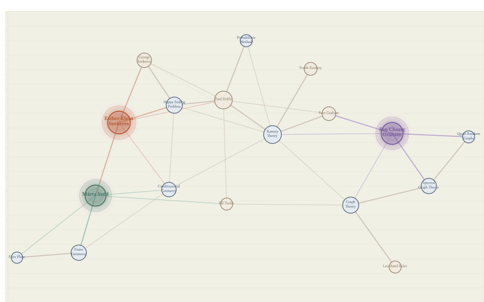
Graph Theory:

a subgraph story told

through 3 women

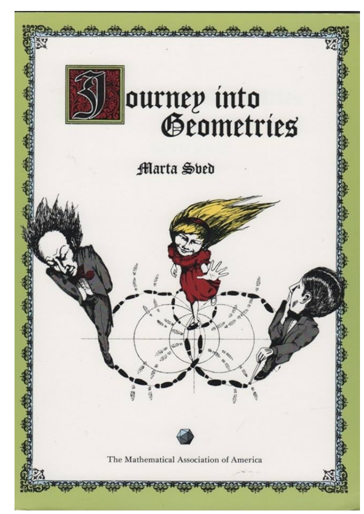
Part 2: Márta Svéd



MATHEMATICAL AND PHYSICAL JOURNAL FOR SECONDARY SCHOOLS

A dear and life long friend of Esther Klein, Márta Svéd shared a similar background. Also born in 1910, Hungary, Svéd was inspired by math in Hungarian High School Journal "Középiskolai Matematikai Lapok" (KöMaL) [which celebrated its 100th birthday in 1994!], and enjoyed solving the problems it published. In 1928 she placed third in the National High School Mathematics Competition. (She beat the future great, Pál Turán, who came in fifth. The winner was none other than Márta's future husband, George Svéd!). Svéd was in the same high school class as Klein. Due to restrictions placed on Jews in 1920's Hungary, only 2 students from their class were allowed to study science or math at the university in Budapest. Svéd took the mathematics position and Klein chose Physics.

George and Márta Svéd emigrated to Australia in 1939 to avoid Nazi persecution in WWII. Svéd was a devoted an innovative teacher for most of her career in Adelaide. She published numerous mathematical articles, an autobiography, and a truly lovely book, *Journey Into Geometries*, in which she teaches alternative geometries via a dialogue between a fictional Lewis Carroll, and Alice.



Svéd went back to school and earned a PhD in Finite Geometry at the age of 75. The geometry we typically study in school concerns what can follow from a set of 5 axioms in 2-D space, first defined by Euclid in ancient Greece. Finite Geometry takes place on a 'finite projective plane', a radically stripped down version of Geometry concerning just a handful of points and lines….

There are many geometries defined within the category of Finite Geometry. You can find a beautiful introduction to some of these in a lovely paper written by Tatiana Shubin giving an overview of definitions and interesting problems in Finite Geometry. [please use the QR code at the end to find the google doc with a link to her paper]

Let's take a look at one of these geometries…

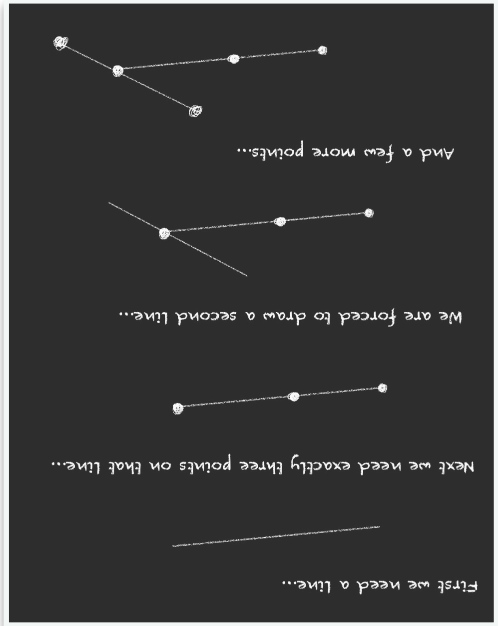
Gino Fano (1871-1952) was a pioneer in finite geometry. He developed a set of axioms which lead to the Fano Plane, the smallest possible finite projective plane.

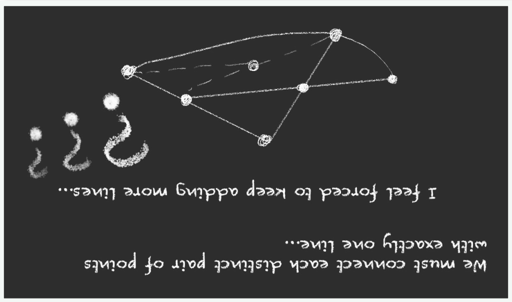
The axioms for Fano's Geometry can be fun to investigate:

AXIOMS OF FANO'S GEOMETRY:

- There exists at least one line
- Every line of the geometry has exactly three points
- Not all points of the geometry are on the same line
- For two distinct points, there exists exactly one line on both of them.
- Every two lines have at least one point on both of them. (ie. All lines meet. There are no parellel lines!)

What will the Fano Plane look like? …
We can start by adding points and lines according to the axioms and see where we arrive…





As I need to ensure that there is a line on every distinct pair of points, I feel forced to keep adding more lines and points like the game of Sprouts… to end this infinite cycle and create the smallest (and indeed only) possible configuration, I will need to condense my diagram and reuse some elements…

cut along dotted line

Did you find a solution? There are many depictions of the Fano Plane on the internet. If you have seen it before, you can still go through the axioms step by step and discover for yourself why the final result must be the solution.

For a list of citations, credits, and extra links for further explanations. Please see the accompanying Google Doc

https://docs.google.com/document/d/1GIIXH18Ak-rS7N0ljcDvCfxRHPKLIWEDc9H1pmnvhTI/edit?usp=sharing