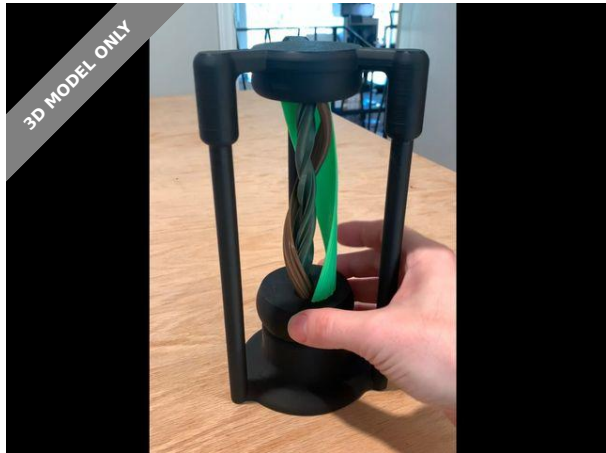




Botanical Portal Desk Toy



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updated 4. 3. 2023 | published 4. 3. 2023

Summary

The third version of my magic portal desk toy, with three independent elements and all printed parts

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

Demo

This is the third, maybe final (but who am I kidding) version of my magic portal desk toy. A bound cord of leaves and vines spans two portals, and can be slid up and down between them, apparently vanishing into the aether.

Previously:

- [Dual Portal Desk Toy](#) - A simpler version. This model has a detailed description of the illusion
- [Magic Portal Desk Toy](#) - The original and simplest version.

Differences from previous versions:

- Stronger illusion thanks to three separate elements
- Compatible with more printers, requiring only 210 mm of build height

- Can be scaled (with adjustment to XY compensation), since all components are printed
- Easier to calibrate for smooth operation
- More complicated to assemble

Note to 3D printing beginners: This is an ambitious project, both in terms of assembly and printing. Particularly on a budget printer, you may have to spend a lot of time fudging tolerances to make it work, and the screw elements may require you to add scaffolding to print successfully, as they are very tall and thin.

Printing

There are three sets of files for printing:

botanical-portal.step-*: These files correlate with the instructions below, which include advice on calibration. The parts are oriented for printing. I recommend printing these while you follow the instructions, and making sure that everything is working well at each step. This will help to minimize the work in reprinting.

botanical-portal.bycolor.*: These files are great if you have a really dialed in printer and want to do everything in as few prints as possible. Everything is oriented for printing and separated by color.

botanical-portal.assembled.3mf: a single file containing all parts in their final assembled position. This is most useful as a reference during assembly.

Each file set contains a “License” object. You can delete that. It's mostly a reminder to folks selling prints online about their obligation to give attribution.

The botanical-portal.for-remixing.step file is a much more CAD friendly version for customizing the model.

Print Settings

I printed at 0.12 mm layer height. This level of detail (or better) is necessary on the screws (which need to be close to helical symmetry), and is highly recommended on the nut to reduce friction. The other parts should be fine to print at whatever layer height you want.

Other parameters aren't particularly sensitive. I do recommend making the arms on the base nice and strong. I personally generally prefer to put my material in walls rather than infill, so I did 2.1mm walls, and 15% lightning infill.

Scaling

If you have more vertical print volume, I expect that scaling vertically will work fine. A 124% scale factor will put the tallest component at 256 mm. Scaling up uniformly should also work, but it might be a little jiggly, since the bearing clearances will scale up too. Scaling down uniformly will probably require XY compensation (or STEP file) adjustments, since the clearances will get tighter.

Other requirements

- CA glue or similar
- CA glue accelerator (optional, but recommended)
- General purpose machine lubricant/grease. Even something like petroleum jelly should work here. (optional)

Assembly

Each step assumes that you have printed the parts in “botanical-portal.step-#” where # is the step you're on.

See the attached exploded drawing for part names.

Step 1

You can delete the **license** card. We start with the **top** and the **middle vine top ring**. We're first going to take a moment to make sure that the bearings fit together properly. You'll see some concentric ridges in cavity on the **top**, one of which should fit the **ring**. Place it and make sure that it sits well. The top should float a millimeter or so over the ridges, and should turn easily. If you're using a lubricant, apply it to the inside and outside of the ring and make sure it turns smoothly.

If the ring doesn't spin easily, you're probably over-extruding. That's OK, you can fix this with a small amount of **negative** XY compensation. I would start with -0.1 mm. However, the ring should **not** bottom out. It needs to float on the ridge to turn easily.

If you needed to add compensation, use that same compensation for the rest of your parts.

Step 2

You should now have the **base**, and the other two **top rings**. Lubricate the rings (optional) and check that they all turn easily in both the base and top.

Step 3-5

These are the screws, each of which has an attached bottom ring. I recommend printing these separately and in different colors, but that's up to you. The illusion will also be improved by using a filament swap to print the rings in black. You can go ahead and optionally lubricate the bottom rings, inside and out.

Step 6

Now print the **nut** and try threading both **vines** and the **outer leaf** through their respective holes. You're looking for minimal resistance, to the extent that the screw components should easily fall through it. If it's sticky, reprint the nut with negative XY tolerance.

Note: If you're using BambuStudio, you can use POSITIVE "X-Y hole compensation" instead, and not impact the outer dimensions of the nut.

Step 7

Finally, the **spacers**. These are included as a separate file, because you may need to shorten or lengthen them to dial things in.

Place the **top** on its flat side, and insert the spacers into the arm sockets. Thread the **vines** and **outer leaf** through the **nut** again. Attach the **top rings** to each of the screws and insert them into the bearing ridges on the **top** piece (remember, it should be sitting face down for now). The **attached rings** on the other side should now line up relatively flat.

Spacer calibration

With the **top** still lying flat, line up the **base** so that you can push its **arms** down into the sockets (they should fit in fairly loosely), and adjust as needed to seat the **attached rings** into the ridges on the **base**. Push it down as far as it will go.

If the **arms** won't reach all the way to the spacers, and the **attached rings** are seated, print slightly taller **spacers** and repeat.

If the **arms** reach the **spacers**, but the **rings** aren't seated properly on both sides, print slightly shorter spacers and repeat.

While holding the **base** down firmly, slide the **nut** up and down. It should slide with very little resistance (although it will make a sound). If it is difficult to turn, print taller **spacers**.

Gluing

Remove the **spacers** and, optionally, spray them with accelerator. Place a dab of CA glue into each socket, then press the **spacers** into them (it may help to use a screwdriver to press them in).

Place a dab of glue on each **arm** of the base, then repeat the process of aligning everything like before. While holding the **base** in place, check again that you can easily slide the **nut** up and down.

Set something heavy like a book on top of the base to let the glue set well. Finally, flip the whole thing over, and you're done!

Other Stuff To Try

- I think this would be a lot quieter with a TPU nut. My TPU is currently pretty wet, and the one I printed was too tight. If you want to give it a try, I'd bump up the XY compensation.
- I would love to see how this looks and sounds with solvent smoothing, but I don't have the setup for that right now.

Other Stuff I've Already Tried

- Loosening the nut makes the toy slightly quieter, but it also makes a little more jiggly
- Greasing the screws sounds like a good idea, but it just makes a mess

Model files

botanical-portalstep-1.3mf

botanical-portalstep-2.3mf

botanical-portalstep-3.3mf

botanical-portalstep-4.3mf

botanical-portalstep-5.3mf

botanical-portalstep-6.3mf

botanical-portalstep-7.3mf

botanical-portalbycolorblack.3mf

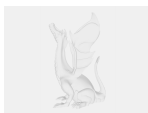
botanical-portalbycolordarkgreen.3mf

botanical-portalbycolorbrown.3mf

botanical-portalbycolorlightgreen.3mf

botanical-portaloriented.3mf

botanical-portalassembled.3mf



botanical-portalfor-remixing.step

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