



# PROTOTYPE HACKERY

A Handbook for Creating Objects  
to Communicate Ideas

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Communicating ideas through physical media is essential in getting feedback on designs. Because of this, rough prototyping is a vitally useful tool to quickly create functional and aesthetic models which convey the experience of an idea.

But how are **ideas communicated most effectively**, for different purposes and to different people?

What are **novel and creative methods** to make prototypes which are communicative experiences?

Where can you go for **advice and inspiration**?

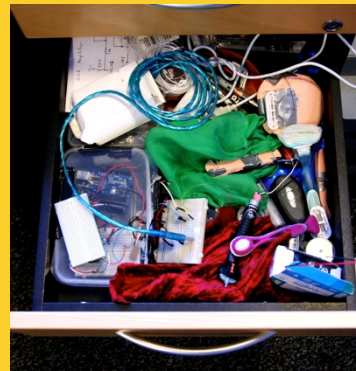
These questions have been posed to collections of representatives from industry and students at conferences, including Sponsor Meetings at the MIT Media Lab, DESIRE Creativity and Innovation conference at the Eindhoven University of Technology and at Procter & Gamble R&D sites.

This handbook is a summary of that exchange of ideas about prototyping tools and techniques which can empower engineers, designers, and management alike to use inexpensive tools and found materials to quickly and cheaply create prototypes which are highly effective at communicating the physical experience of an idea.



## PART 1: STORYTELLING WITH PROTOTYPES

How to use the right prototype at the right time to the right audience to communicate your idea most effectively



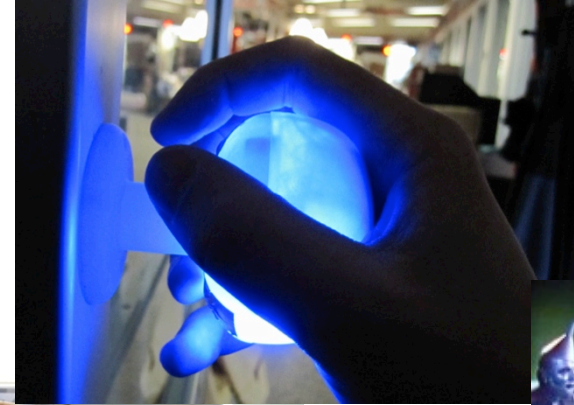
## PART 2: CREATING AWESOME PROTOTYPES

Where to find inspiration, advice, materials, tools and techniques, to help you create amazing prototypes

Prototypes are used at different times for different purposes. Some prototypes need to be engineered to test a technology, others need to have a perfectly finished appearance to get a reaction on a design, some prototypes exist to facilitate an experience, and some are built simply to convey an idea which augments a discussion.

Whatever its purpose, **the prototype ultimately needs to tell a story.** Different objects can tell different messages and convey different experiences to different people. The key to communicating well with any prototype - be it a technical test rig, a 'looks-like' visual model, or an intangible video experience – is to **help your audience understand your idea and imagine the potential** of its impact.

Students at the Media Lab often enhance intangible ideas by adding other sensorial cues. This sensor doorknob included lights to signal that the door had unlocked



Software companies sometimes use 'Wizard of Oz' style UI experiences to prototype the user experience before the underlying software is fully completed



Consumer product companies often present their prototypes in context – from real environments to miniature 'sets'



The automotive industry often uses 'concept cars' to propose radical new design and technological ideas

### TIPS:

- #1:** Understand what you want your audience to remember and design an experience around it
- #2:** Enhance intangible ideas by adding other sensorial cues
- #3:** Context is important; present your prototypes in as natural a setting as possible to help the audience understand your idea



Prototypes tell **different messages to different people.**

While an engineer may be able to understand a prototype of a complex technology and not mind about the odd wire sticking out here and there, they may not be able to immediately relate to a solely aesthetic model of a concept. Similarly, people in management or marketing may want to experience the final vision for a project, and not be able to interpolate how a very rough technical prototype can lead to the completed product.

Overall, the key here is **understanding what aspects of the idea are most important to your audience members and developing your prototype to enhance those.**



Children's product companies have to consider multiple audiences for their prototypes; they must not only test the product's popularity and safety with children, but also consider how to convey the experience of that product to the childrens' parents



Simple form models with a range of rendered images can give viewers a feeling for the shape of a product but also help them imagine what the final design could look like



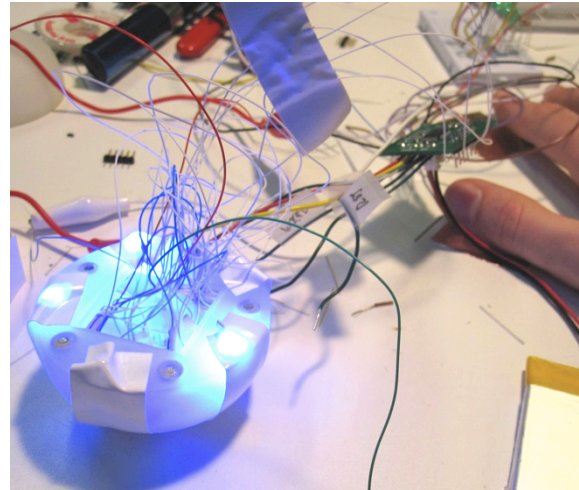
Videos can be a useful medium to communicate a message or experience quickly, especially intangible ones

## TIPS:

- #1:** Understand what message your prototype needs to communicate to your audience
- #2:** Consider what your audience will be able to understand and visualize, and tailor your prototype to their needs
- #3:** Think about what you want to learn and help your audience to focus on that aspect of the prototype so that you can solve the right problems

Prototypes are used to **develop certain aspects of an idea**; they are not the finished product and thus cannot convey a finalized experience.

It is important to keep this fact in mind when designing a prototype which communicates the key concepts in the most time and resource efficient manner possible. In fact, if a prototype appears to be closer to a finished product than it is in reality, your audience may think it is more developed than it actually is – which can lead to problems in the product development cycle.



Keeping prototypes 'rough around the edges' by removing outer coverings or showing unfinished edges or rough wires can emphasize that they are not finished products yet

When showing aesthetic prototypes, use plain white or grey colored form models to focus consideration upon the shape of the object



Prototypes which can convey an experience without needing to perfect all technical aspects of the design can help you get the specific feedback you need, e.g. controlling a robot using a joystick rather than making it completely autonomous

## TIPS:

- #1: Use the **RIGHT** prototype at the **RIGHT** time
- #2: Be clear about what aspects of an idea a prototype is conveying and what is not yet developed
- #3: Use placeholders for the aspects of the design that are not developed yet

It is important to know what **level of fidelity** is appropriate for your prototype for specific audiences; how 'good' does your prototype need to be to fit with the audience's needs and expectations, and produce the feedback you need?

Tailoring the fidelity of prototypes to convey the message you want to communicate means that you only need to **develop the aspects of the prototype which are crucial to its experience.**

Once you know **what** message you want your prototype to communicate, you need to know **how** to make it to convey those ideas. Inspiration for making, as with other creative activities, can often come from the least expected source; the key is to keep your eyes open for new sources of inspiration.

Here are some suggestions to help get you started...



**Making, hacking and design blogs** such as Makezine, Hackaday and Core77 are great resources for keeping in touch with the latest tools, techniques, and visual communication trends.

**Make:**  
makezine.com



**core77**  
design magazine & resource



**Engaging in collaboration with people of different backgrounds and areas of expertise** fosters inspiration by exposing you to viewpoints, methodologies, tools, and techniques that you would not otherwise been aware of.



**Being aware of all available resources** you have access to, no matter how esoteric, can help you to visualize a clearer path between your idea and the finished prototype.



**Collecting samples of interesting materials and parts** can help to spark creativity by allowing you to tangibly experiment with.



Synthesizing what you learn from these activities will help you to achieve the mindset of being able to spring into action to give physical form to your ideas – helping you make things as naturally as you would write.



A key to being able to make things effectively is having access to the right tools for the job.

**Junk pile** e.g. bits of previous projects, fun trash, anything which you find interesting and inspirational, or could take apart and re-purpose



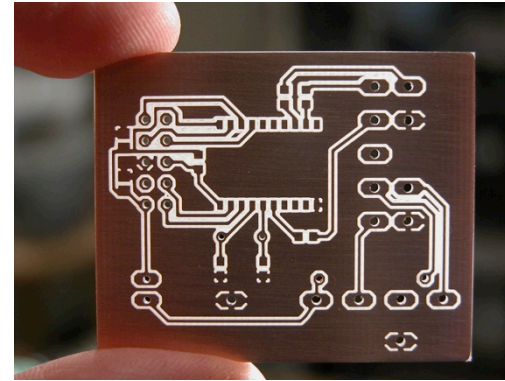
**Small electronics workbench**  
e.g. Arduino, soldering iron, components, multimeter

**Crafting materials**  
e.g. modeling foam, mdf, foam board, acrylic sheet, polyfiller, spray paint, metal wire and rods, fabric, cardstock

**Stash of general mechanical parts**  
e.g. lego, gears, nuts/bolts

**Hand tools**  
e.g. hack saw, wire strippers, screwdrivers, craft knife, superglue/glue gun, sewing materials, cutting mat

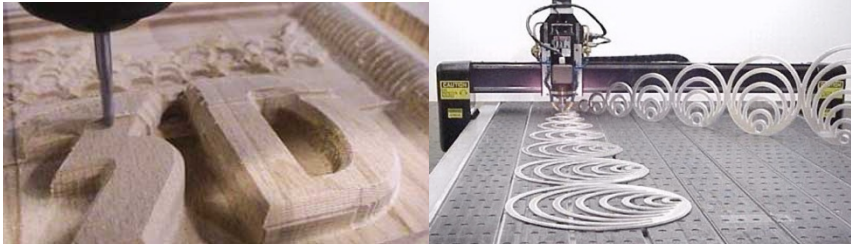
If you just don't have access to the tools you need to complete the task, there are many services which can take your design files and turn them into finished parts for a reasonable price.



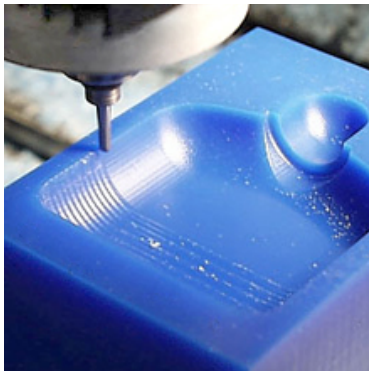
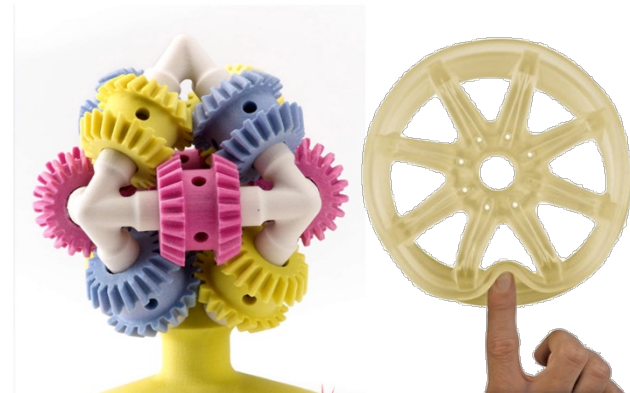
**PCB fabrication houses** such as Advanced Circuits (US) and Futurlec (UK) can produce prototype-quality printed circuit boards very quickly at an astonishingly low price.



**Cutting and routing services** such as big blue saw (US) or The Cutting Room (UK) can cut 2D and 3D shapes out of a variety of materials using CNC routers, laser cutters and waterjet cutters.



**3D printing services** such as Shapeways, i.materialise allow you to upload 3D designs and have them produced using a range of 3D printing techniques and materials.



**Machining on demand services** can be found at emachineshop (US) and First Cut.





It is important to have a wide variety of materials in your making "palette."



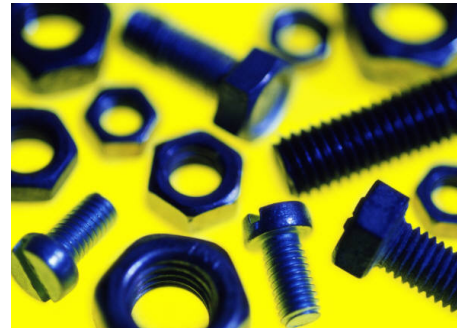
**Inventables** is a site which sells many interesting and unconventional materials, self described as "the innovator's hardware store."

**INVENTABLES**  
explore what's possible.



The **online industrial hardware stores**

McMaster-Carr (US) and ScrewFix (UK) are great places to buy stuff like screws, nuts, bolts, raw materials for machining, etc.



Or even just a trip to **your local art store** can give you some great inspiration for new materials which are great to mix together and experiment with



**Hobbyist electronics suppliers** such as SparkFun (US) and Maplin (UK) stock an excellently curated collection of electronic components that are easy to use for the beginner - many Media Lab demos make heavy use of widgets from SparkFun



## TIPS:

- #1:** Start your own materials library - order more than one part or sample when experimenting with new materials so that you can refer to it in the future
- #2:** Make sure to ask for Material Safety Data Sheets (MSDSs) with any new samples you order



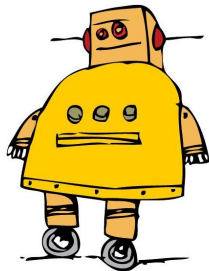
**Engaging** the local making enthusiast community, via hackerspaces for example, can give you access to many people who are passionate about creatively building things and willing to help you accomplish your own goals.



Talking to **experts in the field** can always help shed light on difficult problems. When it comes to DIY-style making, finding an expert can be as simple as going to Home Depot and finding someone who works there for the sheer fun of it to talk to you about how *they'd* go about doing what you're trying to do.



**Instructables** contains user-uploaded detailed step-by-step articles on an incredibly wide variety of DIY projects.



**instructables.com**  
THE WORLD'S BIGGEST SHOW & TELL



**Bildr** is a site which organizes information and source code snippets for working with many electronic components.



**SparkFun** and **adafruit** both have excellently written beginning electronics tutorials, as well as healthy community forums where you can discuss projects as well as request help with what you are trying to put together.



There are a wide variety of resources which can help you learn new techniques as well as help you solve problems that may arise during the process of finishing what you are trying to make.

Rough prototyping can help you to communicate ideas through physical objects quickly and easily.

At the end of the day, the purpose of prototypes is to tell a story. You can help your audiences understand and imagine the possibilities of your idea by carefully considering what messages you want your prototype to convey and how these can be visualized by different people. Enhancing those key aspects of the product which are most important to communicate via a prototype can bring clarity to your audience members as well as helping you to focus on the crucial elements of the product to be developed.

Being able to quickly create these objects to communicate your ideas needn't be as complicated as turning your clock-radio into a rocket ship, either. Once you open your mind to the possibilities of making, anything can be created. And with all of the amazing sources of inspiration, tools, services, materials and support available, nothing can stop your prototype hackery!

All through the magic of...







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## Prototype Hackery

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This handbook is a summary of the interesting thoughts and enthusiastic discussions voiced at the Prototype Hackery Unconference Session held at the MIT Media Lab Sponsor Meeting (April 2011) and at a UK Procter and Gamble site (August 2011).

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Many thanks to all those who attended the session and helped contribute to this handbook.

With special thanks to:

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