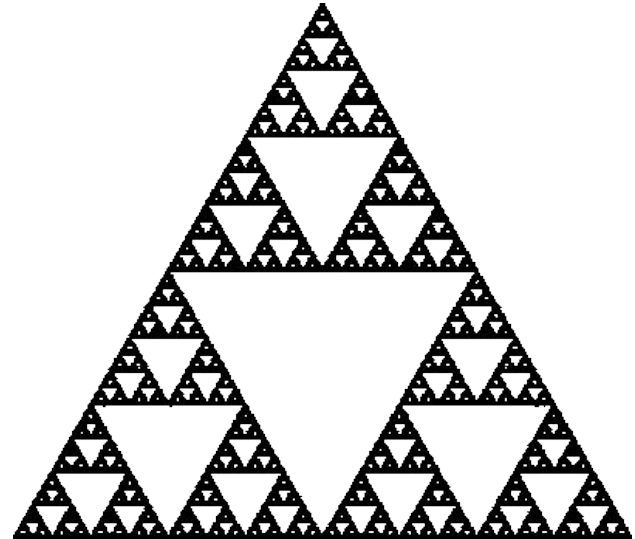


Fractals

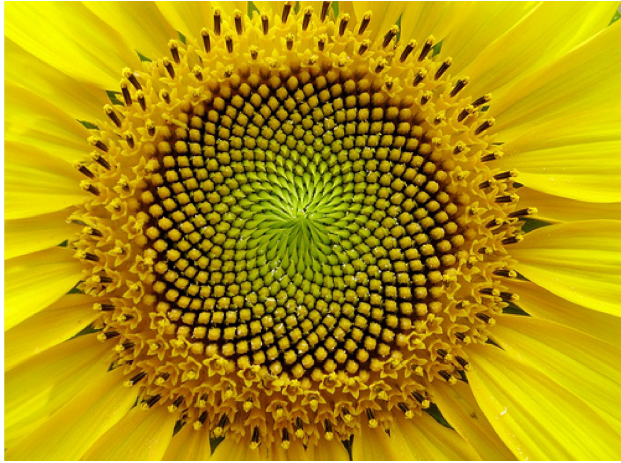
Easterlin Faamausili and
Gabrielle Baird • March 2018



Fractals consist of repeated shapes, and they are different to other geometrical shapes because of their fractional dimension.

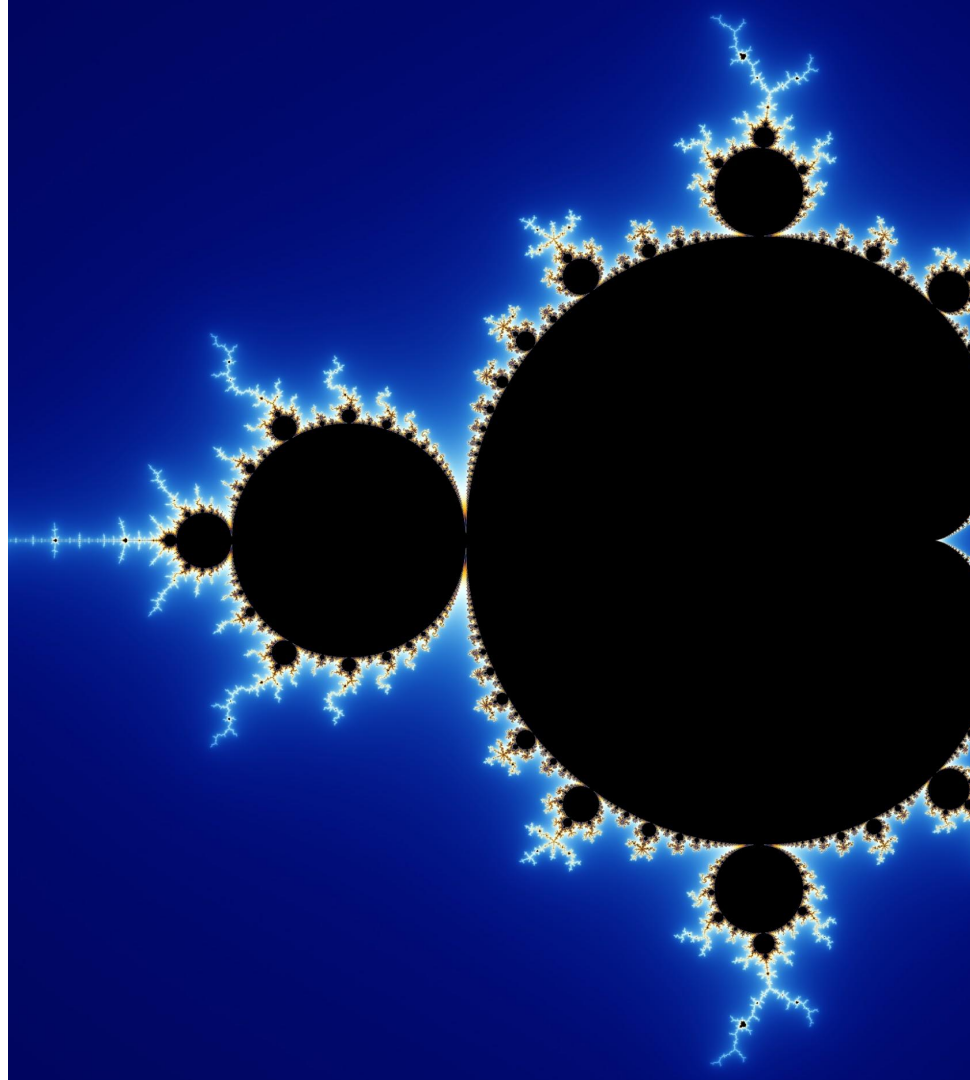


Fractals in Nature



Mandlebrot Set (Apfelmännchen)

*This is the result of the
equation $f(z)=z^2+c$
being applied to each
point in the plane over
and over again.*

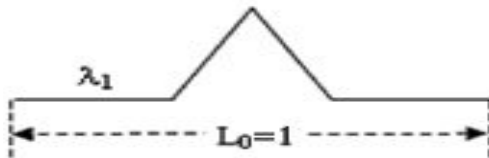


How does Mathematics generate Fractals?

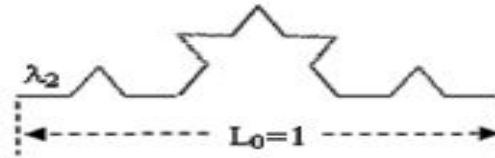
The shape is defined by mathematical rules. These rules are applied over and over again for infinitely many times.

e.g. $f(z)=z^2+c$ (Mandelbrot Set)

Or Koch Snowflake

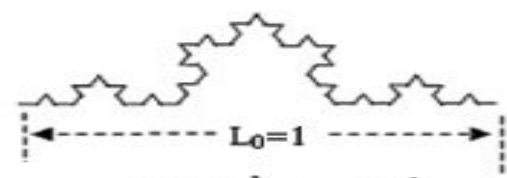


$$\lambda_1=1/3, N_1=4$$

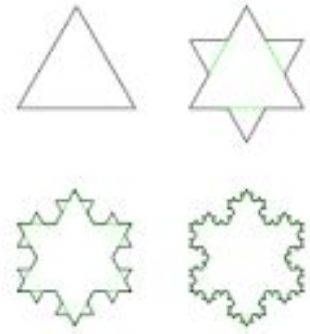


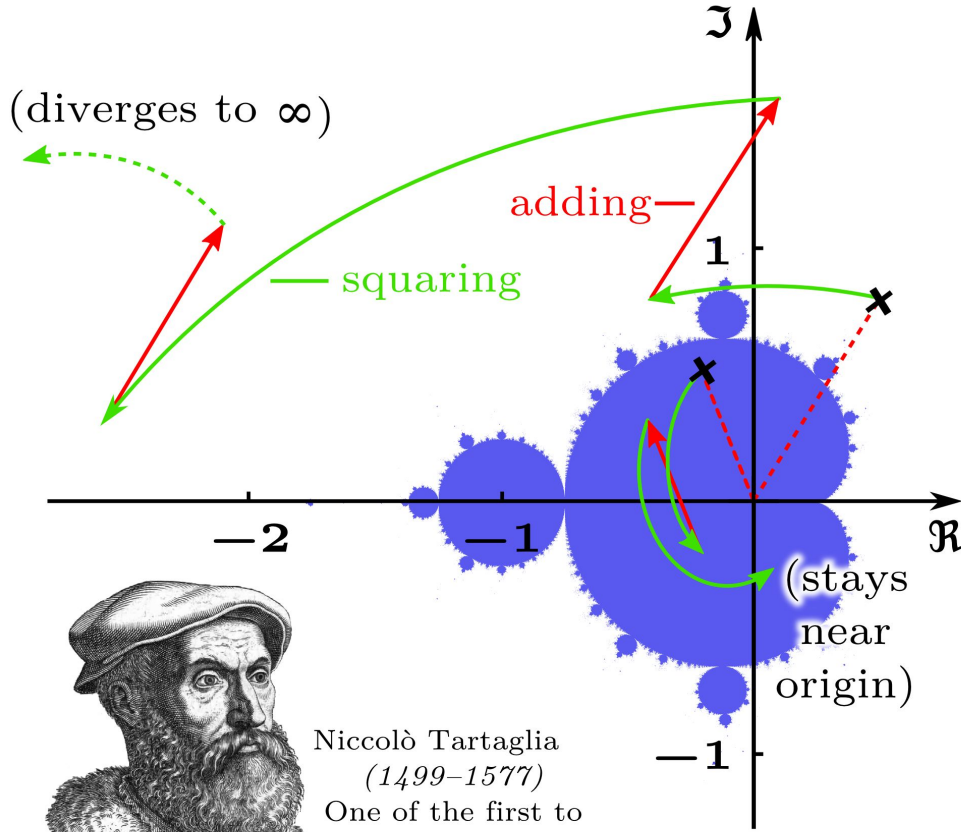
$$\lambda_2=(1/3)^2, N_2=(4)^2$$

Primordial sequence



$$\lambda_k=(1/3)^k, N_k=(4)^k$$





Niccolò Tartaglia
(1499–1577)
One of the first to
use complex numbers

Diverging and Converging

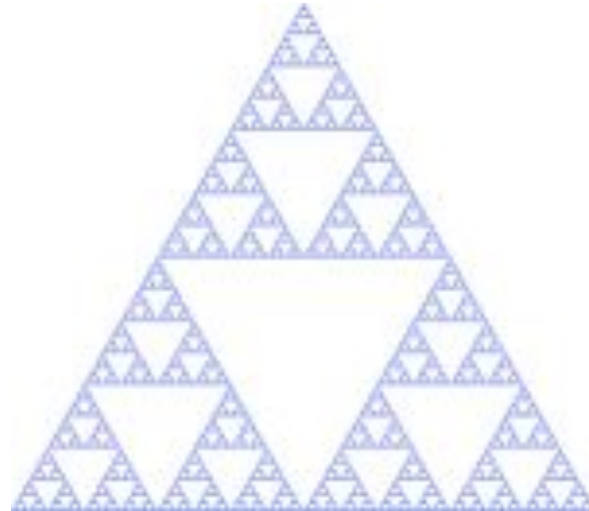
Converging is when the starting point leads to a certain point. Divergent is when the starting point leads off to infinity (not to one certain point).

Why are they called Fractals?

Because the dimensions are fractions.

A line, when one side doubles, the length doubles. (ie. 2^1) When a side of the square doubles, the area quadruples (ie. 2^2), and then when a side of a cube doubles, the volume increases by a factor of 8 (ie 2^3).

When a side of this triangular fractal doubles, it's area increases by a factor of three.



Sierpinski triangle

Working out:

$$2^x = 8$$

$$X = \log_2 8 = 3 \text{ (Dimensions of the Cube)}$$

$$X = \log_2 (3)$$

$$X = 1.585$$

(Dimensions of the Sierpinski triangle)

Dimension 1



$\times 2$

Dimension 1.585...



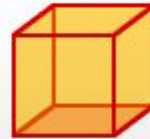
$\times 3$

Dimension 2



$\times 4$

Dimension 3



$\times 8$

Glossary:

- *Dimension:* *Dimension*
 - *Shape:* *Form*
 - *Fractal:* *Fraktal*
- *Diverging:* *divergierend*
- *Converging:* *konvergent*
- *Mathematics:* *Mathematik*
- *Geometrical:* *geometrisch*
 - *Fractional:* *gebrochen*
 - *Equation:* *Gleichung*
 - *Point:* *Punkt*
 - *Fractions:* *Brüche*
- *To double:* *verdoppeln*

Different types of Fractals

