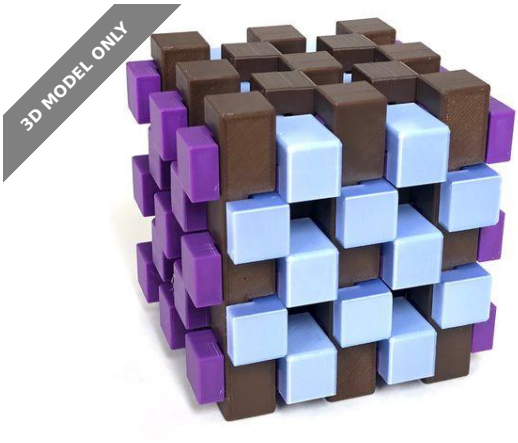

Extended Altekruse Puzzle Set

Printable Puzzle Project

VIEW IN BROWSER

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Summary

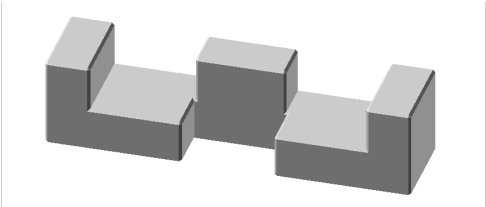
A modular set of puzzle pieces that can form various extensions of the classic Altekruse design.

Toys & Games > Puzzles & Brain-teasers

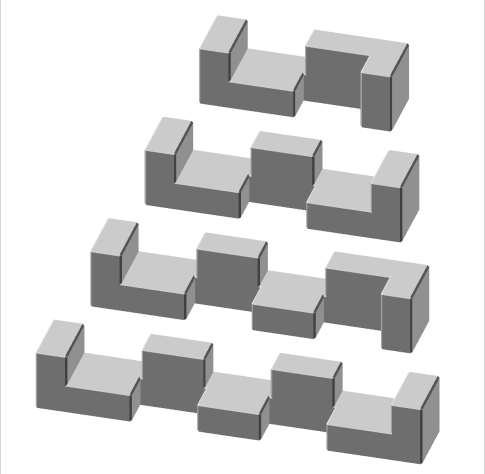
Extended Altekruse Puzzle Set

A modular set of puzzle pieces that can form various extensions of the classic Altekruse design.

In each case, the goal is to assemble some number of stick-shaped pieces into an interlocking configuration such as those shown in the photos. The original Altekruse Puzzle uses 12 identical copies of the basic length-3 piece, with 3 alternating notches:



Larger and smaller variants are constructed with pieces of varying lengths that follow the same basic pattern. Here's a diagram showing lengths 2 through 5:



Constructions can be made with 6 pieces of length 2; with 24 pieces of length 4; or with 36 pieces of length 5. In addition, the length-3 and length-5 versions have variants that use 14 and 38 pieces, respectively. The odd-length pieces are all identical in shape, whereas the even-length pieces come in mirror-image pairs.

The larger variants make particularly good puzzles: they should provide a satisfying challenge even to experienced puzzle solvers, but they have a lovely regular structure that makes them feasible to assemble without hints or computer aid.

If you're new to this type of puzzle, start with the basic 12- and/or 14-piece versions, then progress to the more difficult 24-, 36-, and 38-piece constructions. Still larger variants are possible, as are various rectangular constructions that "mix and match" pieces of different lengths. These and other generalizations are discussed in the Further Explorations section below.

Printing Instructions

- Length 3 (the original Altekruse puzzle): Print 12 copies of altekruse.length-3.stl, 4 in each of three colors. For the 14-piece variant, print one additional piece in two of the three colors.
- Length 4: print 12 copies of altekruse.length-4-left.stl and 12 copies of altekruse.length-4-right.stl. You have a choice of color schemes: either print the left-handed pieces in one color and the right-handed pieces in another; or else print six left-handed and six right-handed pieces in each of three colors. (The choice of color scheme varies the appearance of the assembled puzzle, but it does not alter the solution in any way.)
- Length 5: print 36 copies of altekruse.length-5.stl, 12 in each of three colors. For the 38-piece variant, print one additional piece in two of the three colors.

- Length 2: Print 3 copies of altekruse.length-2-left.stl and 3 copies of altekruse.length-2-right.stl. The same choice of color schemes is available as with length 4.

Background

The original 12-piece Altekruse puzzle was patented in 1890 by one "W. Altekruse," usually presumed to be the Austrian-born William Altekruse, who immigrated to the United States in 1844. It remains popular today, and it is widely available in mass-produced commercial editions (often without attribution to its inventor).

In the 1970s, the great puzzle designer Stewart Coffin crafted around 40 copies of the 12-piece Altekruse puzzle under the name Square Knot. Coffin tells the interesting story of the discovery of the 14-piece variant: "I used to make [Square Knot] in three contrasting fancy woods, one wood for each axis. Once when exhibiting at a craft show, I watched with considerable interest as a bright young girl named Marjorie Hoffman was amusing herself at my booth by trying to put one together in a strange new configuration. I later completed it and found to my surprise that it required fourteen pieces rather than twelve."

Coffin produced the 14-piece version as Plus 2. (See the entry for Square Knot / Plus 2 for more details.) He continued to explore various Altekruse generalizations, including the 6-, 24-, 36-, and 38-piece extensions already discussed, but only the 6-piece version was given a name, Sixticks. Many additional constructions are possible, some of which Coffin hinted at in his writings; these are discussed in the Further Explorations section below.

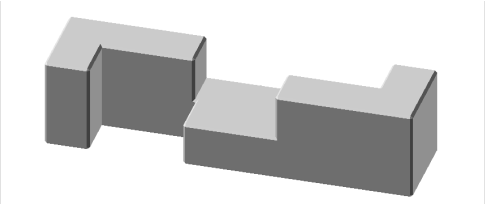
Further Explorations

The basic Altekruse construction can in theory be extended arbitrarily far. There is a length-6 construction with 54 pieces, length-7 constructions with 72 and 74 pieces, and so on. In general, when n is even, there is a length-n construction with 3n^2/2 pieces; and when n is odd, there are constructions with 3(n^2-1)/2 and 3(n^2-1)/2+2 pieces. STLs for length-6 and -7 are provided, should anyone be brave enough to try the 54-, 72-, or 74-piece variants; still larger ones may be generated with the included altekruse.scad source code.

In addition to these "standard" extensions, many other variants are possible:

- All of the length-n Altekruse puzzles discussed above have the assembled shape of an n x n x n cube. By mixing and matching various lengths, one can obtain rectangular constructions as well. One of the photos shows an example of a 3 x 3 x 5 construction made

from 16 length-3 and 4 length-5 pieces. Irregular assemblies are possible too; another photo, reproduced from Coffin's writings, shows (in Coffin's words) "some of the many other interesting variations that are possible, without limit."
- Coffin identified an alternate construction for Sixticks (the basic length-2 version), using one left-handed and five right-handed pieces, as opposed to the usual three of each. (See the listing for Sixticks for details.) What other combinations are possible for the 24-piece length-4 puzzle, aside from the usual twelve of each? I do not know the answer.
- Finally, Coffin hinted at explorations involving new piece types, with patterns of notches distinct from any of the standard Altekruse pieces: "In the standard Altekruse Puzzle, each piece has three notches, with the two end notches facing in the same direction. There is a variation in which some pieces have notches facing in opposite directions.... Which combinations using such pieces are possible?" (See diagram below.) Coffin answered this question for the classic 3 x 3 x 3 shape (see the listing for Square Knot / Plus 2 for details); I am not aware of any experiments with larger variants.



The length-3 "reverse" pieces are published as altekruse.length-3-reverse-left.stl and altekruse.length-3-reverse-right.stl, and altekruse.scad may be used to generate sticks with any pattern of notches (see instructions inside the .scad file). Perhaps some curious reader will be inclined to experiment with them. There is doubtless much more to be discovered about this fascinating series of puzzle.

The Printable Puzzle Project

The Printable Puzzle Project aims to make available high-quality open-source models of many puzzle designs. All of our models are posted with the generous permission of their designers and are licensed for **non-commercial use only**. Anyone may print copies for their own personal use, but selling or otherwise monetizing them is not permitted, and puzzle designers retain all rights as copyright holders of their work.

Our puzzles are modeled using the open-source puzzlecad library. The .scad file is included with this model in case you want to modify any of its design parameters; more information on how to do this can be found in the PPP Puzzle Modeling tutorial.

Happy puzzling!

Model files

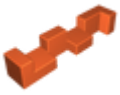
altekruse.scad

altekrusepiece-2-left.stl

altekrusepiece-2-right.stl

altekrusepiece-3.stl

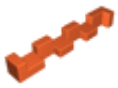
altekrusepiece-4-left.stl



altekrusepiece-4-right.stl

altekrusepiece-5.stl

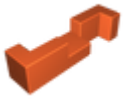
altekrusepiece-6-left.stl



altekrusepiece-6-right.stl

altekrusepiece-7.stl

altekrusepiece-3-reverse-left.stl



altekrusepiece-3-reverse-right.stl

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