THE ART OF TINKERING

MEET 150+ MAKERS WORKING AT THE INTERSECTION OF ART, SCIENCE & TECHNOLOGY

exploratorium®

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A FEW WORDS FROM KAREN & MIKE

For us, tinkering started when we were kids—when we were encouraged to explore our environments, ask questions, and start constructing our own understandings of the world. We were both lucky enough that we were given permission to get messy, find out for ourselves, and try out crazy ideas just for the sake of experience—and allowed to get lost in the woods and in our own imaginations.

These moments sparked a lifetime of learning through making, putting us on a trajectory that included experimenting with various media at art school and incorporating electronics into creative expression at the MIT Media Lab. Ultimately, these moments led us to the Exploratorium, where we foster similarly crucial, formative, and fun moments for our visitors. As codirectors of the museum's Tinkering Studio, we work with a group of talented, inquisitive individuals to design workshops that combine science, art, and technology in playful and inventive ways—inviting visitors to pick up a hand tool, futz around with loose parts, and make a mess while creating their own whimsical, original projects.

But what is *tinkering*? The word was first used in the 1300s to describe tinsmiths who would travel around mending various household gadgets. But in our minds, it's more of a perspective than a vocation. It's fooling around directly with phenomena, tools, and materials. It's thinking with your hands and learning through doing. It's slowing down and getting curious about the mechanics and mysteries of the everyday stuff around you. It's whimsical, enjoyable, fraught with dead ends, frustrating, and ultimately about inquiry. It's also about making something, but for us, that thing reveals itself to you as you go. Because when you tinker, you're not following a step-by-step set of directions that leads to a tidy end result. Instead, you're questioning your assumptions about the way something works, and you're investigating it on your own terms. You're giving yourself permission to fiddle with this and dabble with that. And chances are, you're also blowing your own mind.

The Art of Tinkering is our invitation to you to join in on this invaluable and enriching way of going through the world. In this book's pages, we've profiled beloved artists who have spent time at the Tinkering Studio and who embody what we call the tinkering disposition. For each artist, there are details of their processes—their favorite tools, materials, inspirations, and prototypes—and the stories of how they stumbled upon a method that works for them. Then we talk about other makers working in a similar vein to show you all the possibilities that a certain technique can yield.

Finally, there are ways that you can tinker, too: ideas to get you started on your very own explorations. Because we want you to get your hands dirty. We want you to engage, get stuck, and play with a problem until you come around to a deeper understanding. We find that the combination of confidence and competence that results from tinkering is irresistible—and if we make it part of our everyday lives, we'll all be richer for it.

Karen Wilkinson & Mike Petrich
Codirectors of the Tinkering Studio

TINKERING TENETS

Every day at the Exploratorium, we witness firsthand how empowering tinkering can be—we're there for the head scratching, the trial and error, and the *aha!* moments that result from engaging your world, both physically and mentally. Here we've put together a few of our daily practices and some of the ideas that guide us in our work, and we hope that they will help you in your own tinkering adventures.

MERGE SCIENCE, ART & TECHNOLOGY

On their own, science, art, and technology all make for interesting, fun, and rewarding explorations. But when you mix them together, you get a veritable tinkering trifecta in which technological tools and scientific principles let you express your own artistic vision. Plus, we find that when you make something that's personally meaningful to you, you get especially motivated to make it work, leading to tons of great insights into your chosen tools.

USE FAMILIAR MATERIALS IN UNFAMILIAR WAYS

The world is full of stuff that was invented to do a specific job. But taking a common object and putting it to new use will likely result in unexpected, surprising explorations—like making music with walnuts or crafting tiny cities of tape. A bonus: These materials are often cheap and easy to find, and their universality means you can use them in near-infinite ways.

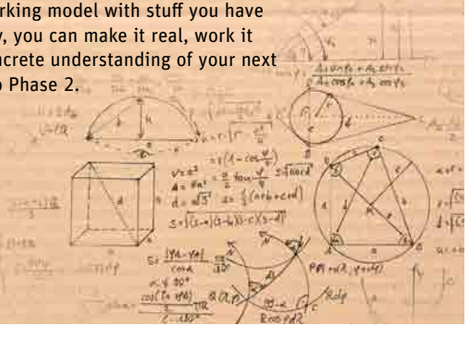
CREATE RATHER THAN CONSUME

REVISIT & ITERATE ON YOUR IDEAS

EXPRESS IDEAS VIA CONSTRUCTION

PROTOTYPE RAPIDLY

When you have a new idea, it's incredibly helpful to get it out of your brain as soon as possible—to sketch a design or build a working model with stuff you have lying around. That way, you can make it real, work it out, and develop a concrete understanding of your next steps, then move on to Phase 2.



EMBRACE YOUR TOOLS

We love tools. Beyond being just plain useful, they're also an extension of your own critical thinking, letting you physically investigate the way things work—to get in there and pry, screw, hammer, and wire your way to a deeper understanding. And when you learn how to use a felting needle, multimeter, or hand drill, you open up a world of possibilities that allow you to fix things, remix things, and bring something new into the world.

BE COMFORTABLE NOT KNOWING

GO AHEAD, GET STUCK

When you tinker, you're going to mess up. You're going to get frustrated, fail, and maybe even break a thing or two. We call this getting stuck, and believe it or not, it is a very good thing. Failure tells you what you don't know, frustration is making sense of that failure in the moment, and taking action leads to a new way of knowing. Treat each of the problems that arise as a problem to play with—rather than a problem to solve—and practice working through times of frustration without judging yourself. You'll find that you develop an astonishing capacity for new understandings.

REINVENT OLD TECHNOLOGIES (AND DISCOVER NEW ONES, TOO)

In this book, you'll encounter dozens of technologies (some old, some new) from all types of art practices and industries. We encourage you to consider all the possible tactics out there that can help you realize your vision—whether your project requires old-school woodworking, photo-making techniques from the 1800s, or relatively newfangled circuitry and programming.

SEEK REAL-WORLD EXAMPLES EVERYWHERE

TRY A LITTLE "SNARKASM"

We like to joke around while we tinker, and we call our particular brand of well-meaning wit and unprecious playfulness "snarkasm." A little humor helps—it's enjoyable and it alleviates the pressure of trying to make something work.

BALANCE AUTONOMY WITH COLLABORATION

Tinkering with other people can be a blast and is a valuable way to get things done. It makes you explain your ideas, allows partners to cross-pollinate and share skills, and lets everyone be part of something larger than themselves. On the flip side, we advise going solo from time to time—it will equip you with a richer knowledge of your tools and materials, and you'll feel your confidence, your dexterity, and even your brain expand.

PUT YOURSELF IN MESSY, NOISY & SOMETIMES DANGEROUS SITUATIONS

Tinkering can get tricky. Prep to use your tools safely, and practice techniques for cutting, drilling, soldering, and welding. But the dangerous aspect of tinkering is a powerful motivator—it forces you to slow down and pay close attention to what you're doing. A little caution goes a long way.

TAKE YOUR WORK SERIOUSLY WITHOUT TAKING YOURSELF SERIOUSLY

Because tinkering should be fun. And when you let go of your ego, you give yourself permission to focus and play. That's when the good stuff happens.

TOOLS FOR TINKERING

One of the most important parts of tinkering is engaging with your tools and materials, and to do that you have to have some on hand! Here are just a few of our favorite tinkering instruments—most of which you can pick up at any hardware or hobbyists' shop, and many of which are tools recommended on the How You Can Tinker pages in this book. Don't let our suggestions limit you, though: Look for other items that can help you complete your projects, and reconsider the possibilities of the everyday stuff all around you.

PUNNETS (A.K.A. STRAWBERRY BASKETS)

SCRAP CARDBOARD

HOT-GLUE GUN

ROPE

THREAD

GOOD SCISSORS

NEEDLES, PINS, THIMBLES & FABRIC

DERDERS (A.K.A. TOILET-PAPER TUBES)

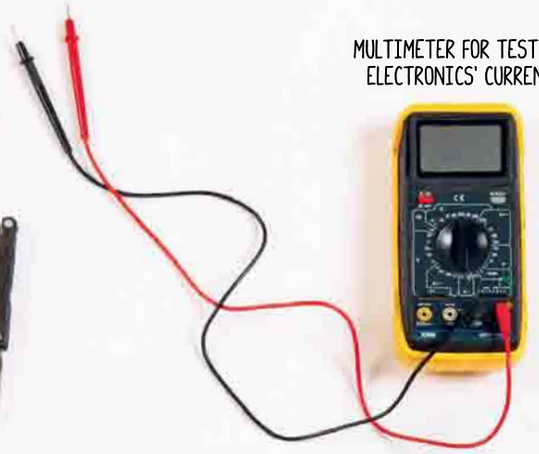
HAND TOOLS FOR MEASURING, SKETCHING, CUTTING & FOLDING

TAPE HELPS! STOCK UP ON A BUNCH OF TYPES.

CRAFT FOAM & FELT

A FEW TYPES OF PLIERS

MULTITOOL



MULTIMETER FOR TESTING ELECTRONICS' CURRENT

SMALL DC MOTORS

WIRE CUTTERS OR STRIPPERS

LEDS

SOLDERING IRON & SOLDER

LOTS OF WIRE, COPPER & ELECTRICAL

BATTERIES & BATTERY PACKS

POWER DRILL

Sometimes the tools you need are a bit advanced—you should use saws, drills, and soldering irons, for example, according to manufacturers' instructions and with all the proper safety gear and considerations.

SAFETY GLASSES

ALLIGATOR CLIPS GALORE

SCRAP WOOD

JAPANESE HAND SAW

WOODEN DOWELS

ALUMINUM FOIL