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# SIMPLY CAD

## COMPUTER-AIDED DESIGN DOESN'T HAVE TO BE AWFUL. THERE'S A CAD PROGRAM OUT THERE FOR YOU.

**HAVING USED VIRTUALLY EVERY CAD** (computer-aided design) program out there at least once, I thought there was no chance they would ever be simple ... until I met Takeo Igarashi. Takeo was a grad student from Japan who wrote an incredible little piece of software called Teddy. It's basically CAD for 5-year-olds: if you want to design a plush toy, this is the program. It's intuitive. It's beautiful. CAD doesn't have to be awful or expensive. It doesn't have to come with 1,000-page instruction manuals.

My hope was that Teddy would influence the world of CAD and make incredible packages cheap and easy to use. That was six years ago. Things haven't changed that much, but there is still hope.

Why, as a reader of MAKE, should you care? I care because I just enjoy using CAD; it's better than playing a computer game. You can spend the same 36 sleepless hours in front of the computer, but at the end of it, you have a beautiful 3D object from your imagination, planned out and ready to be built or shared. But the real and exciting reason to care is because someday kids should be able to unleash their imaginations on a Teddy-type CAD program and then print their imaginings into the real world on a chocolate- or sugar-powder 3D printer.

You should care because the capacity to share 2D and 3D models is at least as important as sharing music and video. Making CAD representations of your "makings" makes it easier for other makers to make things too.

Before I launch into my CAD diatribe, let me sketch out the playing field for the uninitiated. Very broadly, CAD programs can be classed in a number of ways. On the hardcore engineering side, there is parametric 3D solid modeling, with exact equation-driven descriptions of objects; there are surfacing or wire-frame-based programs, which bring nice rounded surfaces and squishy shapes to life; there's a world of rendering tools for making the 3D models look cool; and there are architectural-type 2D drafting programs for laying out plans in 2D.

For completeness, I should also mention CAM, which is computer-aided manufacturing software. It takes your CAD design and converts it into a "toolpath" for a drillbit, mill, laser, inkjet head, or some other tool to follow and construct your object.

Contrary to popular belief, you don't need a laser cutter or a 3D printer or an NC mill to realize your CAD designs. On your desk, you likely already have a high-precision machine tool: an inkjet printer. These things will print designs onto paper with 50-micron,

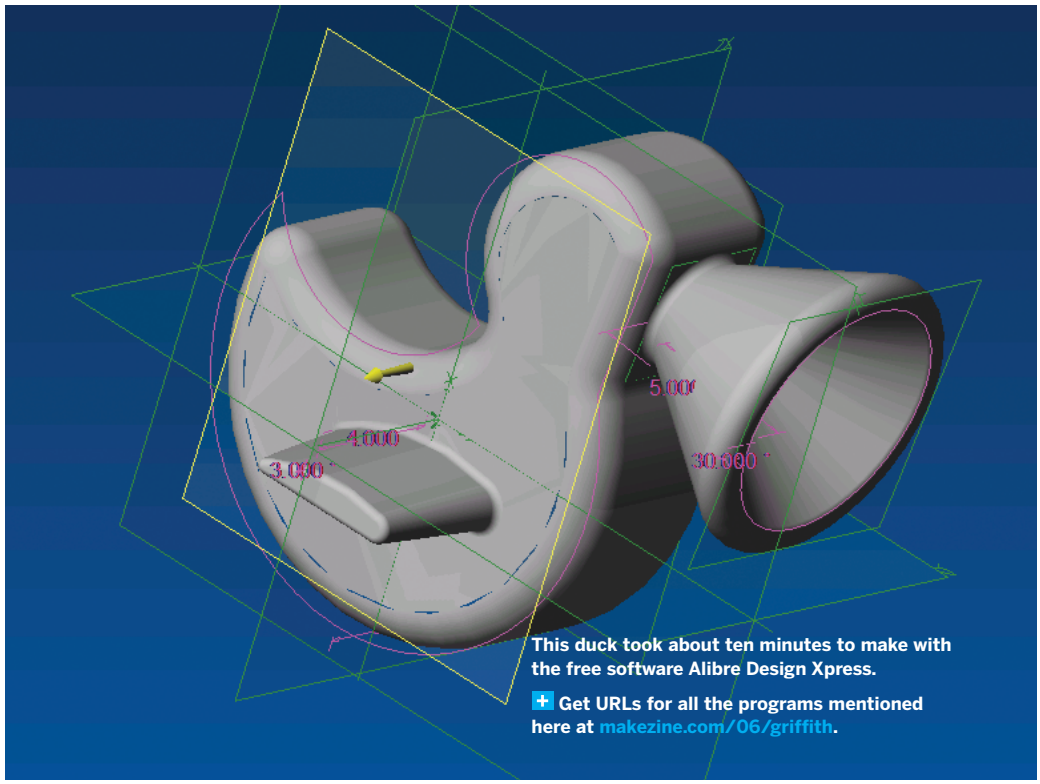
### Build your dream house and stick it in Google Earth! How cool is that?

or better, accuracy. I very often use the inkjet printer to print a pattern or template, which then can be used to align the holes you will drill by hand or to cut out the fabric you will stitch together. So, in fact, the world already has the capacity to build cool CAD 3D models and share them via their desktops.

One program taking advantage of this is Pepakura Designer — it calculates a pattern of triangles that, when folded up, can make your 3D object. It's high-tech origami. I've seen business cards that fold into toy cars made by this technique, and Japanese anime characters and dinosaurs.

In the same vein is a program called Lamina Design, which takes 3D curved surfaces and figures out how to construct them from flat sheets. Again, the nice thing here is that you don't need NC machine tools to get real-world output; you could use this program, print to paper, trace to plywood, cut with a hacksaw, and make beautiful organic furniture, or even design your own kayaks.

A great little company called SketchUp has a CAD package that allows you to build buildings and place the 3D models in Google Earth. Of all the packages




**This duck took about ten minutes to make with the free software Alibre Design Xpress.**

**+ Get URLs for all the programs mentioned here at makezine.com/06/griffith.**

out there, SketchUp is the closest in my mind to the Teddy ideal of simplicity. They have great tutorials and an intuitive interface, and if you've never used CAD before, you'll just enjoy this. Build your dream house and stick it in Google Earth! How cool is that?

The online world Second Life now has CAD packages built into it, so you can realize fantasy objects in the other world. This is cool to me because I can now see real/virtual world crossover. Make something über-cool in Second Life? Bring it into the first life!

So where should you get started? Before you spend a few thousand dollars on a pro CAD package, try some free alternatives: freeCAD.com reviews a bunch. My favorite right now is Alibre Design Xpress. It's a free parametric CAD program with most of the functionality of the pro packages.

Their business model is interesting (a professor of mine once described it as "crack for babies"): they give you the free software, you get addicted, and then if you need higher functionality (more parts, more tools), you can purchase more. Their prices are reasonable, and you only purchase the extras you need.

If you're comfortable in Illustrator or CorelDRAW, you can do a surprising amount in these programs. There are dimensioning plug-ins for Illustrator, and with these programs you can produce nice 2D plans of your wooden boat, air-powered potato cannon, or cigar box guitar. Eagle CAD is a free circuit board design and layout tool. If electronics is your gig, you can CAD it up in Eagle and split the cost of sending out for boards with your friends who also want mint-box MP3 players.

Another idea is to write your own CAD program. David Aberdeen wrote a fantastic CAD package for kite design, called Surfplan, that led a whole community of amateur kite builders to build cool kites for surfing. A lot of people have built small CAD packages within MATLAB and Mathematica with outputs for DXF or PostScript. Robert Lang uses such a thing to create his awesome computational origami models.

The world of CAD still isn't perfect. Converting between platforms is a nightmare. Learning curves are long. Things have come a long way, though, and there are a few packages to get you started with little pain. Hopefully, out there in the MAKE readership, there are hackers who will write cool new CAD programs with simple interfaces and open source extensibility. Get to work.

CAD image by Saul Griffith

Saul Griffith thinks about open source hardware while working with the powernerds at Squid Labs (squid-labs.com).