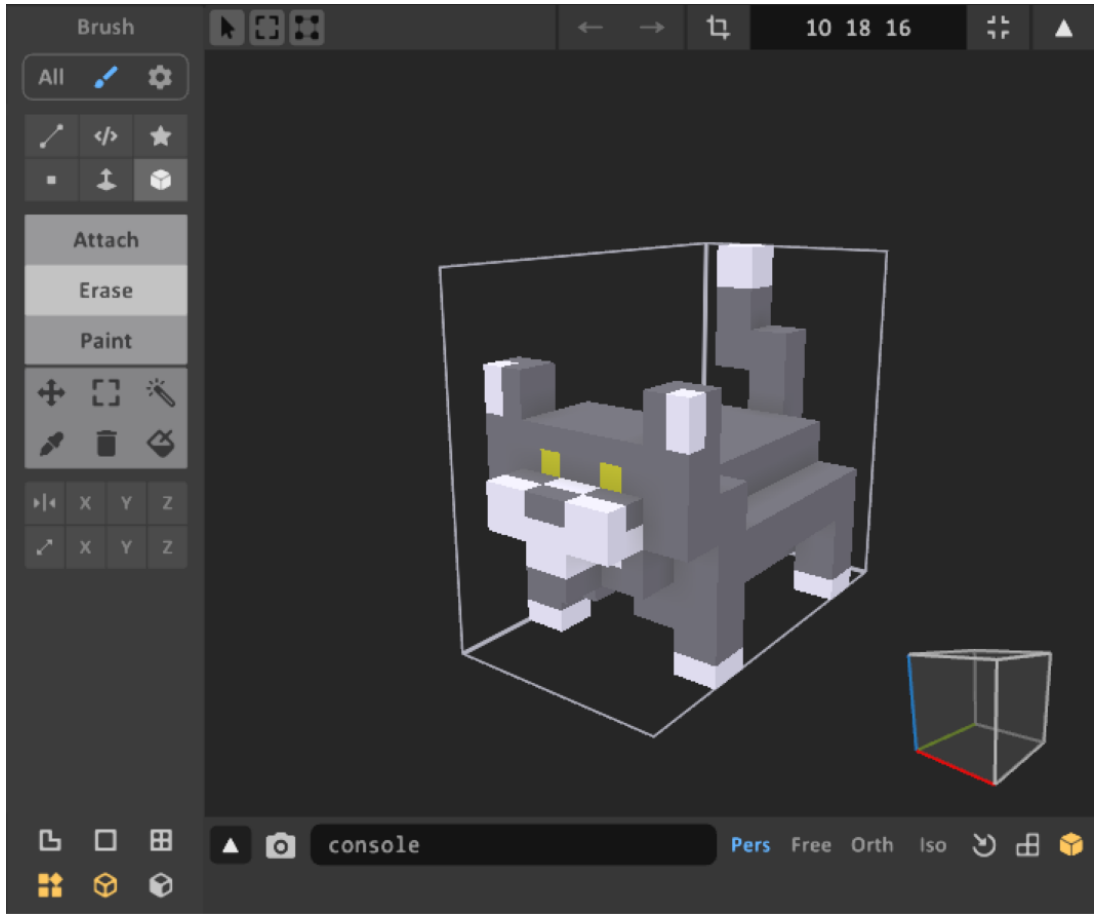
ChIPs – Polycube (Voxel) Construction Set

Polyominoid (Panel) based 3D printer optimized building blocks

Liao Choon Way / Independent Engineer

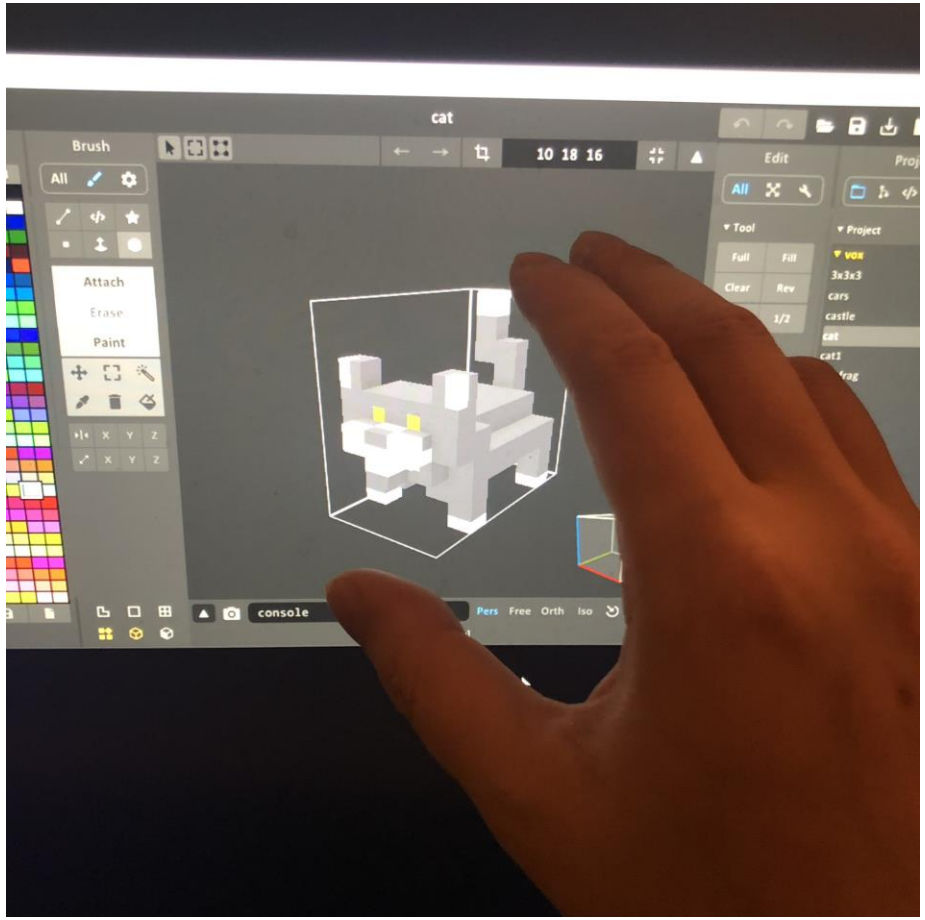
Long story short

- We want to get from here



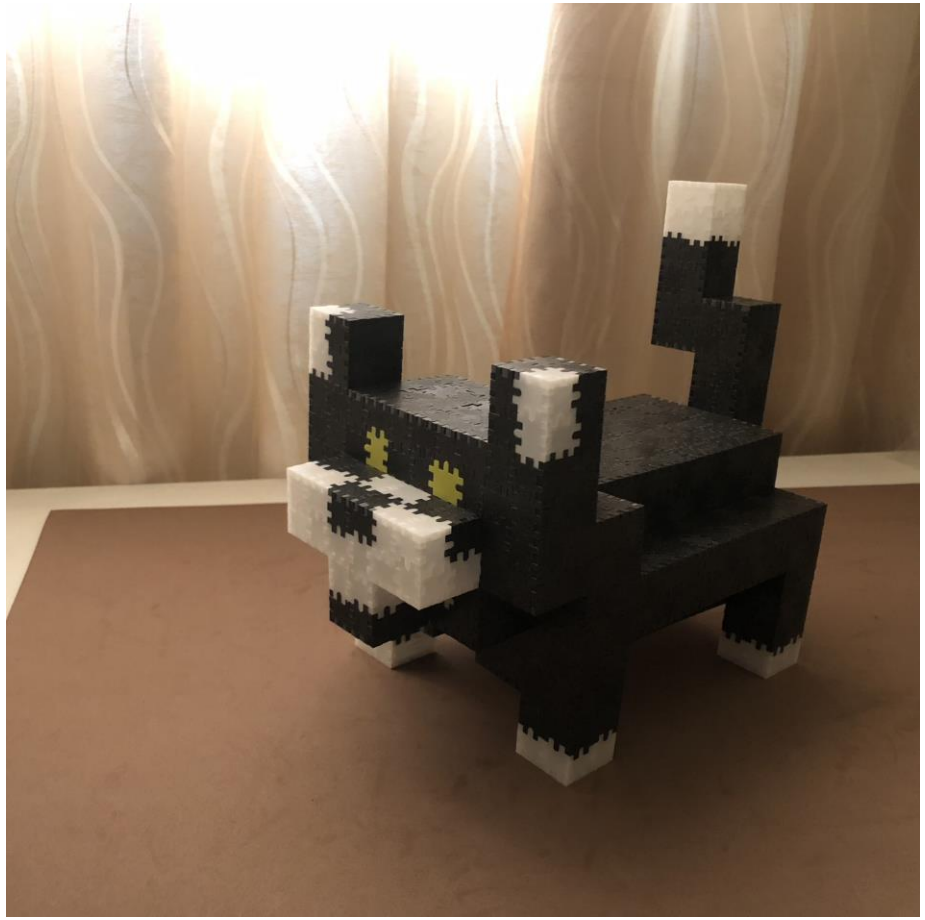
Long story short

- We want to get from here
- Voxels on computer screen, can see cannot touch.



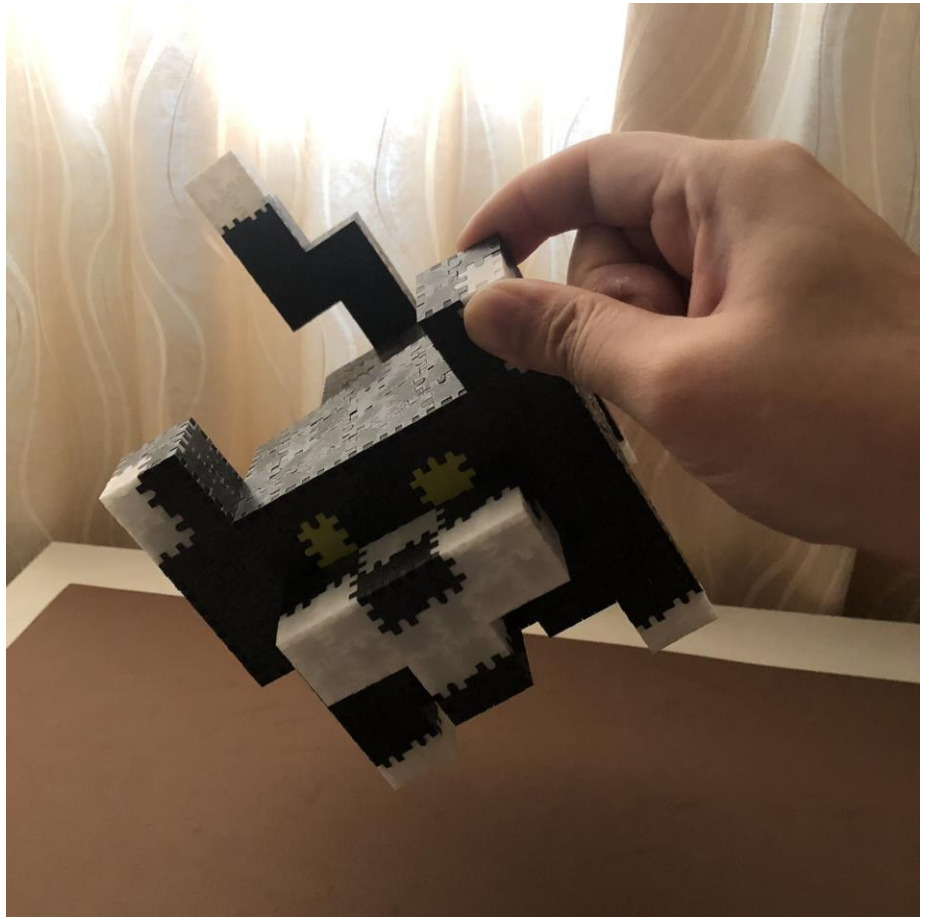
Long story short

- To here



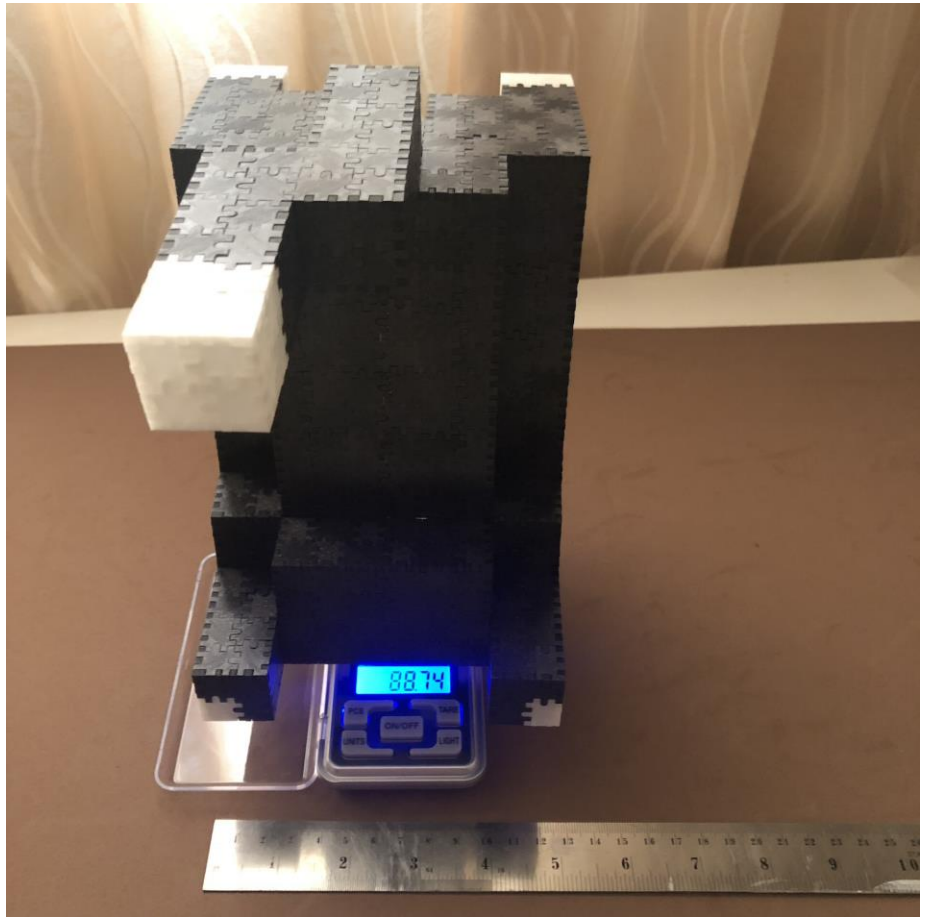
Long story short

- To here
- Physical, touchable object



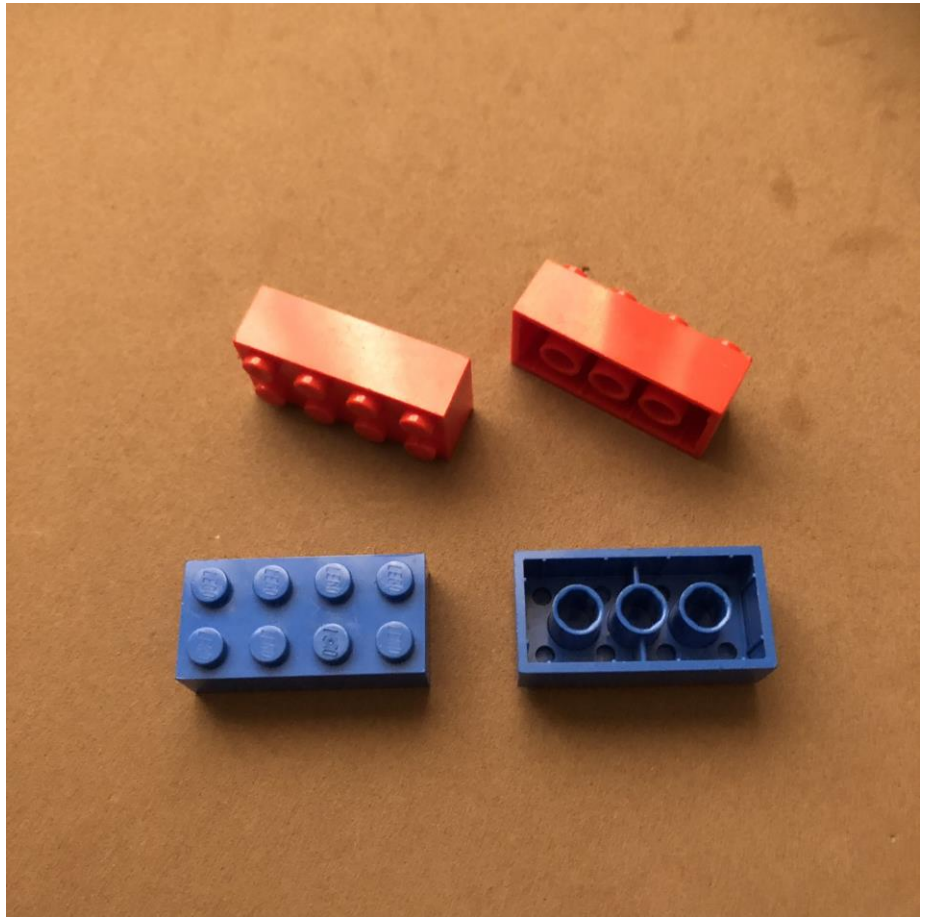
TL; DR.

- To here
- Physical, touchable object
- 125mm(W) x 225mm(L) x 200mm(H)
- PLA material / 88.74g.



Why not use LEGO® blocks?

- Top Studs / Bottom Anti-studs based building block



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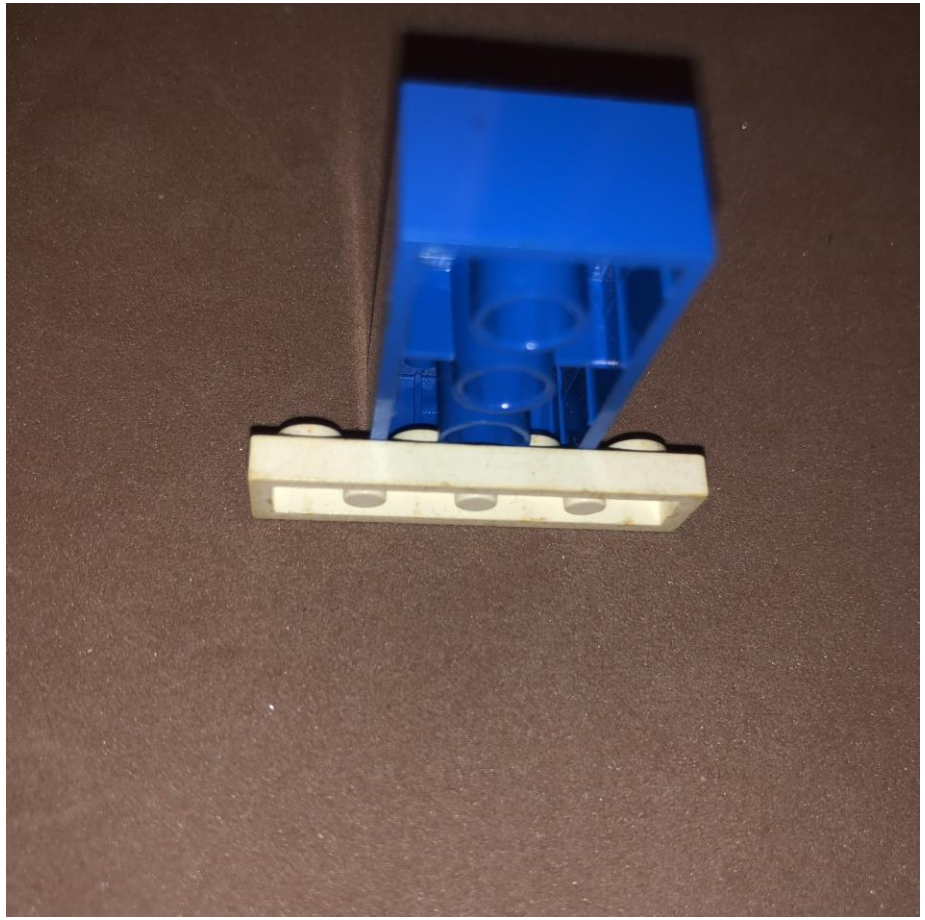
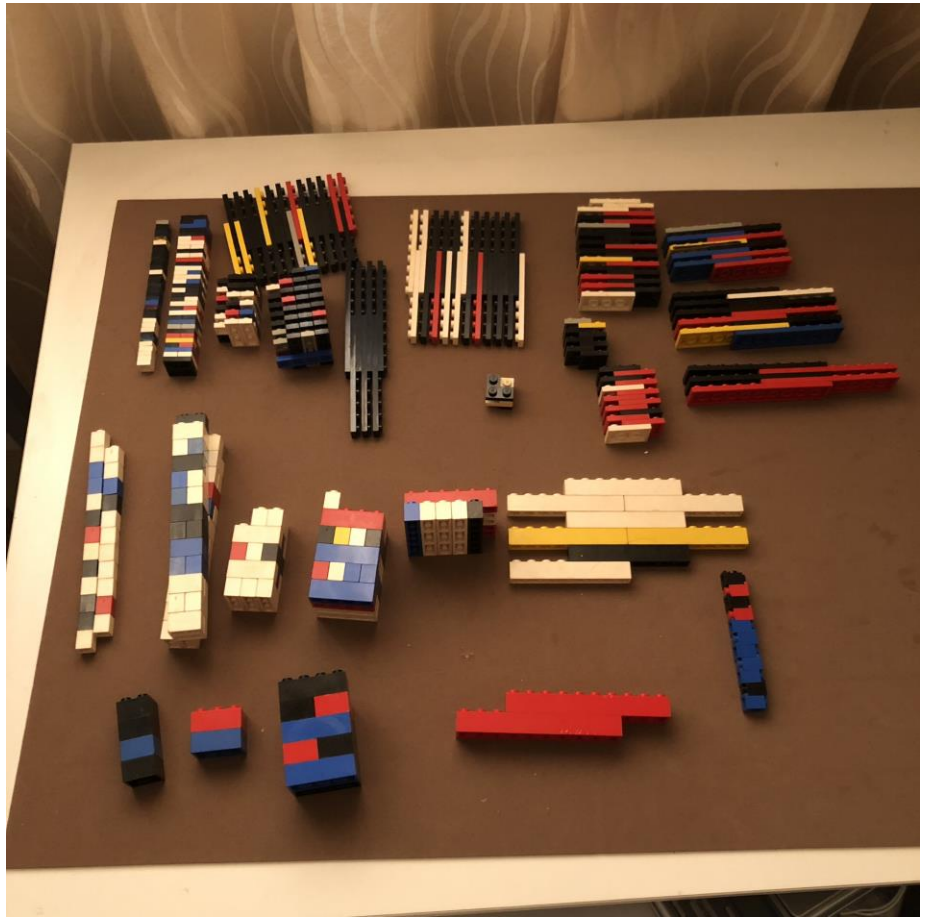
- Top Studs / Bottom Anti-studs based building block
- Connection achieved through an interference fit.



Why not use LEGO® blocks?

- Too many types of pieces creates a logistical burden and unnecessary design constraints.



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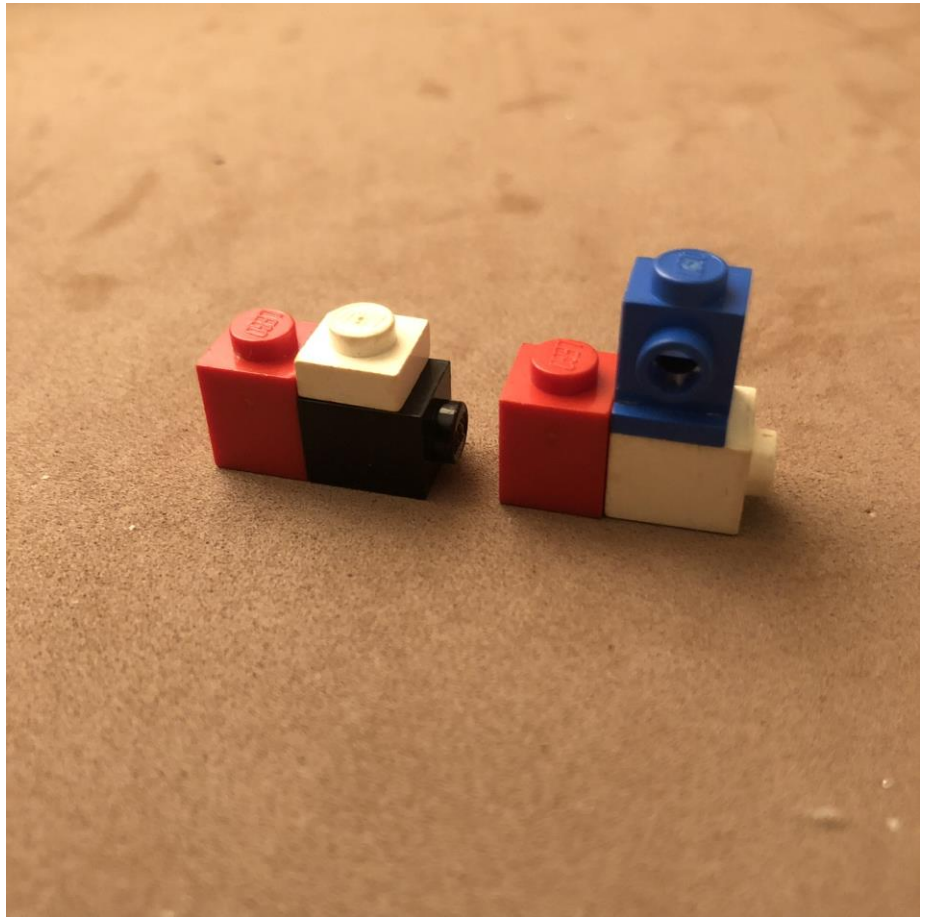
- Not orthogonal, 6:5 height to width ratio. Plates are 1:3 block height.



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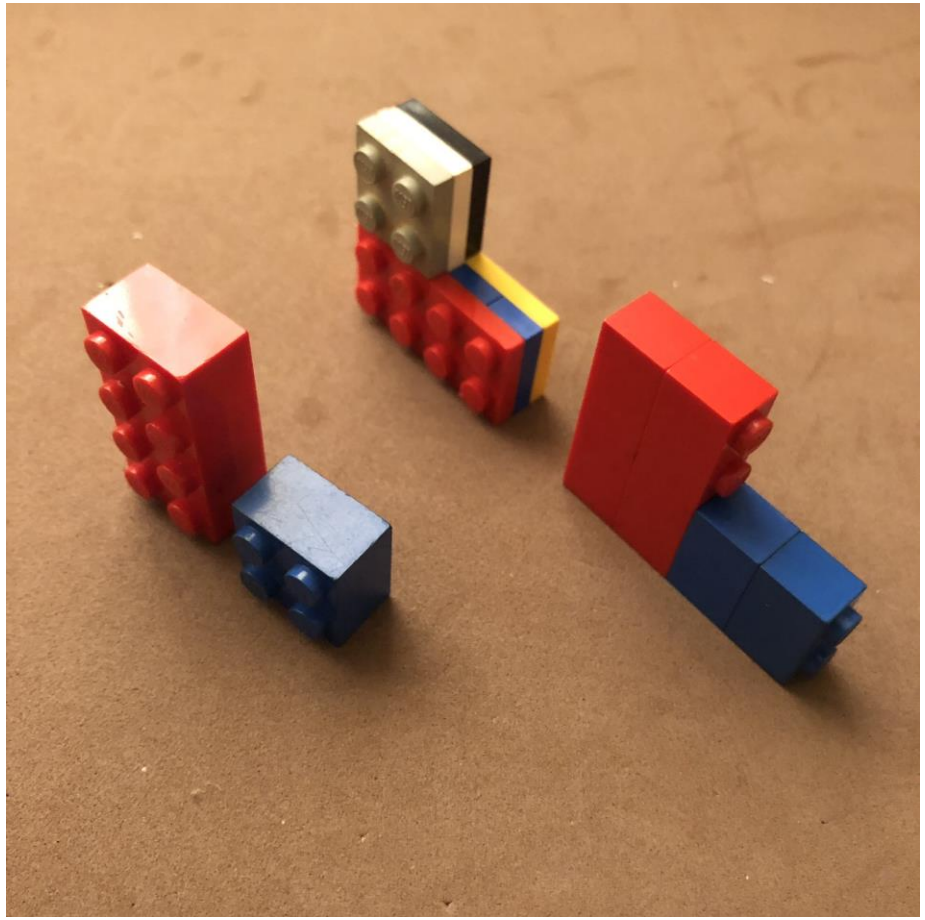

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- Not orthogonal, 6:5 height to width ratio. Plates are 1:3 block height
- Building sideways is different from doing it vertically, introducing complications when modifying existing models
- Making the smallest perfect cubes requires a lot of bricks. (6x6x5).

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- 3D printing can be done in a home environment.

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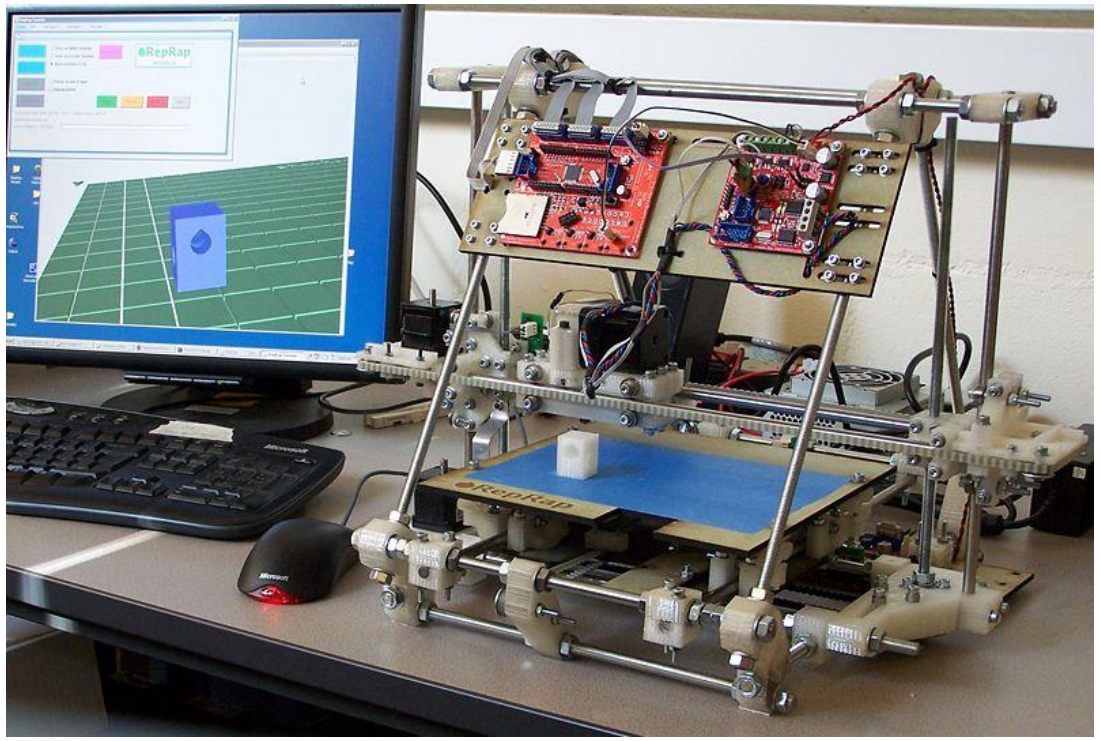
- FFF (Fused Filament Fabrication) is a different technology from plastic injection molding with different design rules - make full use of it!.

Why a clean sheet design now?

- Open-Source has come to Hardware. (Reprap Project in 2009)



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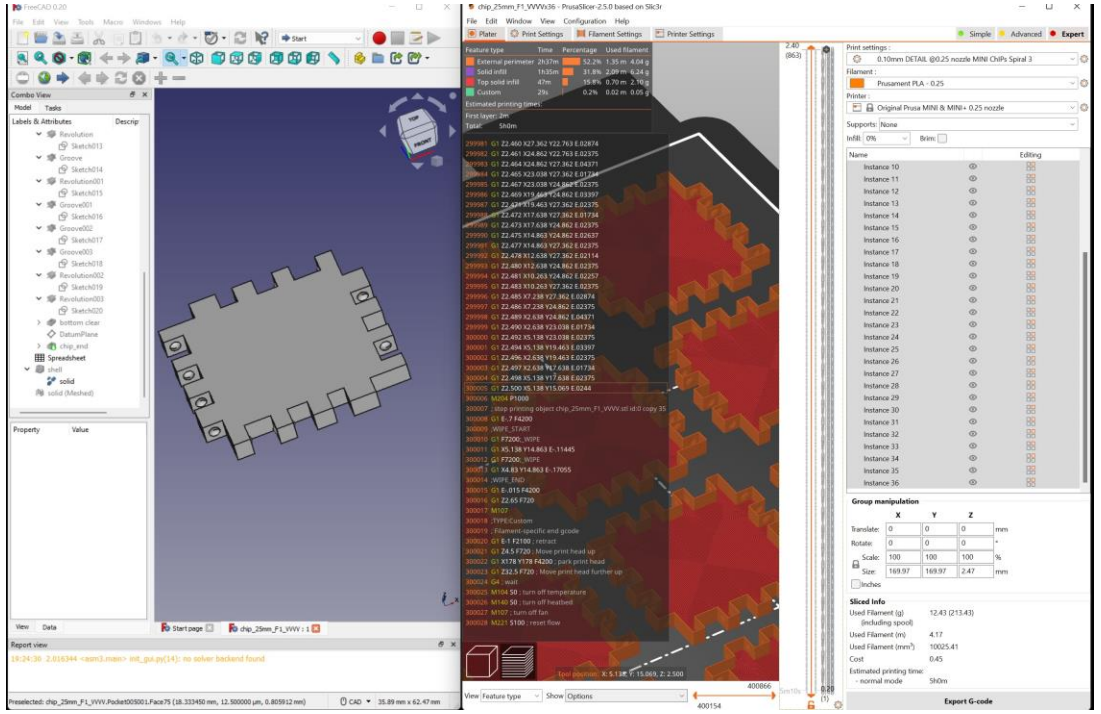
- FreeCAD/Slic3r toolchain is usable.



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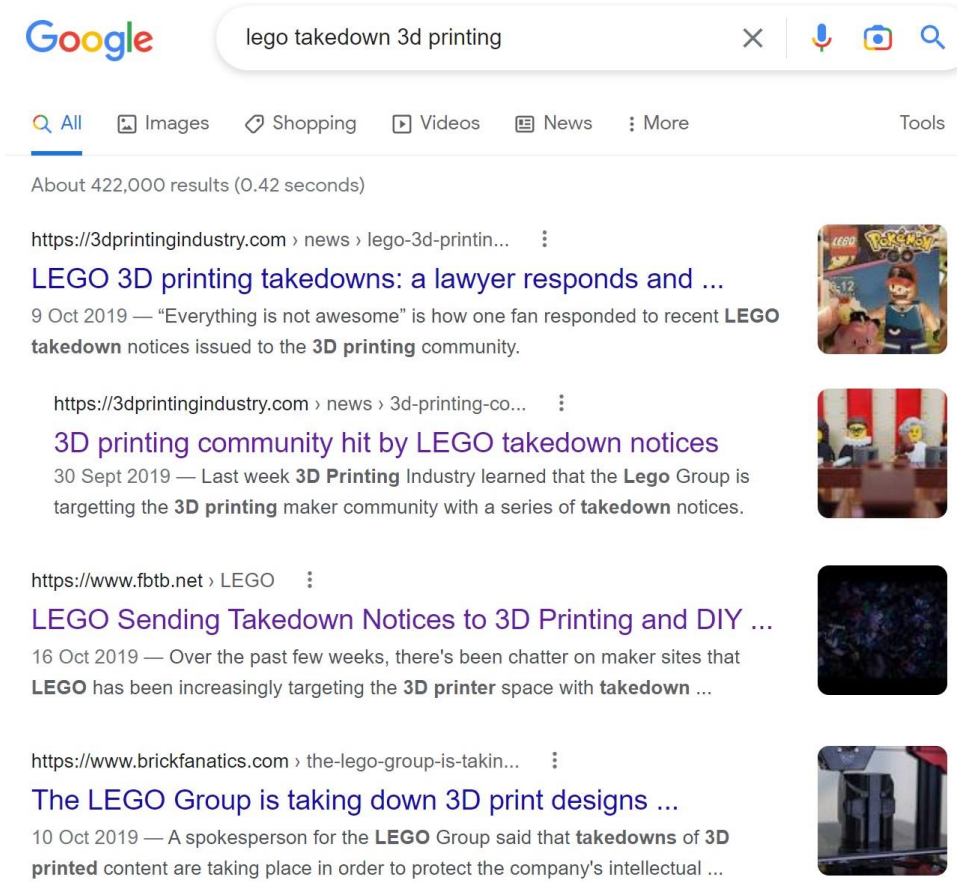
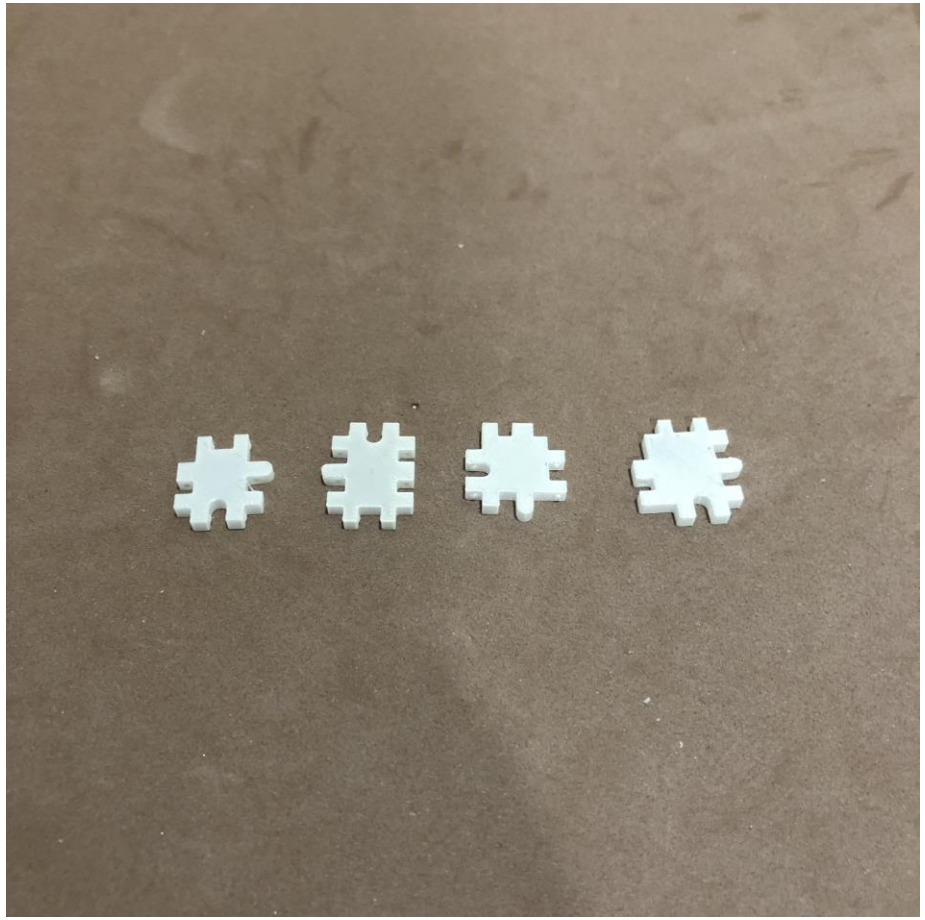
- Open-Source has come to Hardware. (Reprap Project)
- FreeCAD/Slic3r toolchain is usable.
- LEGO® has issued takedown notices in the past.



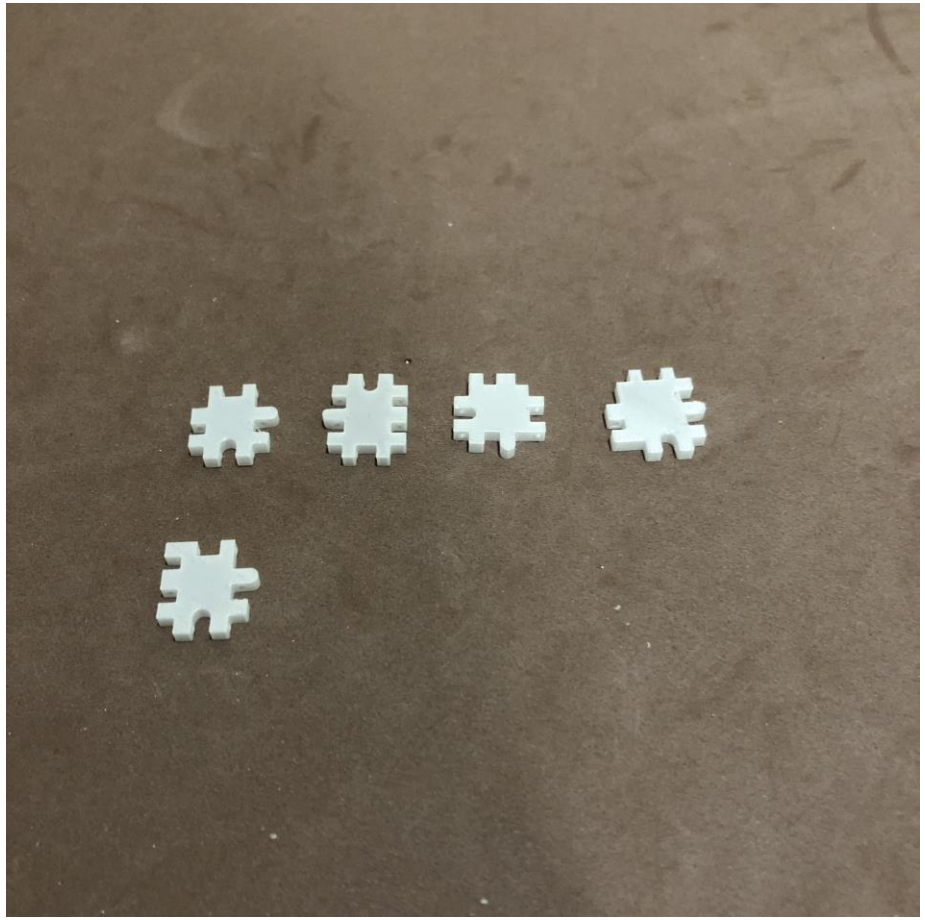
Introducing ChIPs

- ChIPs – Choonway's Interlocking Panels – Only 4 different parts to create any Polycube/Voxel Shape



Introducing ChIPs

- ChIPs – Choonway's Interlocking Panels – Only 4 different parts to create any Polycube/Voxel Shape
- 5th Part is optional, only if sharp corners are desired.



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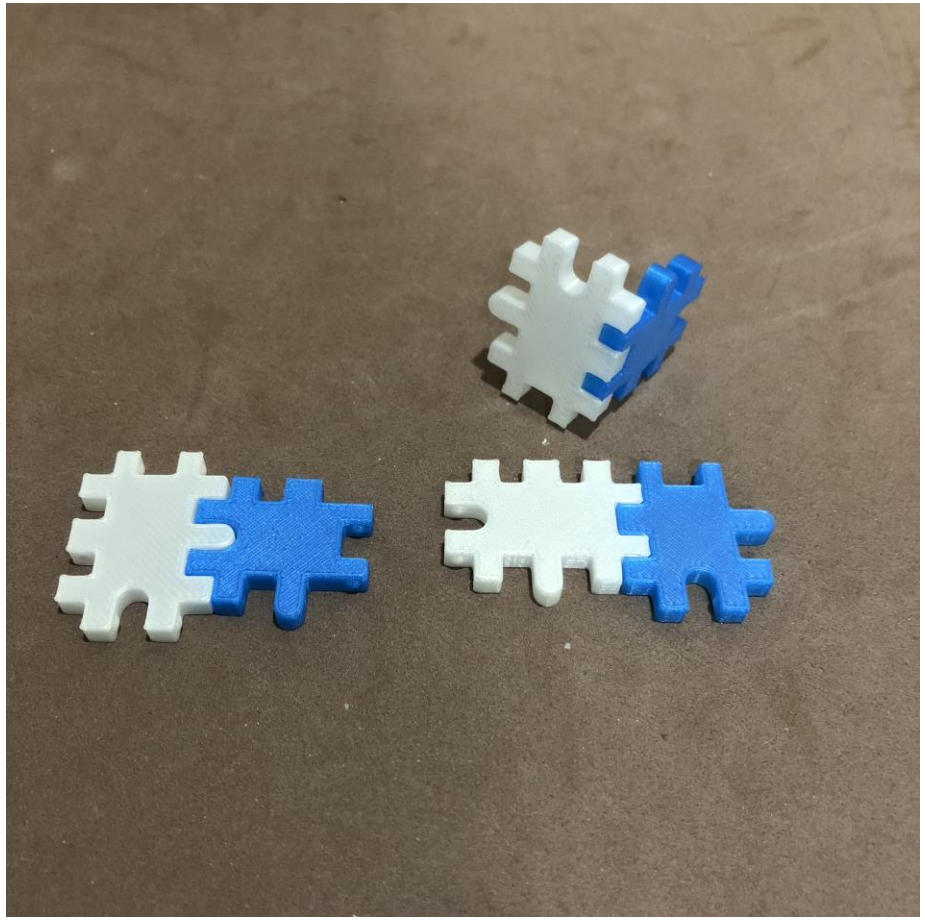
- 3 kinds of orientations for connections



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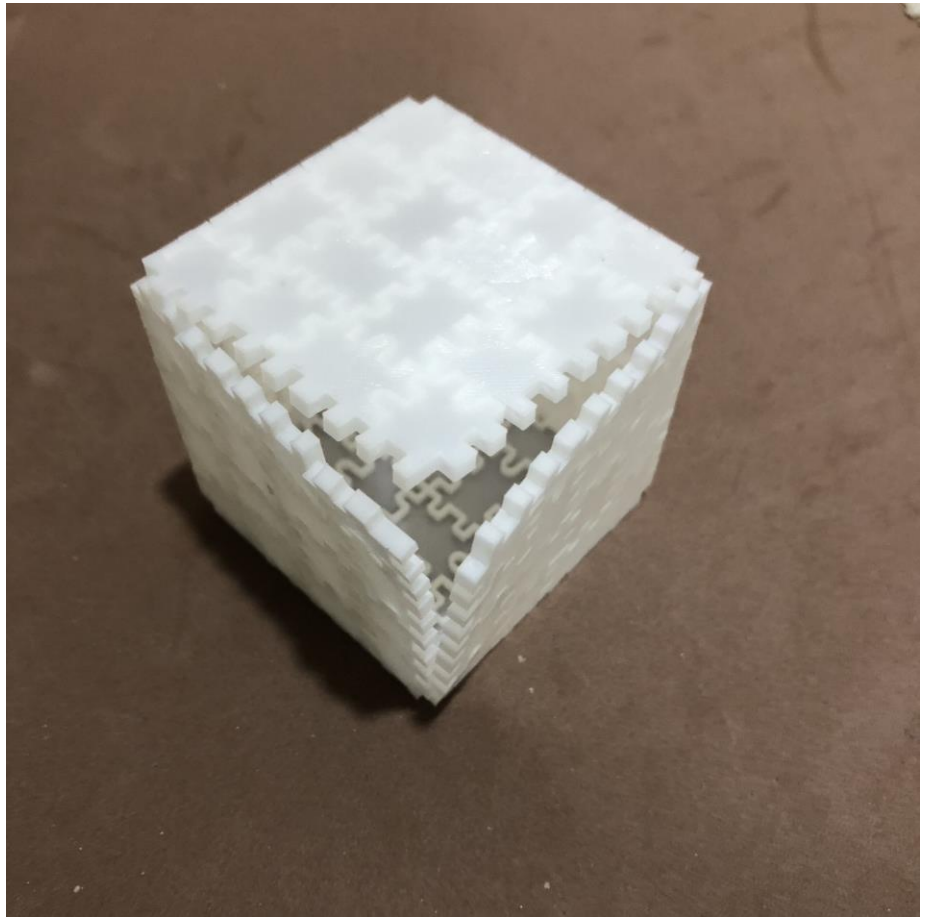
- Bumps and dents on edge connectors lock pieces together
- Connectors are keyed to reduce human errors
- 3 kinds of orientations for connections
- Fasteners function like 3D zippers

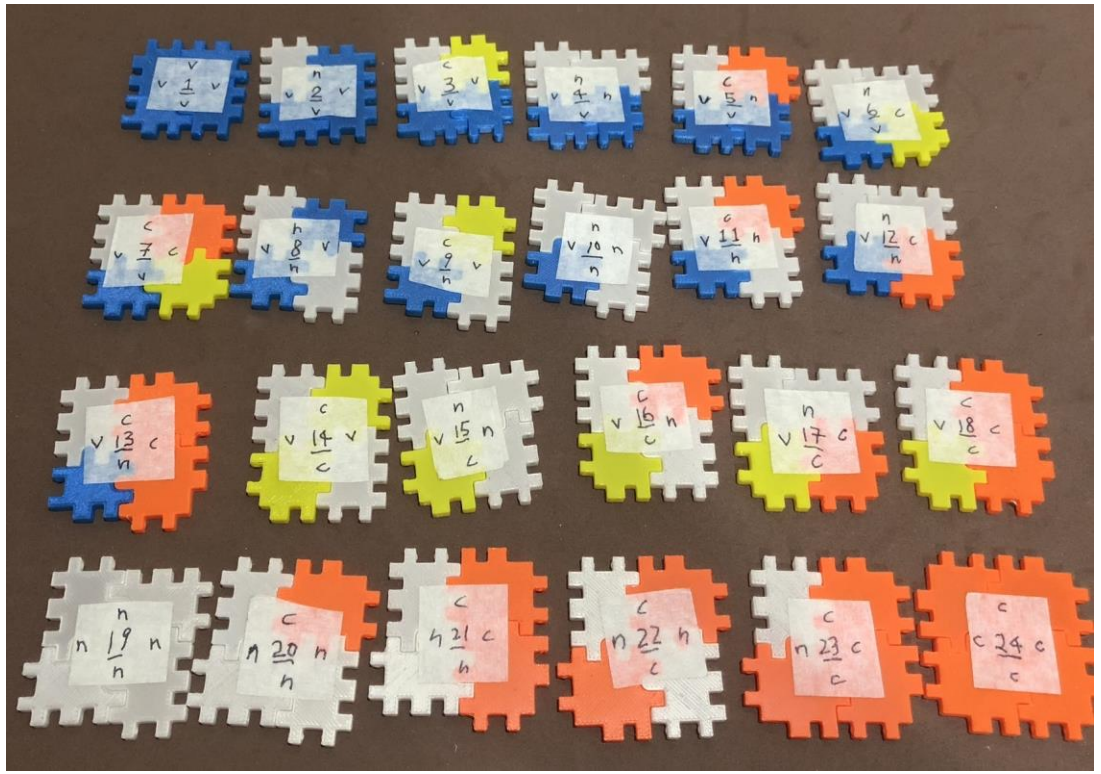


Build Techniques

- Intuitive, Edge following method
- Suitable for fully manual construction
- Memorize 12 fragments.

Build Techniques

- Algorithmic, face method
- Suitable for automation
- Table lookup of combination of convex, neutral, concave edges of each face
- 24 unique faces.



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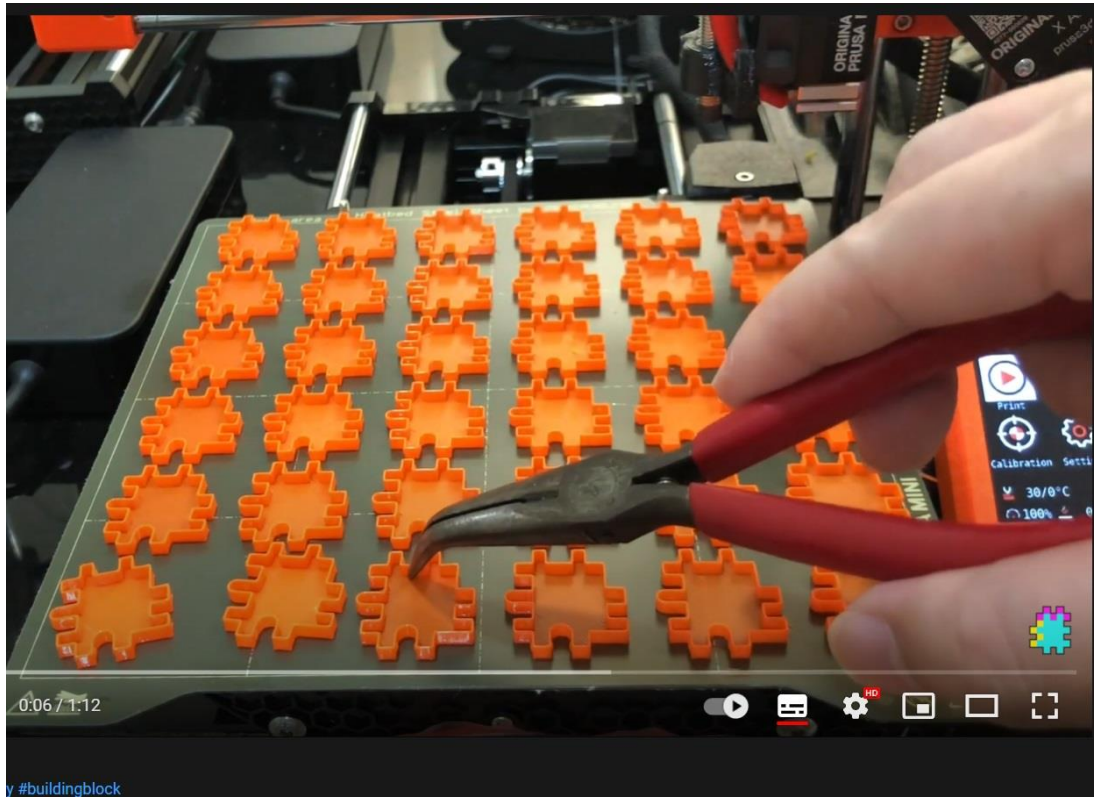
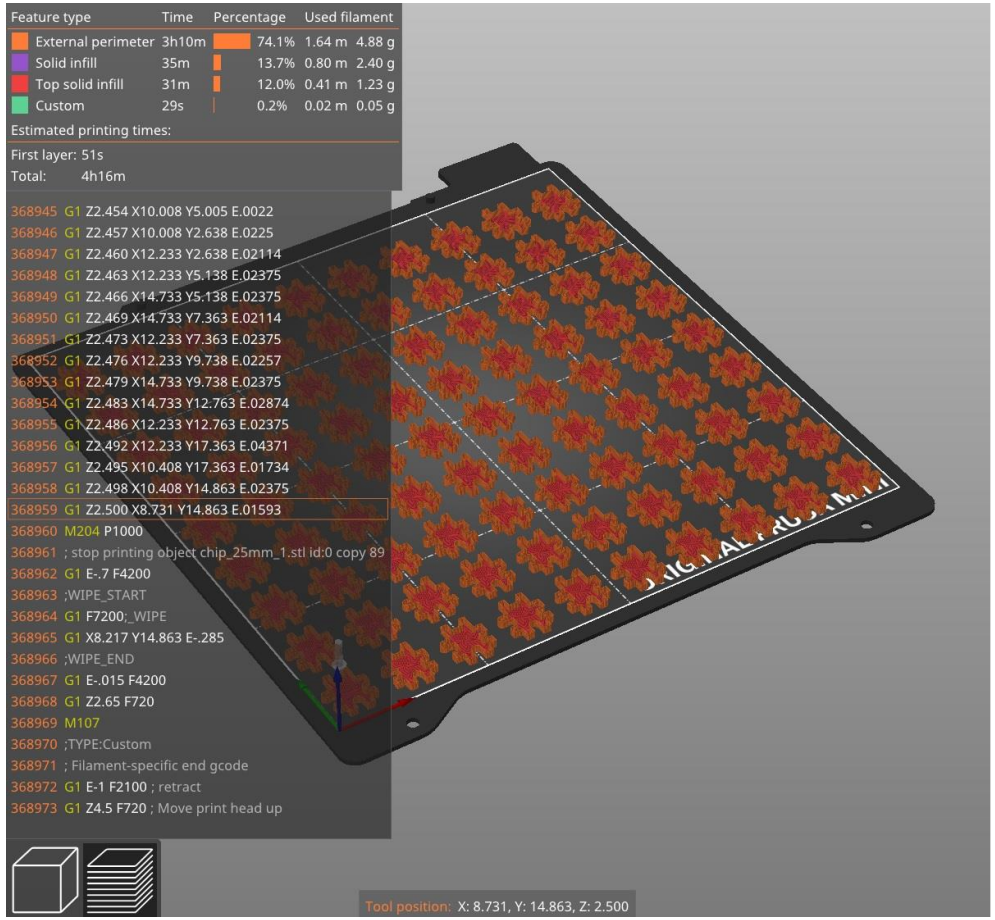
- 3D printable and usable without postprocessing.



Introducing ChIPs

- 3D printable and usable without postprocessing
- Prusa Mini Printing times (25mm variant)
  - Panel 1, 90 pieces, 4h16min
  - Panel 2, 80 pieces 4h36min
  - Panel 3, 72 pieces 3h46min
  - Panel 4, 64 pieces 3h50min



Introducing ChIPs

- ChIPs is Open Source, licenced under CC-BY-4.0
  - Can Share
  - Can Adapt
  - Must Attribute
  - No Additional Restrictions
- FreeCAD design files / STLs etc. available on github.
- https://github.com/choonway/ChIPs

Try it out yourself

- There should be a sample kit given to you when you have registered.
- Follow instructions to try it out
- https://gc2022.choonway.com

The End

- Thank you for your time.