

Soma Gravity Puzzles

by George Bell

Introduction

The ubiquitous *Soma Cube* was designed by Piet Hein in 1933 [1], most of us surely have at least one wood copy. This was the first puzzle I have a memory of as a teenager. I remember my copy came with a set of illustrations showing additional target shapes to build, so this was also my first multiple challenge puzzle.

The *Soma Cube* has generated a huge number of variations and modifications, possibly more than any other puzzle. Colourings [2] as well as piece deformations have been used to limit solutions from the 240 cube solutions. The pieces have been chopped up and reconstituted to make new puzzles [3].



Figure 1. *Soma Perch* by Rick Eason. The puzzle is not solved because the final piece does not stay in place.

In this article I'll look at a different kind of modification where the pieces are not altered, but a new component is added and a new goal for the puzzle given. This goal involves gravity (but not dexterity) as I'll describe below. If you have a 3D printer, you can print this new component, and use it together with your existing wood puzzle to create new challenges. Alternatively, if woodworking is your forte, you can make this new component out of wood.

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In our first example, the added component is a stand (Figure 1). Rick Eason designed *Soma Perch* [4] in 2009. The goal is to build a cube from the *Soma* pieces such that it rests stably on this stand. At [5] you can 3D print a stand to match the size of your wood *Soma Cube*. This can be used as a display stand, but beware that solving this puzzle is not easy, and your *Soma Cube* may appear most often in the state of Figure 1 (unsolved).

A second type of gravity puzzle is what I call "3D anti-slide", and the added component is a box. Anti-slide puzzles are fairly well known, but most are 2D. In a 3D anti-slide puzzle, the goal is to pack the pieces in a box (or other 3D shape) such that no piece can move when the box is oriented in any direction. To test this out properly on all six faces you need a tight-fitting box with a lid.

In 2016 Volker Latussek designed *Black and White Antislid*e (Figure 2). Initially, I did not realize this was a *Soma* variation. Also, the puzzle technically involves piece modification as the *Soma* pieces are coloured (black and white). But it is a 3D anti-slide

Soma variation, and you can still use your wood *Soma* puzzle if you make a mental note of the colouring.

Black and White Antislide has several challenges. First you are asked to pack the white pieces in a 3x3x3 box in a 3D anti-slide configuration. Having achieved that, you must add the black pieces to the box to complete the cube, without moving any of the white pieces. This is more difficult and you may have to search over several 3D anti-slide solutions to find one that meets these requirements. After this, you are asked to repeat this starting with the black pieces.



Figure 2. *Black and White Antislide* and *Shrinking Soma* by Volker Latussek.

Around 2019 Volker Latussek designed *Shrinking Soma* [6] (Figure 2). This is a 3D anti-slide puzzle in a 4x4x4 box, with the additional requirement that the top layer be filled. The remaining (hidden) 11 voxels must somehow support this “roof” in a 3D anti-slide configuration, not an easy thing to accomplish!

Michael Quigley was intrigued by *Shrinking Soma*—he started packing the *Soma* pieces in other size boxes in a 3D anti-slide configuration (without the top layer filled constraint). Eventually, he found that the largest (volume) box where he could accomplish this was 5x5x5. He calls this puzzle *Static Soma*, another challenging and worthwhile puzzle to make.

The boxes can be 3D printed using PuzzleCAD [7]. One can make a nice set of three nesting boxes for *Black and White Antislide*, *Shrinking Soma* and *Static Soma*.

Conclusions

You may feel that you have such familiarity with the *Soma Cube* that you can solve these puzzles in your head! Give it a try, but in my experience working with the physical puzzles, I find them surprisingly difficult. This is probably because the gravity constraints are so different from what I am used to.

One feature of *Soma* gravity puzzles is that they are resistant to analysis by computer solvers. Although the puzzles above are all solvable, I do not know exactly how many solutions each has. I urge you to make your own investigations and discoveries.

References

- [1] https://en.wikipedia.org/wiki/Soma_cube
- [2] Theo Geerinck, Soma Patterns, CFF 108 (March 2019) pp. 29-31.
- [3] <https://woodwonderonline.com/products/broken-soma>
- [4] <http://www.mechanicalpuzzles.org/puzzles/eLPerch/somaPerch.html>
- [5] <https://www.thingiverse.com/thing:4816237>
- [6] <https://www.pelikanpuzzles.eu/detail/shrinking-soma/>
- [7] <https://www.puzzlehub.org/puzzlecad>