



# Quadruple Portal Desk Toy



Ada Cohen

[VIEW IN BROWSER](#)

updated 14. 5. 2023 | published 14. 5. 2023

## Summary

Version 4 of my portal desk toy. Four independent elements appear to pass through the void.

[Toys & Games](#) > [Other Toys & Games](#)

Tags: [fidgettoy](#) [illusion](#) [difficultprint](#) [desktoy](#) [portal](#) [toy](#)  
[magic](#) [fidget](#)

Just when I thought I was out, the portal pulls me back in. This is the most ambitious portal illusion toy yet, with four separate, off-axis elements, all printable parts (except for the mandatory grease and CA glue), and guaranteed to give you a migraine during assembly, or your money back!

This is a very involved printing and assembly process. If you want a much easier (but admittedly less cool) version of the same illusion, check out the other models in my [magic portals collection](#). This is by far the most difficult version.

## New Features

- Four separate elements
- Decoupled nut that allows infinite movement
- Hollow nut that makes the illusion even more confusing
- Geared elements which rotate on separate axes

- Unequal arm spacing to offer a larger unobstructed view
- More modular design to make it easier to tweak settings without reprinting the larger pieces

**Note:** I made a few last minute revisions between assembly and uploading to address some minor issues. I filleted some annoying sharp edges, which should have no functional impact. I also corrected a tiny dimensional error in “Cap 1” which made one of the screws a little bit prone to becoming dislodged.

## Assembly Requirements

- CA glue
- Any general purpose lubricating grease compatible with your print material. I used Super Lube 21030 on PLA
- Patience

I do **not** recommend using CA glue accelerator on this project, because you're going to want some working time to make adjustments.

## Printing requirements

- Minimum build volume: 120x120x245 mm
- A well-calibrated printer

You may be able to scale this model down to print on a smaller printer, but you will likely need to do some XY compensation work to make the nut loose enough, and to make sure the gears and caps are able to slide easily on their rails.

## Printing

### **Note**

This is a difficult print. The screw pieces in particular can be very finicky, because they will tend to wobble. A little bit of wobble can be fine; it will mar the surface finish just a bit, but only at the top, where it's less noticeable. Too much wobble, and the tops will just turn into a mess. See below for tips.

I recommend using the “Quadruple Portal Toy.oriented.3mf” file for printing. This has all pieces in the recommended orientation, and the black pieces separated to their own plate. You can delete the “license” object.

The screws should be printed with a layer height of 0.16 mm or lower. When printing the screws, make sure **not** to print them with infill. Instead,

turn up the perimeters so that they print solid. Grid infill or similar will cause the printer to make fast moves which are likely to cause these to fail. If you're having trouble printing these, you can try adding tree/organic supports to support them in a few places. You shouldn't need a lot of support; just enough to keep the part still. You can also try just turning the print speed way down, which will make them wobble less.

## Filament

I printed the base and outer screw in black PLA+, and the inner screws in AMOLEN Dual and Tri-color silk. You can do them in solid colors instead, but you won't get that cool color changing effect.

I also used a filament swap to print part of the base “arms” in transparent PLA. This is not required, but it should help dispel the misconception that the strands are “pulled through” the arms.

## Assembly

1. Snap the **gear** pieces onto the bases of the screws. The pegs are differently sized, so each **screw** will only snap onto one gear.
2. Apply some grease to the grooves on **gears**, as well as the gears' teeth.
3. Place the **base** down on your work surface and place the gear sides of the screws into the cavity. Don't worry about lining the gears up yet.
4. Thread the **nut** over the **outer screw**. The nut should automatically slide down to the bottom. If it doesn't, check to make sure you don't have any globs inside the thread. If it's just tight, reprint it with -0.2 mm XY compensation.
5. Screw the **caps** onto the **screws**. You should be able to do this **gently**. If they are too tight, reprint them with -0.1 mm XY compensation (incrementing as necessary). These do **not** need to be tight, and the screws are fragile. At this point, the screws should be standing up, and **caps 1-3** should be inside the **outer cap**.
6. Grease the grooves on the **caps**
7. Place the **top** onto the **base**, carefully lining up so that the arms go into their sockets, and so that the **caps** go into the cavity. Do **not** push all the way down. Just get to the point that the caps clear the rim of the cavity.
8. Now you need to move the screws around so that the grooves on the **caps** and **gears** line up with the rims on the **base**. Refer to the cover photo and/or the “Quadruple Portal Toy.assembled” 3mf file. To see which goes where.
9. Push the **top** down some more until it makes contact with the **caps**. Carefully flip the whole piece over, so that the top is on the work

surface. Now you're going to move the screws around some more until their grooves snap into place with the rims on the top. Make sure that they stay lined up with the rims on the base as well.

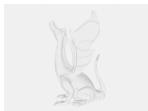
10. Push the **top** down just a bit more, then rest your hand on it to keep it in place, and make sure that everything works properly when you move the nut up and down. If it seems very tight and doesn't want to turn, first make sure that the gears and caps are aligned, and then try backing the top off a little bit. Small adjustments here.
11. Did you just absolutely hate steps 7-10? I'm so sorry. We're going to do them again, now that we know everything is working. Carefully flip the toy back over and remove the **top** from the **base**.
12. Apply a small amount of CA glue to the the **sides** of each arm, near the tips. Don't bother putting glue on the tips of the arms, since those may not actually need to make contact with the sockets.
13. Repeat steps 7-10, adjusting until you can move the nut smoothly, but so that the screws don't dislodge. (This is why we don't use CA accelerator; we need some time to tune this).
14. Allow the CA glue to set.

## Model files



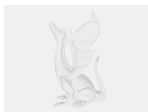
### quadruple-portal-toyoriented.3mf

☐ All parts oriented for printing



### quadruple-portal-toy.step

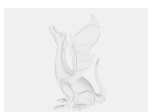
☐ Generic CAD file for modification in most CAD software



### quadruple-portal-toyassembled.3mf

☐ All parts in their assembled position, for reference

## Other files



### quadruple-portal-toyx\_t.zip

☐ High fidelity CAD for modification in Shapr3D, SOLIDWORKS, Onshape, etc.

# License

This work is licensed under a  
**Creative Commons (4.0 International License)**



**Attribution-ShareAlike**

---

- ✗ | Sharing without ATTRIBUTION
- ✓ | Remix Culture allowed
- ✓ | Commercial Use
- ✓ | Free Cultural Works
- ✓ | Meets Open Definition