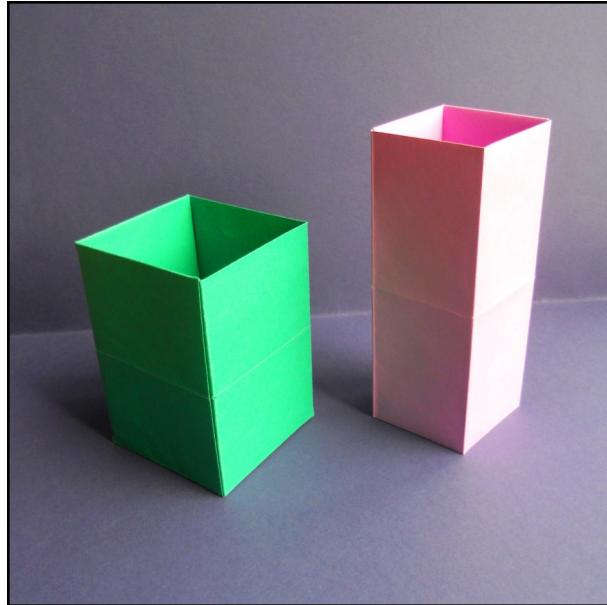


Modular Two-Way Tube

Designed by David Mitchell

The Two-Way Tube is an intriguing flexible novelty in which a square section tube can be flattened and then opened up into a second square section tube of a very different size and shape.

The original Two-Way Tube was invented by Robert E Neale who used it as the basis of several wonderful magical effects.



These diagrams present a way of making a Two-Way Tube in two parts from two identical rectangles. The diagrams show you how to make the design from A4 or US letter size paper but, in fact, the rectangles can be of any shape and size. The contrast in the size and shape of the tubes is however better if the height and width of the rectangles are not too similar. Folding from squares will produce two tubes of equal size and shape.

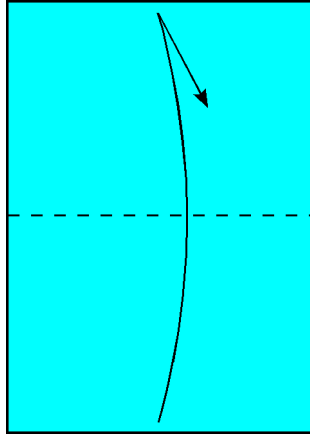
The Modular Two-Way Tube can also be used in the mathematics classroom in an exercise in calculating and comparing volumes.

I designed this modular version of the Two-Way Tube in 1997.

For the sake of clarity these diagrams are drawn with the two rectangles shown in different but in practice the effect works best if both the rectangles are the same colour.

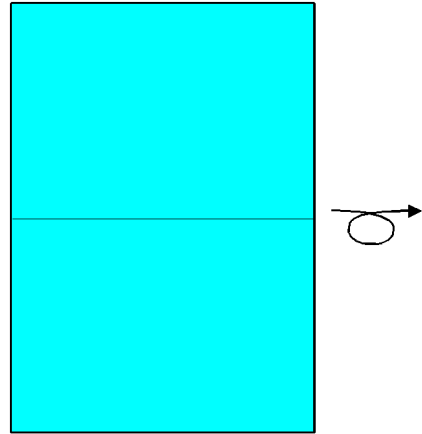
Folding rectangle one

1



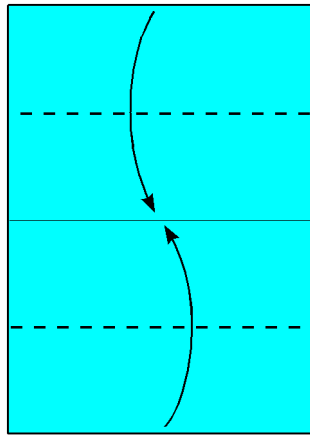
1. Fold in half downwards, then unfold.

2



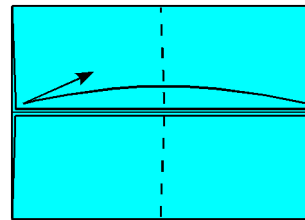
2. Turn over sideways.

3



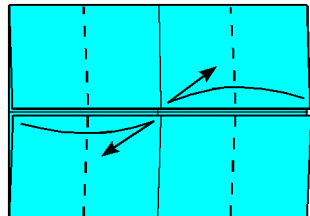
3. Fold the top and bottom edges onto the horizontal crease.

4



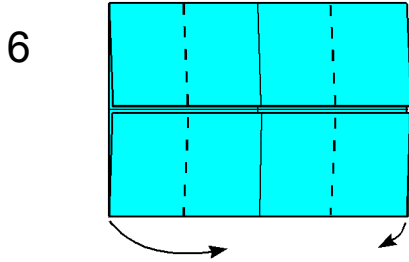
4. Fold in half sideways, then unfold.

5

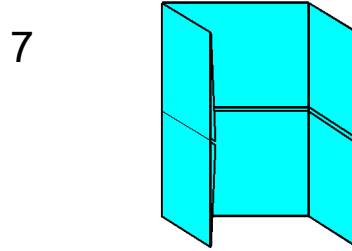


5. Fold both outside edges onto the vertical crease, then unfold.

2

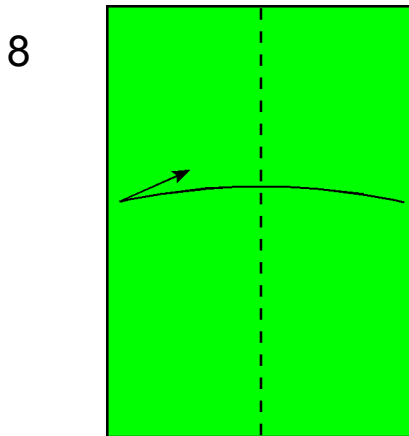


6. Swing the right and left hand flaps forwards at right angles.

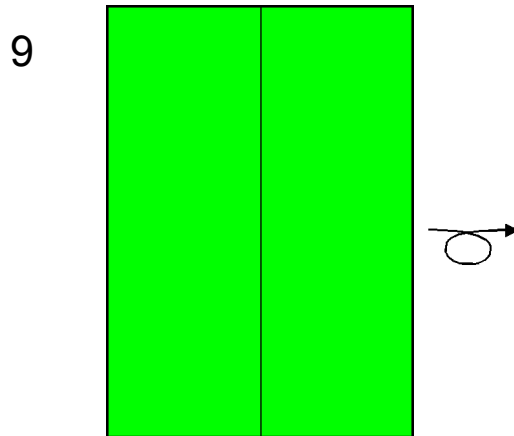


7. The first module is finished.

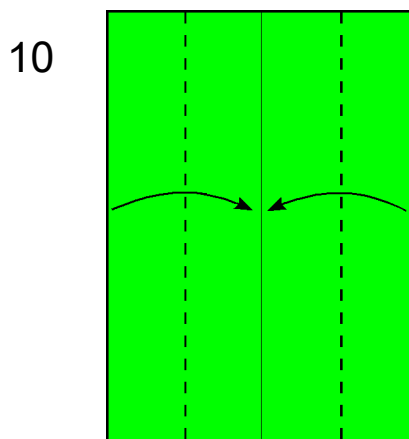
Folding rectangle two



8. Fold in half sideways, then unfold.

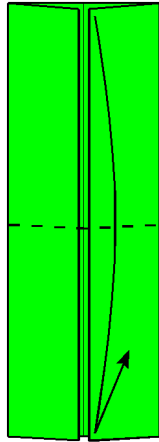


9. Turn over sideways.



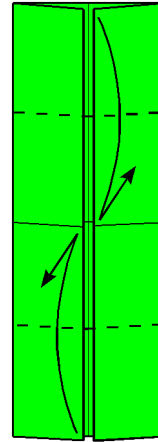
10. Fold both outside edges onto the vertical crease.

11



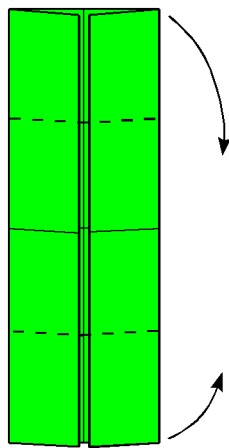
11. Fold in half downwards, then unfold.

12



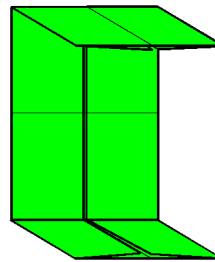
12. Fold the top and bottom edges onto the horizontal crease, then unfold.

13



13. Swing the top and bottom flaps forwards at right angles.

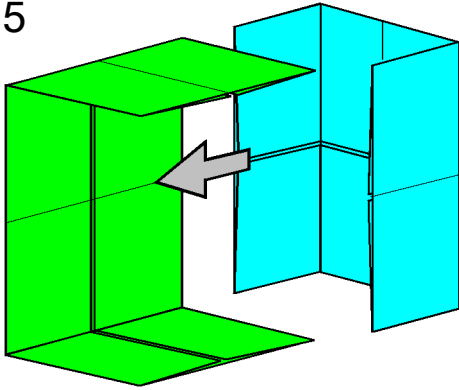
14



14. The second module is finished.

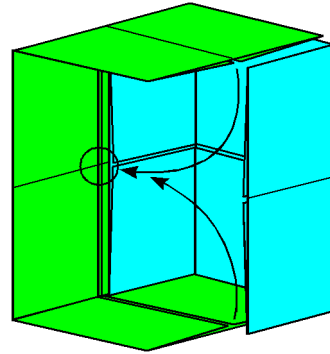
Putting the modules together

15



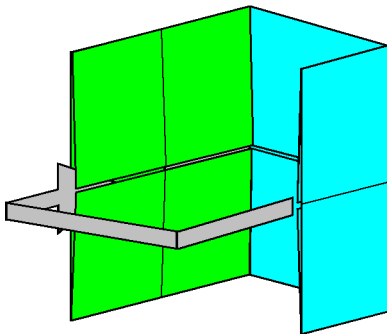
15. Slide the left hand flap of module 1 inside the right hand end of module 2 like this.

16



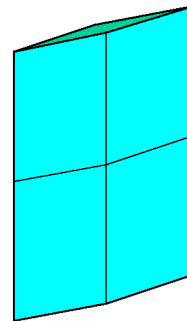
16. Fold the top flap down and the bottom flap up to lock module 1 in place. The centres of the end of both flaps end up at the point marked with a circle.

17



17. Slide the right hand flap of module 1 inside the left hand end of module 2 in a similar way. This looks difficult but is quite easy to do in practice.

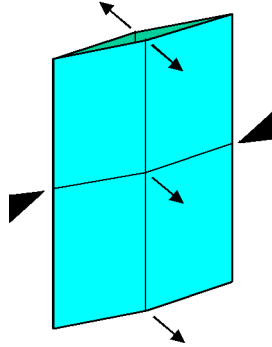
18



18. This is the result. The modules are assembled.

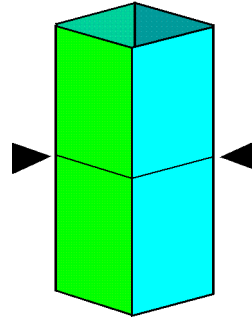
Manipulating the Modular Two-Way Tube

19



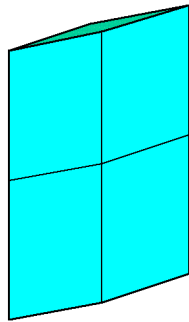
19. Open like this to find the tall, thin tube.

20



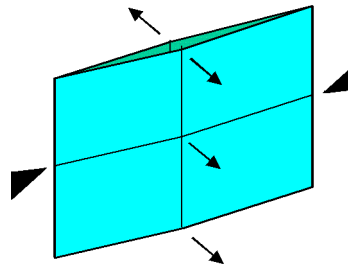
20. This is the tall, thin tube. Squash flat again like this to begin to change to the short, fat tube.

21



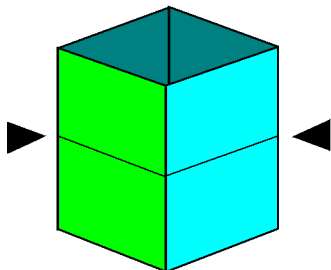
21. Rotate the model through 90 degrees so that it looks like picture 22.

22



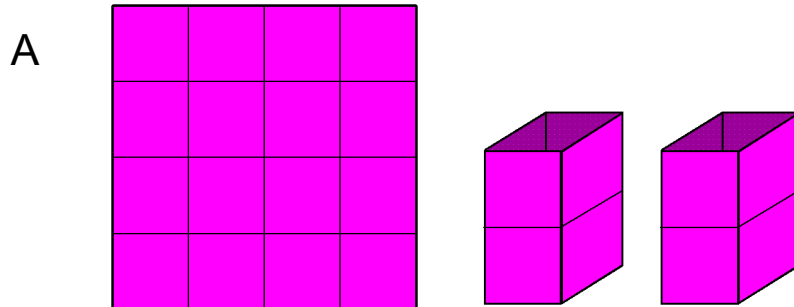
22. Open like this to find the short, fat tube.

23

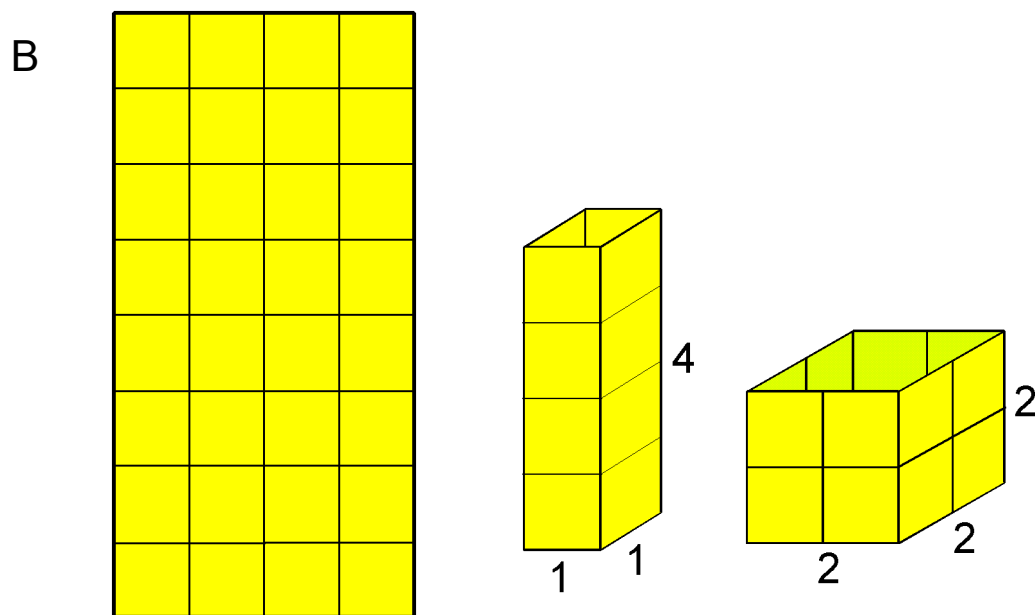


23. This is the short, fat tube. You will need to perform these transformations several times to persuade them to work completely smoothly.

Notes:

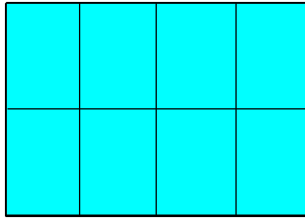
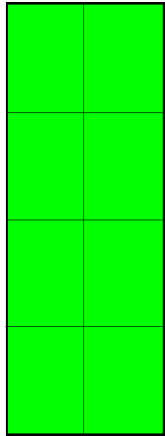


If you make a Modular Two-Way Tube from squares both tubes will be identical in size and shape.



Apart from when the Modular Two-Way Tube is made from squares, the volume of the short, fat tube will always be larger than the volume of the tall, thin tube. The comparative volumes of the two tubes are easiest to calculate in the classroom if they are made from 2x1 rectangles which have been creased into a grid of 32 squares in the way shown above (which means you will need to add a few extra creases when making each module).

C



A Modular Two-Way Tube identical to the one made by following the diagrams could also be made by combining the two non-identical rectangles shown above.

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