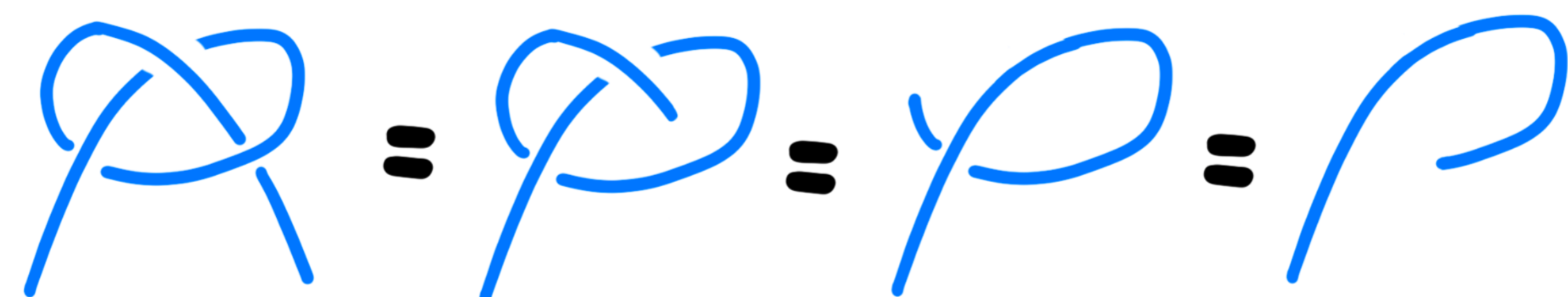# Knot or Not?

Brian Mintz, PhD student, Dartmouth College
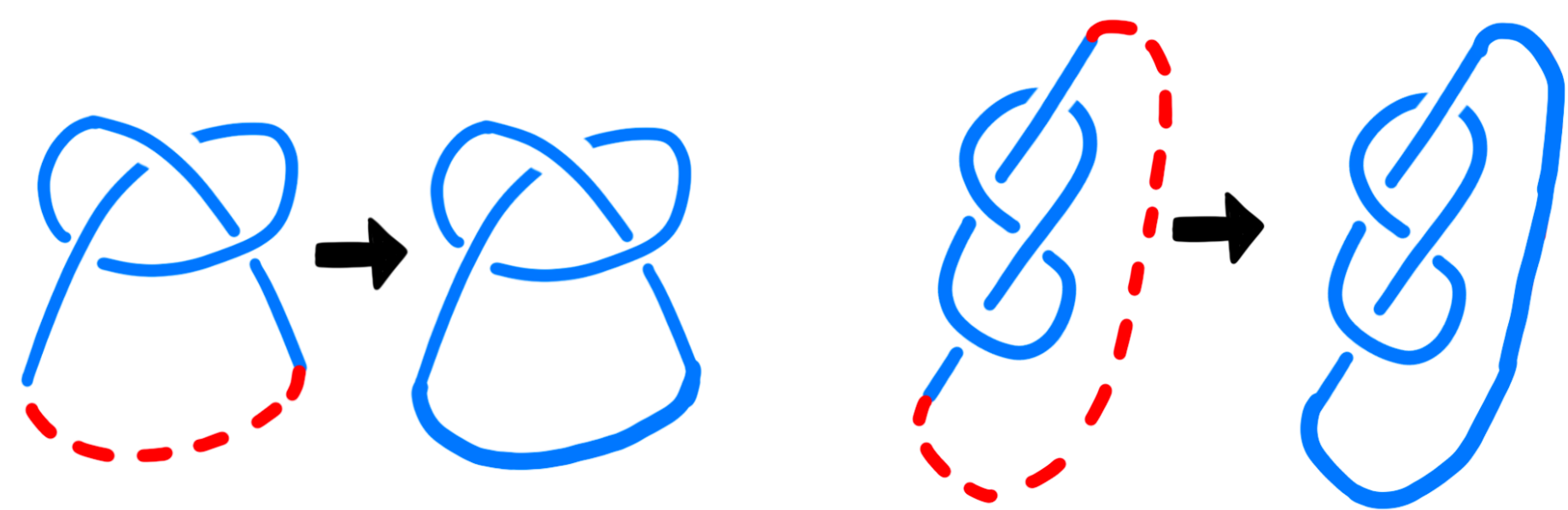
What is a knot?

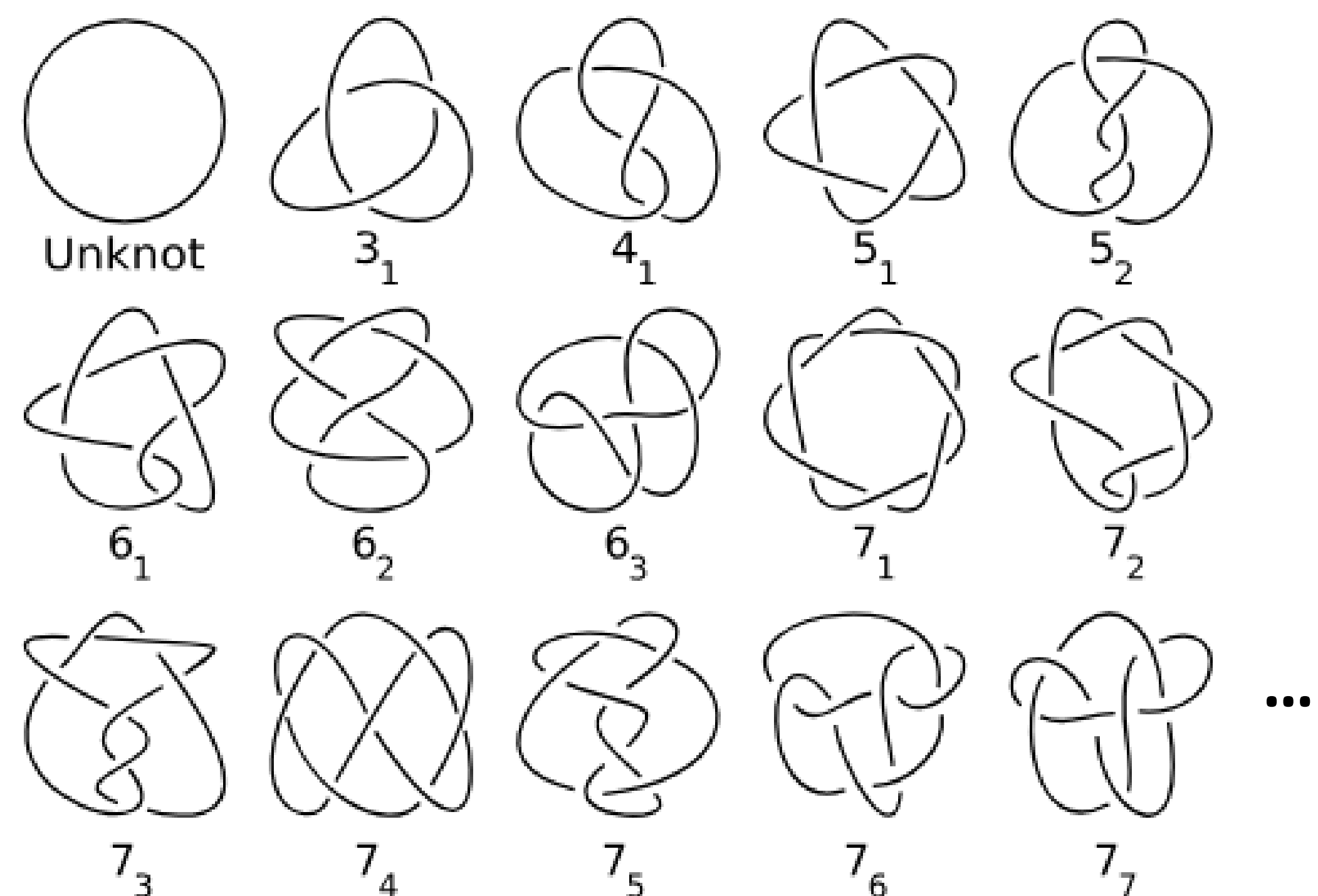Most people think a knot is a piece of rope that you tie. But there is a problem…

All the above should be the same knot, since we only nudge it a bit at a time. But this allows us to unravel any knot!

To solve this, we can connect the ends so the knots can't unravel.

Knot theory is the mathematics of knots.

People have found around 300 million knots, but there are infinitely many that can be combined in infinitely many ways!

The same knot can be tangled up and look a lot of different ways, making it hard to tell knots apart so we can study them.

The "Knot or Not" game

1. Take a knot and unknot from each bin, then turn around so the other player can't see.
2. Choose one to tangle, then give it to the other player.
3. They have 10 seconds to figure out if you gave them the knot, or not (the unknot).
4. If they guess wrong, you win!

What is a Link?

A link is made by tying a few knots together.

A **Brunnian** link is a special type of link: if you cut any part of it, the whole thing will fall apart! The simplest example is the Borromean Rings.
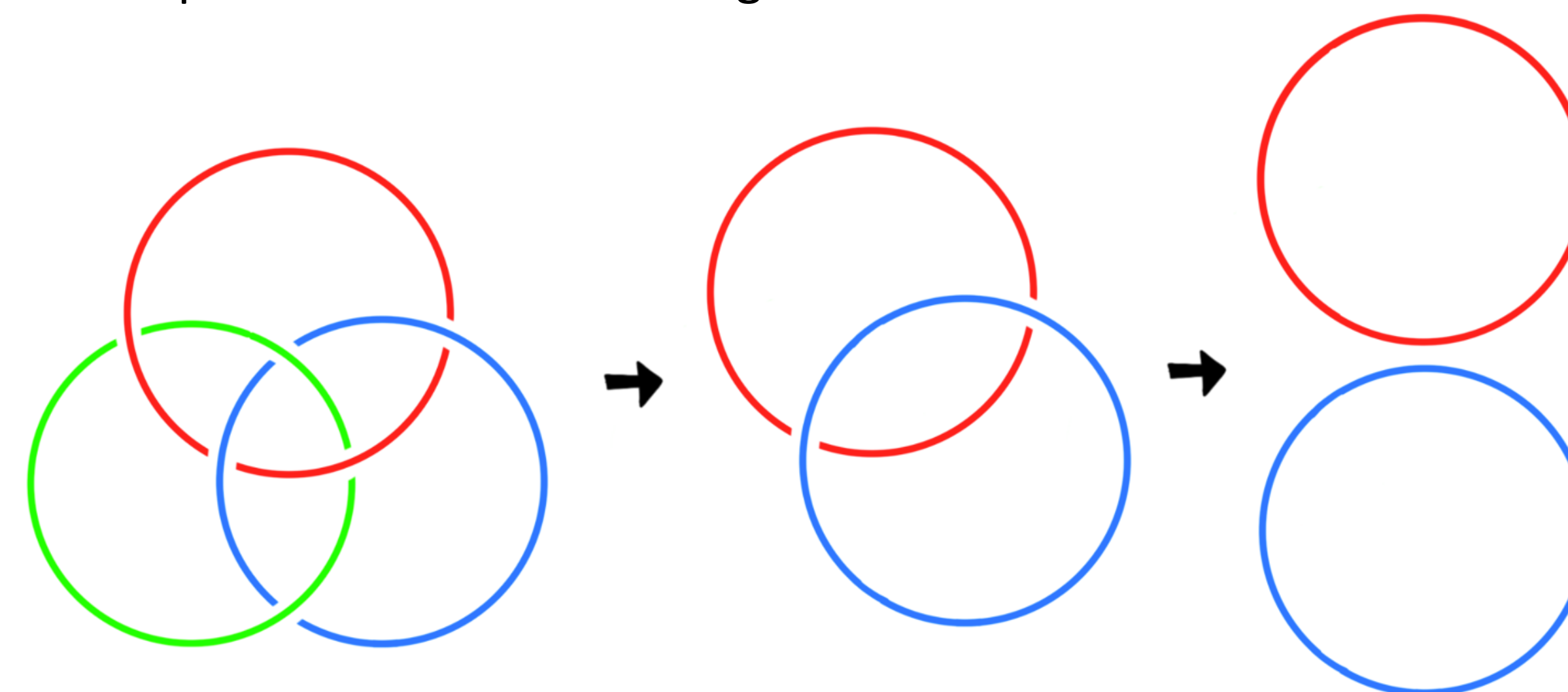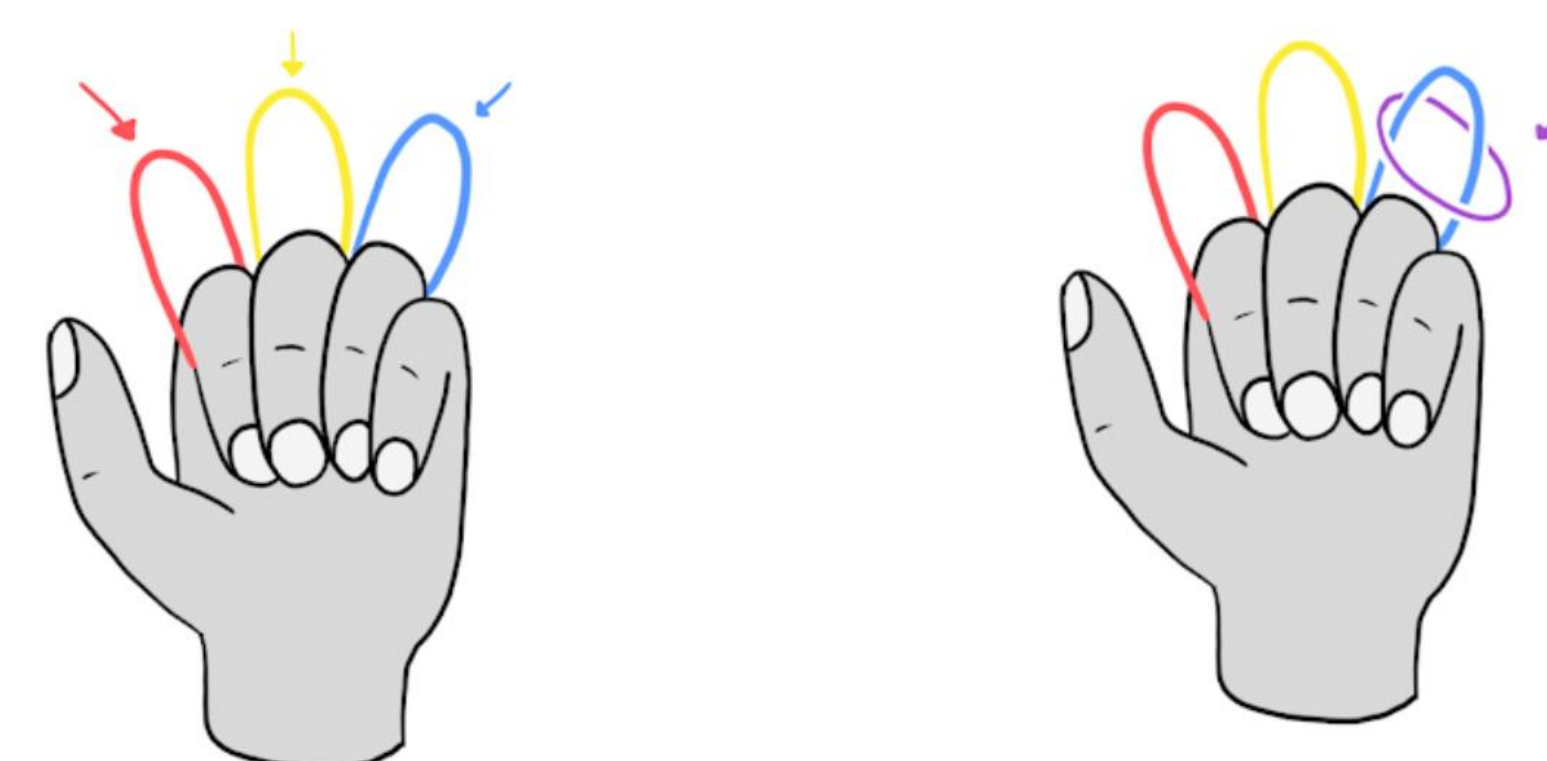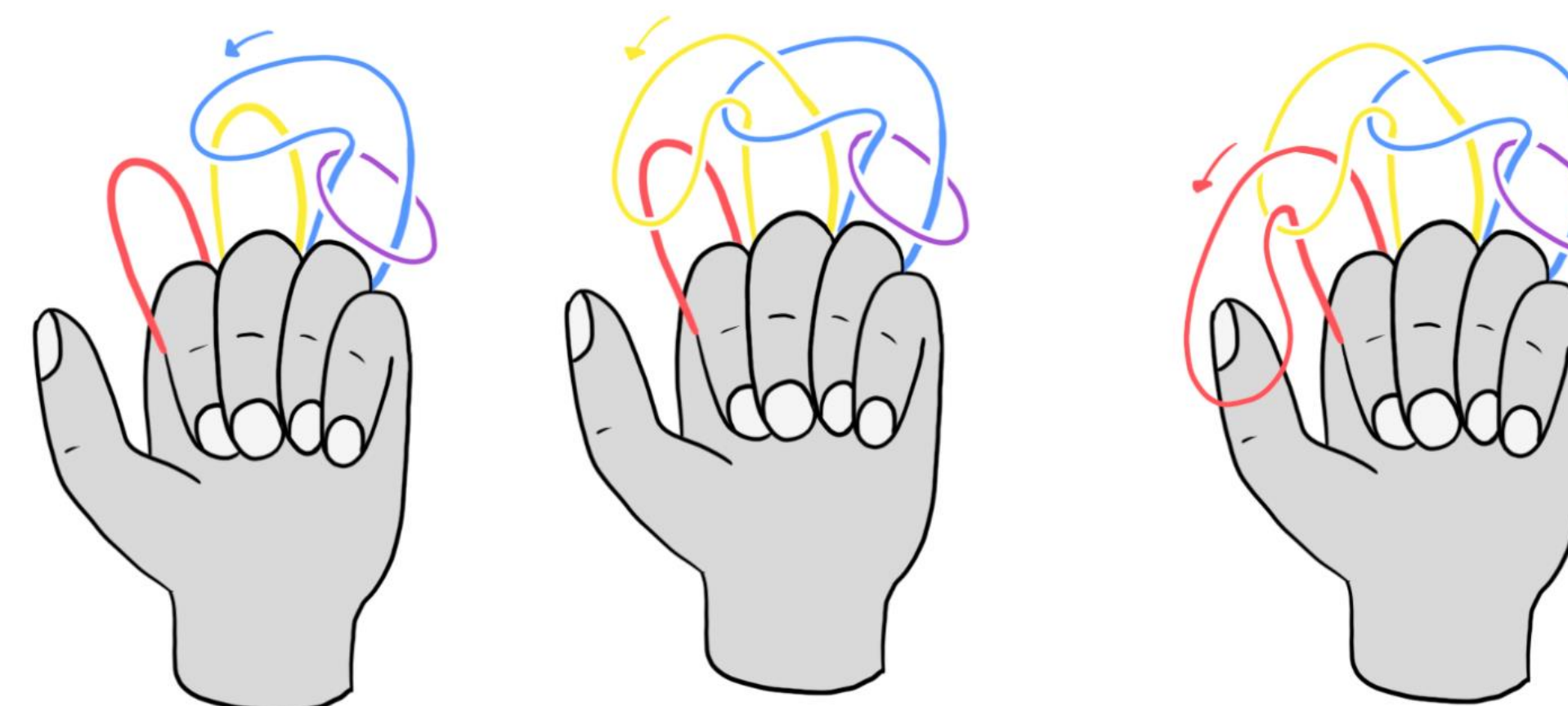

Ti-Links modules

One way to create Brunnian links is by making and assembling these modules.
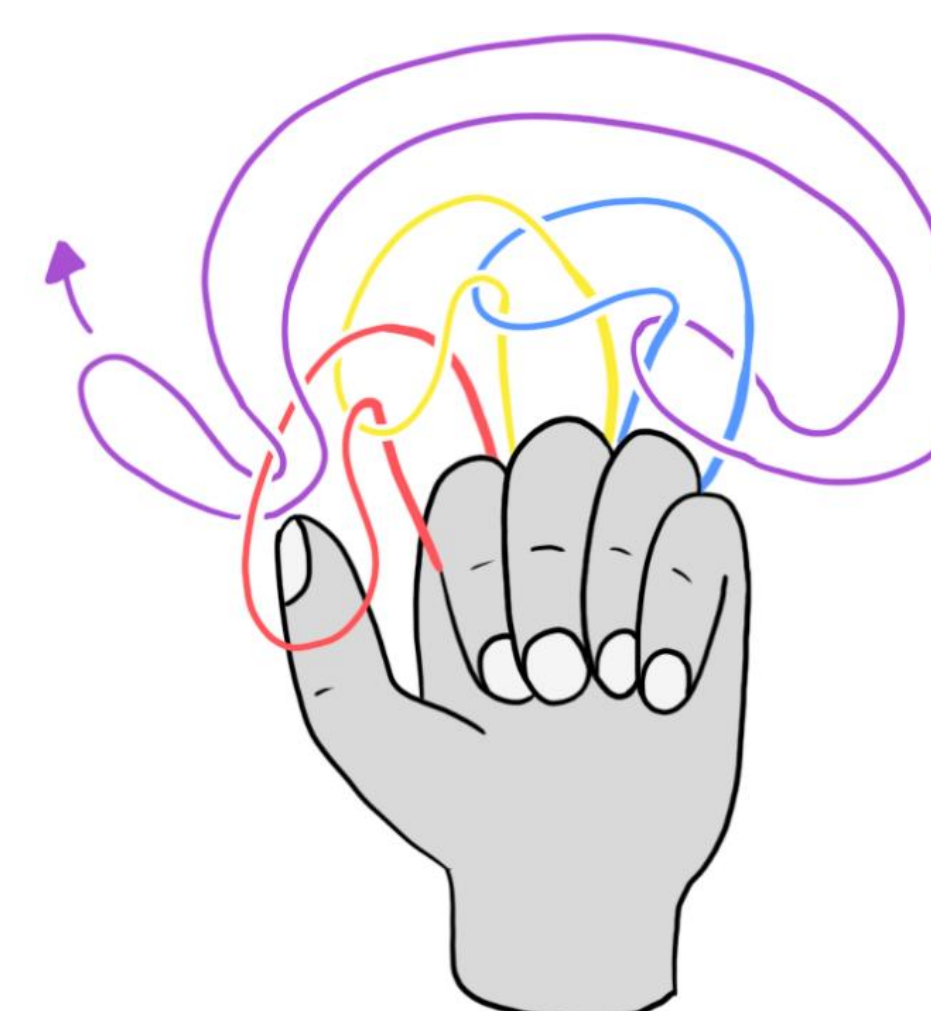
How to make a module

1. **Put one finger through each band (two or three in total). Then load a new band over the one farthest to the right.**

2. **One at a time, from right to left, pull each band over the next. Store the last band on your thumb.**
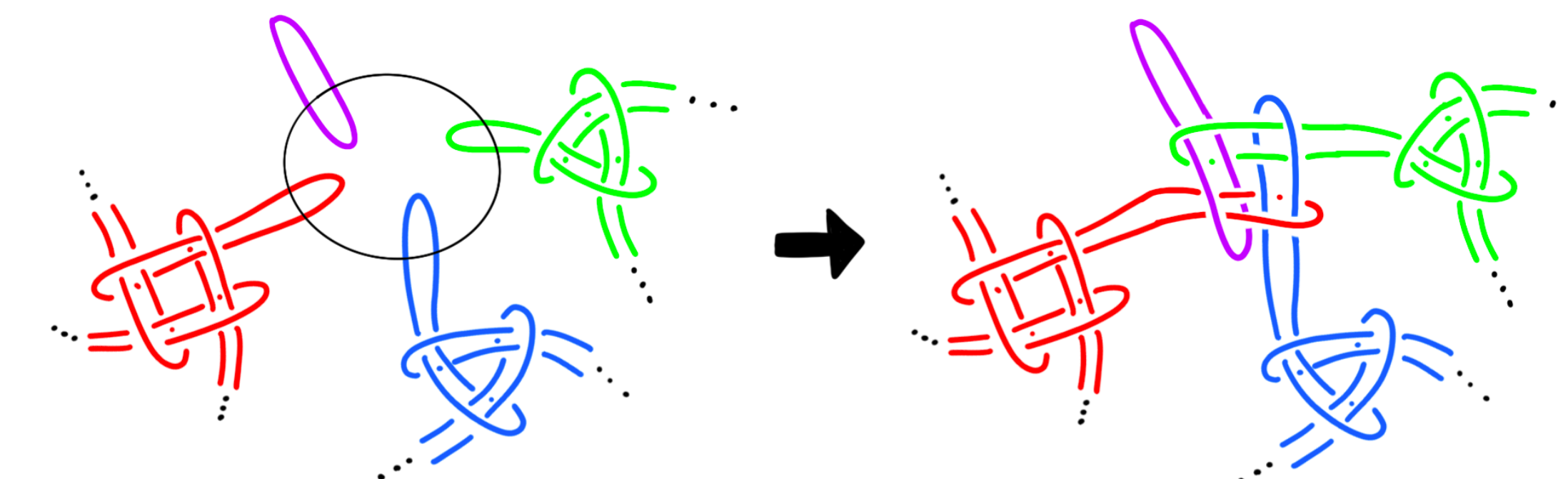
3. **Pull the band you loaded through the band you stored on your thumb. Tighten the link and you're done!**
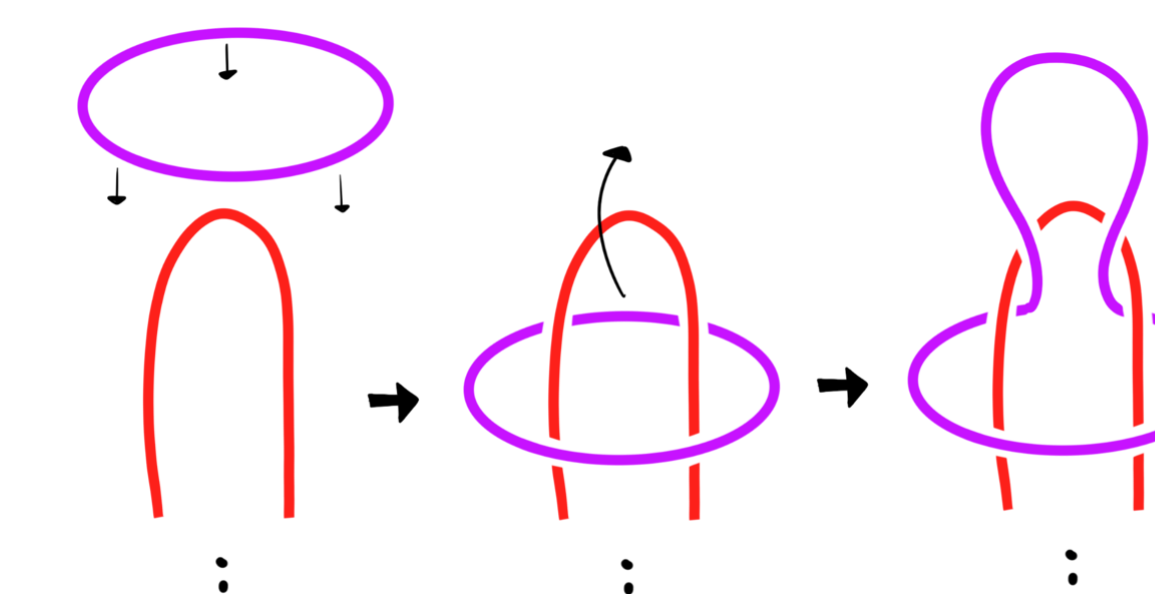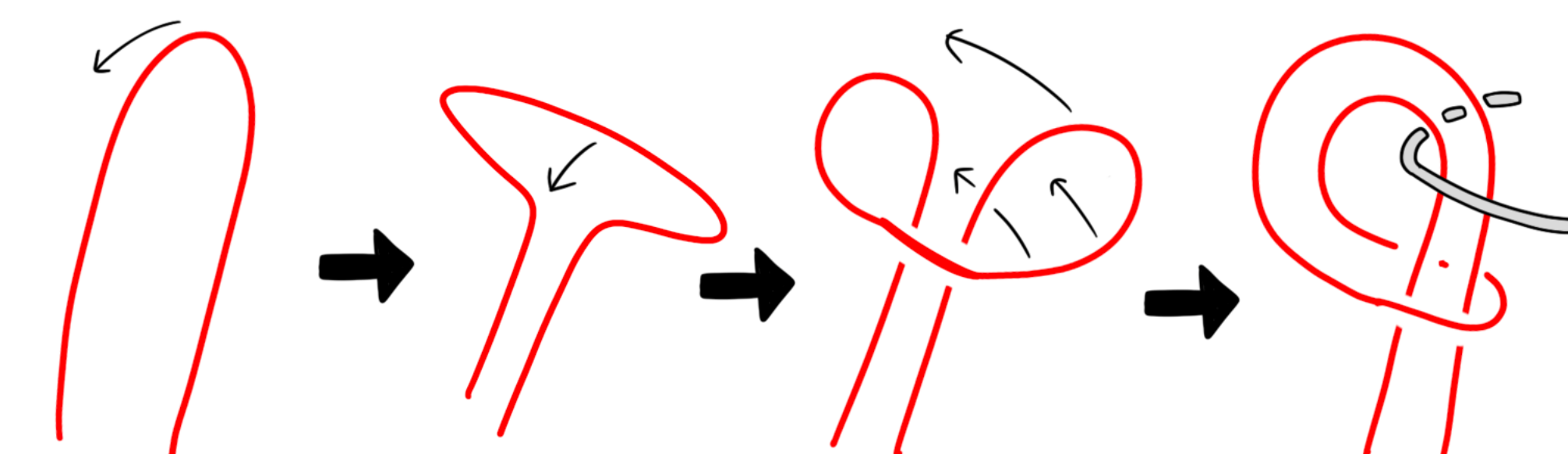

How to make a Brunnian Link?

You can use the same technique to combine modules, by putting the free ends over your fingers.

You can make modules with two bands this way, but the following method is easier:

To complete a structure, make a "cow hitch" at the tip of each free band, and pass a binder ring through them and close the ring.

This approach can be used to make an astounding number of different links!

Each module will come apart if you free any band. This means if you remove any single band, the unraveling will spread to all connected modules, so these structures are Brunnian.

Make some yourself

Use the provided bands and binder rings to make a few Brunnian links.

Each participant can tell us one band to cut and watch as their structure magically comes apart!