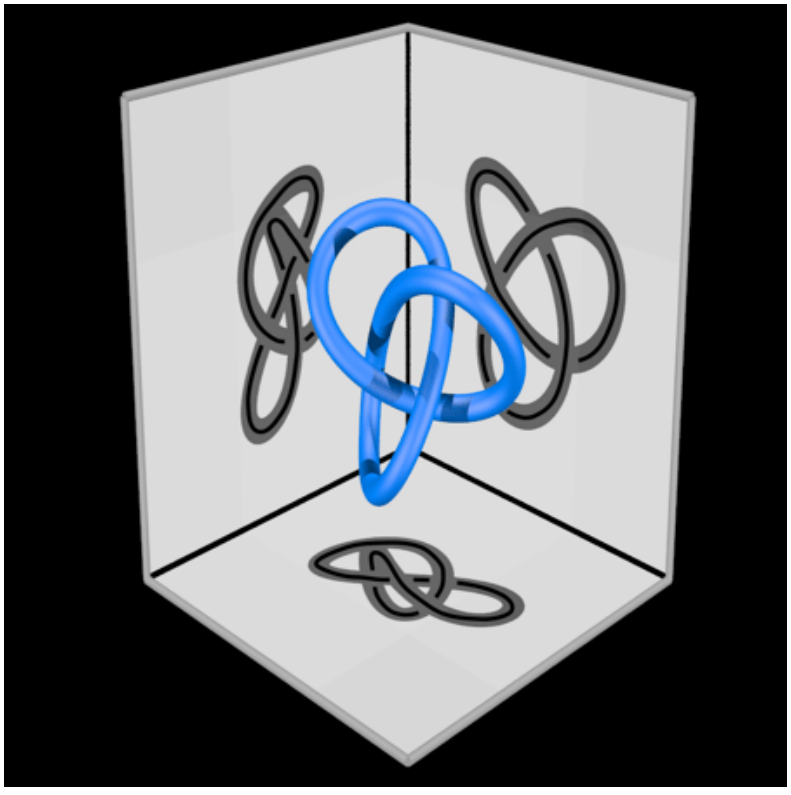
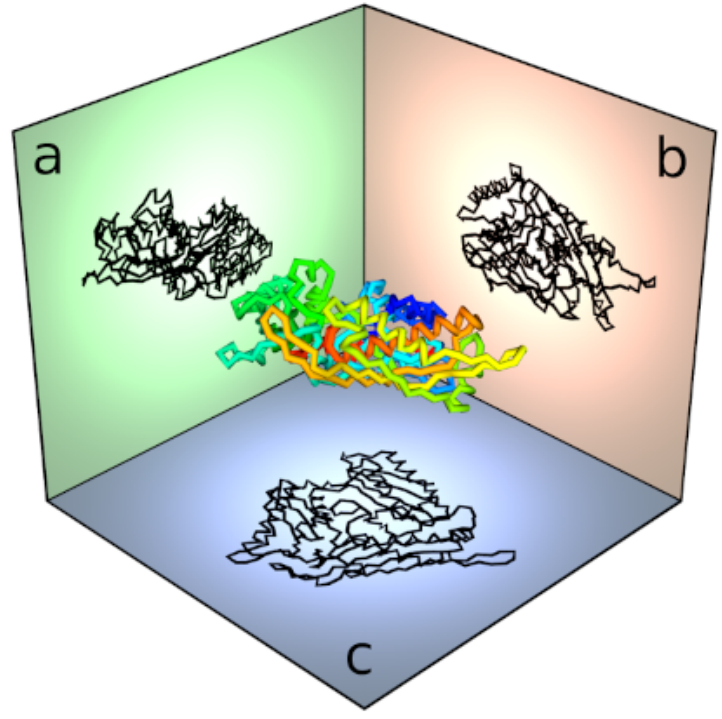
What is...a demon knot?

Or: Why wireless is great

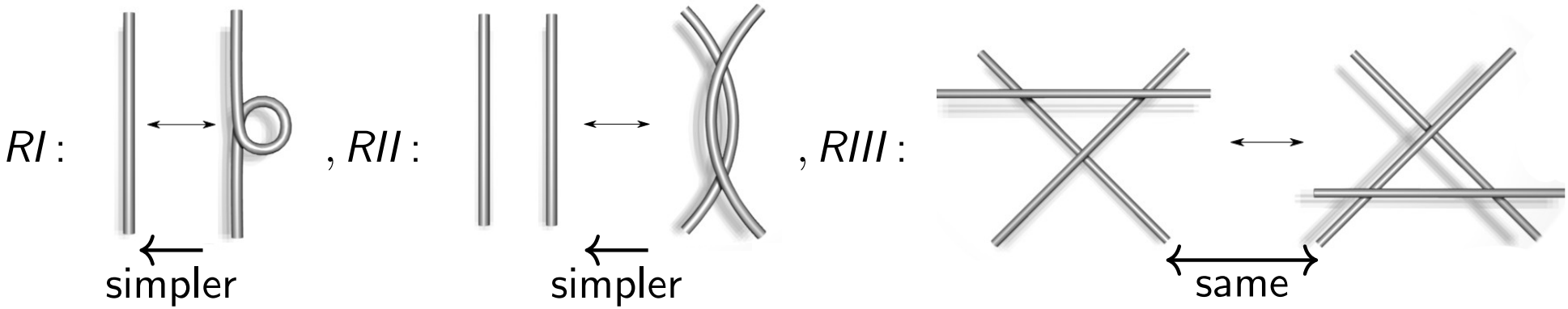
Knot theory is about projections

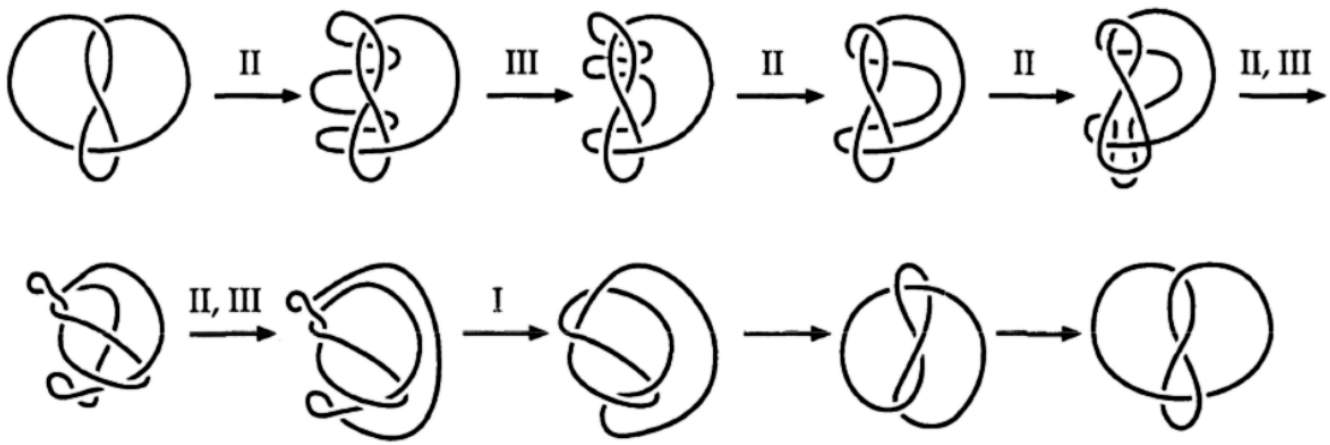




- A knot is a closed string in three spaces
- Knots are studied by projections to the plane Shadows
- Crucial problem in knot theory: distinguish knots only knowing the shadows

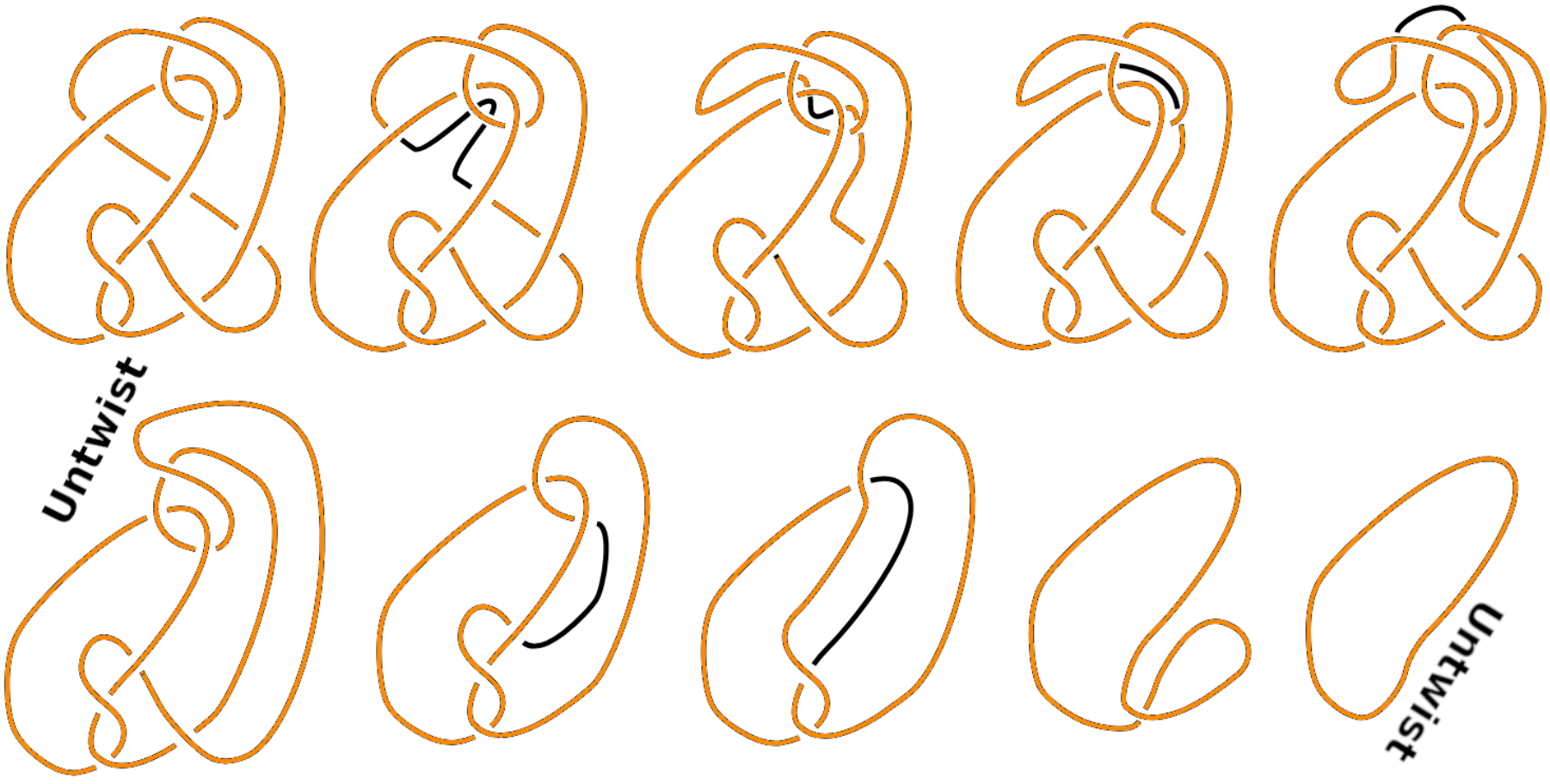
Hard unknots





- Reidemeister theorem Two shadows present the same knot $\Leftrightarrow$ they are related by RI, RII, RIII moves and isotopies
- An unknot shadow is a demon if there are no simplifying RI, RII and no RIII moves
- Hard = you need to make more complex before you can simplify it

An example of a demon



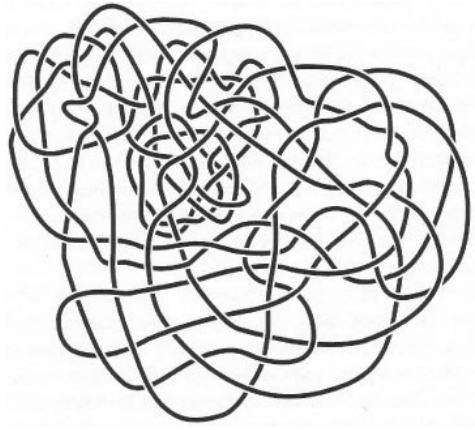
- The above shadow with 10 crossings is called the culprit
- We need to make the culprit more complicated before it simplifies

Enter, the theorem

For any $n > 0$ there exists an $N \geq n$ and a demon shadow with N crossings

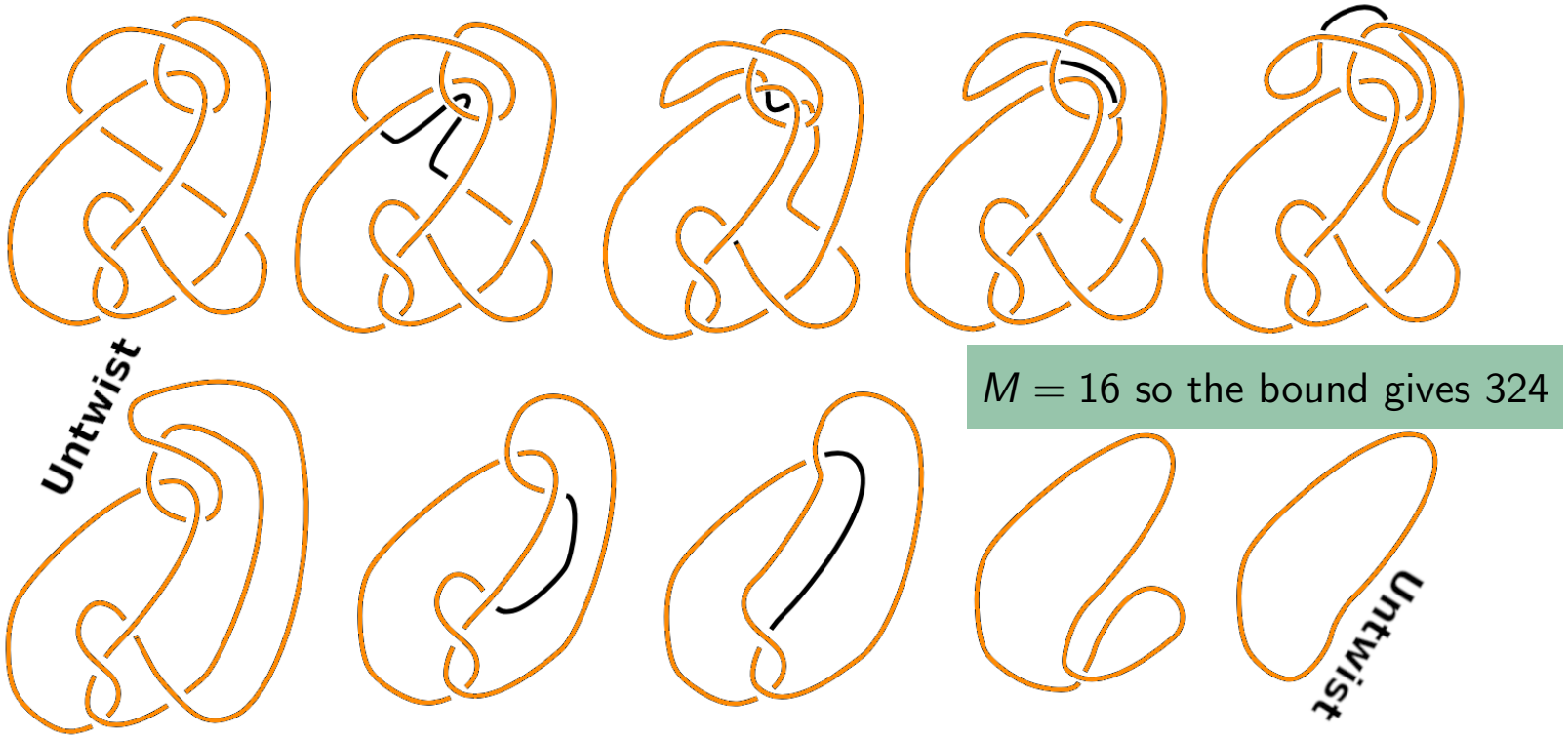
Arbitrary complicated demons exist!

A demon:



A real world demon(?):

We can do better, but there are still many mysteries



- Let $M = 2max(D) + c(D)$, twice the number of maxima of the shadow K plus the number of crossing
- Theorem D can be unknotted by a sequence of Reidemeister moves so that no intermediate diagram has more than $(M-2)^2$ crossings
- This bound is far from optimal for most shadows

Thank you for your attention!

I hope that was of some help.