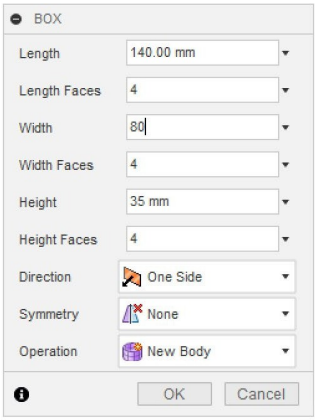
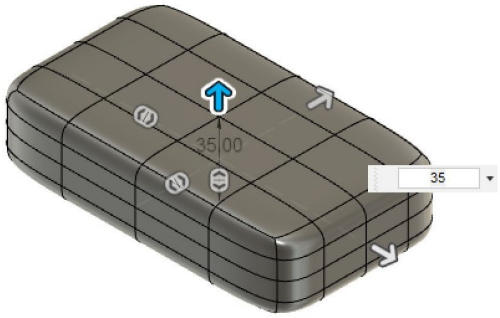
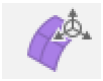
Lab Assignment #6: Creative Part Modeling **ME170**

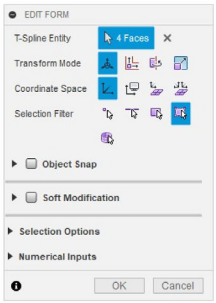
Part I. Model a Drinking Glass, a Shirt Button, and a Computer Mouse
These three parts should be readily available wherever you are, so find one of each, take accurate measurements, and then model them in Fusion.

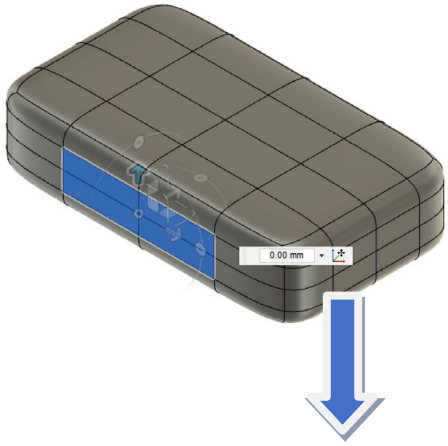
- Create an accurate solid model of each part in millimeter units. Measure all dimensions to within a half-millimeter. A ruler with millimeter markings is sufficient for the measurements; calipers make things easier (if you have access to one).
- Create a Word document containing pictures of all three parts you used with something to provide scale (e.g. a ruler next to the part) for the grader. Take a screenshot of your Fusion parts from a similar angle and include them next to their corresponding real-world picture.
- Use the following file names for your parts: "ME170-Glass", "ME170-Button", "ME170-Mouse". Save them all to your Lab 6 folder.
- Creating a hand-drawn sketch with all the important dimensions is an excellent way to begin. Think about the basic geometric shape of the part and the simple extrusions, 'thickens', revolutions, and cuts, which might be employed to achieve the final shape.
- If needed, Fusion allows pictures to be imported into sketches. This can aid you in create the general shape of the profiles. If you scale the picture correctly, it can aid in dimensioning too.
- You will be graded on the quality and professionalism of your design, sketches, and resulting model. Your measurements should be reasonably accurate, and features should look 'right'. Use logical constraints. Define symmetry and use centerlines where applicable. Use diameter dimensions for complete circular features. With the exception of the free-form mouse features, your sketches should all be fully constrained (remember fully constrained geometry is Black. If your geometry is still Blue, that means that it's not fully constrained!)
- For the mouse: Use the Create Form tool  in the Create tab, choose the Box tool  , and then create the box using the outer dimensions for your mouse (centered at the origin). Then modify it to fit the shape of your mouse. This is not intended to be a functional design with multiple components. Imagine that you are designing the overall shape of the mouse for aesthetics or ergonomics analysis.

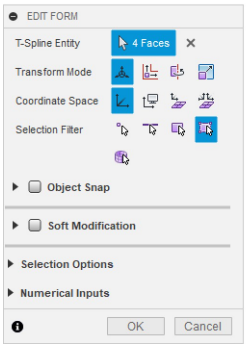


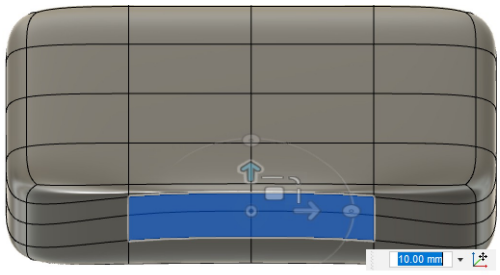


- To have more control, increase the number of Faces in the Box options window
- After making the Box, select Edit Form  and then select vertices, edges, or faces (hold down SHIFT to select multiple options at the same time) and drag along the arrows to adjust the shape





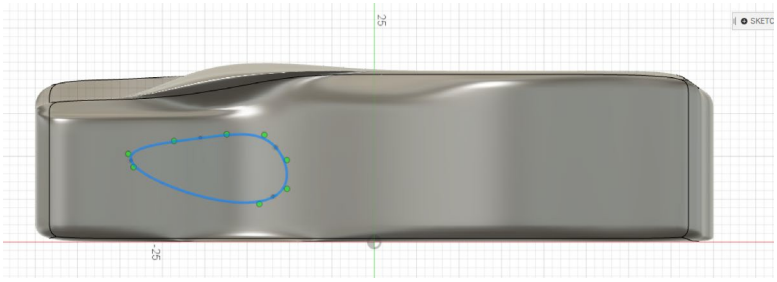




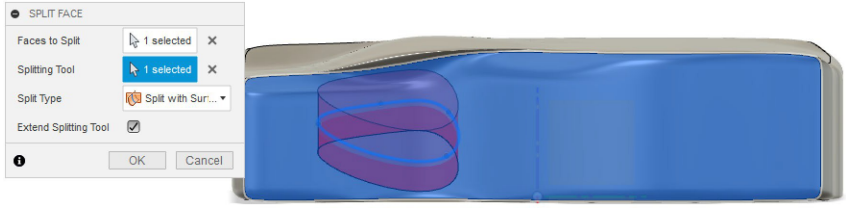
- Do not be afraid to experiment with changes, even if you end up having to restart. Free-form modeling takes some getting used to.

- Once satisfied with the shape, select Finish Form to return to the standard design space.
- It may be necessary to create new faces for an accurate part. This can be done using the Split Face tool found under the "Modify" dropdown:

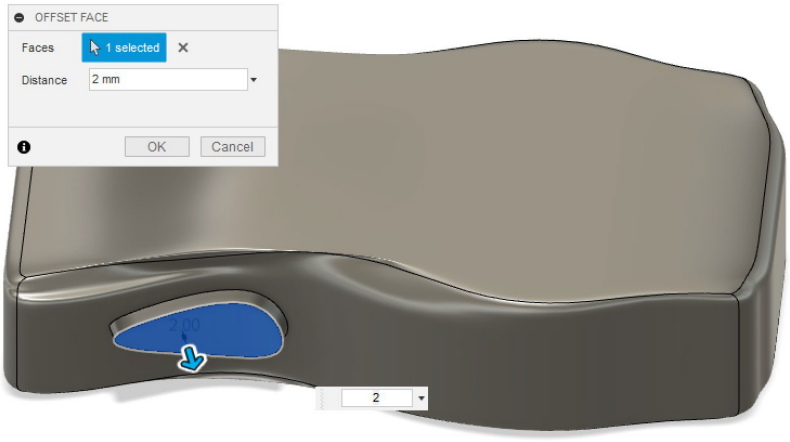
1. Sketch the new face on a parallel plane to where it will be created



2. Select the Split Face tool, then choose the face to split and the shape you sketched to split it along. Once you are ready, press OK to create the split.



3. With the new face, you can color it differently (for multicolor mice) or use the Offset Face tool found under the "Modify" dropdown to to give the face variable depth (for mice with buttons or rough surfaces).
   a. Note: Extrusions can be created of <u>planar</u> faces, but most faces in free-form modeling are not flat



Part II. Mini-Project Creative Part 3D Printing Exercise.

1) In collaboration with your teammates, design a Creative Part that in some way connects with or assembles to your teammates' Creative Parts.

2) Since we must control the cost of making your parts, you must follow the following guidelines (Units in inches are provided for comparison):

   a. Maximum size: (101.6 mm x 101.6 mm x 101.6 mm) or (4 inches x 4 inches x 4 inches)

   b. Maximum volume: 1.0488×10^6 mm^3

   c. Follow the instructions in section II.3 to verify the volume of the model.

   d. Wall Thickness: 1.0 - 4.0 mm

      No more, no less. Do not make any feature/dimension less than about 0.75mm because the material may not be self-supporting during build.

3) Prepare the file for 3D Printing.

   a. **Verify** the model's volume

      i) Ensure that the model's units are in millimeters.

      ii) Right click on the Part name in the Browser on the left and select "Properties"

      iii) Ensure the Volume is below the maximum amount

      iv) Close the "Properties" window.

   b. **Verify** the maximum size of the model.

      i) Use the Measure tool under the "Inspect" tab to select different faces and find the outer dimensions of the part. Press the Restart Selection button  to use the tool multiple times.

      ii) Ensure the part fits within the required dimensions

      iii) Close the Measure tool.

   c. Optional instructions for scaling your part (if the size or volume requirements are exceeded).

      i) Under the "Modify" dropdown, select the Scale tool

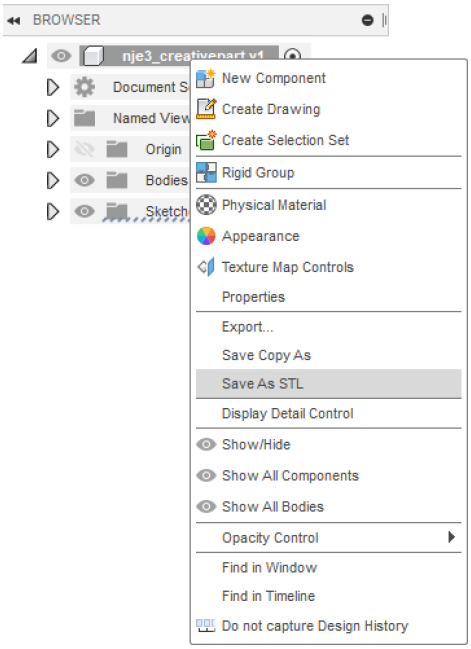
      ii) Select your part as the body to be scaled, and if needed, select a point to scale it about

      iii) Enter the amount the part needs to be scaled by and press Enter to shrink the part

   d. If you make any significant changes to your part. **Re-verify** that your part's maximum dimensions and volume are within the specified limits.

4) Create an STL file, which is required by the rapid prototyping machines and 3D printers. STL is an abbreviation for stereo-lithography, which was the first rapid prototyping method capable of directly manufacturing parts from a solid model CAD file (developed in the late

1980s). The STL file is a standard file that can be used by most, if not all, 3D printers and rapid prototyping machines.



a. Right-click on the File name in the Browser on the left side of Fusion and select "Save as STL"

b. Select your part and click on "Preview Mesh" to see how Fusion parameterizes the part. Then press OK and select a save location.

c. Open your Data Panel and navigate to your Lab 6 folder

d. Select "Upload" and then from the pop-up click "Select Files." Navigate to where you saved the STL and click it to upload it to your folder.

Part III. Submission Requirements

a. Ensure the "Creative Part" STL file, your 4 Fusion parts (Drinking Glass, Button, Mouse, and Creative Part), are all saved in your Lab 6 folder and that your TA has access to the folder.

b. Go to ME170 Blackboard website and the CAD LAB Assignments content area. Click directly on the "CAD LAB 6" assignment title and use the "Browse My Computer" button to upload your Word document containing image comparisons of your models and the real world objects. As before, please do not go back and change your files in the Fusion Lab folder (Lab 6) after submitting to Compass as this also serves to indicate that you are done with your CAD work.

c. Schedule a time to get trained on the 3D printers in the Innovation Studio (D221) and fabricate your part. Take a photo of the finished part and submit this to the "Creative Part Photo" assignment link in the Blackboard CAD LAB Assignments content area. Show the printed part to your TA or grader to receive full grade for the Creative Part exercise in Part II (deadline for this is flexible but try to get it done within two weeks)