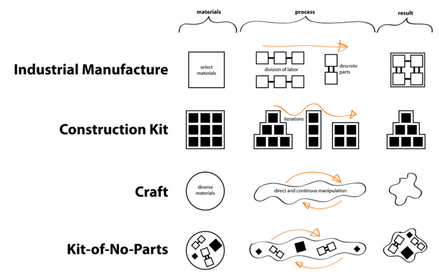
A Kit-of-No-Parts

Recipes for Materially Diverse, Functionally Transparent and Expressive Electronics

AN APPROACH

A Kit-of-No-Parts describes an approach to building electronics that emphasizes the expressive qualities of diverse materials as well as the skill and creativity of the builder. Why confine ourselves to the pre-packaged selection of resistors, when we could be designing and building electronic components ourselves. Components that match our set of building materials, so that if our device is made of paper we can scribble graphite resistors, fold carbon pressure sensors and paint copper traces.

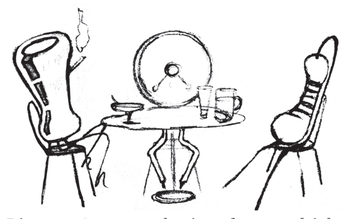


The above illustration depicts various forms of making and how their different processes influence the resulting artifacts. Industrial manufacture processes are optimized for repeatability and ease of assembly, requiring standardized parts which lead to relatively uniform results. Construction kits allow us to iterate through variations, but the parts of a kit limit the number of possible variations. Craft, as an individual, flexible and continuous processes allows a large variety of materials to be worked into an infinite number of forms. With a Kit-of-No-Parts I propose a craft approach to building electronics.

AN ALTERNATIVE

In industry a kit-of-parts approach focuses on designing discrete components that function as modular parts. These parts have been optimized for speed, efficiency, and repeatability of assembly. While this approach demonstrates the power of modular systems that have made many of the technologies we rely on possible, it also constrains us to particular styles of building, influencing what we build as well as impacting how we come to think about electronics.

With a Kit-of-No-Parts approach I want to emphasizes styles of building electronics that exist outside these standardized systems. And while I incorporate a variety of off-the-shelf components in my Kit-of-No-Parts examples, I do not confine myself to working within the constraints of their modular systems.



Discrete components having afternoon drinks

RECIPES

Building electronics ourselves from materials instead of parts gives us more control over the final form and function of our designs, and we can document and share these designs so that they can be replicated and modified by others.

Processes that involve computerized machines normally produce source files containing the details of a particular design such that it can be replicated by somebody else given the same setup. But information about the setup related to a source file is often missing from the data format. A vector graphics file used to lasercut a wooden dial will not specify the machine used, the material cut, nor the power and speed settings selected unless the maker explicitly adds this information to the file in the form of notations. Similarly, handmade designs such as textiles are often documented as patterns that represent the result without providing details about materials or process. Recipes for cooking on the other hand do not simply list the quantities of ingredients used in a particular recipe. An integral part of a cooking recipe is to describe the process of working the raw ingredients into a cooked meal.

When documenting Kit-of-No-Parts designs I take the recipe approach. The aim of these recipes is to share as much information about the process as possible. Besides containing instructions on how to replicate a particular design, the recipes are also detailed accounts of my development process that aim to promote further exploration instead of straightforward replication.

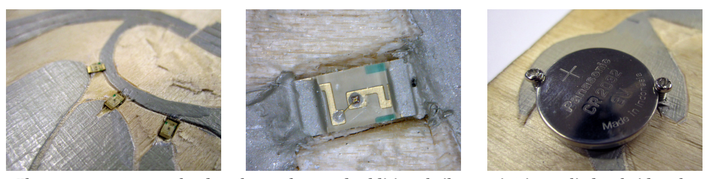
PAINTING AND CARVING A WOOD CIRCUIT

Carved Traces demonstrates how circuit connections can be carved from a sheet of plywood that has been coated with a layer of conductive silver paint.

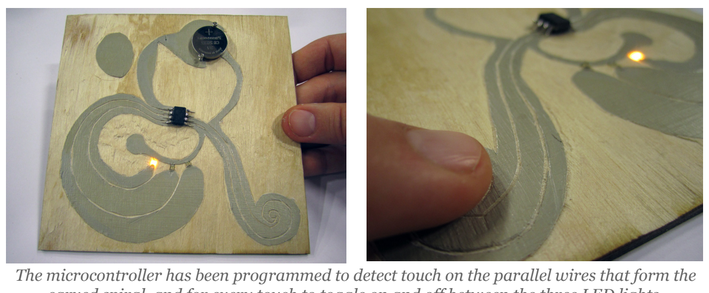
The following images and text are the summary of a recipe as it appears on the Kit-of-No-Parts website. Please visit the website for more information.

Supplies: silver paint, paintbrush, soft wood, acrylic paint, sandpaper, carving tools glue

After the design is decided and the wood has been sanded, primed and coated with a layer of conductive paint, the conductive paint layer can be carved away with a variety of tools.



The components are glued to the surface and additional silver paint is applied to bridge the connection between the painted wood trace and the component lead. Small grooves can be carved out for smaller components to recede into, such as the surface mount LEDs. The coin-cell battery holder was made by screwing two small screws into the wood, making contact with the conductive paint. The screws are spaced so that the battery pressfits between them.

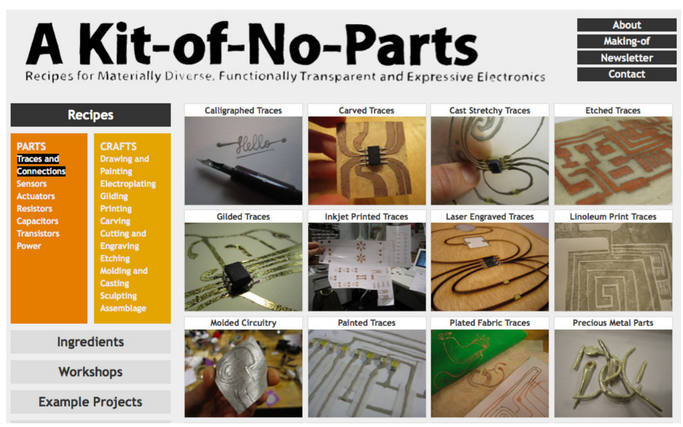


The microcontroller has been programmed to detect touch on the parallel wires that form the carved spiral, and for every touch to toggle on and off between the three LED lights.

THE WEBSITE

www.kit-of-no-parts.at

The Kit-of-No-Parts website is a platform for documenting and sharing recipes for electronics made from a diverse range of materials and tools. Recipes are organized by their electronic function and the process by which they were made, so that somebody focussed on a particular technique or set of materials can browse ways of building electronics by craft, and somebody looking to make their own capacitor can browse recipes for capacitors across all craft techniques.



Screen-shot of A Kit-of-No-Parts website taken September 2012

A COLLECTION OF EXAMPLES

A set of twelve examples represent the Kit-of-No-Parts approach by showcasing electrical circuits made using a variety of materials, tools and techniques.

Collection of 12 wall-hung example circuits

SCULPTED AND PLATED THREE-DIMENSIONAL CIRCUIT

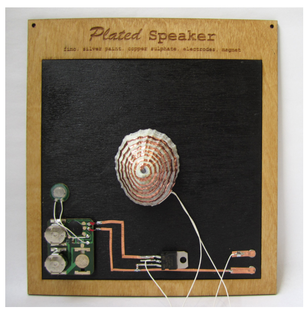
Plated Traces is a circuit sculpted from acrylic clay and then selectively electroplated to build a robust conductive coating that will not crack when the traces of the sculpture are flexed. In making the sculpted circuit the acrylic clay was sculpted right around the leads of the various components and everything was fi red in a toaster oven for the clay to harden. The components were not damaged by the heat. Then conductive silver paint was selectively applied to make the connections between certain components. When the paint was dry, the circuit was disassembled and the traces electroplated individually. After plating, the circuit was re-assembled and the connections to the leads were soldered.

CAST STRETCHY CIRCUIT

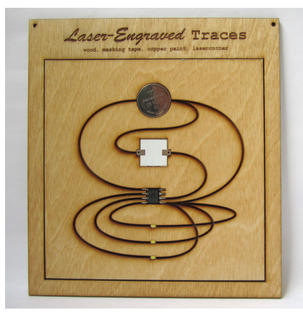
Cast Traces are made from a silver paint and latex blend. Unfortunately it was not possible to mix the conductive paint with the latex at a ratio that yielded both conductive and stretchy results, making this example purely demonstrative of what castable stretchy conductors could be. This example was made by first casting a thin layer of latex and letting it cure. On the cured latex surface, the microcontroller, LEDs and battery were laid-out and the conductive latex blend applied through the tip of a squeeze bottle to create the connections between the component leads. Once the cast traces had cured, additional latex was used to coat the components and keep them in place.

PLATED SEASHELL SPEAKER COIL

Plated Speaker is an example that demonstrates how a limpet seashell can be made into a speaker by plating a copper coil around its exterior and interior with a hole in the tip that connects the two. Because the shell is a much thicker membrane than the tissue paper used in the paper speaker example, it's vibrations move less air and so it is much quieter. But if one holds the seashell up to one's ear, one can hear it play music. The speaker coil was plated onto the seashell, by first painting the coil with conductive silver paint and then submerging it in the electroplating bath.



LASERCUT AND ENGRAVED CIRCUIT



Laser-Engraved Traces illustrates how a lasercutter can be used to engrave channels that connect the different component leads to one another. The lasercutter can also be used to cut pressfit holes for various components such as the coin-cell battery, a microcontroller and a speaker. These cut-outs are just the right size so that the parts press into them and do not fall out. This example has not been completed, but the next step would be to saturate or flood the engraved channels with a conductive paint to complete the electrical connections.

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