WELCOME

By Dale Dougherty

Computers in the Mist

Carl Helmers was designing spaceships in kindergarten. He "lucked out" by learning computers in high school in New Jersey, where he eventually got a summer job programming at Bell Labs. Then, as a NASA contractor in Houston, he installed compilers and even wrote a landing program for the Apollo Lunar Module.

Computers were big, expensive machines in the '70s. At an Intel press introduction for the 4004 and 8008 microprocessors, Helmers realized he could now afford to build one from off-the-shelf parts: "A lot of guys like me who had experience working for other people with computers began building computers of our own."

Just what were these small computers good for? Hobbyists were searching for answers, so Helmers created a magazine for them called Byte. In its first issue in September 1975, Helmers wrote that for the hardware person "the fun is in the building," not using or programming. "The software is an exploration of the possibilities of the hardware." But the whole point of homebrew computers was "to come up with interesting and exotic applications." A computer experimenter was looking up at a large, unclimbed mountain with three possible ascents — the long, technical climb of hardware; the tethered, steep climb of software; and the guided, well-paced climb of applications — each of them dependent on the others and ideally converging at the peak. Nobody was sure what you'd find there.

The hobbyist revolution that Byte chronicled through the 1980s brought computers into everyday life, and our experience of computers today is largely defined by applications. Indeed, the revolution has come full circle so that networked computers have become what the mainframe once was — only now it's the cloud, and computers are hidden in the mist.

"The computer has become an appliance," said Jason Kridner, the developer of the BeagleBoard. "The machine loses relevance if it can't interact with the physical world, if it sits in the corner and just connects to the internet." Kridner remembers the computer that he had as a youth. "My mom took the floppy disks and put them in a safe, so I could hack that computer top to bottom." Like Eben Upton of Raspberry Pi, Kridner wants to bring that kind of computer back.

Kridner was an electronics hobbyist growing up, reading Forrest Mims. "Using a microcontroller to blink an LED would be the stupidest thing to do," he remarked. "I'd use a 555 timer." He started developing BeagleBone to satisfy his own goals and help out Texas Instruments as well. His target was Linux developers. "The goal was to put in their hands a platform that would allow them to do new things to advance Linux."

"I didn't know about the maker market, per se," said Kridner. "Yet when makers started picking up the board and doing crazy, fun things, the lights went off." At Maker Faire Detroit, near Kridner's home, there was a pick-and-place machine by Jeff McAlvay and a security device by Phil Polstra, each powered by BeagleBone. The OpenROV project, featured in Volume 34, also runs on BeagleBone.

In this issue, we chronicle a second hobbyist revolution that's starting small with new hardware — a growing number of credit card-sized microcontrollers and processors including Arduino, Raspberry Pi, and BeagleBone.

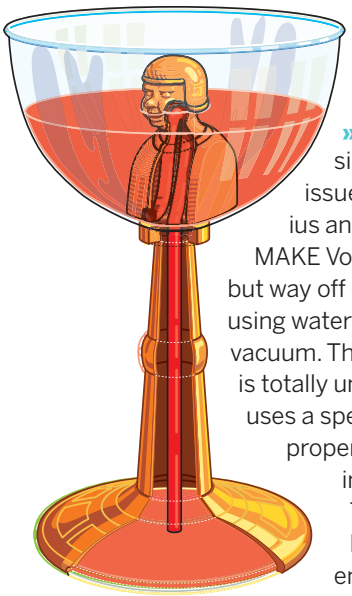
"What interests me is seeing technology connecting to everyday life, not just stuff in the cloud," Kridner said. "It's about taking away the mystery of computers and allowing people to build things out of electronics." Projects like ArduSat, an open source CubeSat satellite (see Volume 24, DIY Space), and the Earth-imaging satellites from Planet Labs demonstrate that it's possible to get above and beyond the cloud.

Dale Dougherty is founder and CEO of Maker Media.

James Burke

READER INPUT

Siphon Logic, DTV Antennas, Arduino Sound Synthesis, and Japanese Toolboxes Galore.



» Nice article on siphons in the latest issue of MAKE ("Ctesibius and the Tantalus Cup," MAKE Volume 35, page 134) but way off on science. A siphon using water will not work in a vacuum. The example you gave is totally unfair. The example uses a special fluid with extra properties not considered in a classical siphon. Take a tube 30 feet long, closed at one end. Put the open end at the bottom of a reservoir of water. Draw a vacuum in the top and the water seems to be pulled up the tube, but by what force, cohesion? No. It is pushed up by the pressure of the atmosphere. Though for the "super" fluid used in the video, cohesion works for that case; it is not correct to suppose that atmospheric pressure is not working in other cases. Bad logic and bad science. Tsk! Tsk! *—Dr. Arthur G. Schmidt, Evanston, Ill.*

MAKE TECHNICAL EDITOR SEAN RAGAN RESPONDS: Whoops! Our bad. The video Bill mentions does actually demonstrate a siphon that works under vacuum. However, it is not a water siphon; it's an ionic-liquid siphon. Ionic liquids have much stronger intermolecular attractions than other liquids, and it is likely this unusual property that makes it possible for them to siphon under vacuum. But we were wrong to infer, from that special case, that atmospheric pressure is not involved in the siphon effect with more familiar liquids like water. Thanks for writing and keeping us honest!

» Not everyone will take it the same way, but the "Water-to-Wine Cooler" project (Volume 34, page 46) could be construed as honoring (not disparaging) Jesus' first miracle, which itself had an element of humor in it (surprising a crowd).

—Michael A. Covington, Ph.D., Athens, Ga.

» A couple years ago I made your DTV coat hanger antenna (vimeo.com/2931902) — my shirts are still on the floor of my closet — but never hooked it up until last night when PBS was supposed to air the remake of Hitchcock's *The Lady Vanishes*. It worked great for picking up our public TV station about 35 miles away. Wish I had done this long before. Thanks for publishing even though the jerks at PBS sired something else during their pledge drive.

—Jock Ellis, Cumming, Ga.

» Thanks to MAKE and Jon Thompson for the "Advanced Arduino Sound Synthesis" article (Volume 35, page 80). Though I don't have much interest in sound synthesis, this was a little more in-depth than the typical Arduino article, making it more interesting. Please consider doing other more advanced Arduino articles. *—James Matthew, Sheffield, Vt.*

» I'm a professor of mechanical engineering at the University of Colorado. I really enjoyed Jon Thompson's article on using the Arduino and advanced interrupt code to synthesize waves. I like it so much that I used the article as a lab in my System Dynamics (senior level) course. Actually, it's kind of funny, I've been developing new labs for this course all summer and was at a point where I didn't quite figure out the next lab idea for the following week and then MAKE 35 landed on my door! Just in time!

—Shalom D. Ruben, Ph.D., Boulder, Colo.

EDITOR'S NOTE: Shalom shared the lab with us: makezine.com/go/lab.

Rob Nance

Richard White

Scott W. Vincent

Michael Levy

Greg Kent

EDITOR'S NOTE: Master woodworker Len Cullum's Japanese toolbox project (MAKE Volume 34, page 110) inspired a lot of readers, who shared their builds with us. Make your own at makezine.com/projects/make-34/japanese-toolbox.

» This was a great beginner's project. I didn't have a miter saw big enough to cut the 1×12, but it still worked out great. I also used red oak for my build. It cost a bit more and is heavier. Once I made the first box and did some reading and just studied the box, I was able to make the second one with my kids. The smaller one was made using only glue.

—Richard White, Bowie, Md.

» I really enjoyed this project and I'm very happy with my completed toolbox. Thank you Len for this wonderful project! Here's the information on mine: lungstruck.com/projects/japanese-toolbox. The only thing I did to make it a little more unique was chiseling my first name onto it in Japanese.

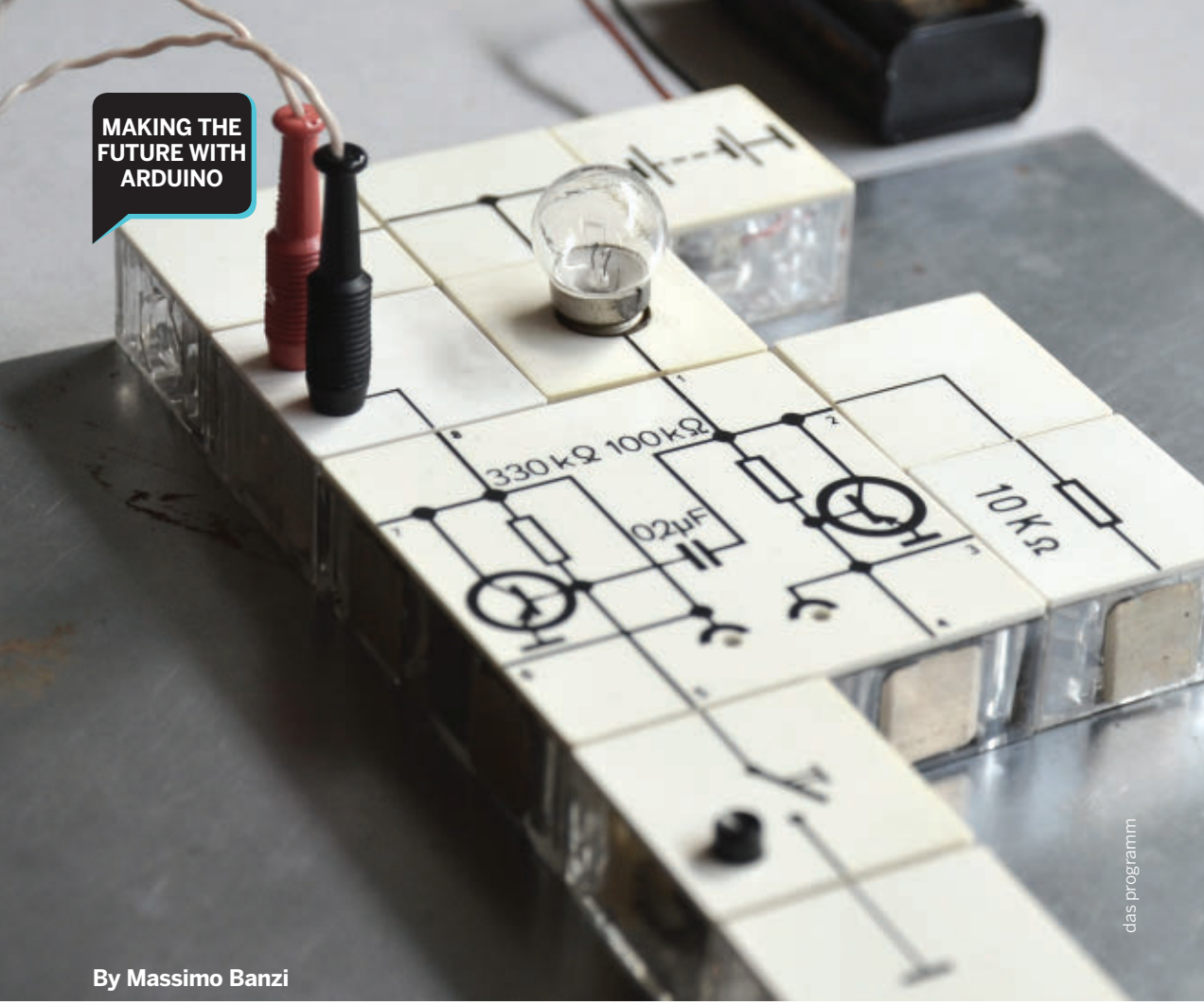
—Scott W. Vincent, Geneva, Ohio

» Really functional design. I made an 800×400×400mm toolbox for my van from a single sheet of 17mm ply. Total cost was $65 (Australian) and ~4 hours work. Much stronger than any of the sheet metal toolboxes you can buy for ~$200.

—Michael Levy, Wollongong, NSW, Australia

» I love it, my daughter loves it. Thank you MAKE! *—Greg Kent, Kailua, Hawaii*

AUTHOR LEN CULLUM RESPONDS: I can't tell you how this makes my day. Seeing that other people have been moved to make something because of an article I wrote is way more gratifying for me than the result of building it myself. Really. I am so honored that this is happening. I would happily shed my client work to get others to try woodworking/making for themselves. Thank you to everyone at MAKE for giving me the unexpected opportunity to experience this.



By Massimo Banzi

People Over MEGAHERTZ

When I was a kid I got into electronics because I started reading specialized magazines on the topic. At the same time it was hard for me to learn electronics from them because the content was not really beginner friendly and the projects were not very exciting. They were conceived more for people who were already into the technology and loved circuits than for explaining to newbies what circuits do and what you can do with them.

The way I really started learning electronics was when I received a kit as a present. It was called the Lectron System and was made by the German company Braun. It was composed of cubes you could snap together magnetically to build different circuits just by following some simple drawings and instructions. The cubes were transparent, so you could look inside to learn about the electronic parts.

The kit was a complete experience because it also had a book with great illustrations and simple explanations designed to look very appealing and make technology less scary through hands-on experiments. The original ad said: "Hey look, I just built a radio in two minutes" and it was actually true!