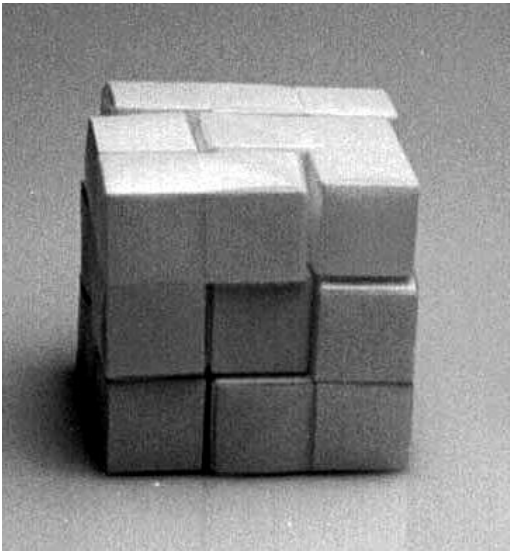
The Soma Cube

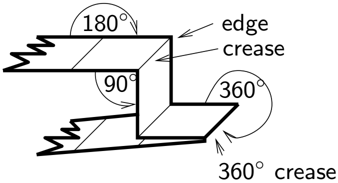
A TelExperiment by Sebastian Marius Kirsch



The Soma Cube was invented in 1936 by Piet Hein, a Danish poet and puzzle inventor. It represents all possibilities of combining three or four cubes in a ‘not-straight’ way. Its seven pieces can be assembled to form thousands of figures; it is a kind of three-dimensional Tangram in this aspect.
A first origami version of the Soma Cube was introduced by Steve Biddle in his book ‘The New Origami’. Steve Biddle uses Sonobé units to produce the pieces and arrives at the impressive number of 120 units. Maarten van Gelder has developed a Soma Cube whose pieces are each folded from a single square; he uses *box pleating* techniques developed by Max Hulme. I am presenting a version that is folded from ticker tape. My version gets by with seven 1.1 m long strips of ticker tape; each piece requires between 40 and 60 squares.
All seven elements are folded from the same principles. Instead of describing each element step-by-step, I will therefore describe the basic elements and the methods of extending them. These methods are then presented with four of the pieces; the remaining pieces are only described verbally, but are constructed from the elements that have already been described.
Before I start, I would like to thank two people: Philip Noble, whose FlexiCube has contributed much inspiration to this model, and Heinz Strobl, who has worked his way through the whole instruction and who has helped by removing many blunders and mistakes.
This is a translation of a German article that originally appeared on no. 22 of der falter, the magazine of Origami Deutschland. I dedicate this translation to Jan Polish, whom I tried to teach the model at the Würzburg ’97 Convention at one o’clock at night, but in vain. I hope that my diagrams are clearer than my verbal instructions.

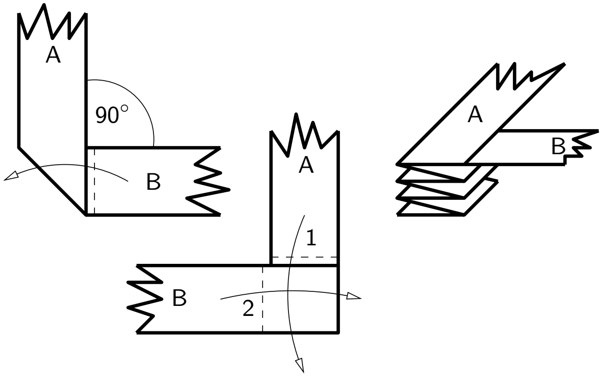
1 Some introductory remarks

1.1 Symbols



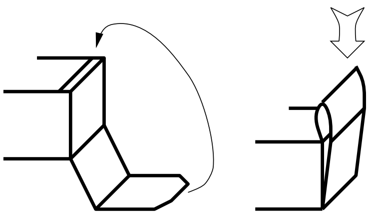
The diagrams distinguish between a simple fold and the edge of the strip. For folds (180° and 90°), a thin line is used (—). For the edge of the strip and 360° creases, a thick line is used (**—**). An open arrow (—▻) is used to indicate that the end of the strip is to be laid across a frame, and a filled arrow (—►) is used to indicate that the strip is to be pulled through under a frame.

1.2 The 'Witches' staircase'



Before beginning, the strip must be divided into squares. This is done easiest with a fold that is called a 'Hexentreppe' in German. Some people may still know this from kindergarten, but I will briefly repeat how to produce it. You begin by folding a valley fold of 45° in the middle of the strip. Both end of the strip are now perpendicular to each other. Now you fold B along the edge of A to the left, A along the edge of B down, and so on till the end of the strip. Then you undo the resulting staircase.

1.3 Locking the ends



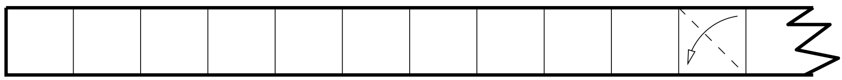
The ends are locked by shortening the remaining strip to two squares, sharpening it a little, and tucking it into the opposite slot. Long fingernails and/or tweezers can be helpful for the last bit.

2 The basic unit

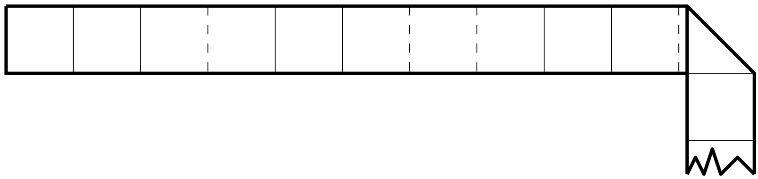
Length of the strip = $42 \times$ width

I will now describe how to make a basic unit with three cubes. The variation with two cubes is easy to produce: Just make each frame two squares shorter.

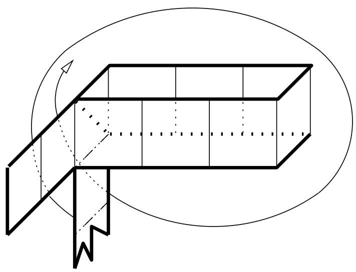
1 Valley fold field no. 11 down. (Field no. 9 for a unit with two cubes.)



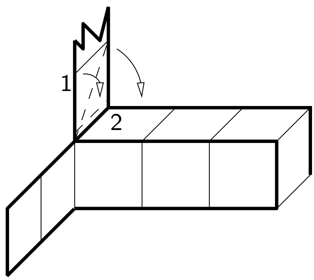
2 Form a loose horizontal frame, based on the shown valley folds.



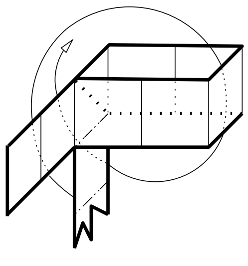
3 Lay the tape one time around the frame. This is the vertical frame.



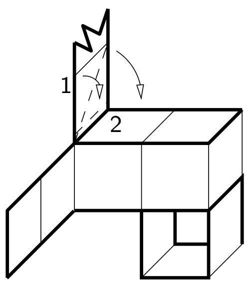
4 Valley fold the tape to the back and to the right.



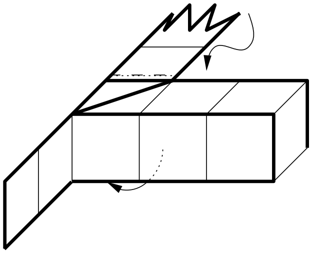
3a Variation of step 3 for piece 3, 4, 6 and 7: Pull the tape through under the frame on the right, lay it over the frame on the left.



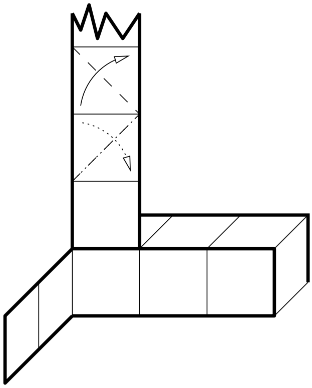
4a Variation of step 4 for piece 4, 6 and 7: Let a loop stick out on the underside.



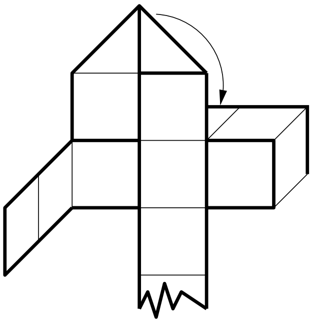
5 Pull the tape through under the horizontal frame on the back and in front.



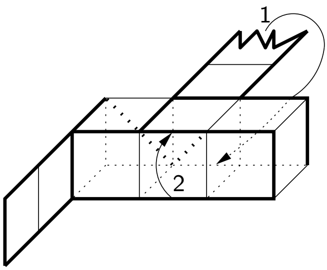
6 Valley fold and mountain fold the tape: a right-angled triangle is produced.



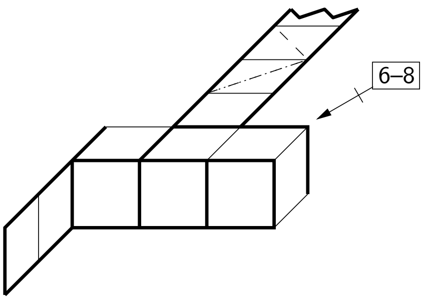
7 Tuck this triangle behind the horizontal frame.



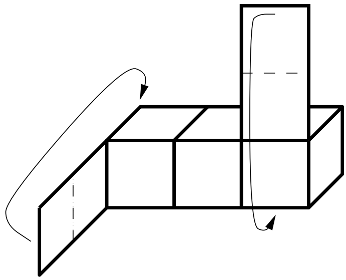
8 Pull the tape through under the vertical frame underneath and over.



9 Repeat steps 6–8 and pull the tape through under the horizontal frame one more time.



10 Lock the ends.

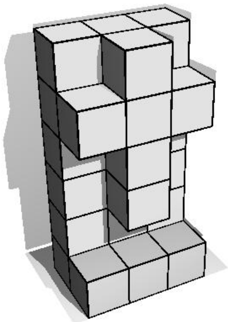


3 Extension of the basic unit

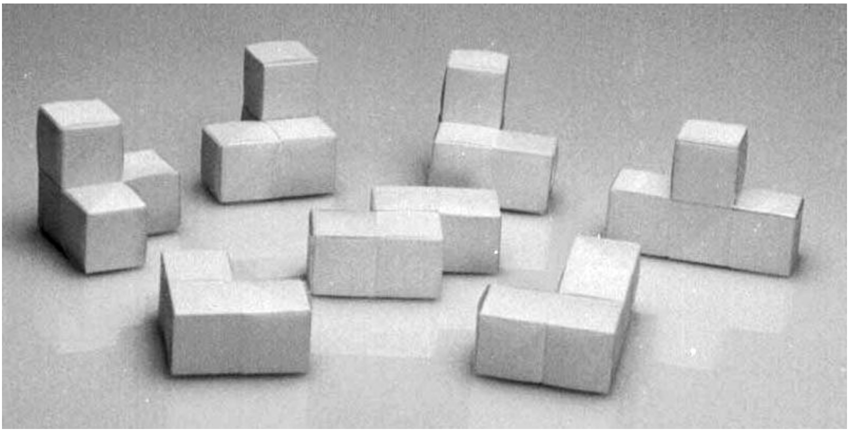
The described basic unit can be extended by allowing a loop to stick out in step 3 or 8, and by weaving around it afterwards. If you let the loop stick out on the second frame, the woven unit is perpendicular to the basic unit. If the loop sticks out while weaving the basic unit (steps 8–9), the woven unit is in the same direction as the basic unit.

Before continuing, you should first try to make a basic unit with two cubes, since five of the seven pieces are based on this unit.

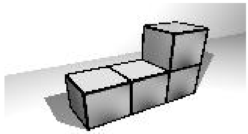
4 The pieces of the cube



Using the basic unit, the seven pieces of the cube can now be folded. They can be assembled into thousands of figures—into arches, walls, monuments, snakes, ships and much more. An example is shown on the left.
While pulling the tape through under a cube, the tape can occasionally be caught. You can help it by first putting a small strip of paper in as guidance. Thin tweezers or a thin metals strip can also be used as guidance for the tape. After the first steps, the diagrams usually omit the beginning of the strip, because it would get in the way during later steps. Please do not be alarmed by this omission.

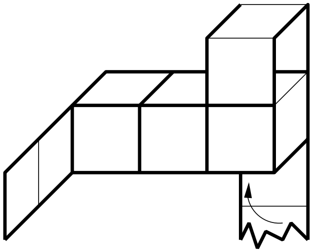


4.1 Piece 1

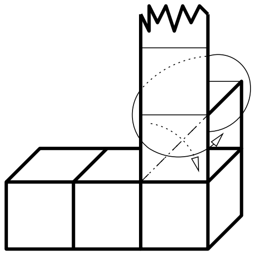


Length of the strip = 55 × width

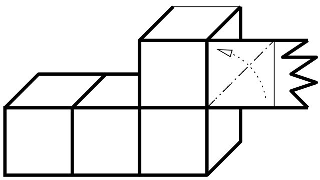
1 Fold a basic unit with three cubes. Let a loop stick out during the repetition of step 8. Pull the tape through under the frame one more time.



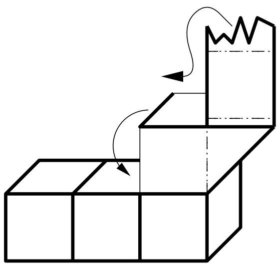
2 Mountain-fold the tape to the right and lay it once around the loop.



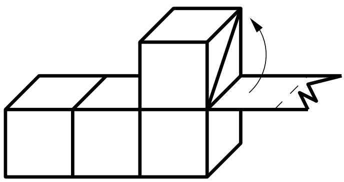
3 Mountain-fold the tape to the top.



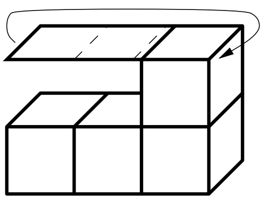
4 Pull the tape through under the loop on the top and between the two cubes in the middle.



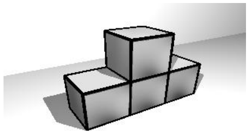
5 Pull the tape through under the loop on the top.



6 Lock the ends.

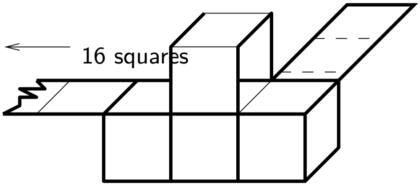


4.2 Piece 2

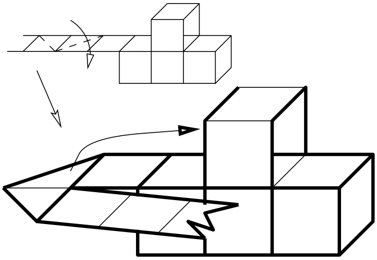


Length of the strip = 58 × width

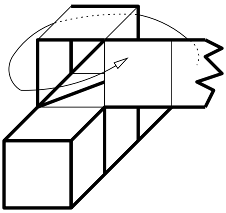
1 Leave 16 squares at the beginning, then fold a basic unit with three cubes. Let a loop stick out during step 8 of the basic unit. Then complete the unit.



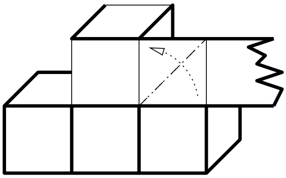
2 Valley-fold the beginning twice: A triangle forms. Tuck this triangle into the loop.



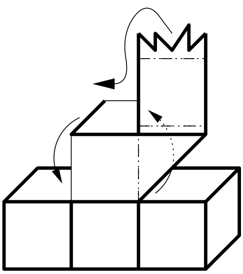
3 *(new position)* Lay the tape one time around the loop. (cf. piece 1/2–5)



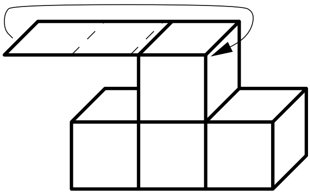
4 *(old position)* Mountain-fold the tape to the top.



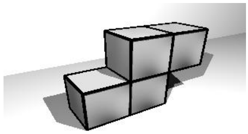
5 Pull the tape through under the loop on the top, between the two units in the middle, and once more under the loop on the top.



6 Lock the ends.

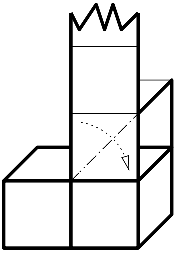


4.3 Piece 3

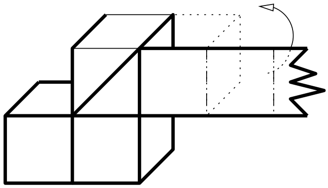


Length of the strip = 53 × width

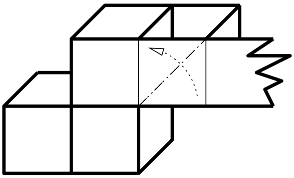
1 Fold a basic unit with two cubes. Let a loop stick out during step 8. (cf. piece 1/1)



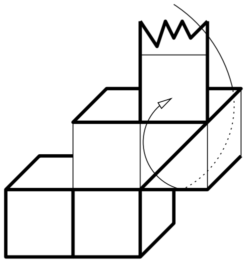
2 Lay a two cube wide frame around the loop, as indicated by the dotted lines.



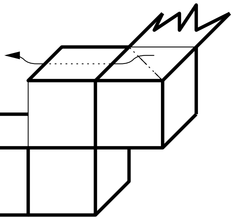
3 Mountain-fold the tape to the top.



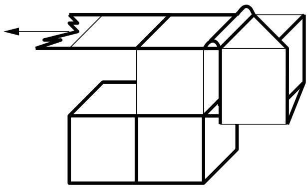
4 Lay the tape once around the new frame.



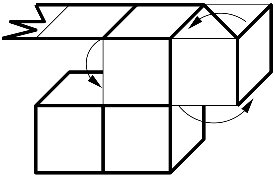
5 Mountain-fold the tape to the left and pull it through under the original loop.



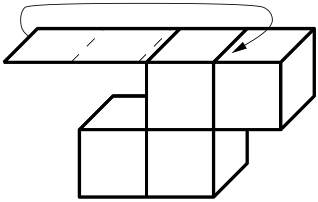
6 While pulling it through.



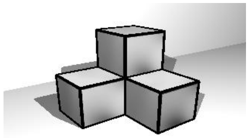
7 Pull the tape through between the unit, on the right under the new frame, and under the loop.



8 Lock the ends.



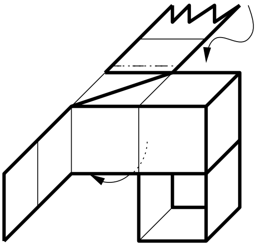
4.4 Piece 4



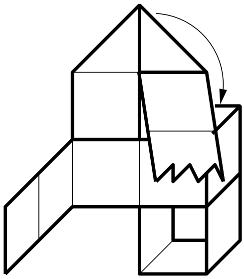
Length of the strip $= 60 \times$ width

This piece is one of the most difficult. Two distinctive loops have to stick out. This makes the first steps particularly unstable. Persevere!

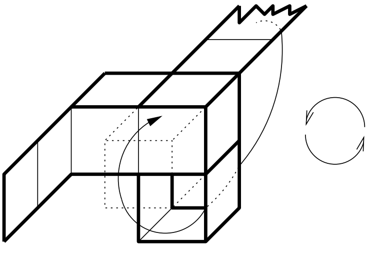
1 Fold a basic unit with two cubes, and let the vertical frame stick out (cf. steps 3a, 4a of the basic unit). Pull the tape through under the frame twice and fold a triangle.



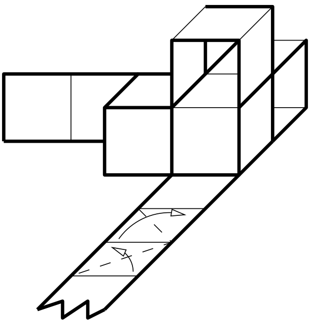
2 Tuck this triangle under the frame.



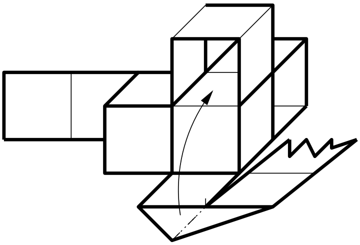
3 Pull the tape through on the top and on the bottom under the vertical frame, let a loop stick out in front (as indicated by the dotted lines).



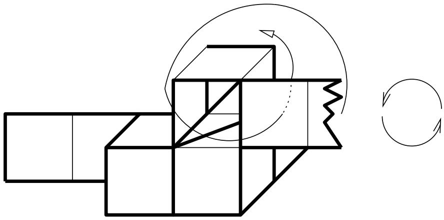
4 *(new position)* The loop on the back is a result of the last step. Valley-fold the tape twice.



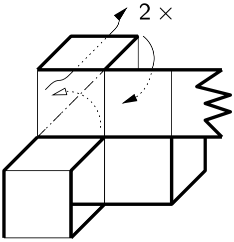
5 Tuck the triangle into the loop.



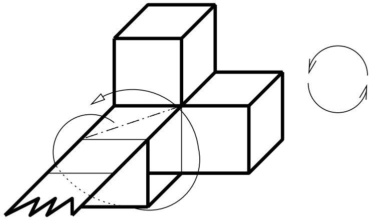
6 Lay the tape once around the loop.



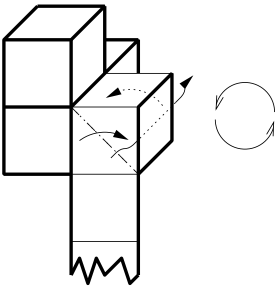
7 *(new position)* Mountain-fold the tape to the top, pull it through under the loop on the top and in the middle **twice**, so the vertical crease is hidden.



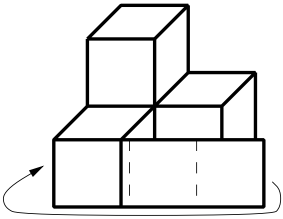
8 Mountain-fold the tape to the left and lay it once around the loop.



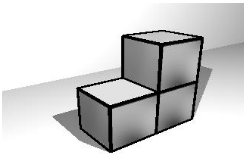
9 *(new position)* Mountain-fold the tape to the left and pull it through on the right and in the middle three times.



10 Lock the ends.



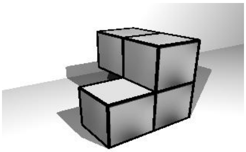
4.5 Piece 5



Length of the strip = 44 × width

This is a variation of piece 1. You begin with a basic unit with two cubes, let a loop stick out during step 8 and continue as in piece 1.

4.6 Piece 6



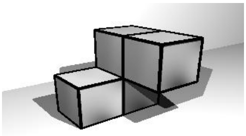
Length of the strip = 54 × width

This piece consists of a basic unit with two cubes, where the vertical frame has been formed into a loop, and a unit with two cubes that has been woven onto it.

You can follow the directions for piece 4 until step 5, *but you may not let a loop stick out during step 3!* Just imagine that the loop in step 3–4 is not there.

Then you do not weave a single cube onto the loop, as in pieces 4/6–7, but you weave two cubes onto it as in piece 3. You lay the tape to the back around the loop and allow a three-squares long frame to stick out behind. Then you turn the cube for 90° clockwise around its vertical axis. Now you can follow the directions for piece 3. The loop is in the same position as in piece 3/2.

4.7 Piece 7



Length of the strip = 56 × width

This is a mirror-image version of piece 6.

You follow the directions for piece 4 until step 5, *but do not let a loop stick out during step 3!* Now you turn the basic unit around its vertical axis again, but in the opposite direction as in piece 6, that is, counter-clockwise.

Now the tape will stick out to the back. You lay it once around the loop to the left, so it lies on the front side. Then you can follow the directions for piece 3 and weave two cubes onto it.

In the pictures of pieces 6 and 7, the two cubes at the bottom are the basic unit, as you see it in piece 4/4. The two cubes on the top are the cubes that are woven onto the loop.

Ticker tape? What's that?

META: *This page is to contain a short article on ticker tape, where to get it, etc. Unfortunately, it is not written yet. Expect it for the final revision, which is to come out in a few weeks. (Just before the OUSA Convention, to be precise.)*

META: *I can only judge from my experience here in Germany, where you can occasionally find a few rolls of ticker tape still on stock in some office supply stores. I'd very much welcome any tips from people in other countries regarding where to find rolls of ticker tape or any other foldable paper tape in their country.*