LangTominoes!?

Saturday Zoom G4G Social

JoHN MiLLeR

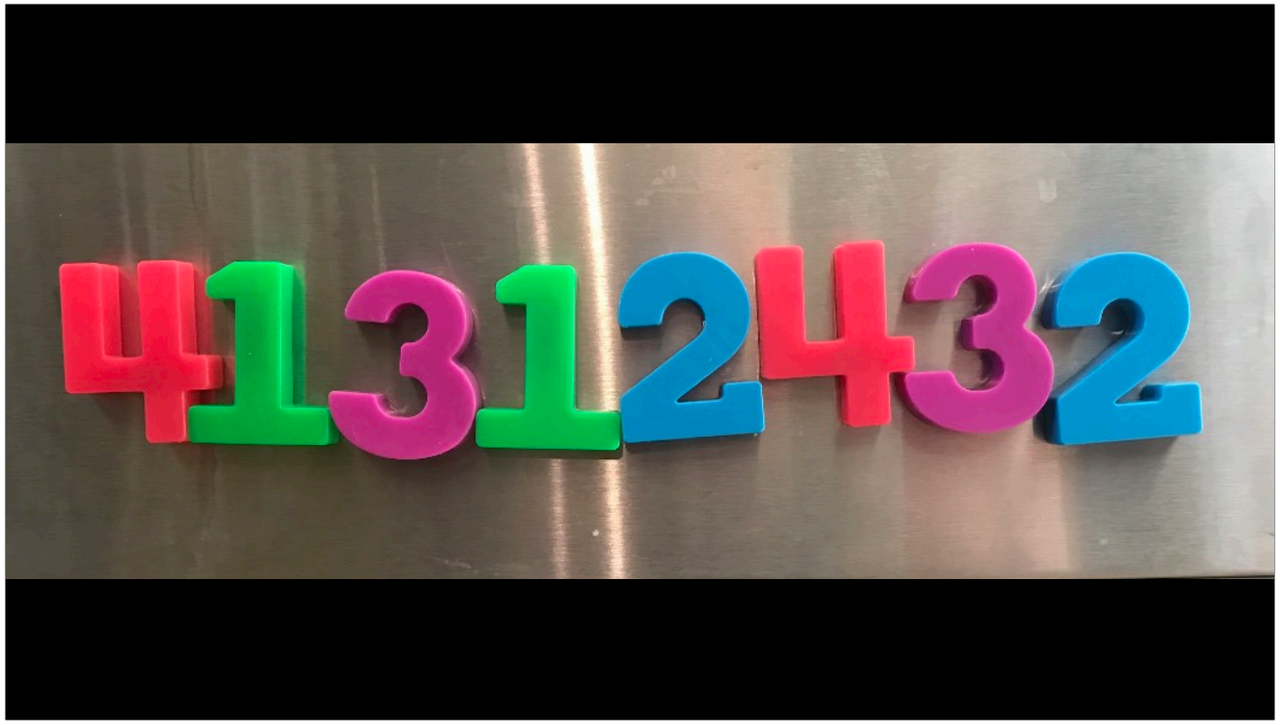
June 28, 2025

`dialectrix.com / langford / LangTominoes.html`

My blurb for this talk said "Toy" - but they could be a puzzle, or a game. In any case, they are a new representation of LP.
I'm looking for any feedback here prior to G4G16!

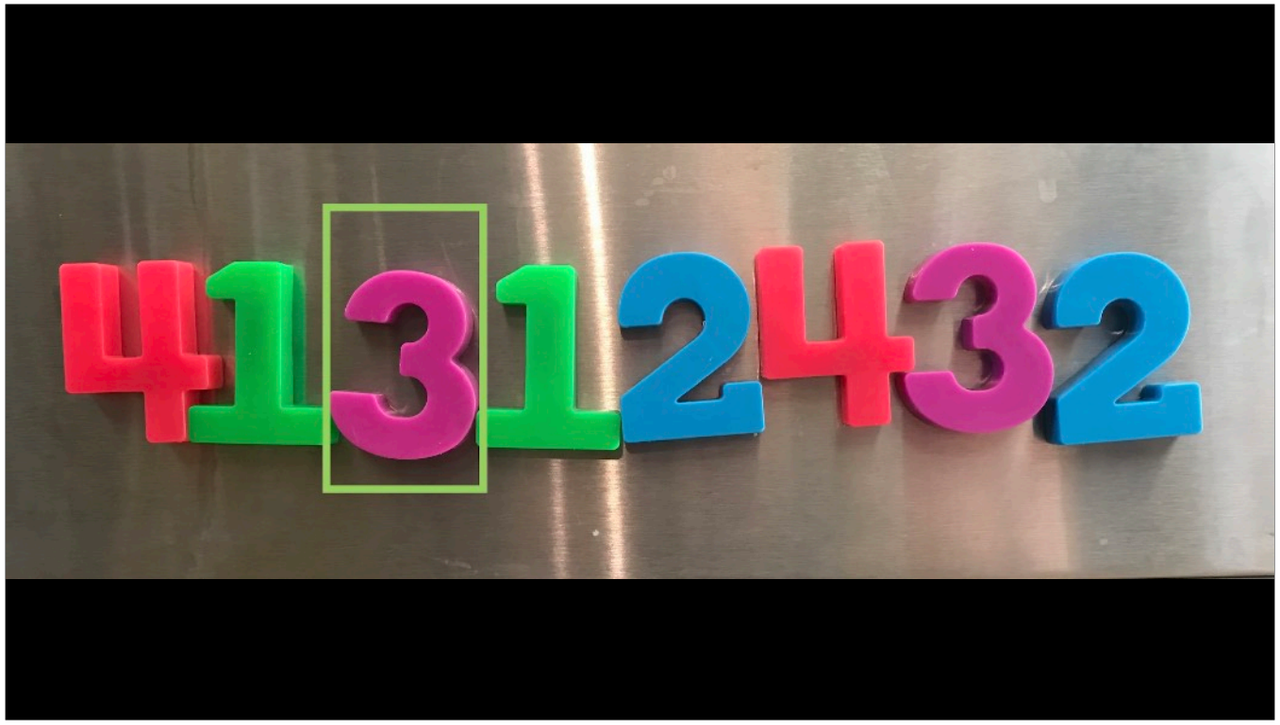
The first half of my slides show what things that were swimming around in my head prior to Kate Jones' March 29 presentation, when this idea came to me, 91 days ago.

WHAT *is* LANGFORD's PROBLEM ??

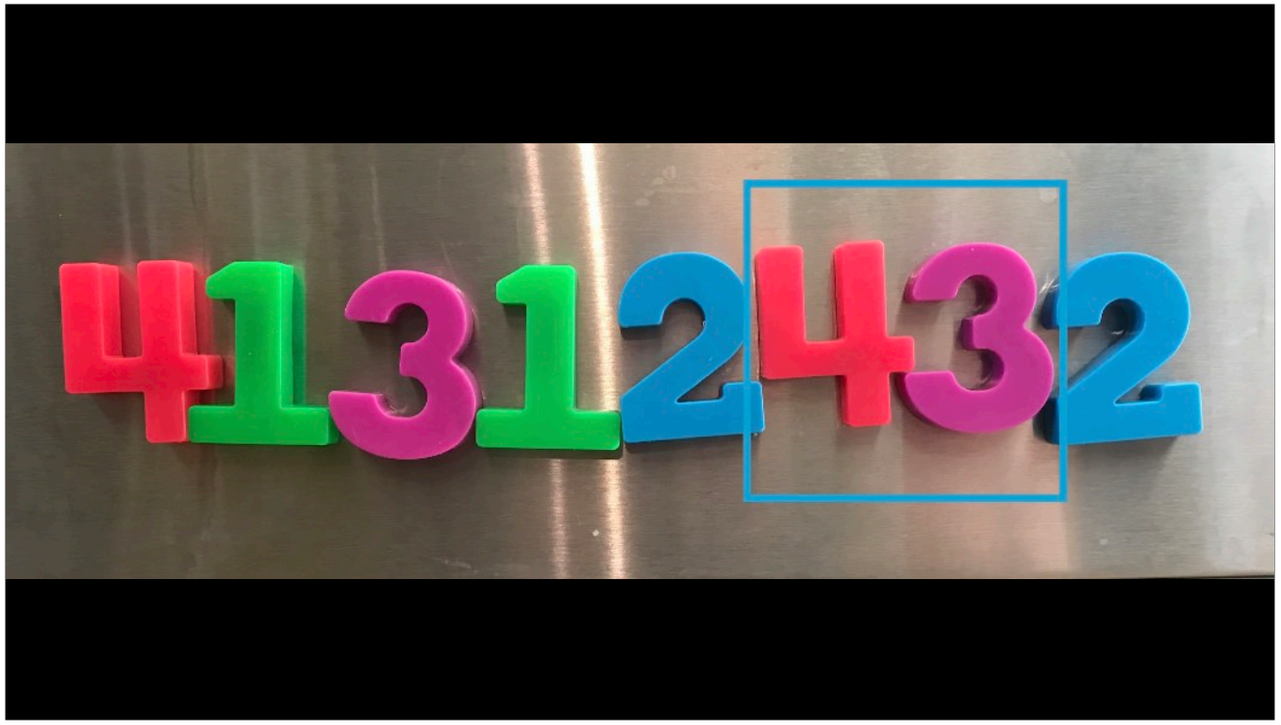


the Problem is about Arrangements of Pairs of Objects.
Langford saw his son playing with pairs colored blocks.

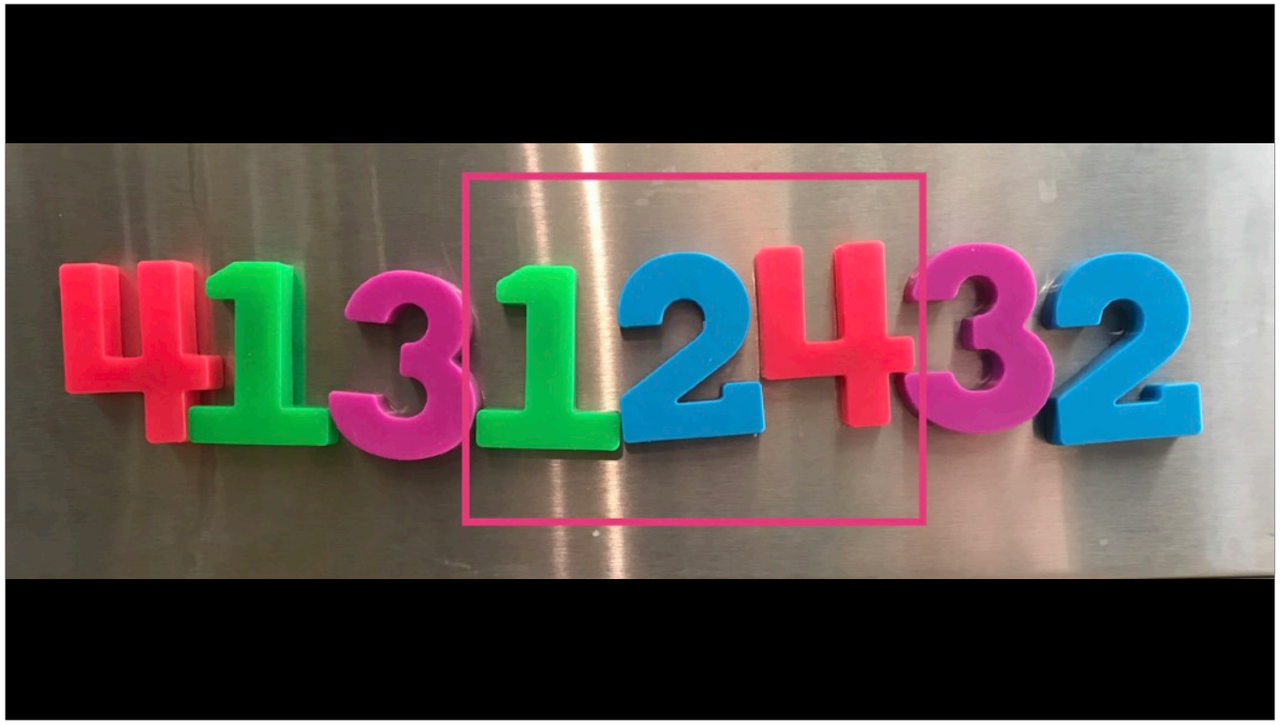
Here we have pairs of refrigerator magnets.



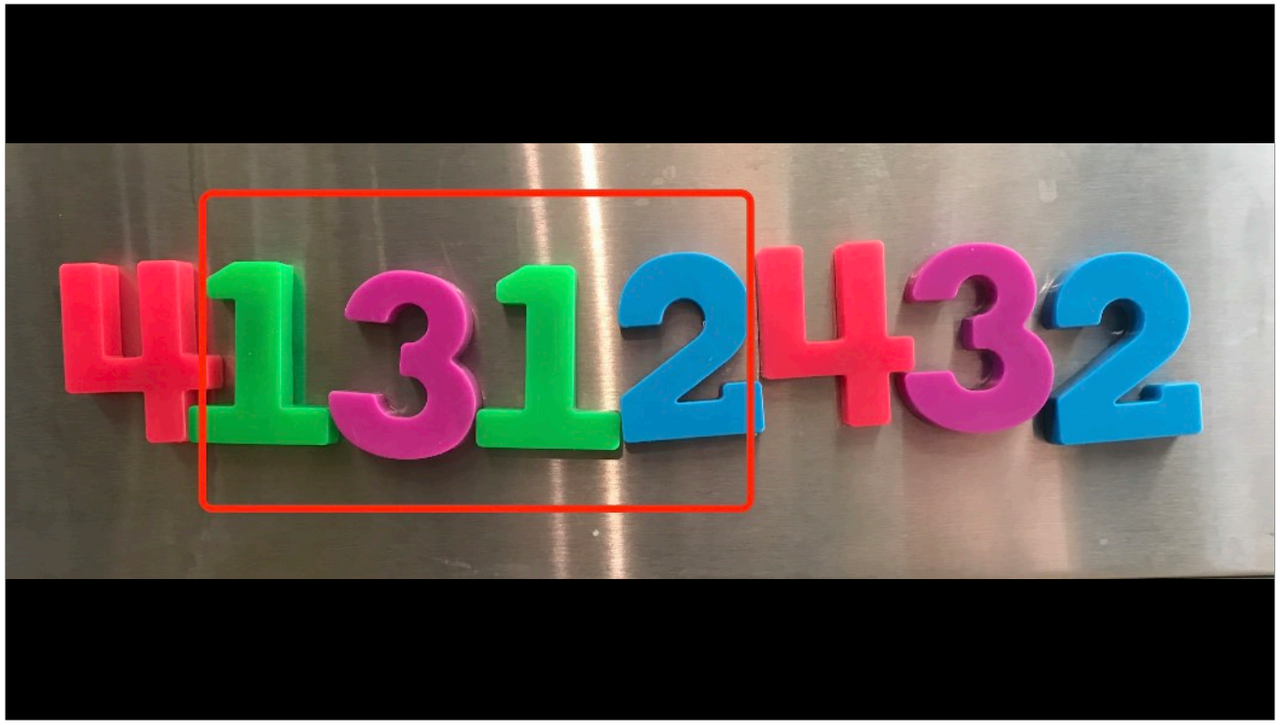
There’s one magnet between the two 1’s



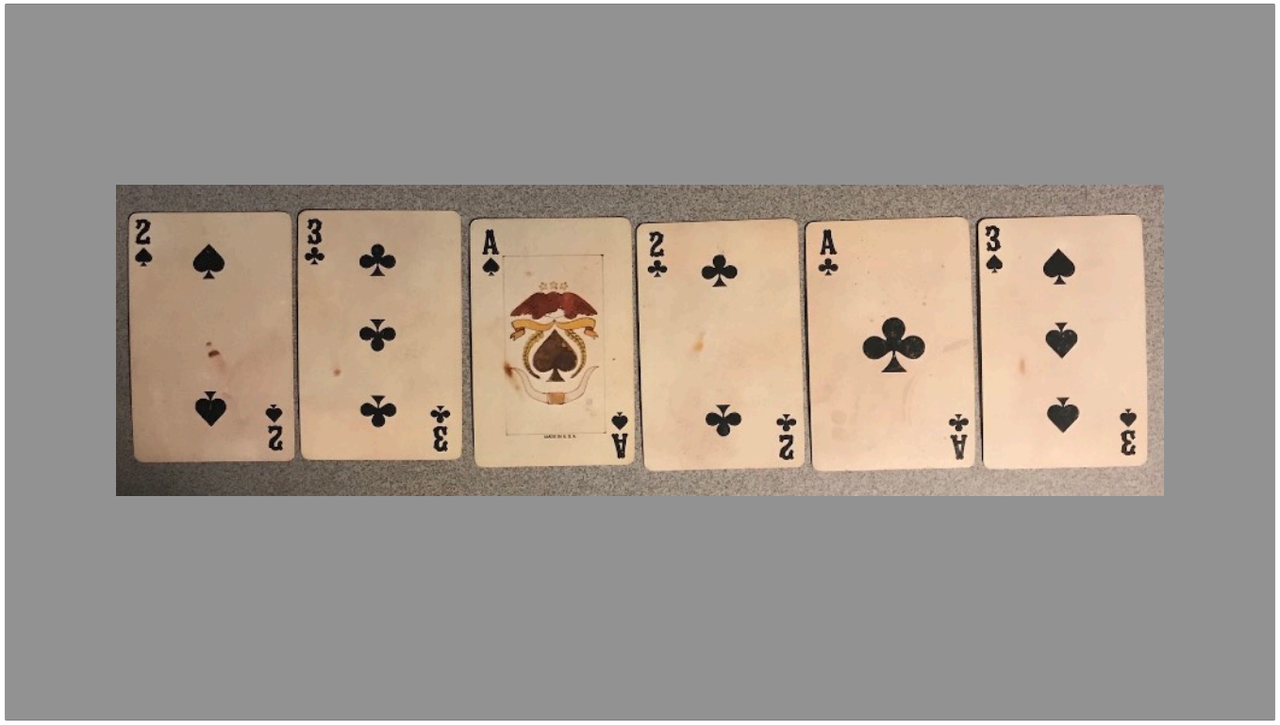
Two magnets between the two 2’s



Three magnets between the two 3’s



Finally, four magnets between the two 4’s.



Can do this with pairs of cards!

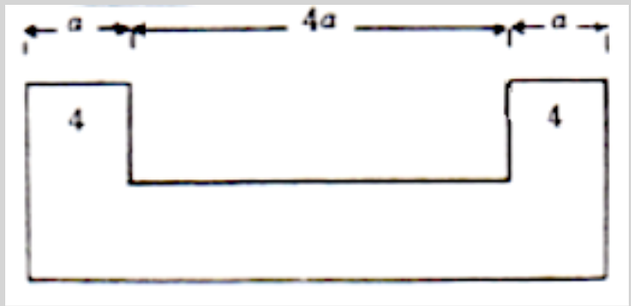
Langford found that you could make such an arrangement with 4 pairs, but not five of six pairs.

Turns out, it can only be done if the number (of pairs) is a multiple of 4, or one less.

My web page is the top hit for Langford’s Problem on Google Search, so you can read all about tit there.

“Things that led me to LangTominoes…”

Was I Pre Disposed to invent LangTominoes?

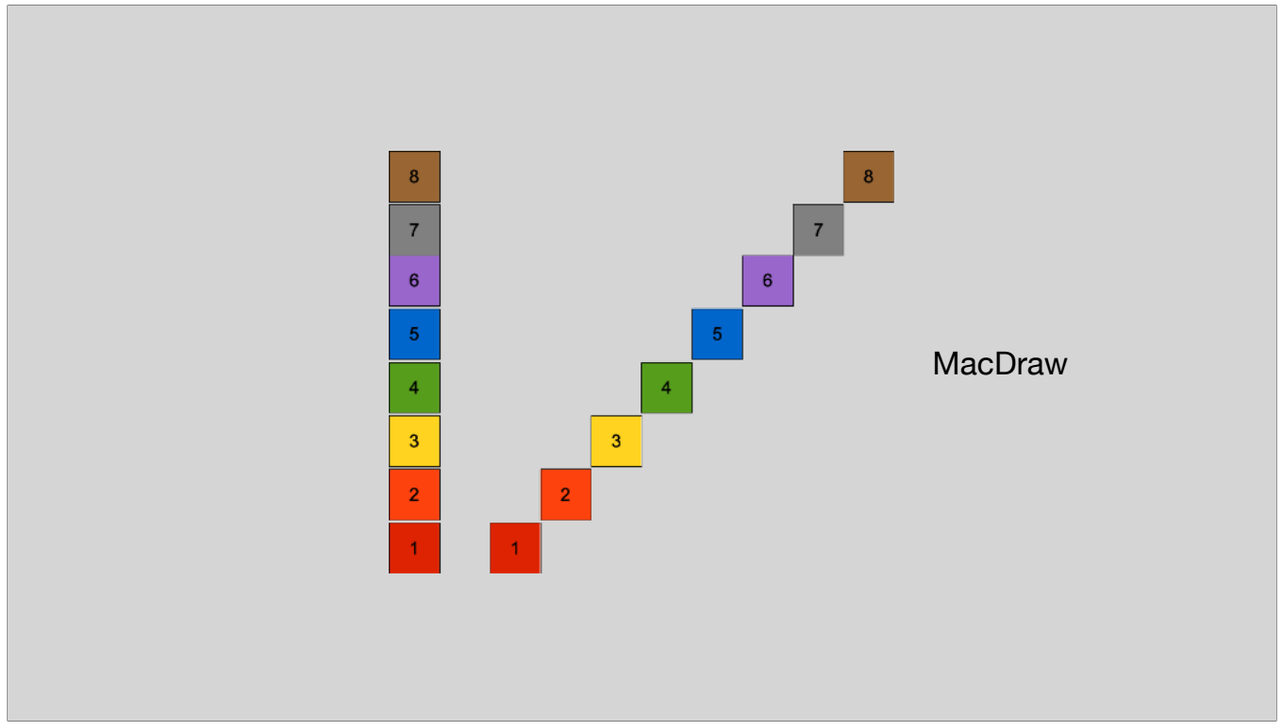


Langford’s illustration

From his 1958 Math Gaz blurb

I puzzled over Langford's card stock shape… shown in 1958 Math Gaz. (a, 4a, a)

I held this shape Up during my G4G11 talk.



MacDraw was an object-oriented drawing program, c 1986?

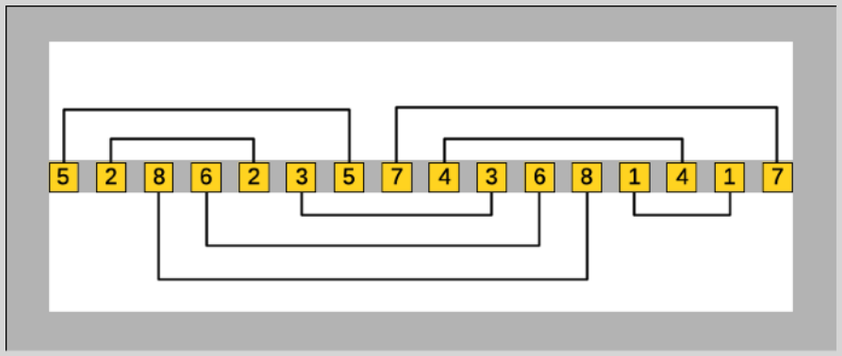
I grouped pairs of blocks into single objects so I could move the PAIRS around easily. (But Black & White at the time!)

Compare this to the Frig magnets — you have to move each magnet, and adjust spacing.

I saw a picture of one puzzle that maintain this distance and pairing,
but I'm avoiding a survey of other puzzles here. See my web page.

(Hardisky, Singmaster?)

One of Knuth's planar solution for n=8



Continuing with the mixed bag of ideas here..

Knuth referred to planar solutions in Art of Computer Programming (Vol 4 Algorithms)

George Hardie

poster

I recently came across this poster, spelling G E O R G E in 3D rectangular blocks

Seen Dec 2024
George Hardie Exhibition, 2020
France
https://www.slanted.de/george-hardie-exhibition/

“Zeichen” by

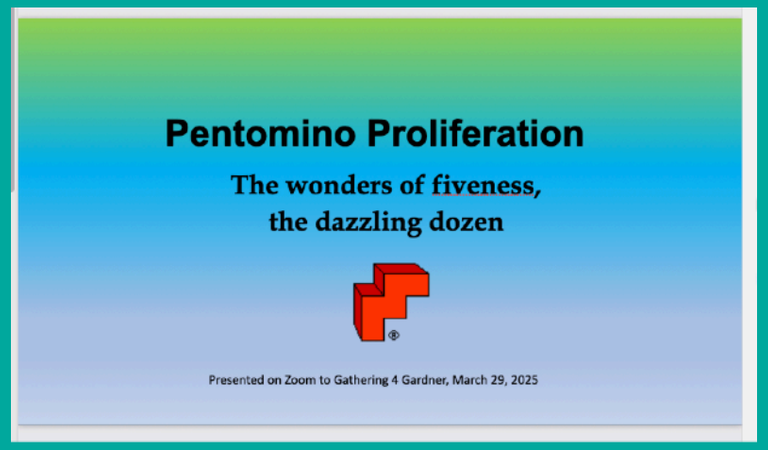
Gerhard Hotter

I saw this in Gerhard Hotter's recent exhibition catalog “CODES”.

Just days before Kate's talk, I was designing this stained glass piece for my grandson’s 3rd birthday.

I thought I might also make a wooden puzzle for K-I-T, but decided to wait another year.

Kate Jones, March 29, 2025 !



Then came March 29. I show up for Kate's Pentomino Proliferation expecting lots of alliteration!

((Not "Pandemonium", as I wrote to Colm in my blurb for the talk! I do apologize to Kate!))

I'd known about pentominoes since MG covered them in Oct 1965. I have an early set of polystyrene tiles, somewhere.

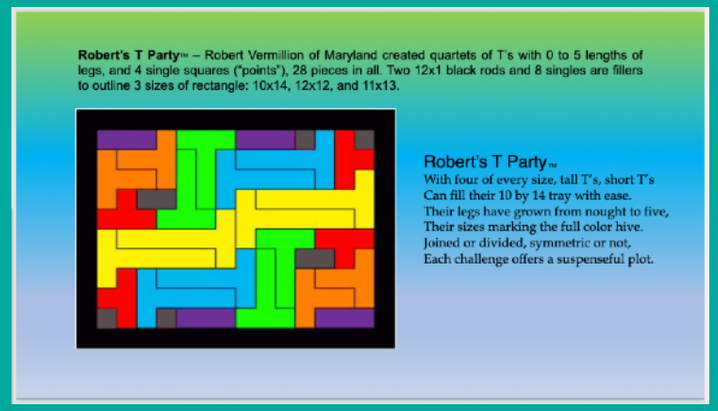
QUINTILLIONS

Polycube version of Pentominoes

I got my lovely Quintillions directly from Kate at G4G11or maybe G4G12.

During this slide, and “Poly4”, I was seeing polycubes, not tiles.

Robert’s T Party

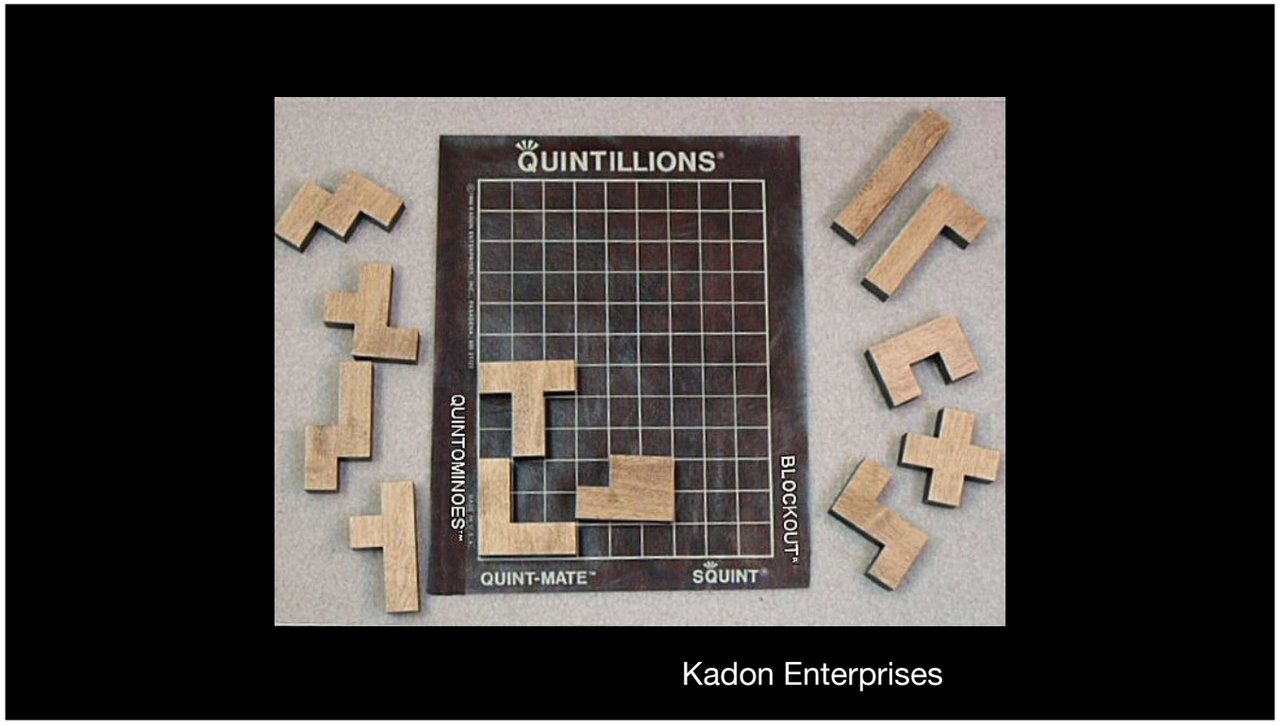


Aha!

Then BaM! For some reason the LONG T shape jolted me. “Wow!” Maybe I could do something similar for Langford’s Problem.

There were T’s of all sizes, 1, 2, 3, 4, 5 ! !

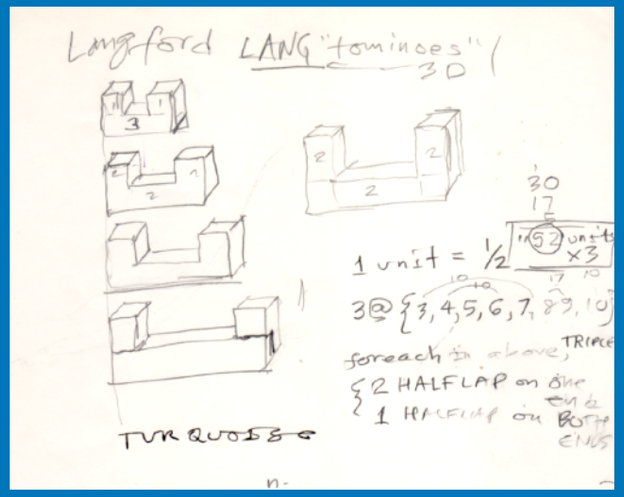
"Robert’s T Party", by Robert Vermillion (LINK)
https://www.gamepuzzles.com/polycub4.htm#RTP
IMAGE (These are Tiles.. more later on this)



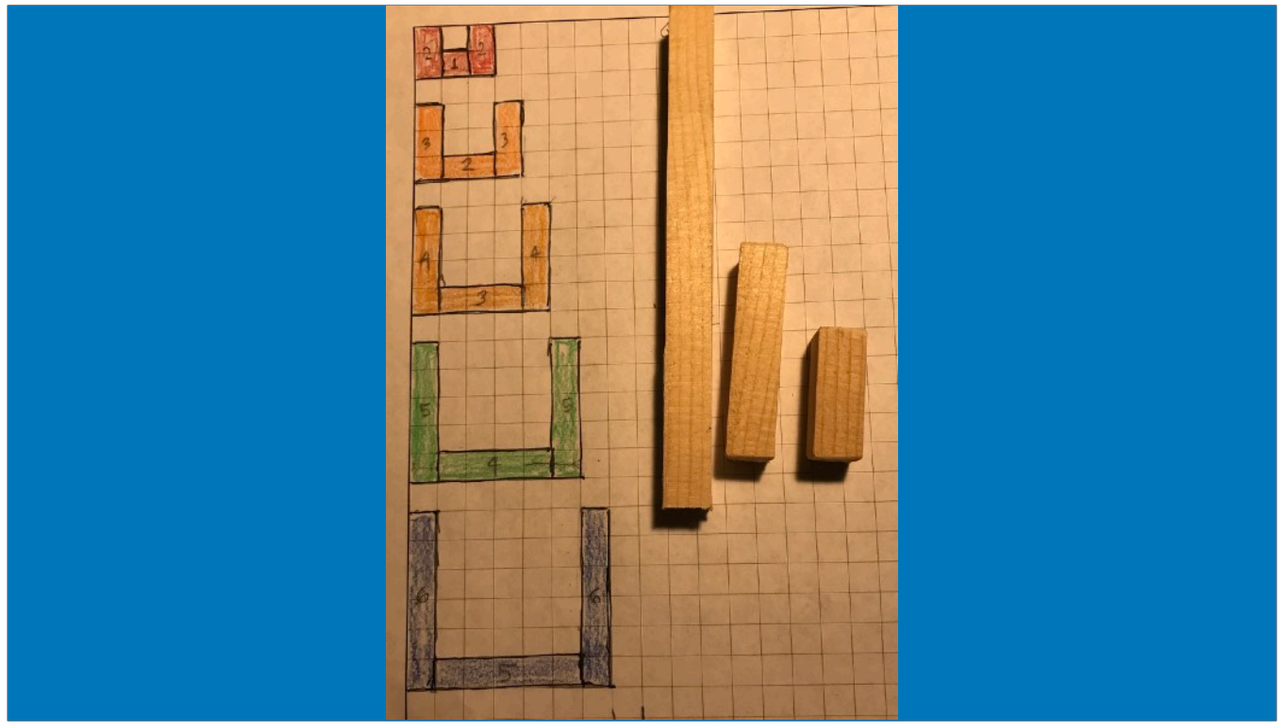
Kadon Enterprises

Once again, Here are the "Quintillions" (polycube version of pentominoes.) 5/8"

Even though I've had 'Quintillions' for years, I'd never thought of solid Langford pieces. Why would I ?

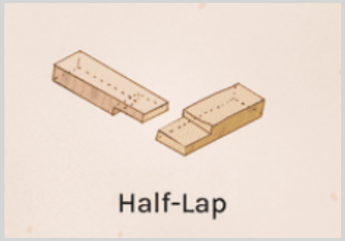


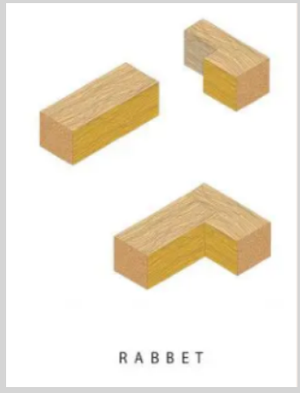
But, after Kate’s talk, I started doodling.

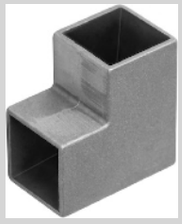


I evidently figured out that Taller “wickets” might work better, than all the same height!

((I didn’t cut anything out of paper. Those were wood pcs from the KIT puzzle.))







SLIDE How would I make these things? Not laser-cut out of solid wood - afraid of leverage, breaking at corners.

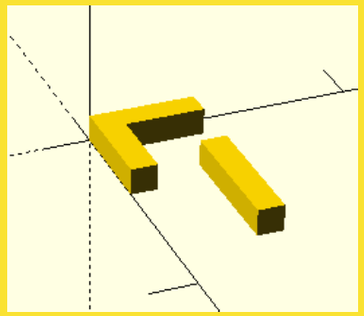
So, could I make Langford pieces up out of Wood,
requiring different kinds of joints??

Aluminum tubing with corner connectors?
I Found metal "U" brackets on line. And so on.

Molded plastic seemed obvious, but how to make all the molds??

OpenSCAD

```
1.  n = 3;
2.   union( ) {
3.      cube( [n+1,1,1] );
4.      cube( [1,n+2,1] );
5.      translate ( [0, n+1, 0] )
6.      cube( [n+1,1,1] );
7.   };
```



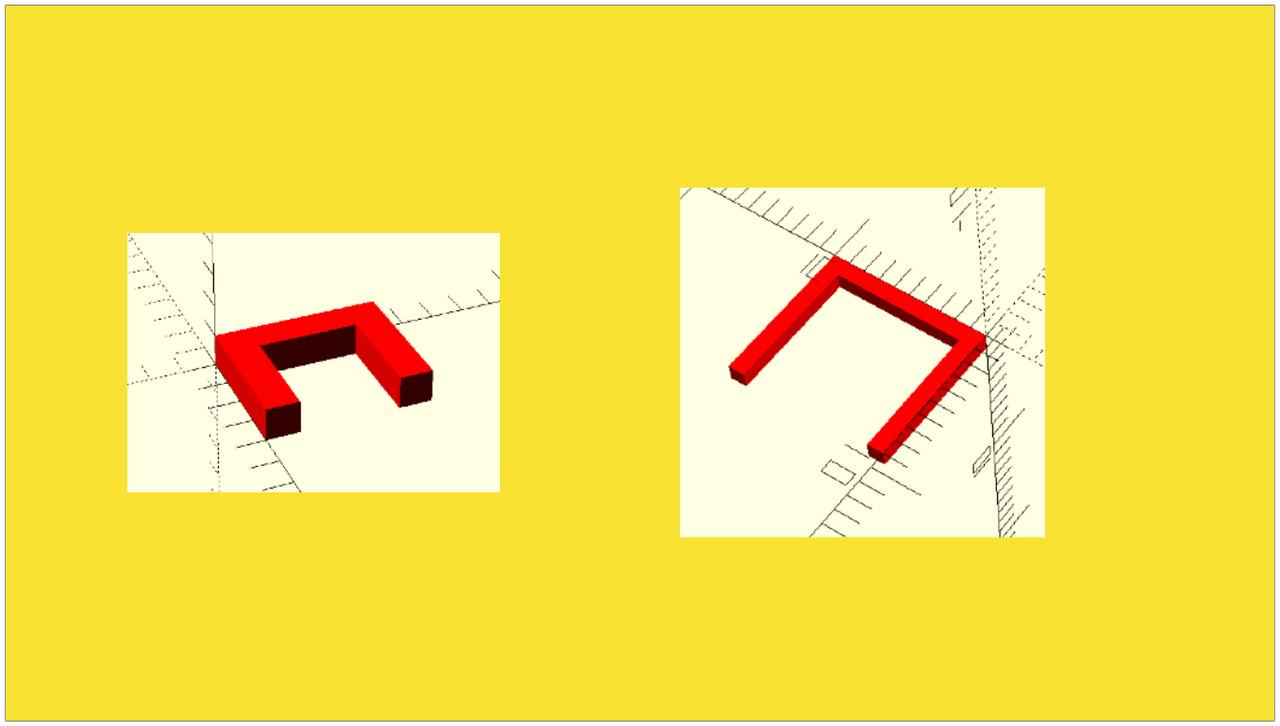
Duh! - 3D Printing so... But, Oh boy, there's got to be a learning curve.. for that.

I wrote to Bruce Oberg, who gave me great advice, ref'd me to Open SCAD, script-based CAD.

This turned out to be a trivial project - a base piece, with two prongs.

Easy to figure this out, cuz you can render at any time and see what you have.
Modify script. Repeat.

Another way to model…



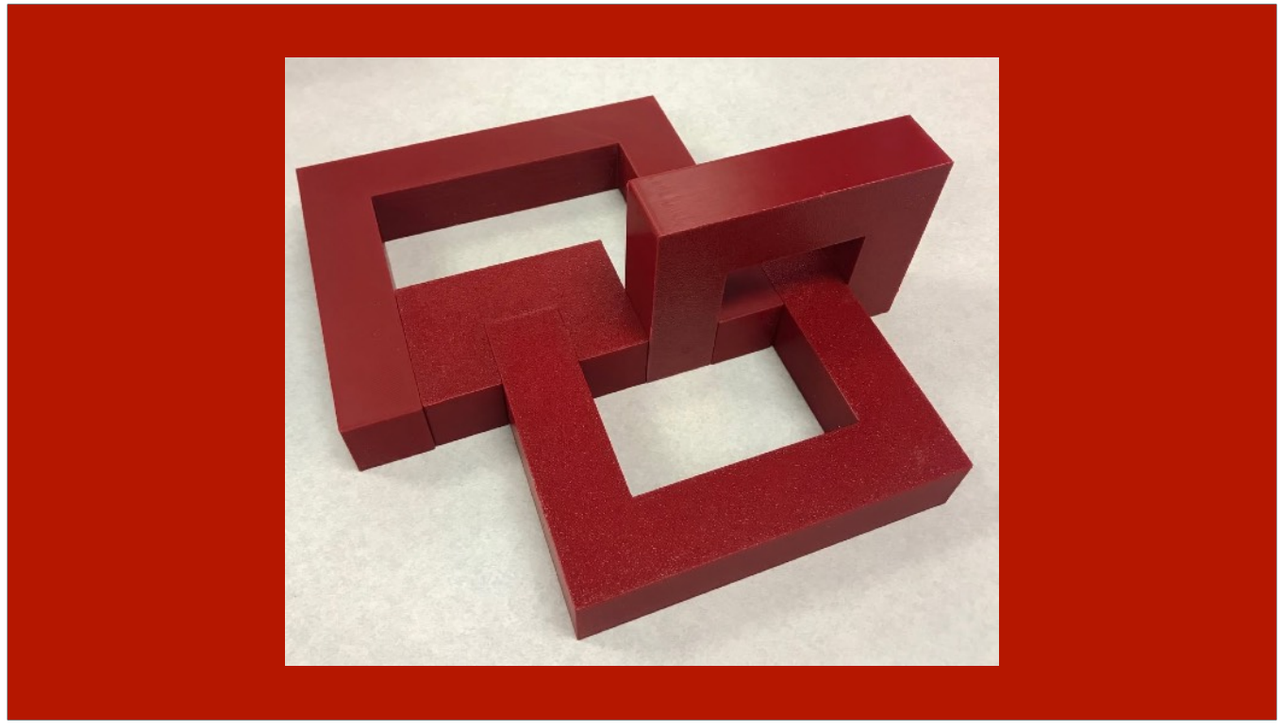
Learning Curve

For example - it's not good to just have components adjacent / touching.
The printer needs to know that they are in fact solidly joined.

Same with rendering - I saw Flicking on the boundaries.

SO, to avoid any ambiguity, I defined the SCG with over-lapping "corners".
Need Good diagram.

But once I had the models, where would I print??



Aha! Talus Design 3D in SE Portland. I walked in and chatted about the project.

I had 1, 2, 3 & 4 printed at 1" size AS A TEST to see if they'd FIT.

That is, would the Geometric Ideal shapes be too tight??

Turned out they did fit / nest! Amazing.

I don't wanna explain what I'd have done if they were too tight!

((There was no point doing different colors, so I chose ALL RED.))

A few slides from here - we'll see this same arrangement, but with 4 colors.

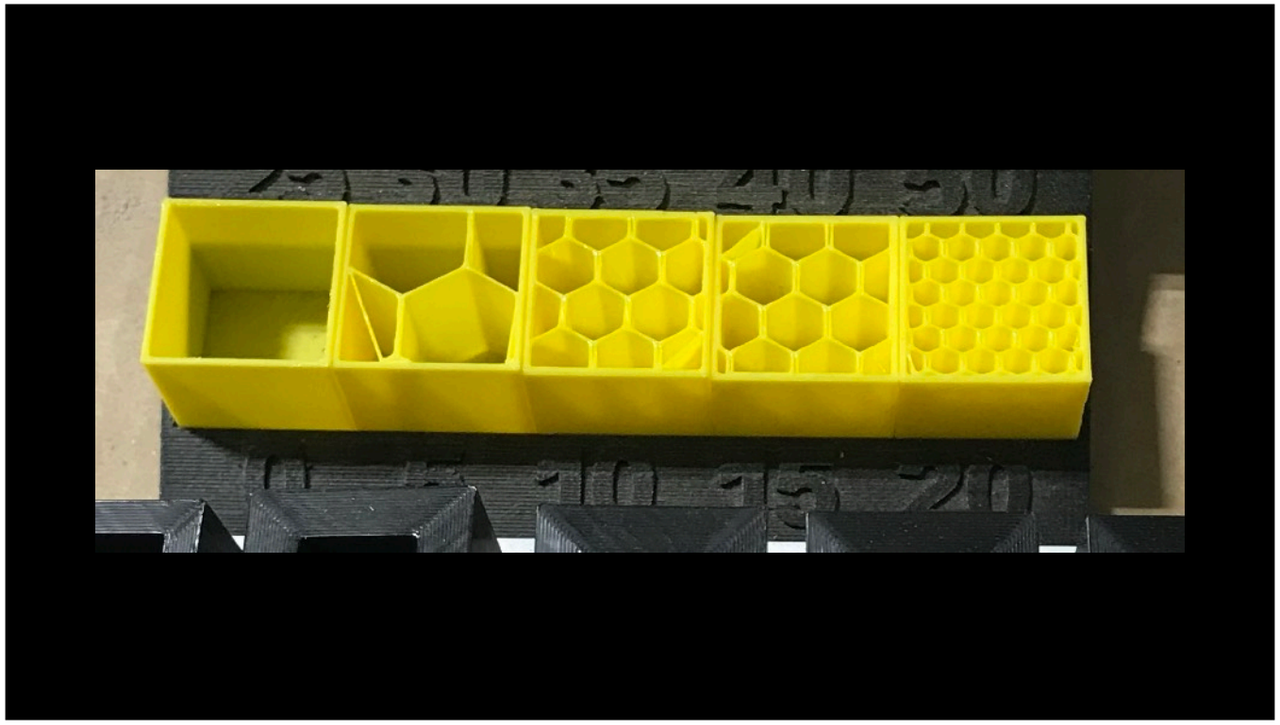
BTW - Each of these took about 3 hours to print!

What I learned about 3D Printing.

These kinds of things are not SOLID plastic.

There are OPTIONS for
Fill pattern (Yellow here)
Wall thickness

I chose
3 shells for the Walls.
and 10 cells in the Fill.



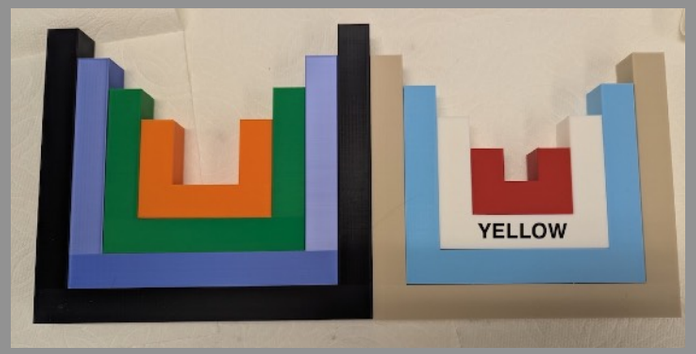
Close up

Some of the fill patterns

Hexominoes on Etsy

“Items by CL”

In the meantime, I found a set of 3D-printed Hexominoes on Etsy.
These Lovely polycubes are smaller - 18mm.



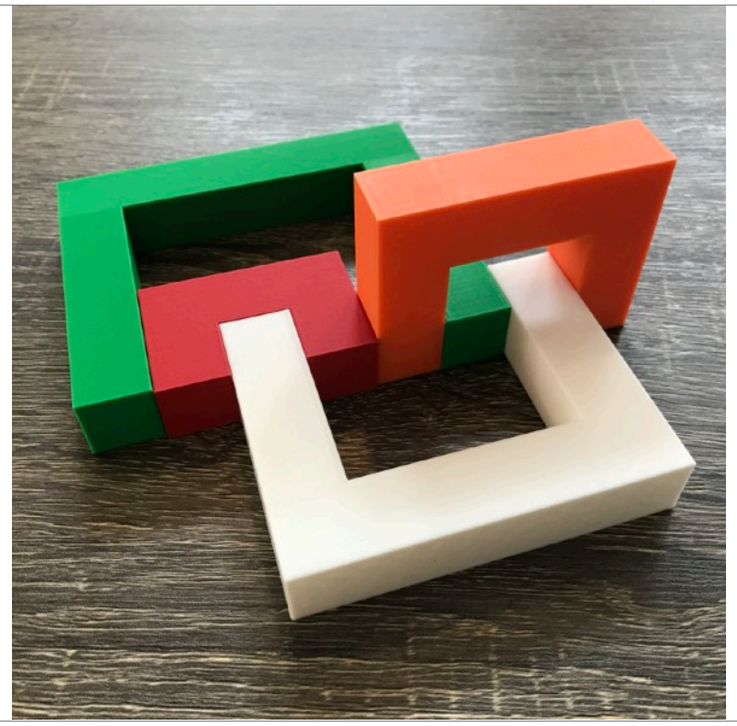
After seeing how nice the Hexomimoes were, I went back to Talus and had LToes 1-8 printed at 18mm, in ROYGBV-GT colors.

$50!

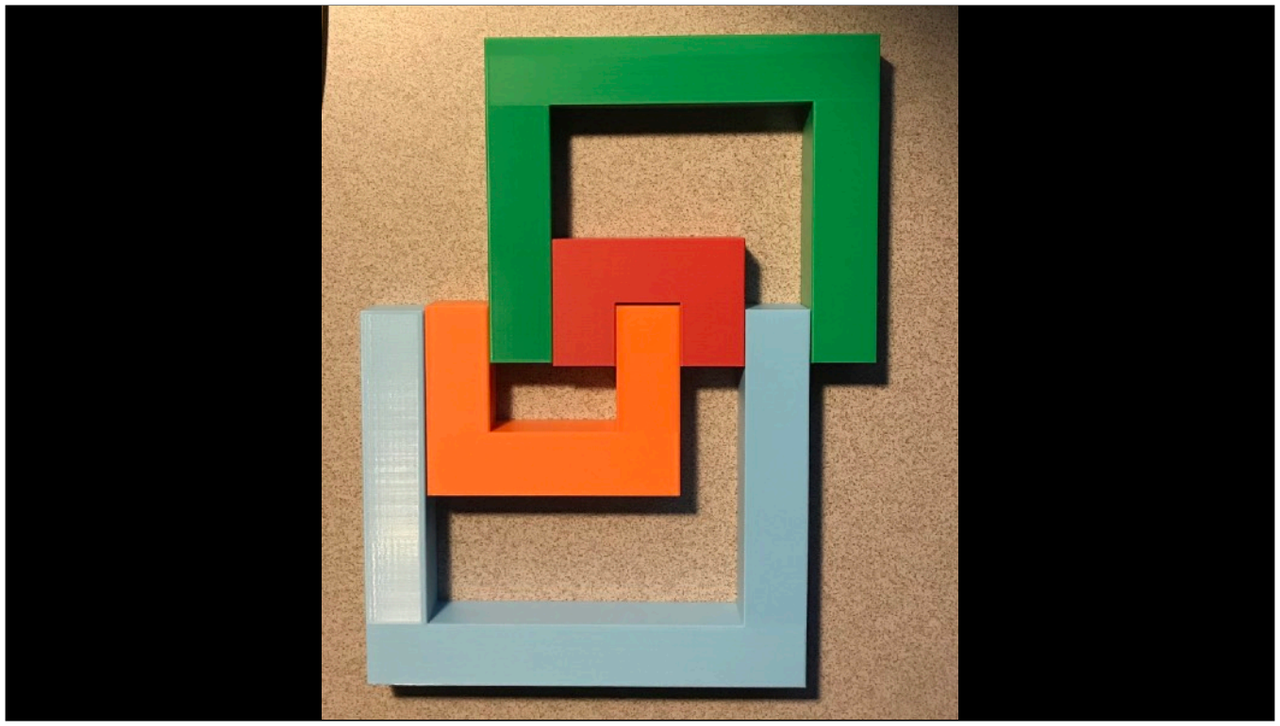
Kyle told me that he printed them "standing up"... Prongs up … for speed in printing..
Think about that...

I then ordered 10 sets from ItemsByCL on Etsy in Ottowa.
On Sale $22 for a set (plus shipping)

Still waiting for them to ship!
Customs + shipping alone takes maybe two weeks!



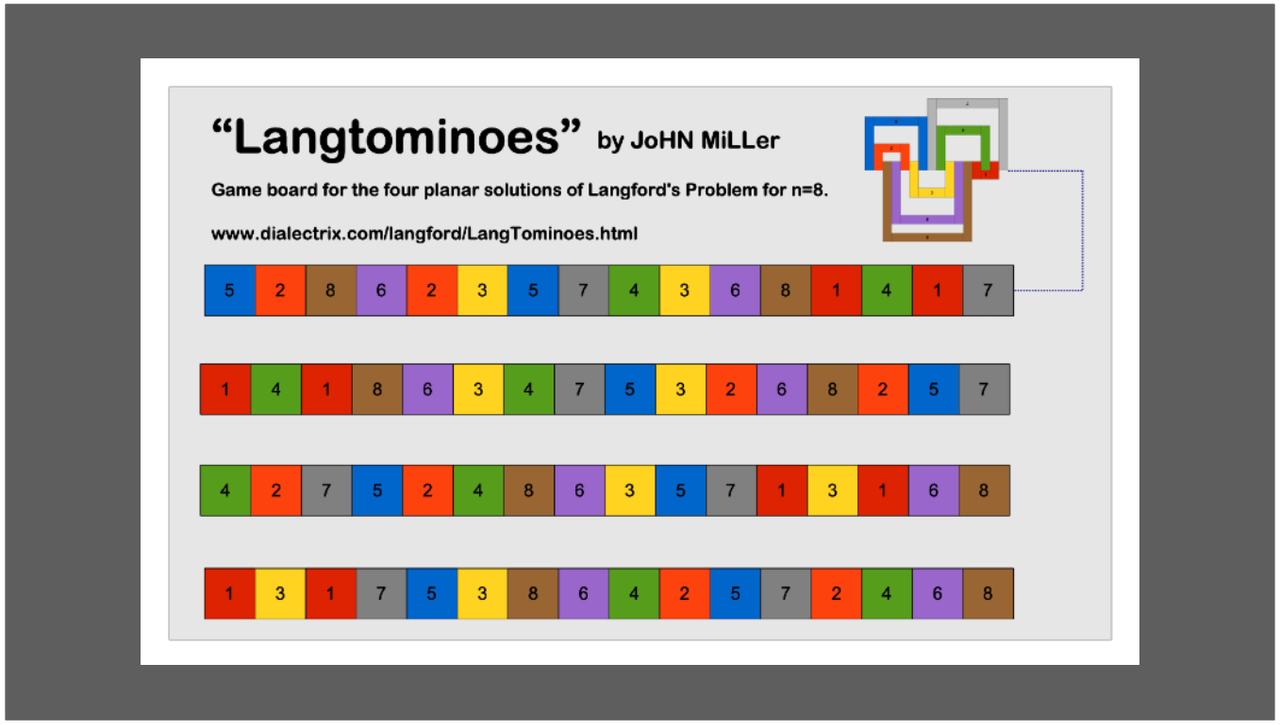
Here’s that same arrangement for 41312432 as in the All Red



Knuth challenge with Rainbones…. do 2 + 3 + 4 +5

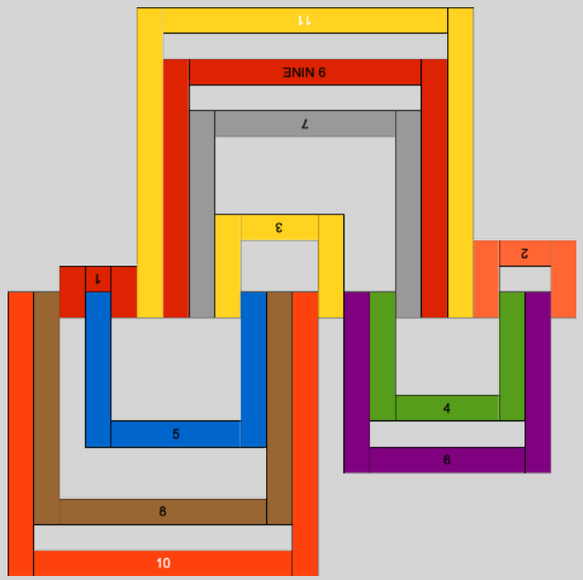
[5,2,4,1]

One of the planar Solutions for n=8.

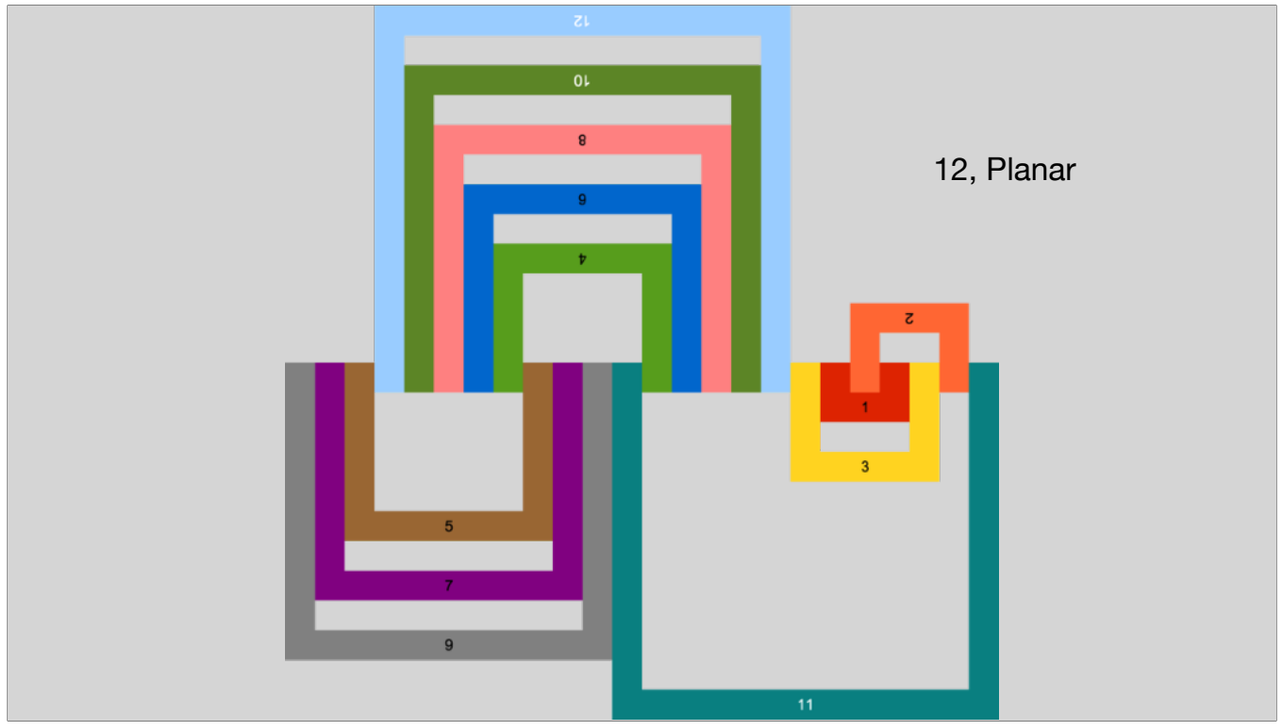


Game board to help beginners set up 4 the planar solutions.

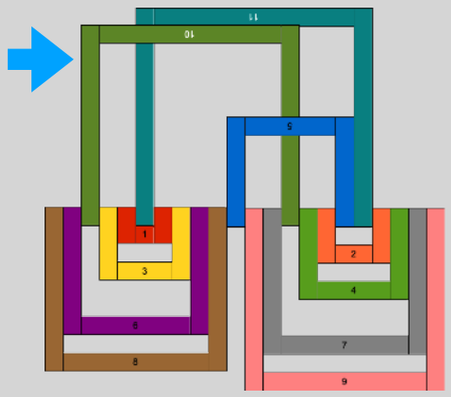
11, Planar



If you had 11 LangTominoes!



Planar arrangement of LangTominoes 1-12. (This is one of 40 such 2D planar solutions.)

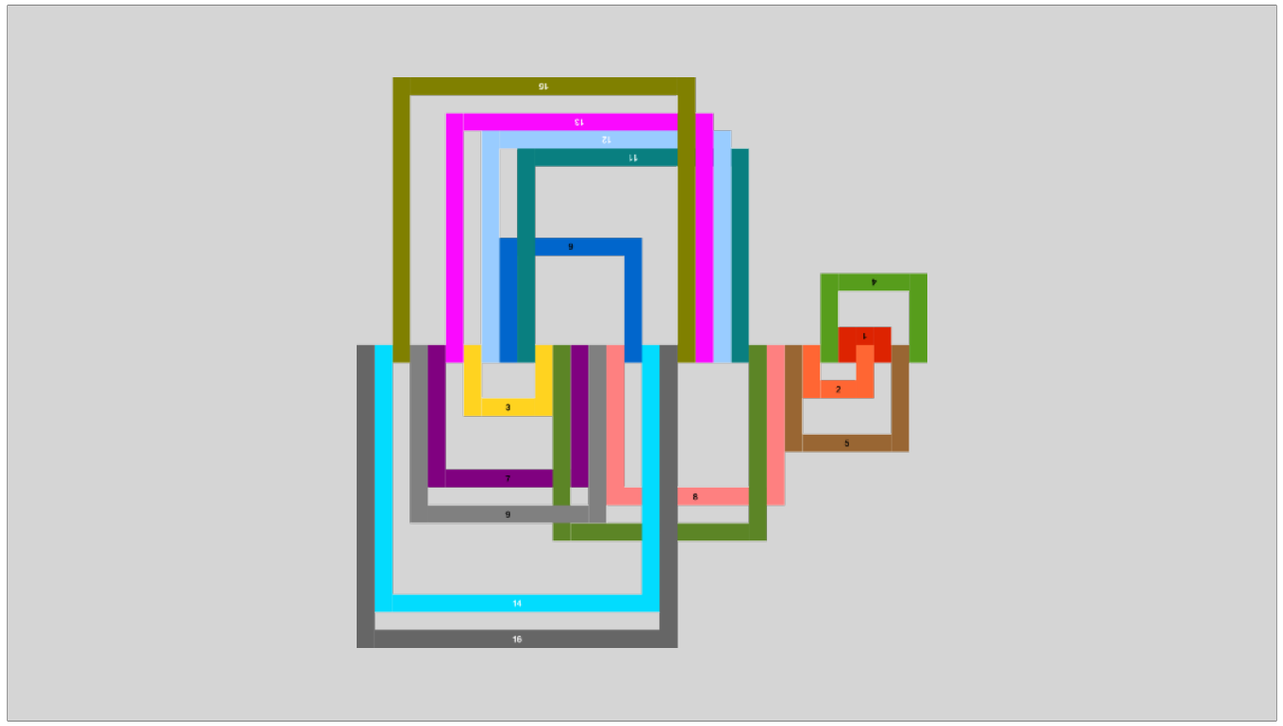


8 6 10 3 1 11 1 3 6 8 5 9 7 10 4 2 5 11 2 4 7 9

Davies Construction for 11
8 6 10 3 1 11 1 3 6 8 5 9 7 10 4 2 5 11 2 4 7 9

Non planar - the 10 crosses both the 11 and the blue 5.

Standing green #10 up on its prongs would allow a ‘3D planar’ solution.



Here is the first, algorithmically generated solution to 16. (Seems non-planar!)

QUESTION is, can you flip certain ones toward you and other ones away from you, to make this ‘4D’ Planar?

G4G16 -- must do a 16 arrangement as a LangTomino Solid.

Discussion / Activities

- Can we 'do' all solutions with Langtominoes? (Not just planar ones.)
- Exercise: Consider n=7. Do solutions for some or all with LangToes.
- Is a Game possible? (Solitaire! Two-player?)
- You can Download the STL files if you wanna print your own.
- You can buy 1-8 on Etsy. (Cesar has my permission to make & sell.)
- See dialectrix.com / langford / LangTominoes.html

VANES and Planarity

Years ago I visualized 2 "vanes" in use for computing "Planar" Solutions.
I realized there could be 3 or 4 or more such "VANES".

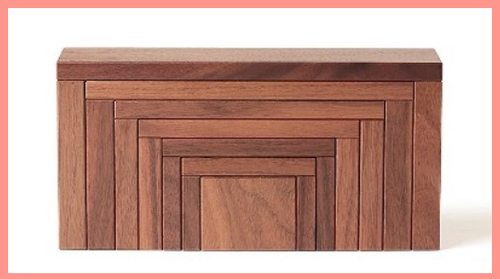
Research Question - how many vanes would be required for a given n, so that each vane contains a planar subset of connections?

Two vanes at 90 degrees. Same as flat plane.

Work to be done here! Computing and graphics.

FUTURE work

- Visit the Stanford archives to see plans for other such devices.
- Network with Gerhard Hotter on his art project(s).



naefusa.com

NAEF USA

Angular

Down the rabbit hole!

Langford Construction
https://builtbylcs.com/home/about/

PAUL KLEE - With the Rainbow - 1917

fin

dialectrix.com

dialectrix.com / langford / LangTominoes.html

We end with the 0 LangTomino!

The prongs for LangTomino #0 are 0 units apart, but they are also 0 units long (tall). So, the 0th LangTomino is a degenerate case, with no prongs, and a base of 2 units. Funny, huh?