

CAD



for Jewelry Artisans

Tools for high tech design

BY SHARON ELAINE THOMPSON

“THEY’LL BE THE FIRST GENERATION that will have no experience touching the material,” a prescient jeweler and university professor told us in 2006. Rebecca Strzelec at Penn State University Altoona College was talking about the growing importance of computer aided design and manufacture (CAD/CAM), and hazarded a guess that in about five to eight years — about now — many students would seek out schools where CAD was prevalent, becoming a new breed of hands-off jewelry makers. Was she ever right.

If you’re in any kind of manufacturing world including jewelry making and design, you can’t avoid the existence of CAD. You can love it, hate it, or be ambivalently curious about it, but you can’t ignore it.

JEWELRY CHOICES

CAD comes in two flavors: two-dimensional and three-dimensional. The one most common in jewelry making, as you might guess, is 3D CAD. These programs allow you to sculpt jewelry without touching wax or metal by drawing lines in a simulated three-dimensional space.

Many CAD programs are based on Rhinoceros, or Rhino. This broad-based program is used for design in many industries — automotive, medical, jewelry, power tools, and more — and this is one reason why it’s often taught in university design programs. And while Rhino is more complex than the jewelry-specific programs that do exist, explains Jay Song, Jewelry Department Chair at Savannah College of Art and Design (SCAD) in Savannah, Georgia, “it’s the most popular 3D modeling program used in the industry, especially in Asia where most of the work is done.”

At the Gemological Institute of America in Calsbad, California, where GemVision’s Rhino-based Matrix

is taught, Manager of the Jewelry Manufacturing Arts Department Mark Maxwell, CMBJ, says that jewelry-specific CAD programs include RhinoGold, 3Design from Vision Numeric, and ArtCAM JewelSmith by Delcam. Some jewelers have used Space Claim Engineer and Autodesk programs, too, as well as more graphically oriented programs such as Z-Brush or Sculpttris.

MODELING AND RENDERING

There are two complementary parts to CAD: *modeling* is the part used to draw the design graphically; *rendering* is the part of the program used to make the virtual model look “real” or photographic. Jewelry-specific programs, such as Matrix or 3Design, have rendering capability built in; Rhino requires a rendering plug-in. (A plug-in is a set of software components that adds specific capabilities to a larger software program.) Another popular plug-in for jewelry CAD programs is T-Splines, which allows a user to make organic forms more easily.

Jewelry CAD programs have been structured to give you single-mouse-click ways to add stone shapes, setting styles (such as heads or bezels), and shanks; you can then change the thickness, height, and width to suit your design concept. Metal and stone colors are also only a click away. Rhino, designed for all kinds of industry, demands more attention to these details, though it does allow you to design a reference file of basic shanks, heads, and stone shapes yourself so you don’t have to create every new design from scratch.

But even jewelry programs are not point-and-click automatic. The computer adage GIGO — garbage in,

OPPOSITE PAGE
Lisa Krikawa

Shooting Star Engagement Ring
From sketch to CAD rendering to final ring.
Sterling silver, 14K white gold, turquoise inlay, diamonds

PHOTO: COURTESY KRIKAWA JEWELRY DESIGNS

RIGHT
Mark Maxwell
Wedding Set
Platinum and
diamonds
Matrix software CAD
PHOTO: COURTESY G.I.A.



garbage out — holds just as true here as elsewhere. At GIA, Maxwell has noticed students' tendency to overbuild, to try to work too much complexity into too small a space. Students find it tempting because everything looks enormous on screen. "You can fill the monitor with a 2mm element," he says. In class, they keep dial calipers on every desk. When students start checking the actual size of their design against what it looks like on screen, "they begin to see just how small half a millimeter is," he says.

DESIGN TO MANUFACTURE

Because of its reliance (so far) on casting precious metals, if you come to CAD from areas of jewelry making outside of casting, you can run into other design issues that become technical issues when it comes to production. "It's really important to understand the manufacturing aspect of jewelry making," says Maxwell.

"In addition to being a computer person, you also need to understand how metal files and sands, how stones are set." This will affect how easily — if at all — the cast piece can be finished. You should also understand metal

flow during casting, or you may design areas that are too thin to fill or flow during casting.

In the end, CAD is all about getting to producible, functional, wearable jewelry — but first your CAD design has to run the CAM file gauntlet.

Phil Renato has seen firsthand what that is like. As Chair of the Allesee Metals/Jewelry Design Program at Ferris State University's Kendall College of Art and Design in Grand Rapids, Michigan, Renato explains that one of the disappointments beginning CAD users experience is 3D printing's complexity.

"Because we call it 'printing,' people think it works as simply as an ink jet or laser printer," he says. It doesn't. "How many times have you sent a file to the printer and had it tell you, 'I can't print that. The data is irregular.'? Not often. However, for 3D printing, the data has to be structured perfectly in order to print."

When beginners use professional level CAD software, they make a lot of mistakes. "The models may be so eccentric — missing parts and connections — that not everything is printable," says Renato. Even if the CAM system does print out the model, it will likely be unusable.

To get your CAD to a CAM system, the file has to be converted from the design (.3dm) file into a printing (.stl file) in order to tell the mill or printer what to do. When you make this conversion (which most CAD programs will make), says Song, you'll see where there are gaps in your design: these have to be closed before you can print the design correctly. This is your opportunity to see whether or not your model will cast correctly.

You can do this manually, by going back into your CAD file and reworking it, or you can use other software, such as Magics RP, by Materialise Software, that will help you do it. "Magics is brilliant at actually stitching together, curing,

BELOW
Elizabeth Bailey Christenbury
Savannah College of Art and Design
Bird of Paradise Ring
Rose gold and diamonds
Matrix CAD rendering
PHOTO: SAVANNAH COLLEGE OF ART AND DESIGN



ABOVE
Aimee Petkus
Savannah College of Art and Design
Odyssey Ring
18K gold, blue topaz, emeralds, diamonds
Matrix software with V-Ray rendering
PHOTO: SAVANNAH COLLEGE OF ART AND DESIGN

“Make a piece of jewelry traditionally, and if you don’t sell it, you’ve lost time and money in metal and stones. Working in CAD, all I lose is time.”



Aimee Petkus
Savannah College of
Art and Design
Nouveau Necklace
18K gold, platinum,
blue topaz, diamonds
Matrix software with
VRay rendering
PHOTO: SAVANNAH COL-
LEGE OF ART AND DESIGN

and healing the CAD files,” says Maxwell. However, even better is finding a service bureau that has the software and offers “fixes” as part of their service.

As you design your model with CAD, you’ll also have to consider the support system the model will need when it goes to CAM. As the model is being cut or grown, it needs to be held in place by a structure that is cut away after milling or printing. “Some CAD programs pre-build a generic support system,” says Maxwell. “However, in general, people customize the supports. Each ring or pendant has a different geometry that drives the support system. No one size fits all.”

WHY BOTHER?

If you’ve never considered CAD before and have not talked to anyone who has used it, your head is spinning right now: milling, printing, supports, resins, eccentricities, and weird file names. Is it worth trying to learn? It could be. Here are several reasons why.

- **Accuracy.** If you work with wax or metal clay or fabrication, and you’ve spent hours trying to straighten a line, get a curve right, or mirror one side of a model to another, you might well come to love CAD. “The accuracy working straight in 3D is amazing,” says Maxwell. “Doing things by hand, it’s difficult to get the level of accuracy that you can with CAD.”

- **Reduced costs.** Although the initial cost to buy a CAD program can be steep — Rhino kicks off at about \$1000, with plug-ins extra, while jewelry software can be much more, though student discounts may be available — that cost quickly flattens.

First, there is no studio space or equipment to maintain. You can work on your dining table.

Second, overhead is virtually nil. “The risks inherent in traditional metalworking are different from those inherent in using CAD,” says Strzelec. “Make a piece of jewelry traditionally, and if you don’t sell it, you’ve lost time and money in metal and stones.” Working in CAD, she says, “all I lose is time. And I can put the extra time that might have gone into preparing the studio and repairing things into the design of the object.”

By using a rendering program to create a photorealistic image of your CAD design, you can sell virtually. “Lots of companies populate their websites with renderings,” says Maxwell. “Not until someone says they want it does the manufacturer make the product with CAM and send it out.” No more money tied up in inventory that is not moving.

- **Speed and volume.** If you are planning to design a line, CAD can be your friend. CAD allows you to “design and manufacture jewelry in a very efficient, streamlined way,” says Maxwell. “You can generate a lot more pieces

find CAD

GemVision.com

3Design.us

SpaceClaim.com

USA.AutoDesk.com

Rhino3D.com

TinkerCad.com

SketchUp.com

123dapp.com

how far we’ve come

“CAD/CAM for the
Studio Artist,”
Lapidary Journal, 2001

“Craft at a
Crossroads,”
Lapidary Journal,
December, 2006

“3D Printing,”
Lapidary Journal
Jewelry Artist, June 2013

> shop.jewelrymaking.com

RIGHT

Aimee Petkus

Savannah College of Art and Design
Rediscovery Earrings
18K gold, alexandrite,
diamonds, emeralds
Matrix CAD software with V-Ray rendering
PHOTO: SAVANNAH COLLEGE OF ART AND DESIGN

FAR RIGHT

Mark Maxwell

Round Threadwork Ring
Platinum, diamonds,
emerald
Matrix CAD software
PHOTO: COURTESY G.I.A.



in CAD than you can using traditional methods. Some of the large RP [rapid prototyping] machines can build 100 rings at a time. Those with a three-inch build plate can do 10 to 20 rings overnight," he says. And CAD allows you to make significant design changes and edits during the process of creating. That doesn't happen in the traditional jewelry manufacturing processes of fabrication or wax carving and casting," says Maxwell.

LEARNING TO USE THE TOOL

As you might expect, CAD takes time and practice to learn. Using CAD, says Song, "is like using any tool." Even something as simple as a hammer is not learned in one day. "You have to learn what the Rhino tools will let you do. It takes time to learn how to manipulate them."

At SCAD, says Song, classes meet for five hours a week for 10 weeks. She says learning the basics takes about 20 hours. By the end of the quarter's 50 hours, students can work with basic shapes to build designs. At GIA, says Maxwell, students in the seven-week classes "can come out with the ability to make fairly basic and simple pieces that are saleable."

Complex setting styles and forms take longer to master. "It takes six months to a year of intense work to become a proficient modeler." When Tucson, Arizona, custom jeweler Lisa Krikawa, who works almost exclusively with virtual designs, hires a CAD tech, she considers 10,000 hours the minimum in acceptable experience.

You'll have to get training somewhere. Most software programs offer training online or at changing locations. Community colleges, jewelry trade schools, and universities also teach CAD, although you won't be using jewelry-specific software unless the school has a dedicated jewelry program. "Teaching yourself CAD is possible but difficult," says Maxwell. "Just

the idea of 3D can be hard to wrap your head around. I taught myself SolidWorks and it was a cumbersome experience."

BEFORE THE PLUNGE

Time, training, money, commitment . . . it's a lot to ask. But there are ways of test driving CAD before you commit.

"Before you get into buying software," says Maxwell, "some companies offer free versions, so you can try them out." For example, Rhino's free version lets you experiment with the program, you just can't save your designs.

There are also free or low-cost programs that are marketed at hobby level, such as the playful little TinkerCad, Google SketchUp, and Autodesk 123D. While these are not for jewelry making, they can give you the chance to get your feet wet in CAD.

"Besides being free and easy to learn," says Renato, hobby programs offer the advantage over Rhino that "all of them will produce printable models." Though limited, the program is structured so that you cannot make a non-printable model. And most of these sites link directly to a service provider so you can order your design and learn exactly how CAD connects to CAM. This will give you a good feel for whether or not you want to move up to something like Rhino or jewelry-specific software.

So if it interests you at all, try a smaller, more goof-proof program, and find out if you see a place for CAD in your jewelry hobby or business. Who knows? Your future with CAD may be closer than you think.

SHARON ELAINE THOMPSON has written for *Lapidary Journal Jewelry Artist* since 1987. Her book, *Good Bones: the Elements and Principles of Design for Jewelry Makers*, is coming soon from Brynmorgen Press. You can learn more about her at sharonelainethompson.com.

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