Sebastian Esteva

CLASS PROJECT- 3-D PRINTING GLASSES FRAMES

Project 2 is what?

Design a part that includes at least one of the following features:

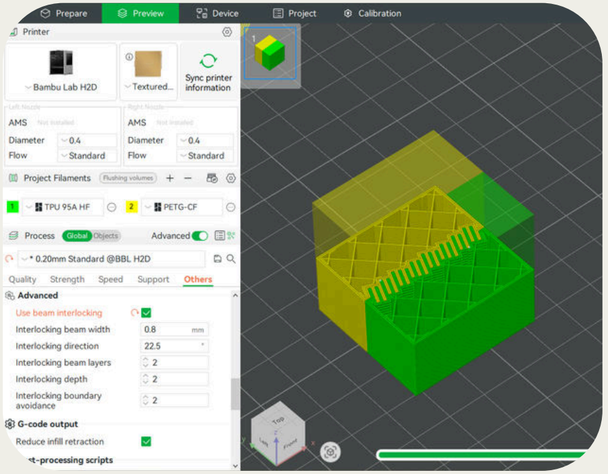
- Print-in-place
- Multiple materials
- Print-in-plate

My Purpose:

Create a **multi-material hinge** for glasses.

Challenge:
Glasses Hinges are **small**!
+
Aesthetics Are Important

Mult-Materia Research



learnings

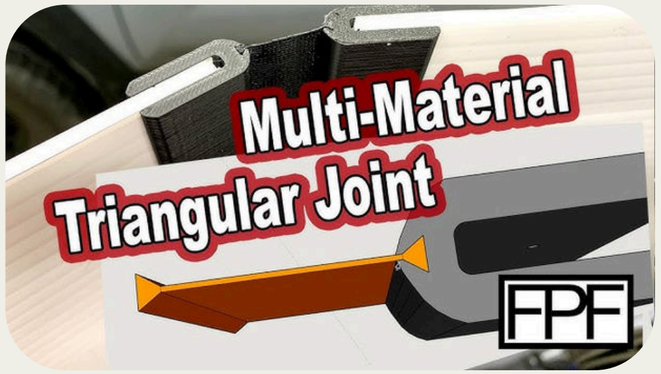
(1) Securely bond rigid and flexible materials using Beam Interlocking, (2) filaments need to dried.

Bambu.com

learnings

(1) Embraces the hinge as part of the design. (2) Use of flexible material for structural, and utility integrity.

"All You Need to Know..."



learnings

This print illustrated (1) the purposeful use of geometry for interlocking and (2) potential designs for a thin structure.

Mult-Material

Comparisons

Basic Vs. Multi Material 3D Printing

More materials = more properties

One material = one set of properties.

Comparisons

4 pieces

Traditional manufacturing vs. 3D Printing

	Traditional	3D Printing
Durable	+	(Can be with good design)
No Assembly		+
Few pieces		+

A Quick Aside: The *Frames* Journey

Wire frames designed for a **perfect fit.**

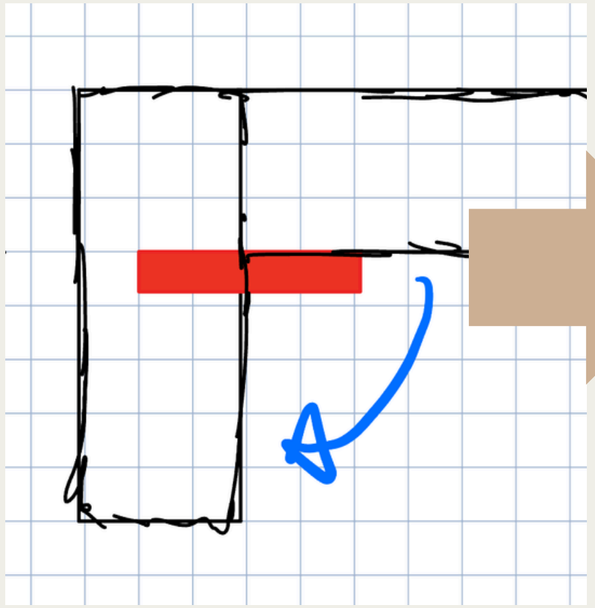
Measurements from wireframes **used for design.**

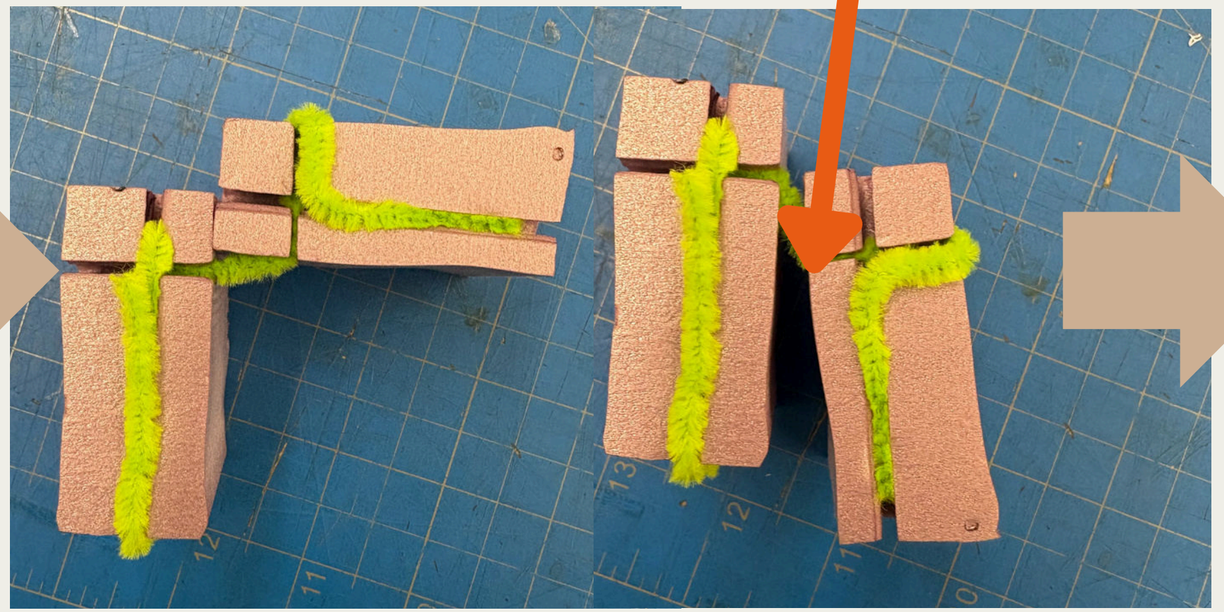
3D Printed Prototype of Just Frames

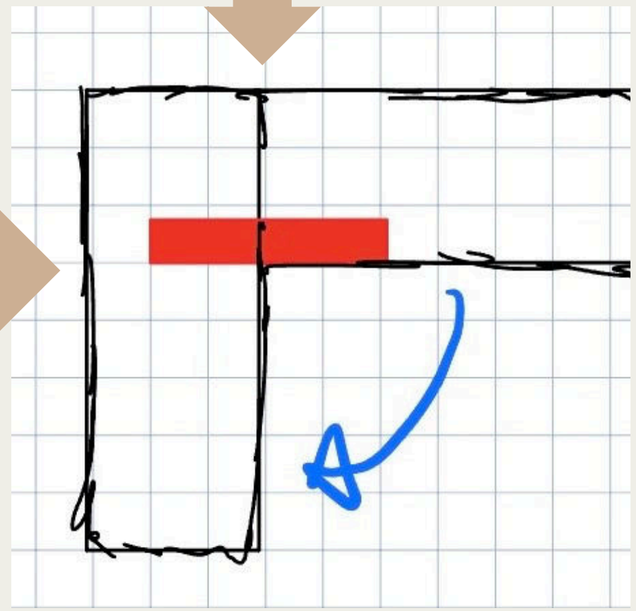
Idea Generation

“Arm” portion pushed out by connector

moved connector in for “flush” bend



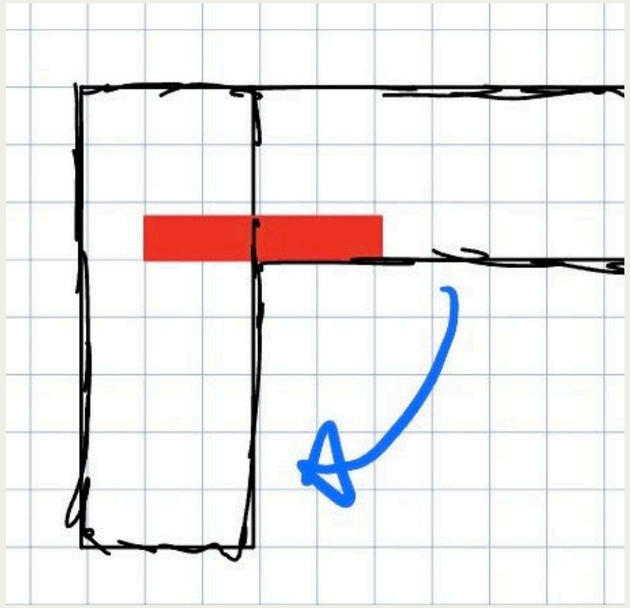




Base principles
simple, hinge

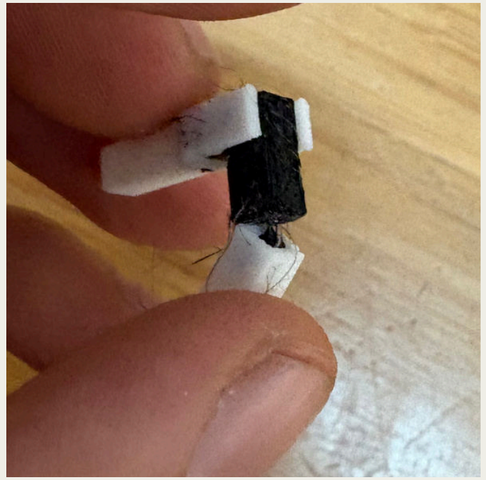
prototype

Idea Generation



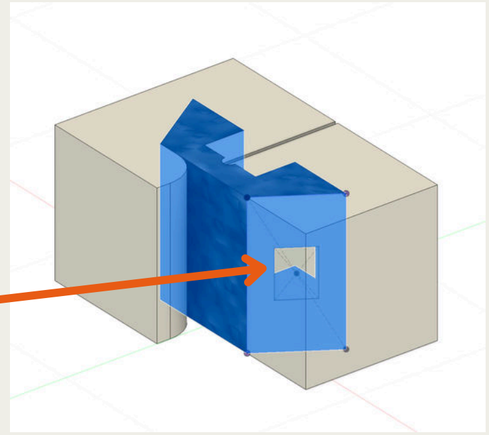
How do I bond the two materials?

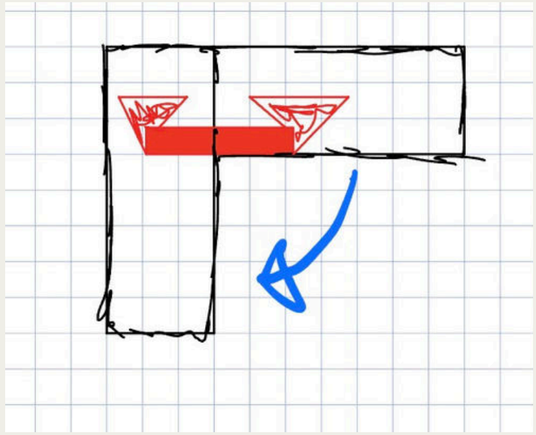
Cross Bridges?



NO, to small

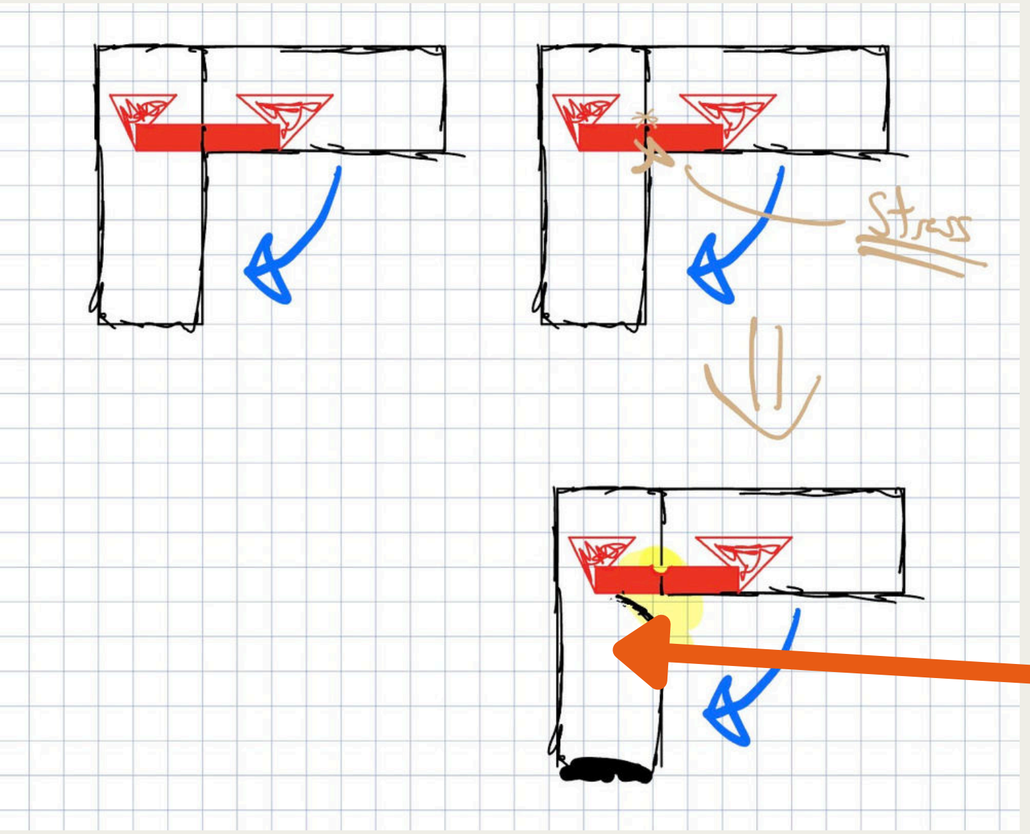
Hole in flexible section to complete restraint.





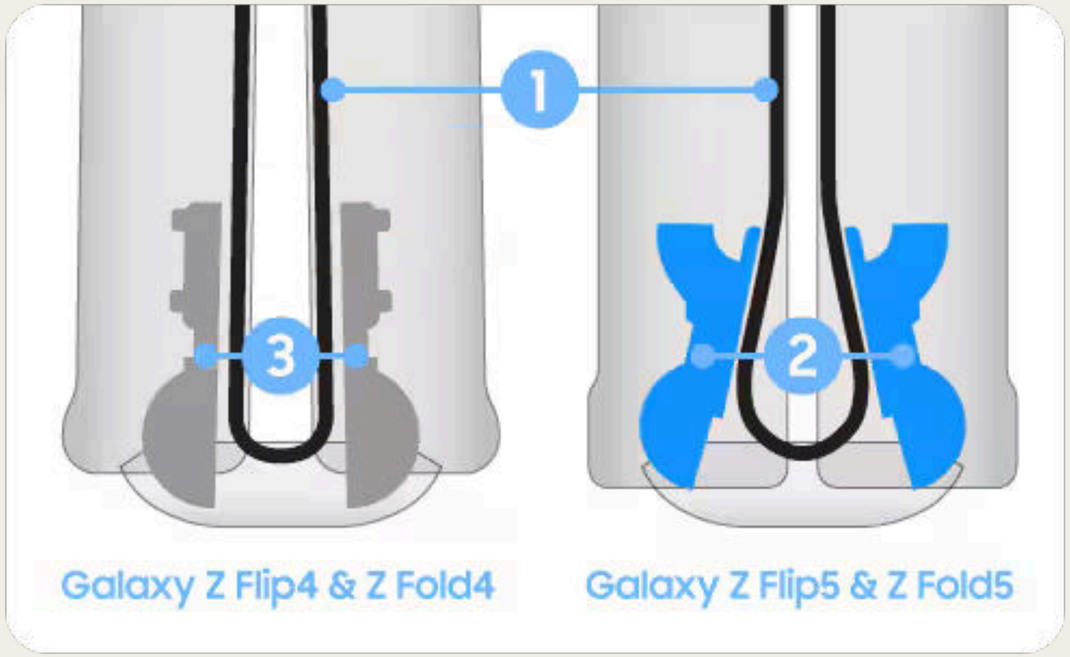
Geometry (only hope)

Idea Generation



Modify geometry to reduce stress build up at single point

loop cut out



"Loop" cut out Inspired by a video I watched on foldable screens, which also try and prevent wear from repeated use.

Material Selection

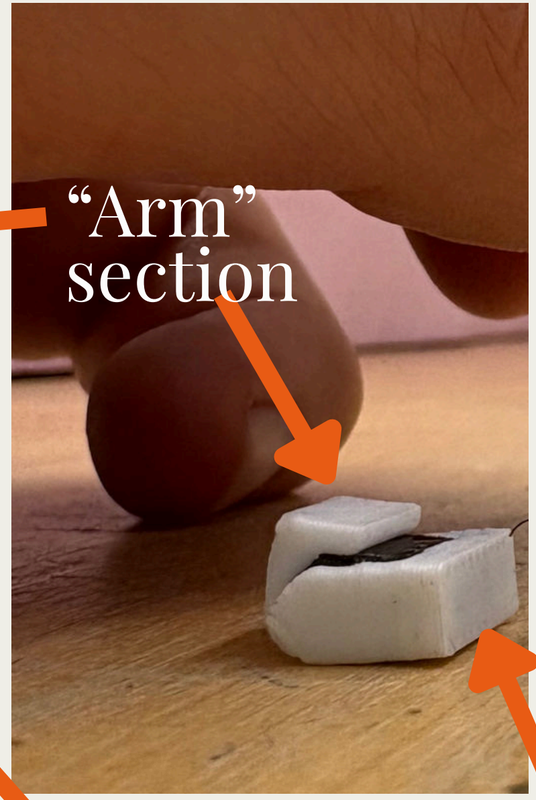
Rigid material was needed, **PLA** was the obvious choice due to its reliability and affordability.

For **flexibility**, **Overture TPU** excelled in all relevant material properties, while also being available.

Property	Overture TPU (Standard)	Bambu TPU for AMS
Shore Hardness	95A	68D
Est. Flexural Modulus	~75–100 MPa	~450–600 MPa

Hinge prototypes

“frames” side



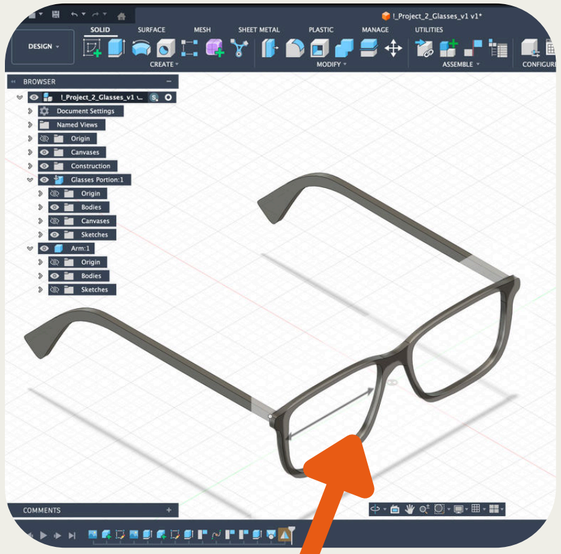
“frames” side (always the smaller part in these prints)

Printed with the “frames” side down.

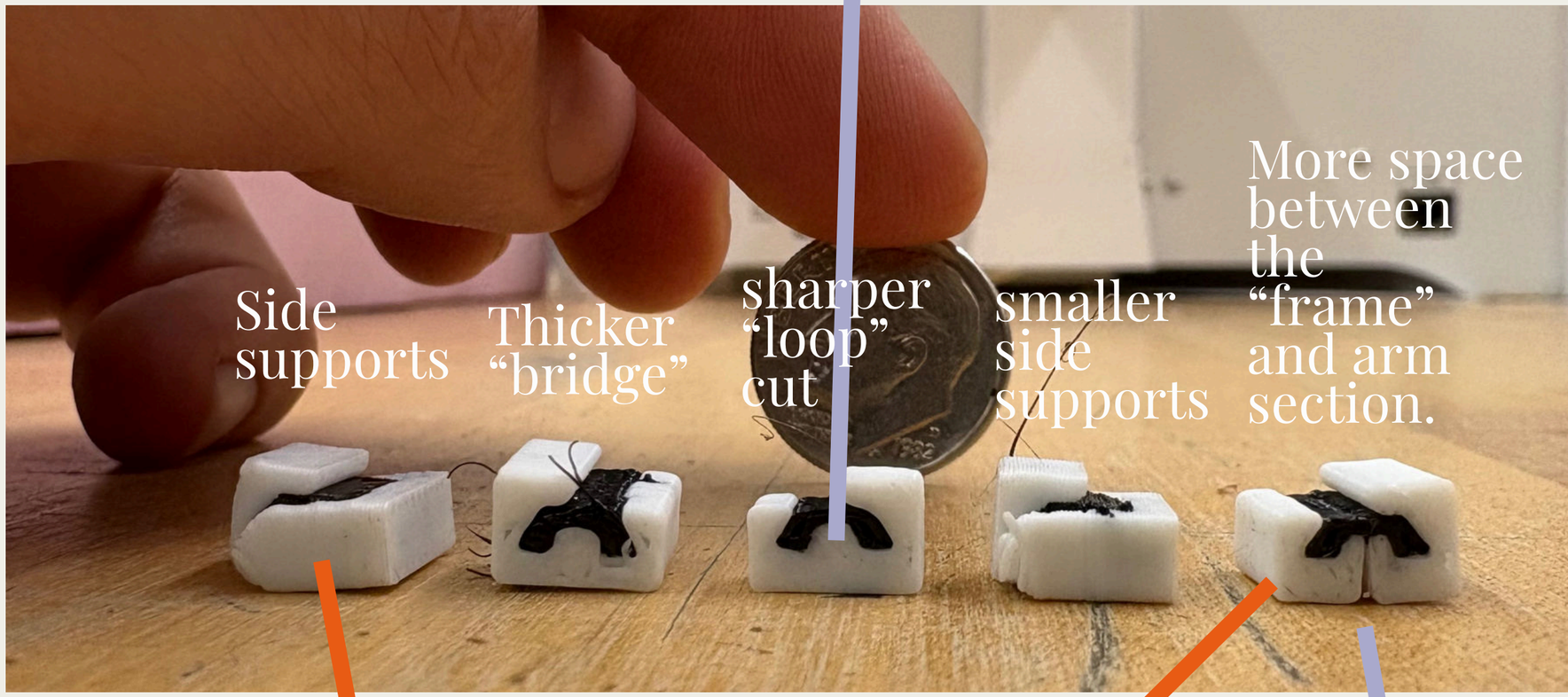
needed to **break the fused “frames” and “arms”**, but the **hinge functioned well.**

Hinge prototypes

Note “fused” parts, from very little space between parts in CAD



“frames” side

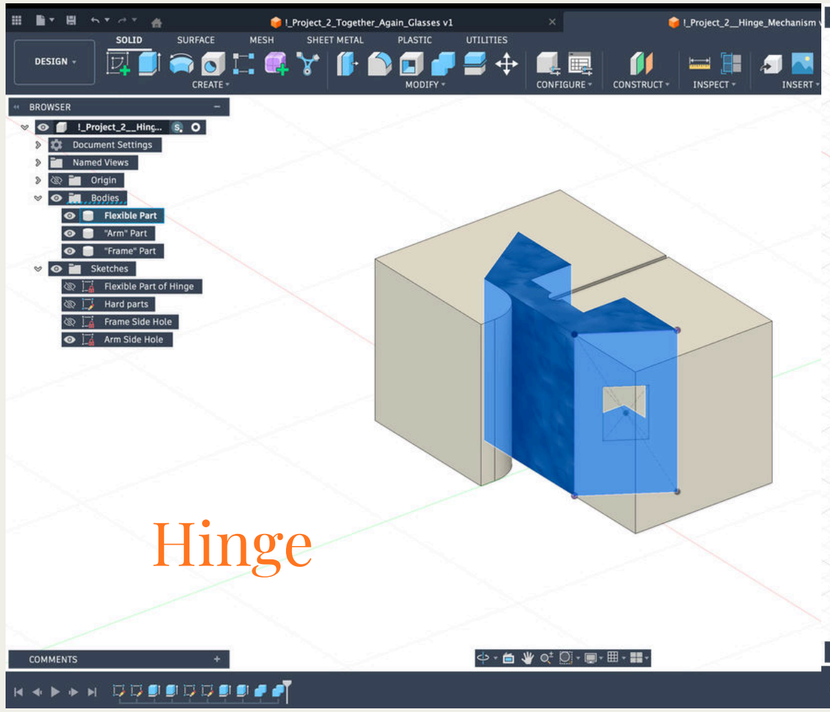


Combine “side supports”(only well functioning hinge) print orientation with “more space…” to create optimal functional hinge.

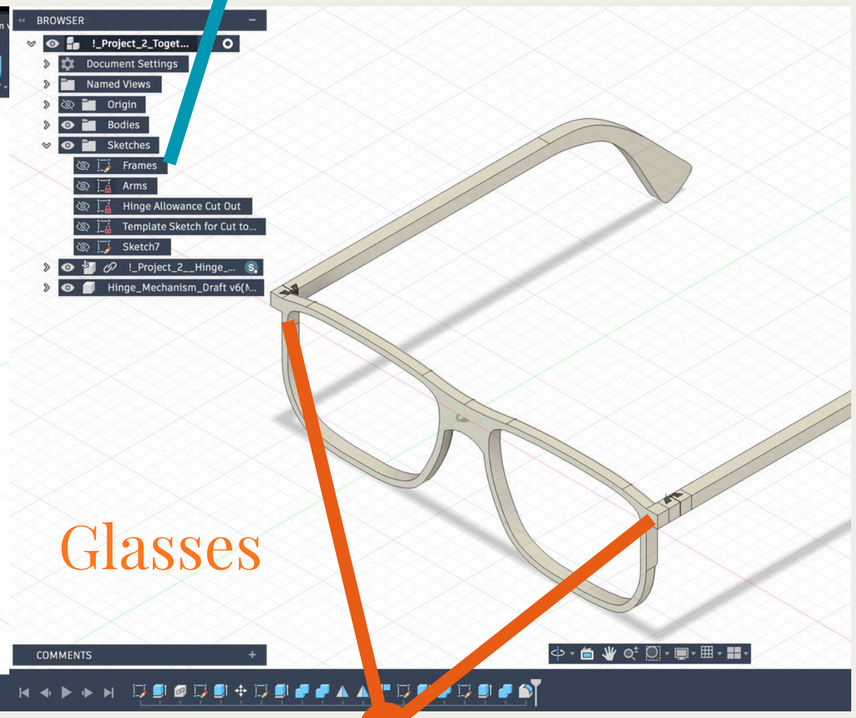
only not fused

Final CAD

Frames sketches not fully restrained due to Spline Use



Hinge



Glasses

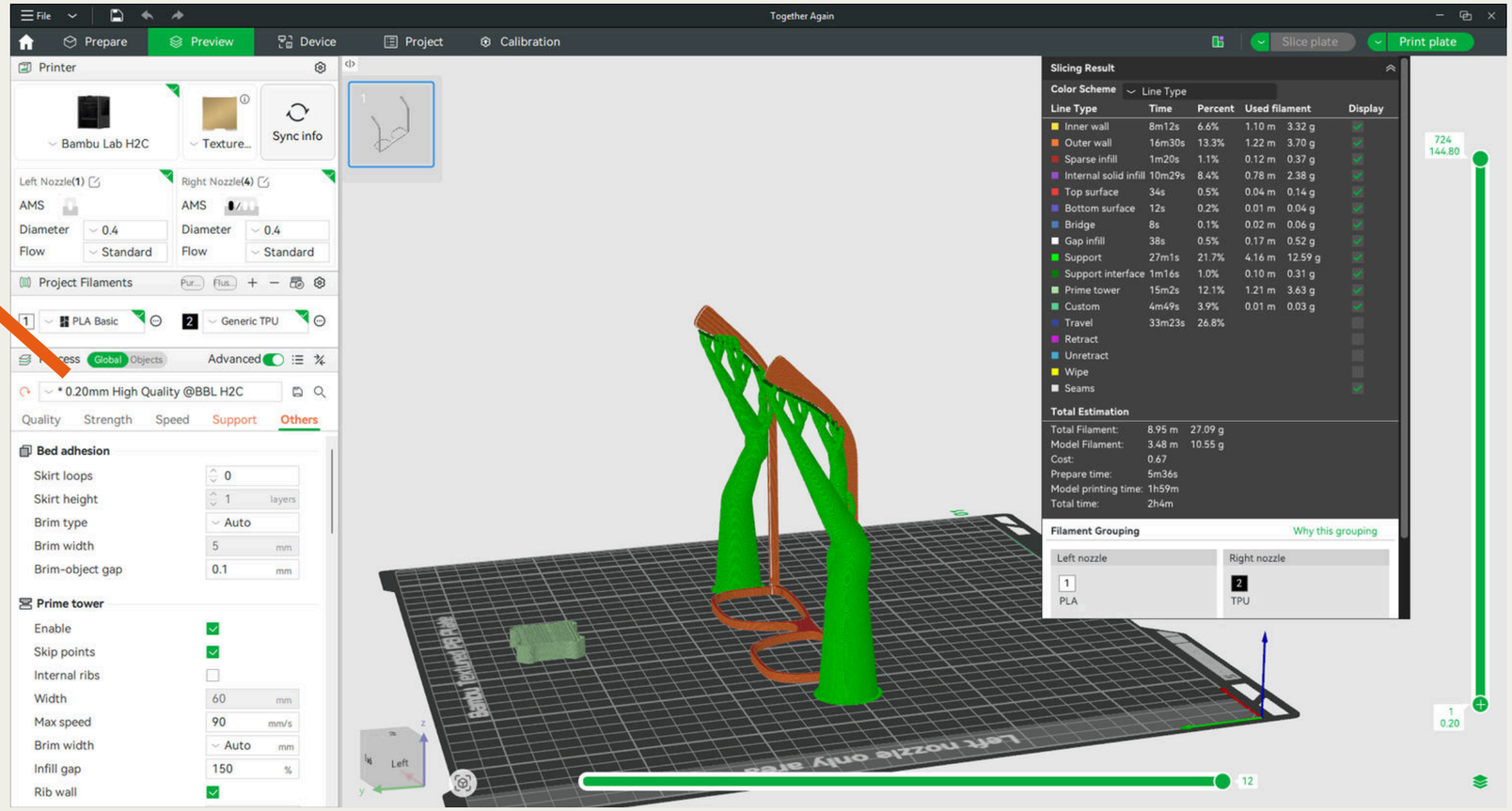
No filets on flat printing side; minimal use elsewhere for aesthetics.

Note the **offset hinges**, allowing both arms to fold flat

Slicer

Frames sketches not fully restrained due to Spline Use

“High quality” print mode used



Always Together Glasses

ME 227, Winter 2026

Sebastian Esteva

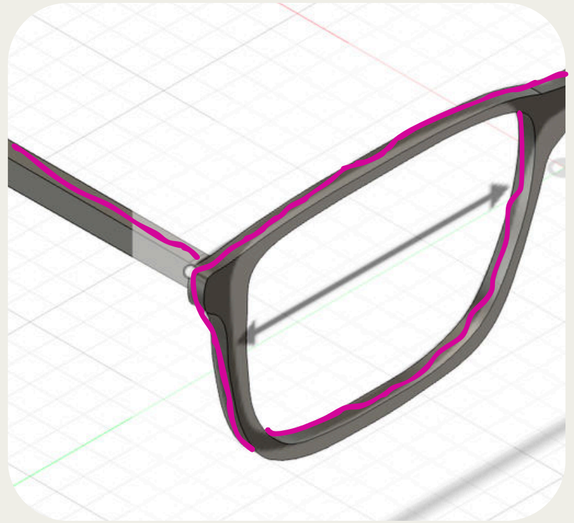
1) Always **double your timeline** when working with **new equipment**; the new H2Cs caused me many issues.

2) **Small scales** make every princple of 3d design (print oreiantino, slicer settings, ect) WAY **less tolerant** for mess-ups.

3 Learnings

3) When CADing at small scales, **better results** come from using **multiples of** your **layer thickness** or **nozzle size** (i.e. 2 or 4 mm).

1) Try running TPU down the center of the print for strength, hinge bonding, and aesthetics.



2 Future Improvements

2) Try the beautiful hinge in the image; I discovered it only at the project's end!

Metal 3d printed glasses