

#flo #inclass #cool

1 | systems of systems? of systems? damn.

identify with the math as you identify with characters

we are a system! we can think about different levels of abstraction and some work better than others?
#question what does that mean?

"math story"

oh hey, we get to learn some category theory!

one works at exploratorium, and one works at <https://topos.institute>

1.1 | category theory

1.1.1 | contextualizing category theory:

- group theory talks about symmetry,
 - construct a language which can identify symmetry agnostic to the implementation
 - * this is about **finding the right abstraction**
 - characterize by operations that land in the same place (ie, flip, rotate, ect.) <- the abstraction! it's here.
 - * this means we can get the concept of "triangular symmetry" when things are isometric with themselves in the same way a triangle is
 - adding actions in sequence means we can get algebra, as one operation composed with another can be equal to a third
 - every two actions in sequence can be represented by one
 - * so we can get a multiplication table, in a sense
 - * that table, is a **group**!
 - there is one of these for every group
- had to go covid test, missed topology overview
 - but essentially, when making languages for each set, we can communicate between them
 - * but we need a higher level abstraction!
 - * yes. yes we can, with a ... directed graph!

1.1.2 | directed graphs as meta-abstraction

for topology, an arrow represents a map between two objects. ofc, there are essentially inf possible maps - a map is a continuous map where topology is preserved when mapping specific points between two objects - the "verbs" are the maps - between any two nodes, there is a bundle of maps going to and from every node - + reflective loops, maps to themselves - instead, we represent a bundle in a direction as a single arrow - making this directed graph for every possible topology is a **category**

we can do the same for linear algebra,

abstraction scheme: find uniform representation -> get ideas category theory is this, but one layer of abstraction higher

"category theory is the mathematics of mathematics"

- logic can also fit into category theory,
- and also programming,
- and even categories can form a category!
 - fit across multiple layers of abstraction, called doing "yoga"

1.1.3 | what it feels like to do category theory

- alexander grothendieck: big name
 - went crazy, turned into a monk guy, and drank dandelion soup a lot
- argued,
- proving a theorem like cracking a nut
 - hammer and chisel style, (elegance)
- but instead you need
 - dropping the nut into water, and having it slowly soften over the course of months

category theory solves interoperability problems

birds eye view of mathematics - details become invisible, but you can spot patterns that would otherwise be impossible to spot. - emergent property!!

1.2 | accounting systems

?what rules are there for pointing?

math is just an accounting system. about, what has to stay the same, and what can get disrupted (ie. algebra, preserve the equality but disrupt the sides)

mathematical move of "what am i made out of / what makes things work together question mark?"

when you find the right abstractions that contain two things, you get a lot more

think, distance and cheese both lead to numbers

1.2.1 | interface

humans be represented as an interface, with inputs and outputs mike levin, neuroscientist. check em out!

life organizes themselves

life, is what counters entropy? they organize themselves **more**

this is crazy cool!!!

do your own thing, not someone else's thing.

2 | we are back!

prototyping, so we can come back!

- he has a new type of thinking about algebra
 - node based? ideas borrowed from functional

"writing is an antique interface"

so, what is better? alternatives to written notation: gesture calculators very visual

why is written notation so powerful? you can switch between models without having to switch representation systems

five years later!

instead of operational, we have constraint systems

functional -> flexible relational framework

he's making "gateway games"

2.1 | the circuit system

remember: no ui is in here yet! this is all about the relational interface under the hood the big idea: everything is reversible just about structure, devoid of data

the model and the data are separate

solution through emergent property

abstraction through node collections this is node based but with dynamic directionality

2.2 | lineage system

new models of numbers come from exceptions from the previous

algebra as geomatrey "kinematic" system

operators first instead of numbers first

u should be able to drag anything!

both are: unknown agnostic. orientation agnostic?

identities become emergent

what defines a different language is what is obvious and what isn't

2.3 | ideas

vector field 3d -> ar build math yourself

how does the third dimension come into play?