

# Fully Functional 3D Printed Guitar – Charlie Carey

## Graphic Design

I had an idea of 3D printing a guitar since year 10 when I was assigned an industrial design major project. I had previously designed guitar accessories and successfully 3D printed these items; they include guitar picks, stands, and a capo. I had decided I wanted to challenge myself and design a fully functioning 3D printed guitar with exceptional sound quality and useability. After extensive research and learning on a 3D model software named Rhino, five separate pieces were printed in a jigsaw figuration. I Combined the five individual pieces of the guitar with the electronics, strings, and neck of a Stratocaster Guitar I previously owned and I had a finished functional product.

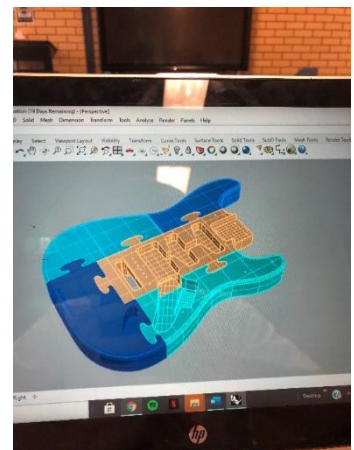
The project was time consuming and required frequent observation to ensure the parts were printing correctly. Four of the pieces of the guitar took between 15 to 30 hours to print on a Flashforge Guider 2 3D printer. The middle section of the guitar where the pickups of the guitar sat had to be printed at a higher infill percentage because of the tension it would be under. This piece provided major attention and time taking around 50 hours to print. Once all the pieces were printed they were set in place with glue to fix the guitar together as one whole guitar. The wiring was then completed so the guitar could be connected from the pickups to the output jack which allowed the sound to be played through the guitar. The pickup guard and neck were screwed into the guitar to finish the process. The finished result was a functioning useable guitar created entirely from a 3D printer which produces exceptional sound quality and performance.

## Preparation

### Rhino 3D

To be able to design this project I had to research and teach myself the 3D software Rhino which was new and foreign to myself. I was learning how to use new tools and techniques every time I opened the software. With the help of my graphics teacher and many YouTube videos, I understood the software at an adequate level and was able to apply these skills to better my project design. See Figure 1

Figure 1



## 3D printer

Another piece of technology that I had to learn to master was the use of a 3D printer, specifically a Flashforge Guider 2. This machine allowed me to turn my designs into reality. There were numerous occasions when a piece would fail at the 14 hour mark, these setbacks provided a harsh learning curve.

The printing failures were uncontrollable at times as the machine over a long period of time may have a fault or mechanism error which would cause the error in printing. There were additional errors which could be attributed to human mistakes such as not loading enough printing filament into the machine resulting in an incomplete piece being printed. This would result in having to start the whole process again from scratch. Despite the many setbacks, and learning experiences, the final product was reached after multiple attempts of perfecting the design.

I learned how to export files from computer to 3D printer via software's such as flash print, learn the job of supporting materials and when to use them and calculate the temperatures different filaments would acquire to produce a high quality standard print.

## Research

I started by researching different shaped guitars to determine which shape would be ideal for the project. Different factors were considering in the decision making process such as looking at the price of guitar parts, availability of the required materials, surface area of the guitar body, pickup guard position and output location. The Stratocaster shape was suited best for the 3D print because of how common it was and could be found at an affordable price.

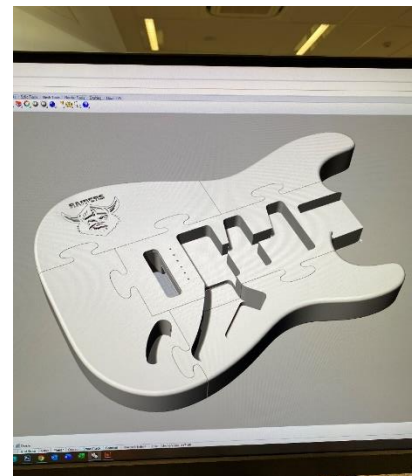


Figure 2

## Design

Once I knew the shape I was using, then became the design process. On the Stratocaster website I found the plans and dimensions of a stock standard Strat guitar which I converted over to Rhino. From there the 2D plans slowly became 3D models. I then ran into the problem that I would have to split the body into five separate pieces to allow them to fit inside the Flashforge Guider 2 3D Printer. I decided to make the pieces resemble a jigsaw puzzle not just for aesthetic looks but for stability as the pieces interlock with each other. This creates a strong body so when extra weight and tension are applied the force is distributed equally throughout the body.

Once I had the basic jigsaw shape (see figure 3), I had to cut out the right divots and holes for screws, output jacks, neck slot, guitar strap pin and pickups. This was achieved by following dimensions found online and using tools such as Boolean union, Boolean difference, offset, split, explode, patch, join and many more tools on Rhino. After weeks of designing, I was finally ready to move on to the production stage of this project.



Figure 3

## Production

Production started slowly with the smallest piece being used as a test for the rest of the project, taking three attempts to get the right temperature as errors were visible in the first five minutes of printing. Once the right extruder temperature and base plate temperature were calibrated multiple machines were put to work. After weeks of changing filament colours cleaning machine parts and testing each part fit, five unique pieces were complete and ready for assembly.



Figure 4

Before I glued the pieces together, I had to disassemble an existing Stratocaster I had at home (see figure 5). This consisted of destringing the guitar, unscrewing multiple screws, taking off springs and disconnecting wires. Once the body was separated from the rest of the parts I assembled the guitar

back together with its new 3D printed body. Once I knew it fit perfectly, I was ready to assemble the body with glue.

This was an easy process as I glued one piece at a time together and the product was very strong body ready to be assembled with the remaining parts. Next, I fitted the electronics into place feeding the wires to their respective positions to be soldered. I reconnected the springs allowing tension for the wammy bar and reconnected the pickguard which holds the pickups in place. After soldering the wires back to the output jack all that was left was to connect the neck and restring the guitar.



Figure 5

## Client

After the completion of the first 3D printed guitar, I went straight to work creating a 2<sup>nd</sup> guitar for my Uncle as a gift. The difference was I had a client brief to follow so the aesthetics were personalised and unique for the client. This is when I had an idea to take the personalisation even further. I played around on rhino with some tools and was able to take PNG photos turn them into vector files on photoshop and engrave them into the body of the guitar. This took lots of time and effort but changed the whole dynamic of the project. From a fully functional 3D printed guitar to a fully functional, completely personalised, one of a kind guitar tailored to the clients' preferences. For this specific guitar I engraved the Canberra Raiders Logo, a Holden Charger and Happy 50<sup>th</sup> Birthday imprint onto the guitar. (see figure 6 and 7)



Figure 6



Figure 7

## Marketing

After the 2<sup>nd</sup> guitar was finished, I decided to put my ideas out into the world and made an Etsy, Instagram and Facebook account hoping people would have the same love of guitars and design as I did. Not long after I posted I had my first enquiry, I got straight to work and after lots of discussion had the colours, engravements, placements and shape the client wanted. A month later I delivered my 3<sup>rd</sup> guitar to the client who only had positive feedback. (see figure 8)



Figure 6

## Conclusion

Overall, this project has allowed me to acquire a whole new skillset which has helped me throughout the last couple years not only in skill but at home as well. It has also opened a whole new range of job opportunities in the design sector that I once would not have known of. (See figure 9 and 10) for the three complete fully functional 3D printed guitars I have created. Thank you for the opportunity to put my work out there.

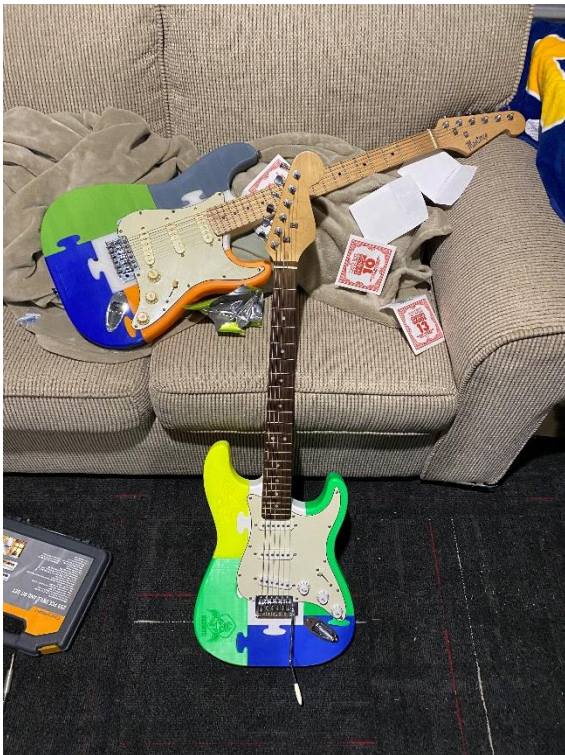


Figure 9



Figure 10