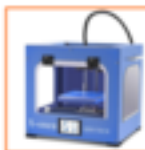


Integrating Additive Manufacturing into the Artistic Process: A Case Study of Utilizing Additive Manufacturing to Create Miniature Sculptures

There are a variety of artisans who create handmade miniatures for adult collectors and show their artwork in galleries around the world. As an alternative to expensive handcrafted pieces or commercially mass-produced toys, many Miniaturists are now turning to design technologies like laser cutting and 3D printing (Additive Manufacturing). The latter has already been used extensively in the arts for restoration and educational purposes. However, creating unique sculptural artworks with 3D technologies brings a human element to an otherwise robotic realm. Like sketching before painting a masterpiece— the process of prototyping can be used to work out errors in a 3D model before a final is made, which can take weeks or even months. Additive Manufacturing can make artistic productivity more efficient and accurate. In this poster, I present a case study of how integrating Additive Manufacturing with Art can benefit both the artist and the viewer.

The Creative Process

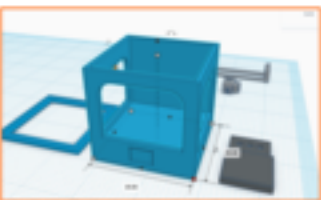
The process starts with an idea. Modern miniatures can be infrequently available to purchase, so I often resort to creating the things I seek. I had never seen a miniature 3D printer in 1:12th scale before, so I decided to use one of my FDM printers as inspiration.



The free browser-based program I use is called Tinkercad. I virtually design the mini printer's model by forming a more complex configuration out of several fused geometric tools. I build every part of the mini printer in separate configurations so they can easily be printed across a flat surface with minimal supports.



While I often sketch larger ideas and plans by hand, I mostly do my "sketching" in Tinkercad. 3D modeling software is very efficient for getting ideas down quickly while the concept is still fresh.



Using millimeters when modeling miniature pieces can be efficient because most 3D printers (FDM and SLA) utilize this form of measurement. Since I make this model in 1:12th scale, I base the millimeter measurements on the real-life size measurements of the machine.

Once I complete the design process, I export the file from Tinkercad to my computer by downloading the STL file. I then import the STL file into a slicer software called Simplify3D. After slicing the STL file and uploaded the G-code to an SD card, the design is ready to print.

Proto-typing Phase



I print all the parts out in various filaments, making sure to group similar parts together. I spray paint the mini rods and print bed in the post processing phase. When I initially printed this model, there were defects. I had to print multiple versions with slight adjustments for the supports to work efficiently.

I will often print many models in the proto-typing phase. Sometimes models only need one reprint. Alternately, a model can require twenty reprints until perfection!



Supports (or skirts) are removable bits of filament that help the model print correctly. I remove the supports in my mini printer before painting and assembling. I also sand any rough edges and dissolve any filament stringing left on the model.

The plug and cord to the mini printer are not FDM printed. The cord is made of plastic string and the plug was printed on an SLA (or Resin) printer. SLA printers can print extremely small layer heights which make it perfect for microscopic details, like this plug.

Post Processing & Assembly



After removing the supports and sanding the pieces, I paint the mini platform bed black and the rods silver. I then start assembling the mini cross rod to the top rod. I then glue the mini printer head onto the rods and glue it into the shell.



After gluing everything inside the shell, I drill a small hole on the back of the shell. I insert the cord with the plug attached into the hole and glue it in place.



I then glue the mini filament holder to the back. I glue it slightly off center, like its life-size counterpart.



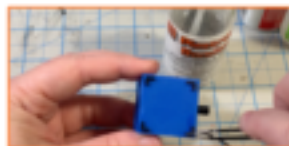
I use various sizes of black plastic cord to make the mini feeder tube and power supply cord. I glue them into place with super glue.



I shrank an image of the printer screen in Photoshop and printed it out to scale. I cut it out and glue it onto the front of the mini shell. This can be optional to give the illusion of the printer being turned "off".



Finally, I glue the tiny L-shaped feet to the bottom of the shell to add more detail. I also add cut acetate to the side openings to act as mini windows.



And it's done! This miniature takes quite a bit of post-processing and assembly. However, the final piece is scale accurate and unique. I now add this piece to my miniature scenes and add a modern twist to my artwork.

The Integration of Additive Manufacturing & Art



Additive Manufacturing took my miniature artwork to another level professionally and creatively. It grants me the freedom to make anything imaginable without the headache of building it from scratch. Rapid proto-typing helps me quickly adjust the model and print a revision while I work on other details.

Scale accuracy was something I struggled with as a new miniaturist. It was hard to make changes to an item I had completed, only to discover the scale was inaccurate for the diorama. Making tiny objects by hand was tedious at times, but it taught me to be proficient in scale accuracy. This became an essential skill for when I began utilizing my 3D printers for unique miniature creations. Now, I can make to-scale items that bring my scenes to a realism that I want to achieve. It also brings a quality to my work that elevates the illusion.

The goal of my art is to make the viewer, even for just a moment, think that it's real. My work often showcases significant periods in my life. I create miniatures to demonstrate the importance of physical liminal spaces. The messiness of reality is a central theme throughout my work. Miniatures are such a mystifying art form because of its ability to teleport the viewer into another world. Personally, I prefer my room boxes not to contain dolls in order to enhance the illusion. I love when miniature scenes have a cluttered and lived-in look to them as if someone just left the room. An empty glass, receipts on a counter, trash overflowing, and half-eaten chocolate bars - those are the details that bring a miniature scene to life!



The Arts in Society