Of Loops, Braids, and String Figures

The Loopy Calculus of Cat's Cradle

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Thanks!

Thanks for coming out to this workshop. This is a test run of a workshop that we'll present at Bridges 2026. A conference on mathematics and art happening at the University of Galway in Galway, Ireland, 5–8 August 2026

Workshop Outline

Please make sure that you've got: **the paper**, **the supplement**, and **a string**.

- **Playing with string (30 minutes):** Participants playfully learn to create several warm-up string drawings culminating in the string figures Brokhos and Koura.
- **Heart-sequences and figures with partners (30 minutes):** Participants pair up to replicate the figures by carrying out their loop-based constructions.
- **Applying loop braid relations to string figures (15 minutes):** Working in pairs as before, participants explore the effect of loop braid relations on the figures.
- **Question and answers:** We chat about life, mathematics, university, and anything else. Really, ask us whatver you want!

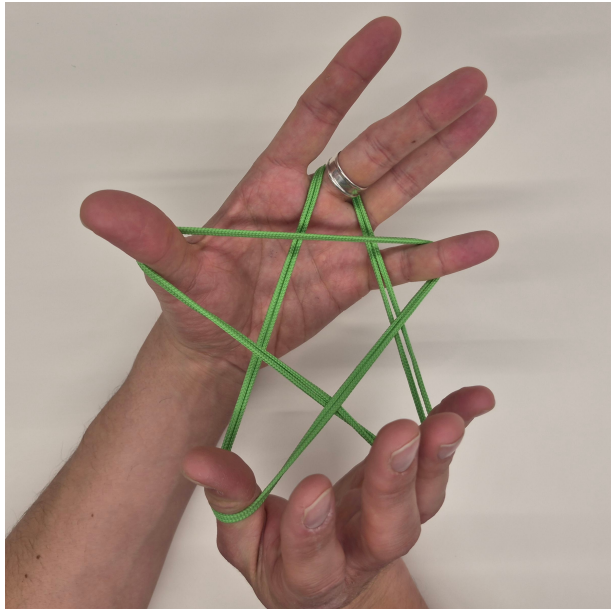
The notes are available online here. ⟶

`https://pgadey.ca/notes/talk-bridges-2026/`

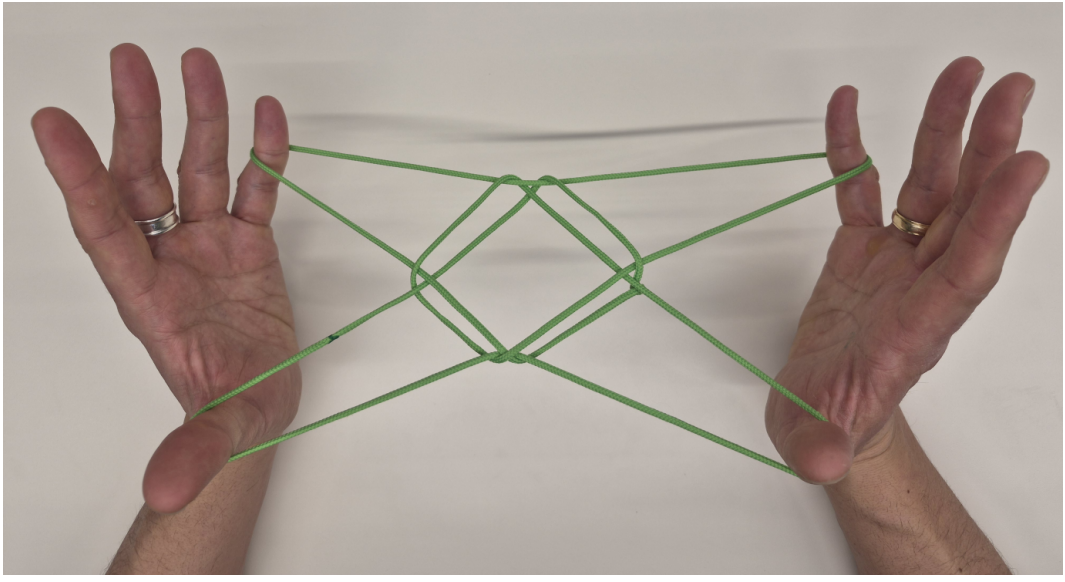
An Important Warning

NEVER PUT THE STRING AROUND YOUR NECK.

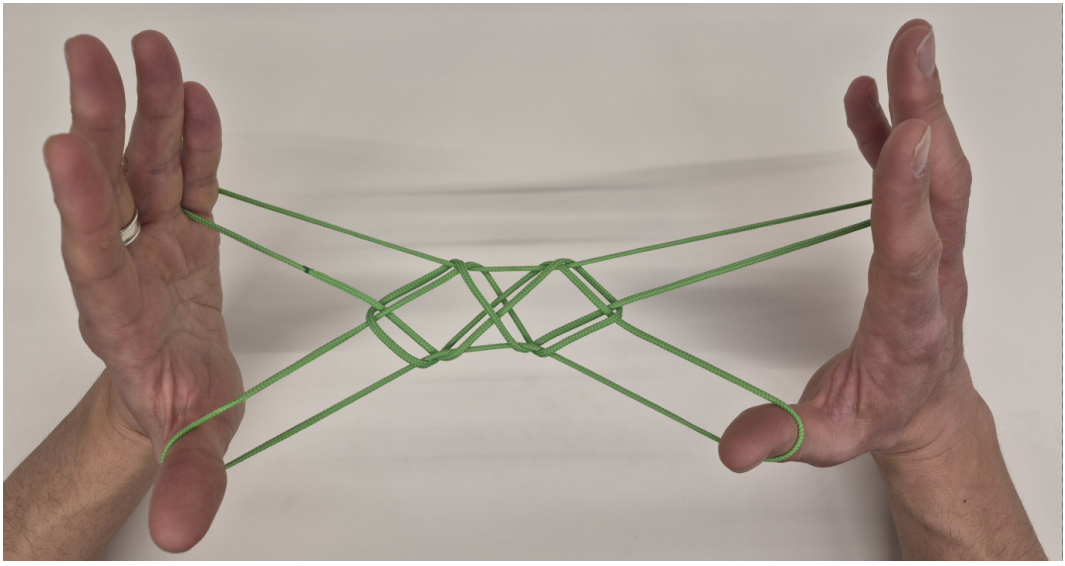
Star



Brokhos



Koura



What is Algebra, Really?

In algebra, we want to understand numbers via the study of equations.
In contemporary mathematics, it is common to define things via equations.

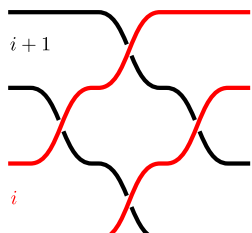
- **Commutivity.** For all x and y we have: $xy = yx$.
- **Identity.** If $x \neq 0$ then there is x^{-1} so that: $xx^{-1} = 1$.

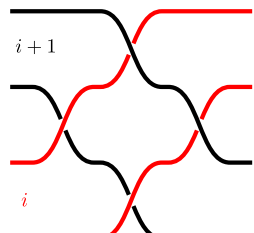
This approach to studying numbers via equations has the advantage that it generalizes.
We can find things that are not numbers but which behave *like* numbers.

String figures and braids behave like numbers.

Generators

Operation	Loop Braid Notation
Half-twist loop i clockwise.	$>i$
Cross loop i over loop $(i+1)$.	$\overrightarrow{i}$
Insert loop i over and down through loop $(i+1)$.	$\overrightarrow{i}\downarrow$





The Braid Region

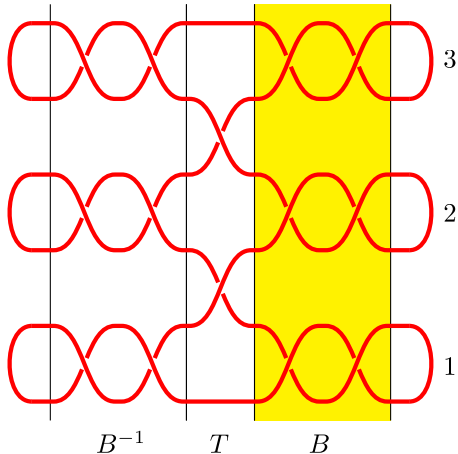
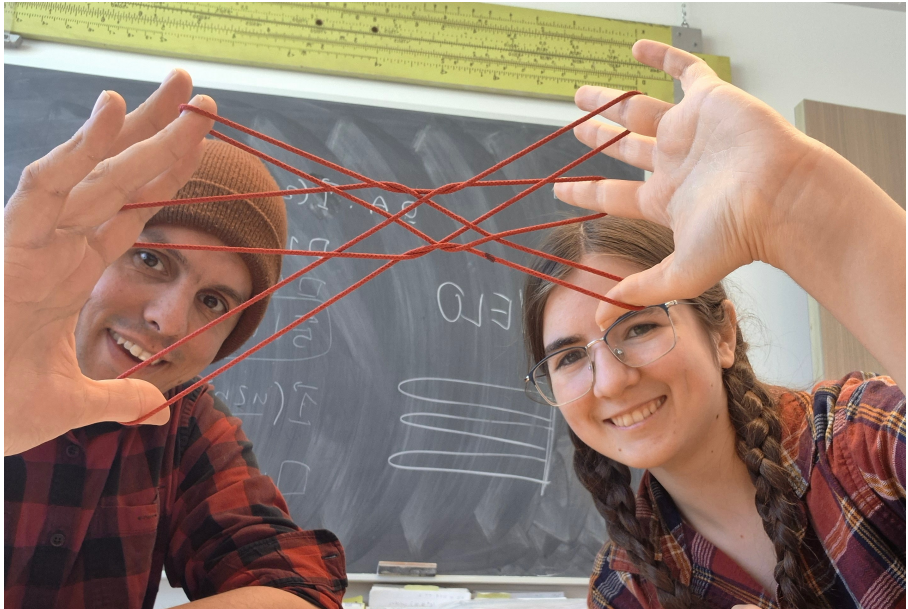
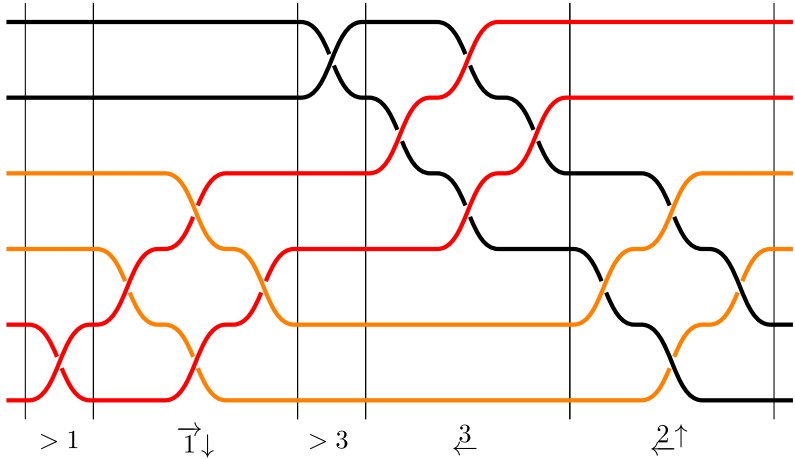


Figure: The braid region B, its inverse, and the central tangle T.

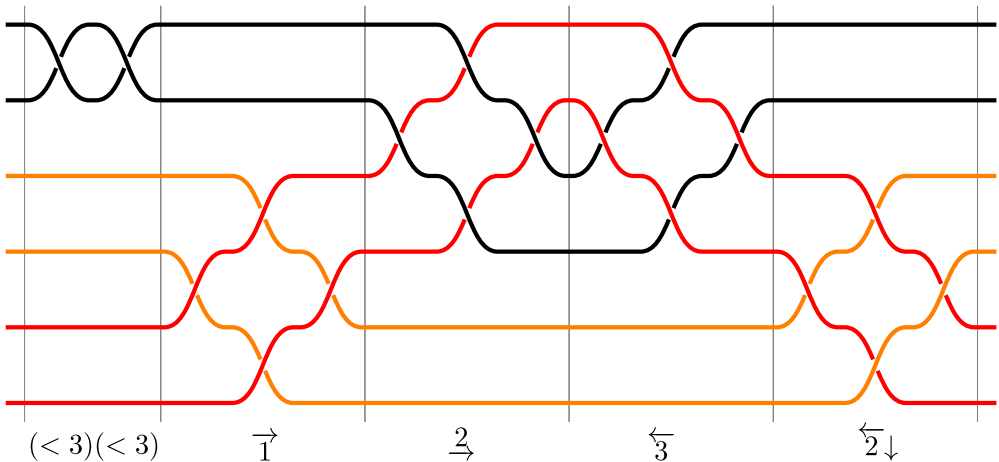
Tacking: A Way to Play String Figures Together



The Brokhos Loop Braid



The Koura Loop Braid



Twist Commutivity

Theorem

If $m \neq n, n+1$ *then:* $\left(\overrightarrow{n}\right)(>m) = (>m)\left(\overrightarrow{n}\right)$ *and* $\left(\overrightarrow{n}\downarrow\right)(>m) = (>m)\left(\overrightarrow{n}\downarrow\right)$.

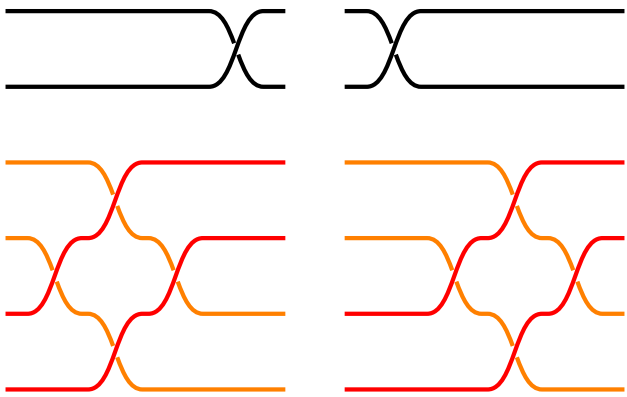


Figure: The twist commutation relation $\left(\overrightarrow{n}\right)(>m) = (>m)\left(\overrightarrow{n}\right)$ for $n = 1$ and $m = 3$.

A Braid Relation

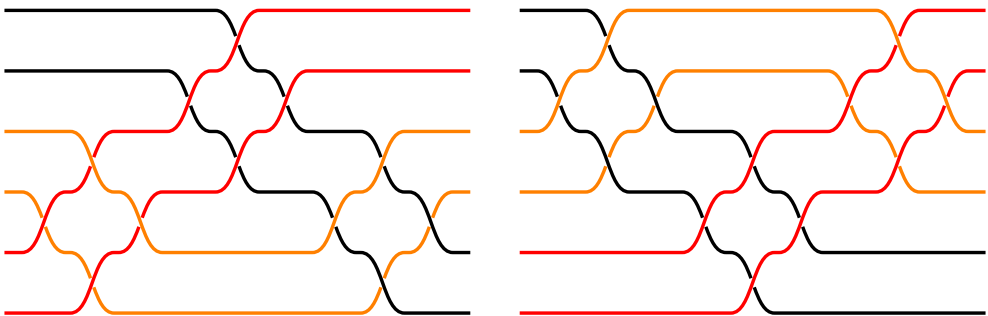


Figure: A braid relation $\left(\overrightarrow{1}\downarrow\right)\left(\overrightarrow{2}\right)\left(\underleftarrow{2}\uparrow\right) = \left(\underleftarrow{3}\uparrow\right)\left(\overrightarrow{1}\right)\left(\overrightarrow{2}\downarrow\right)$.

Thanks for playing with us today.

Questions?