Abby Hall

3D Car Reflection

In the 3D car project, I chose a matchbox car to replicate and took accurate measurements of the car. With this information, I use OnShape to create a 3D model of the car with accurate dimensions and other features. I then created a CAD drawing, printed the car using a 3-D printer, and made a display for my car.

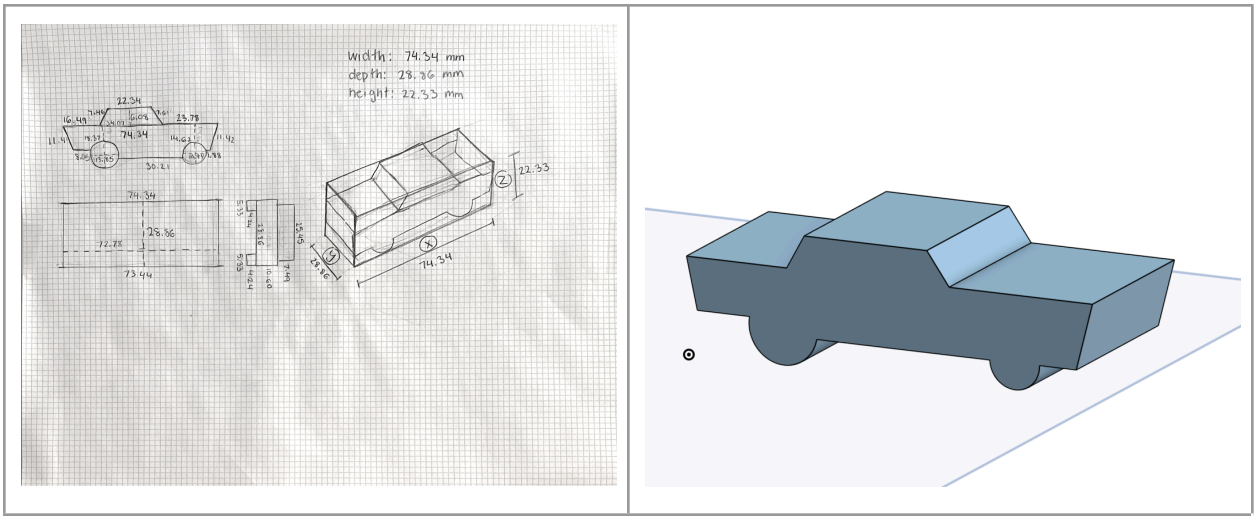
The steps were as follows:

- Take precise measurements of the chosen car using a caliper to create an accurate engineering drawing that is drawn to scale with the proper angles and lengths
- Upload pictures of drawing to OnShape
- Using OnShape's drawing tool, sketch the shape of the car onto a 3D prism
- Remove extrusions to create 3-D car
- Continue to use sketch, extrusion, transform, and boolean tools to create other features of the car such as wheel wells, tire rims, bumpers, logos, a windshield, windows, interior of the car, and headlights
- Ensure each layer is well labeled and a there are no errors
- Using the 3D design, make a CAD drawing on OnShape using several views (front, side, top, bottom, etc.) and a detailed view and display the dimension of each profile view (length, height, depth).
    - Calculate ratio of error to original engineering drawing
- Upload STL file into Ultimaker Cura and specify plastic and support
- Print using 3D printer
- Create a display stand using wood and acrylic paint

The process:

The first step in my process was choosing a car. I chose to do a 1957 Chevy because I liked the angular and vintage look. Once I chose my car, I used a caliper to precisely measure each dimension of the car. This included the length of each profile, the length of the roof, the length of the front and the back, the diameter of the wheels, and other specifications. I used these measurements to make an engineering drawing that was drawn to scale. I also made efforts to replicate the angles of the car (e.g. the roof) as accurately as I could. I drew each profile of the car (front, side, and top), labeling all measurements and also made a 3D view with the measurement of each dimension (XYZ). Once I finished my engineering drawing, on On Shape, I started by making a 3D rectangular prism using the sketch and extrude tool at the origin point. I then uploaded the image of each of my profiles (X, Y, Z) onto the sides of the prism. This allowed me to use the sketch tool to outline the shape of my car, using the drawing as a guide, which allowed me to make sure I had accurate measurements. I then used the extrude remove tool to remove parts of each profile. I sketched and extruded the front and back of the car (YZ profile) to create the rim in the

back and the headlights in the front. Because the car was asymmetrical, I had to do separate YZ sketches and extrusions for the front and the back so that they could have different dimensions. I also did two separate extrusions in the back to create two different depths. I then used the filet tool to smooth aspects of the car to make it more accurately represent the car. Next, I returned to my drawing to create the outline of the wheel well using the sketch tool. I then extruded it into the car 2.2 mm, transformed it to the other side, and boolean all the parts together. I continued to add features to my car by creating a windshield and slightly extruding it to score the outline of the windshield. I also extruded a window through the car. I removed the interior of the car and created a console and two sets of benches which I did in separate sketch and extrusion layers. I also created headlights using circles and made a bumper on each side according to the original car. For the front bumper, I did two separate sketches and extrusions and also added a Chevy logo. Lastly, I used the sketch and extrusion tools to add a rim to each of the wheels. Before finishing my design, I made sure all of my sketch and extrusion layers were properly labeled and organized and made sure there were no errors or extra constraints. With my finished design, I made a CAD drawing where I displayed several profile views, including the front, top, bottom, side, and a detailed view. I then used the dimension tool to record the measurement of each profile and the wheel well in the detail view. I used these numbers of my actual 3D car design and compared them to my original engineering drawing measurements, so I could calculate the ratio of error. I recorded the reason for the side discrepancy in my CAD drawing and pushed the file to GitHub. I then exported the On Shape design as an STL file and uploaded to GitHub, the shared folder, and into Ultimaker Cura. Here, I specified the plastic size, the specifications for the support, such as the overhang angle (45) and support placement (touching build plate) and whether I wanted a skirt or brim. I then uploaded this G-Code to GitHub, the shared folder, and onto a disc. I turned the disc into a 3D printer and printed the car. I used pliers and sanding tools to remove the support from my 3D printed car and smooth any rough edges. I created vinyl stickers on Illustrator and printed them using a vinyl cutter to add stripes to the car. Lastly, I created a display stand for my car using an ovular block of wood and acrylic paint that matched the colors of my car.

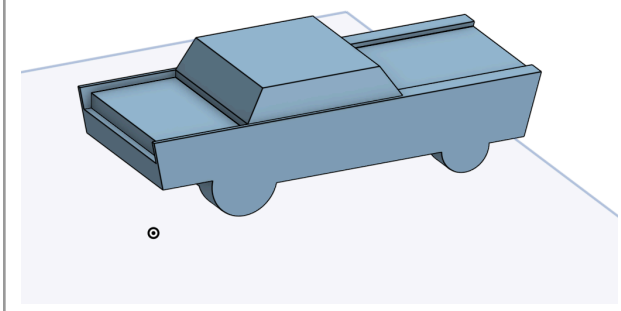


Engineering Drawing

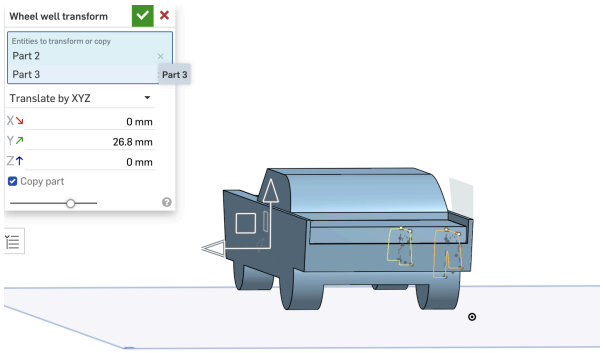
Car design after initial profile extrusions (without specific details)

Challenges, setbacks, and solutions:

While the process was overall smooth, I had some setbacks when creating my 3D design in On Shape. I had to figure out how I could use several extrusions to replicate the model of my car. For example, the front and back of my car don't have the same dimensions and have a rim on the sides with a lower middle section, but both with different depths, heights, and widths. The back also had a sharp angle while the front was smooth. With this in mind, I knew I couldn't have one sketch and one extrusion in the XY playing like I originally had planned. To remedy this, I created two separate YZ sketches (front and back) of my car and closely replicated the measurements of my original drawing with different dimensions. I created separate extrusions of different depths and used the filet tool differently on each side. I also had to make two separate extrusions in the back because there were two levels, so I used the same sketch to create different extrusions. Another setback that I encountered was when my wheel well wouldn't show up on the other side. When I was transforming my wheel well by XYZ, I miscalculated the measurement of my YZ side, which caused the extrusion not to show up on the other side. Once I noticed that something was wrong, I looked at where the transform was and the measurements and realized that I had to further transform the wheel well extrusion by 0.2 mm to get it on the other side.



Differences in the front and back extrusions (different dimensions, several extrusions)



Wheel well extrusion not on the left side because of improper translation measurement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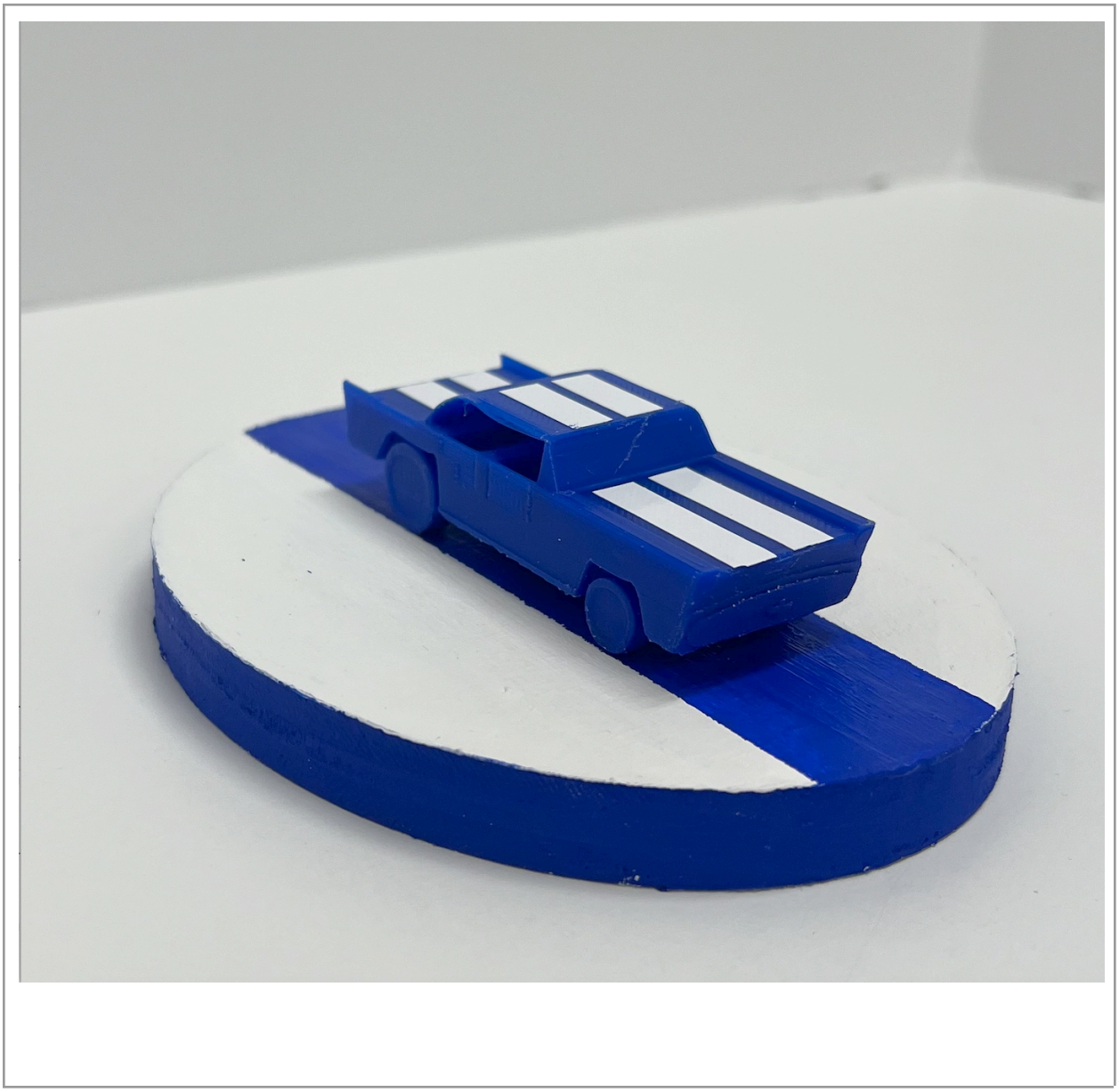
HOT Wheels



Finished project below original car