

3D printing part 3: Advanced topics

As noted in previous articles, my push to learn 3D printing was driven by the failure of the sill plates on my 1953 Chrysler. Appropriately, the 1st thing that I laid out myself was a coaster based on the Chrysler wax seal logo used through the early 1950's and revived in the late 1990's. To create this, I started with a black and white image that I found on the internet. I opened this jpg file in Inkscape (www.inkscape.org) which can convert the jpg image into a vector image that the CAD program can use.

Steps: 1) Import image – pull down the file menu and select import and select your image to convert. 2) Pull down the “Path” menu and select “Trace Bitmap” 3) Select OK in the pop up after which the image should appear. 4) After closing the pop up you need to delete the original image. This can be a bit tricky. To be certain, move the top image slightly and zoom in. The image with rough or fuzzy edges is the original non-vector image and must be deleted. 4) Save the image in svg format (default for save)

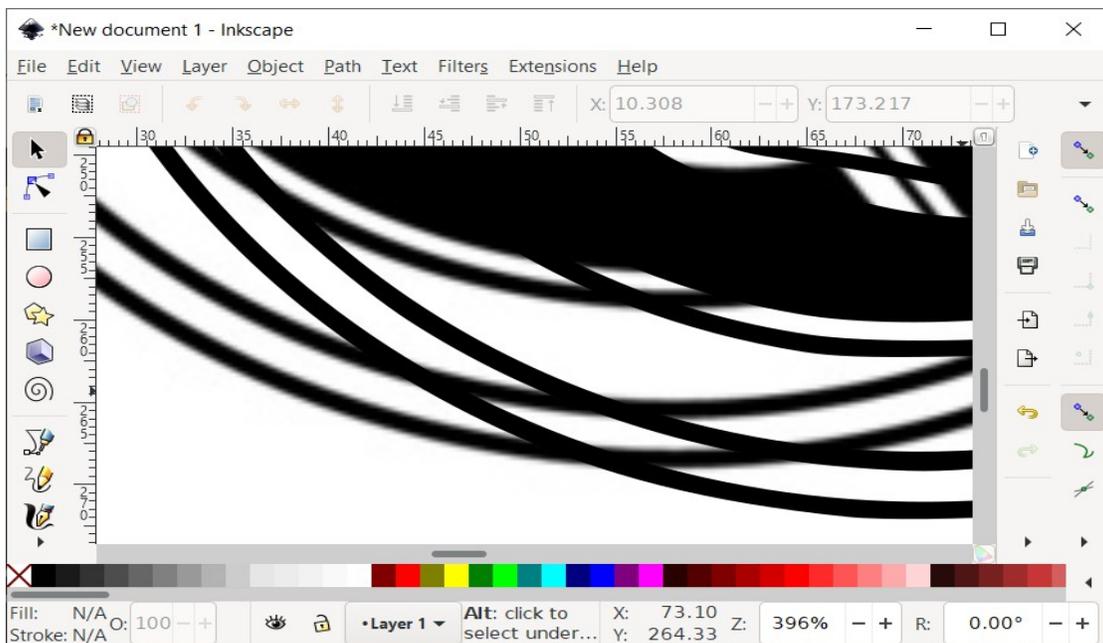


Illustration 1: Inkscape example with original and vector images

After launching the CAD program I imported the .svg file and selected the various areas to be extruded to make the logo 3D. The more complex the base image, the more difficult it will be to pick out the areas to extrude. Images changed from color to black and white or images with low resolution can be more difficult to work with.

I have recently created a coaster using the AACA logo as pulled from the internet which was not the best quality. It took 8 hours of CAD time to get a good result versus less than an hour to do the Chrysler coaster. One issue with using a complex and/or low resolution image is tied to the artifacts left behind in converting it to a vector image. In the image below, note the small ovals and irregularities in the arc of the wheel and the gaps in the outer tire circumference from the AACA logo. These were triggered by digitizing the low resolution original. Eliminating these and any portions of the drawing that will be too small to be useful will reduce odd behaviors in your modeling program.



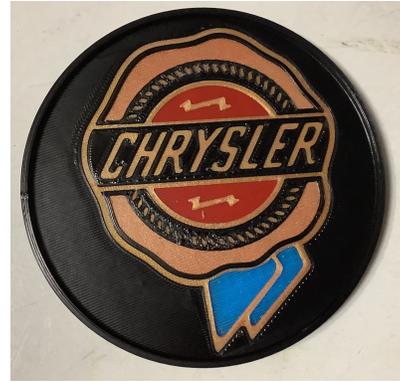
This cleaned up version will work much better.



The main learning from this exercise were to get the best quality image to start with and minimize content of the digital images including small unprintable areas prior to attempting to import it into the 3D modeling program.

Please note, US Copyright and Trademark law allows you to design things with images owned by others for personal use but you cannot sell nor share them.

After printing my 1st Chrysler coaster, I decided to investigate using multiple colors. Changing colors can be done as a function of the slicer program. I selected the 2 top slices to be a different color from the rest of the coaster and printed it in black with the top layers in gold. I made other coasters including a Cadillac logo where I used a single layer of an alternate color embedded between layers of black. This single layer does show, but for most prints, a minimum of 2 layers should be used to ensure that the color stands out. More recently I've revisited the Chrysler logo coaster creating a stackable coaster with 4 colors.

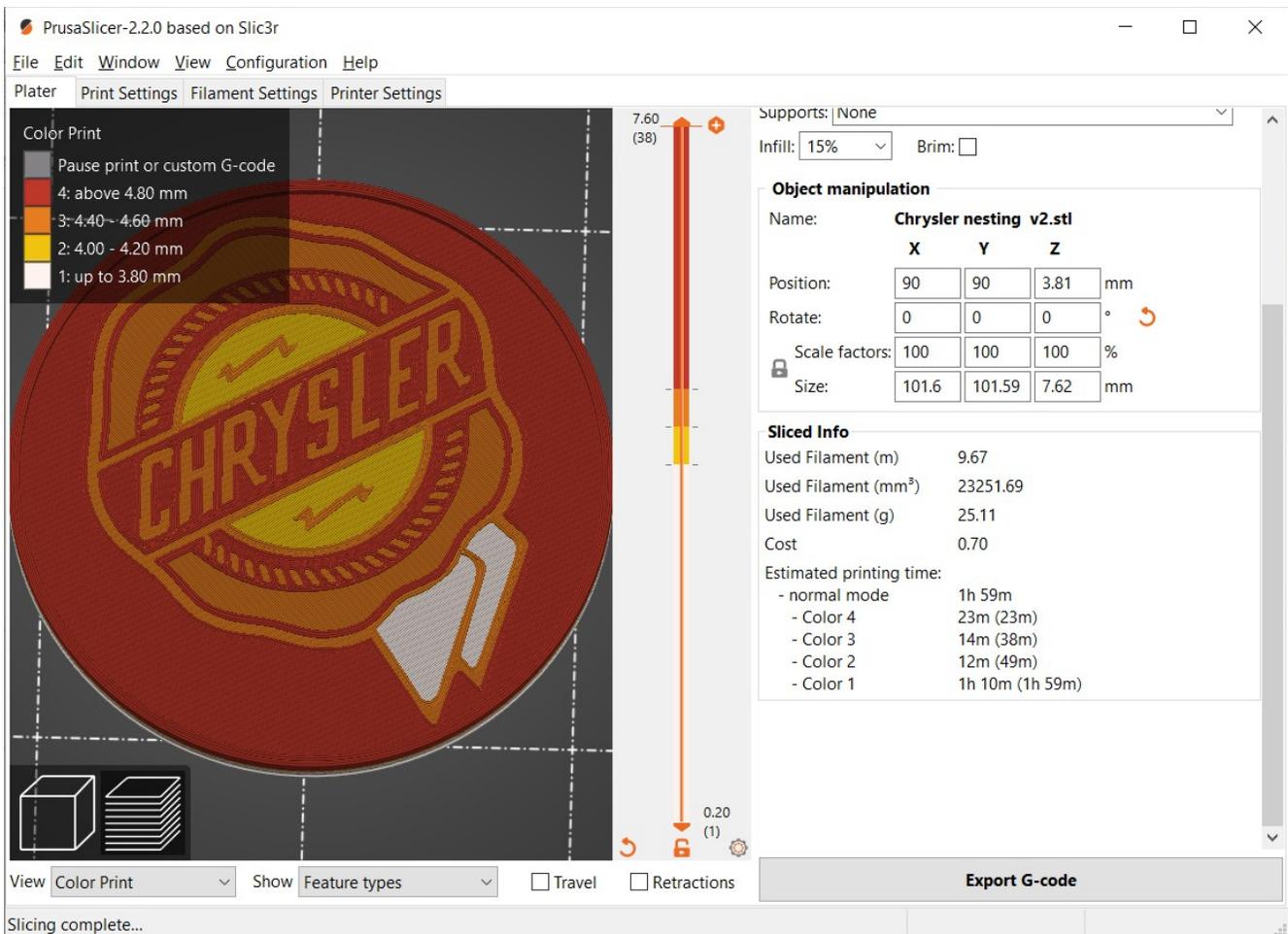


A color print

Another reason for using 2 or more layers of a color is to ensure the color below is properly hidden. The reproduction 1927 Nash Carb heater panel I created (www.thingiverse.com/thing:4736166) shows minor voids in the arrow and the 'A' that would likely have been covered if more than 2 layers of silver were used. Printing with a smaller nozzle at higher resolution may also address this type of issue. I've also had some success increasing the flow rate on the printer for these layers.



One issue with multi-color prints that I struggle with to this day is selecting the correct layers to change colors on. It's straight forward for top layers as the slicer will show the color changes as shown in the image below, but can be confusing if you're trying to do something with the bottom layers. One way to avoid this is to ensure that you have more than 2 layers worth of depth for any color change area so you can select 2 for change and have the 3rd as a backup to avoid this glitch. Keep in mind that the printer typically will have layer height of 0.15 to 0.2 mm or .006 to .008 inches.



Slicer with 4 color changes - note print times per color are provided

With my printer and slicer, when I've specified a color change, the printer automatically ejects the filament and waits for you to install the next color. Some of the higher end printers are capable of printing in 2 or more filaments allowing multiple colors without manual intervention.

If printing in different colors won't work for you, you can paint some of the 3D printable plastics like PLA. Although I have not tried this there are many examples on the internet and many of the models on Thingiverse.com are shown painted.

3D models have a visible lines at the layers and the top will also show lines where the plastic was laid down. These are visible in the Nash Carb Heater image above. Many plastics can be sanded. Some plastics like ABS can use Acetone to smooth the surface. I've been pleased leaving things as they were printed and have not done any investigation in this area.

My experience with metallic colors has found them to be more prone to voids as shown in the Nash heat control panel and also that different vendors products do not behave the same. I've found that working with the temperature and flow rate for these plastics can improve the outcome. Based on my experience and the comments on sales sites, the metallic colors tend to have consistency problems. While one person has no issues another reports problems with extrusion or adhesion. I have returned a roll of copper colored PLA because it failed to extrude properly even after manipulating temperature, flow rate and printing speed. It damaged my printer in the process. Luckily the repair was only a \$2 part.

I suspect my printer is somewhat more likely to be damaged by this sort of issue because of the design. For FFD printers like mine, there are 2 common extruder designs, Direct and Bowden. Each has its issues. Mine has a "Bowden" extruder where the motor and gears are separate from the hot end where the plastic comes out. Bowden extruders rely on a section of Teflon tubing between the drive and the hot end that are held with compression fittings. This tubing was damaged when the filament stopped extruding but the motor continued to push the filament resulting in the tubing pulling loose from the compression fitting and skinning it, making it impossible to tighten that piece of tubing properly again. Direct extruders would not likely be damaged by this type of issue.

The basic difference between the 2 types boils down to this: A Direct extruder puts more mass at the print head and can cause issues with print quality, particularly if your printer is on a table that may be prone to wobbling. I saw a review in 2020 on a large format printer with a Direct extruder and the reviewer noted that the prints were significantly better when the printer was on the floor rather than on a table. A Bowden extruder has less mass at the print head and can theoretically print faster but can have issues with stringing or oozing. I have had issues with stringing, particularly with flexible filament. I also had to upgrade my Bowden extruder to a dual drive Bowden extruder in order to print flexible filaments reliably.

3D printing can bridge generations. If you've got a need, but not the experience, ask your children or grandchildren. They might be more comfortable with the computer and may jump at the chance to make use of your printer to print things they want. My Nephew was thrilled when I let him know it was available.

If you don't want to purchase a 3D printer, but have something that you want printed, there are businesses that will do both the 3D modeling and printing. I've begun looking for someone that could print my 42" long sill plates as a single piece before moving ahead with purchasing a printer in the \$1000 range that could print it in 3 pieces or one of the new infinite Z axis belt printers. There are sites that can print things as big as 5 feet long and can also print things out of metal and other exotic materials. Some examples of sites offering these services would be Craftcloud3d.com, 3Dsystems.com and Shapeways.com. Note that I have no experience with these vendors and cannot vouch for their capabilities. I did get a quote of \$900 from one vendor to print one 42 inch long sill plate making the cost of a large format printer seem more reasonable.

I hope these articles have helped the WPC community feel more comfortable with this new technology and understand how it can help us keep our old cars on the road. Although I have not completed my sill plates, I'm well on my way. At this point I have about \$500 invested in my printer and have already had more than \$1000 worth of fun.