

Print it at home – in 3-D

More people are buying 3-D printers to turn their own designs and creations into real products



Lea Wee

When Mr Eric Weber's wife told him one night that a part of her electric breast pump was broken, he turned to his 3-D printer. To her delight, he handed her a plastic replica of the missing part a few hours later.

The 35-year-old German manager in a telecommunications company bought the printer two months ago so that he could use it to rapidly create parts for his remote-control model planes and cars.

He has also been using the printer to "make" educational toys for his two-year-old son, and items such as clothing hooks and cabinet door handles.

Mr Weber, a permanent resident here, says: "They do not have the same finish and smooth surface as commercially produced items, but the important thing is that they work as intended."

What he found most satisfying about the 3-D printer is that designs created on the computer can become tangible objects in a "very short period of time".

He says: "It's an entirely different thing to see something on the computer and to hold it in your hands a short while later."

Like him, more people here are "making" their own toys and household items without stepping into a shop. All they need to do is to click on a digital design they desire, from websites dedicated to the sharing of such files, print it on their 3-D home printer and – presto – the digital design will be physically transformed into a solid object made of sturdy plastic.

Developed in the 1980s, 3-D printers build tangible objects from computer design by repeatedly depositing thin layers of material one over the other, layer by layer, to form a three-dimensional object.

3-D home printers use plastic materials such as ABS (acrylonitrile butadiene styrene) and biodegradable bioplastic called PLA (polylactic acid), which gives the product a glossier finish.

They usually cannot print products longer, taller or wider than 20cm. Depending on the density of an object and the details needed, printing can take between one and six hours or more.

If you find a 3-D home printer, which can cost more than US\$2,000 (S\$2,499), too expensive to buy, you could just pass a 3-D file of your design to companies which offer 3-D printing services and get your prototype within a couple of hours or days, depending on how big the item is.

Unlike home models, professional 3-D printers cost between \$90,000 and \$1.5 million. Highly precise, they can capture details such as the dimple texture of orange skin or the finer texture of hair.



Customers Stez Chong and Alexis Ng (above) got 3D Matters to print figurines of themselves with powder-based printer ZCorp. Telecommunications manager Eric Weber took seven hours to 3-D print this educational toy (above right) for his two-year-old son. It is a large screw with holes to insert smaller screws of different diameters.

Printing industry insiders estimate that about 40 home printers are being sold here every month, up from about 20 in 2011. It is believed that home printers first arrived in Singapore around 2008, through orders placed on online stores, mostly American ones.

At least two companies here started selling home printers recently. SG Tooling at Fook Hai Building in South Bridge Road started with DIY 3-D home printer kits from local company OrangeKnob LLP last year. It has since switched to, and now sells only, American brand MakerBot, the market leader in ready-made home printers. It is its main distributor here.

The MakerBot Replicator 3-D home printer costs between US\$2,199 and US\$2,799.

Mr Mike Kong, 40, who set up SG Tooling, which specialises in hobby tools and desktop machines, said he has seen a 30 per cent rise in demand for such printers since last year. They include research students who want to make prototypes of products they have designed and people who want to make toys and household items.

DIY 3-D home printers such as Panther 3-D printer can be bought from OrangeKnob LLP, believed to be

the only local maker of 3-D home printers here. Its home printers are said to cost between US\$480 and US\$960.

Another local firm Pirate3D, which has an office in Mountbatten Road, is developing what it hopes will be the world's most affordable 3-D printer, the Buccaneer. It is estimated to cost about US\$347.

The 3-D printer-making company made its debut recently on online crowd funding site Kickstarter.

But there is still a long way to go before 3-D printing is as simple as printing a paper document.

A user needs enough technical knowledge to, for instance, replace damaged or worn parts. A 3-D printing rookie could also visit online forums for tips.

Mr Weber said his two-month experience with his first 3-D printer has been bittersweet. He is happy when he gets his product but it usually takes about two or more attempts and the process can be frustrating. But he is optimistic that things will improve. He said: "The technology should get better and maybe one day, every home will have a 3-D printer."

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3-D home-printed objects include (anti-clockwise from above) a chess piece, two toy replicas and a pencil holder, all made by SG Tooling with a MakerBot Replicator.

PROFESSIONAL 3-D PRINTING IN SINGAPORE

There are at least two companies in Singapore offering 3-D printing services.

3D Matters, set up in April last year by aerospace engineer Mark Lim, 27, and mass communications graduate Hayden Tay, 26, works mostly with those in the creative industry, including architects, and product and jewellery designers.

It helps them make prototypes of their designs, which measure up to 24cm tall, 20cm long and wide, as well as the final product.

Prototype.Asia was set up in 2010 by Canadian engineer Benoit Valin, 34 and French engineer, Guillaume de Lazer, 30. It works closely with local enterprises dealing with consumer products and electronics, advertising and marketing, as well as aerospace, naval and military industries, helping to design and prototype parts and products of all types.

Both companies say demand for their services have gone up.

3D Matters was not able to share details but Mr Valin of Prototype.Asia, which also has offices in China and Hong Kong, said it now takes in about \$2,000 to \$3,000 a day in 3-D printing services, mostly from customers in Singapore.

3D Matters uses a \$100,000 powder-based printer, ZCorp from the United States.

The end product is like hard plaster. It can be made even stronger and harder with a layer of epoxy coating. This type of coating has allowed 3D Matters to make products such as a piano key, a ring and the face of a watch.

Unlike other 3-D printers which print colours based on the colour of the raw material, ZCorp can print the different colours of the model in the design file.

Prototype.Asia has four professional printers in its Singapore office, which can produce parts in four different types of metal and 18 different types of plastics in volumes up to 34 x 34 x 62 cm, with different properties such as flexibility and strength.

Companies offering 3-D printing services see a "huge potential" for their services across all industries, except for maybe the food and beverage industry, as not all 3-D printed materials are food safe.

Certainly, Prototype.Asia does not limit itself to engineering.

Mr Valin says: "We also design and produce 3-D printed jewellery and fashion accessories, medical devices such as prosthetics and implants, and household items like cabinet handles, fridge magnets and telephone covers. The possibilities are endless."



Mr Jackson Aw asked 3D Matters to make a figurine of himself with a powder-based printer ZCorp.

DO-IT-YOURSELF



What printing from a 3-D home printer involves:

Step 1 (above): Search and download licensed product designs from one of the many websites dedicated to the sharing of digital design files, such as thingiverse.com.

The website has designs for more than

100,000 items. Alternatively, you can use free online 3-D modelling software such as Google SketchUp to draw your own model.

Download the design product and open it into the printer management software, choose the printing parameters such as resolution and print speed, and press "print".

Step 2 (right): Make sure that you have already loaded plastic filament into the extruder and pre-heated the printer.

The extruder contains a heating element with a temperature of about 185 to 230 deg C, the temperature at which plastic melts. Plastic filaments come in hundreds of different colours including red, yellow and blue. Some even glow in the dark.



As the filament emerges from the nozzle (or head of the extruder), the molten plastic deposits on the platform, following the desired computer design and layer by layer, the printer physically builds the object. When the object is completed, you can remove it.

Sources: Benoit Valin and Mike Kong

Step 3 (right):

Once ready, the 3-D printer feeds the filament into the machine. It will go through the extruder and onto a platform.

As the filament emerges from the nozzle (or head of the extruder), the molten plastic deposits on the platform, following the desired computer design and layer by layer, the printer physically builds the object. When the object is completed, you can remove it.

