what was considered good and fulfilling work. Similarly, the migration to the digital fabrication tools doesn't spell the end to craftsmanship. Rather an adaptation of it, driven by swaths of opportunity that the capital-intensive factory production model can't serve efficiently.

If anything, the current trends of workmanship are pointing toward a more human-scale marketplace, a throwback to the small, local, and personal artisans and makers that existed before the factory production model took over. As people gain access to the powerful new tools of desktop prototyping and production, they are making everything they can imagine. And the new tools of distribution, fueled by the Internet and online communities like Etsy and Kickstarter, have made it easier than ever to connect and find a community of people to sell and share their wares.

Chris Anderson, the wisest oracle of long-tail maker economics, articulated it best in *Makers*:

These niche products tend to be driven by people's wants and needs rather than companies' wants and needs. Of course, people have to create companies to make these goods at scale, but they work hard to retain their roots. Such entrepreneurs often state that their first obligation is to serve their community, and to make money second. Goods made by passionate consumers-turned-entrepreneurs tend to radiate a quality that displays craftsmanship rather than mass-manufactured efficiency.

Meet the twenty-first century artisans. They understand the value they are creating. It's tactile. It's real. They made it because they wanted it themselves. They can tell you exactly how everything is made and where their materials come from. They blend the proven tools of the past with the current tools of today, picking and choosing whatever suits their aesthetic. Joel uses Twitter and Vimeo to promote himself and his knives to his community. Mike Miller has created a website as a platform for distributing flint knapping knowledge and products. Celia uses CNC mills to aide her craft and amplify her production capabilities. They're filling unique niches for the makers and users of things. It's an adaptive radiation of cultural entrepreneurship.

The new maker movement is an opportunity to discover, define, and share your own unique craft. The spoils will go to those who can find that elusive sweet spot between personal satisfaction, a dedicated approach to the work, and an openness to the evolving technologies.

Now, let's meet some of these new tools.