VISUAL THINKING SUPPLEMENT TO BOOKS ONE AND THREE "Visual Thinking, Seeing Through Time," by Roger Burrows

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From Sunflowers to God's Divine Architecture of Life

Nature is fundamentally about **growth**, and growth often follows **patterns**. One famous pattern appears in sunflower seed spirals and leads to the **Fibonacci sequence** and the **Golden Ratio**.

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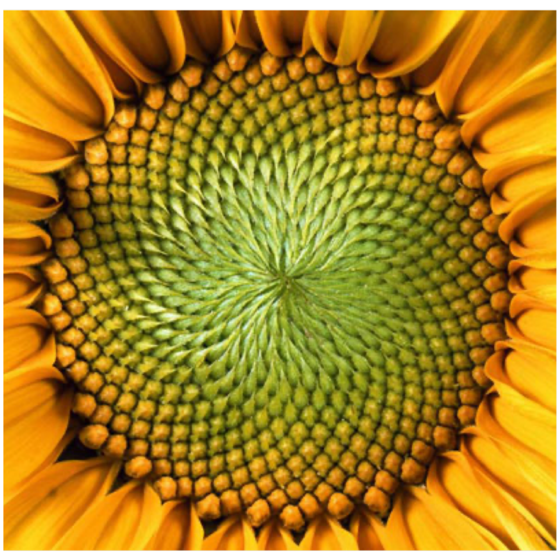
1) Nature's Pattern in Action

When a sunflower grows, each new seed (floret) squeezes into place. Over time, **two spiral directions** appear (clockwise and counterclockwise). The spiral counts often match Fibonacci numbers—like **34 spirals one way and 55 the other**.



✅ **Example Spiral Counts (as the sunflower grows):**
5 & 8 → 8 & 13 → 13 & 21 → 21 & 34 → 34 & 55

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2) Fibonacci Sequence (Know This!)

The Pattern

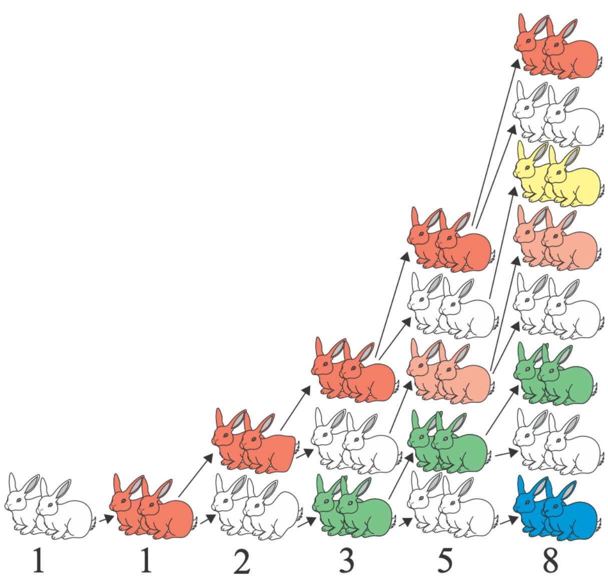
1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, ...

Where it shows up

Not only sunflowers—this pattern appears in **cacti**, other plants, **seashells**, and even **animal population growth**.

Who described it?

In the 1200s CE, Leonardo Fibonacci (Leonardo of Pisa) described this pattern while studying **rabbit population growth**.



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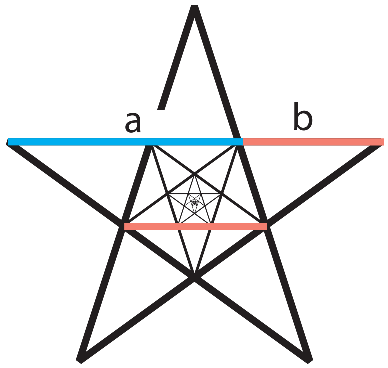
3) Euclid's "Mean and Extreme Ratio" (Geometry Connection)

Around 300 BCE, the ancient Greek mathematician and scientist, Euclid. identified the "**mean and extreme**" proportion in geometry—especially in shapes with symmetries of **5 or 10** (like **pentagons**, **decagons**, and **dodecahedra**).



Euclid's Definition

A line is divided so that:
whole : larger part = larger part : smaller part

This creates a **nesting**, self-similar relationship—like a **fractal** idea where the same proportion repeats at different scales. As an equation the relationship looks like this:

$(a+b)/a = a/b$.

The following values for 'a' and 'b' get closer and closer to solving the equation, where 'a' and 'b' are any two successive numbers in the sequence:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, ... where, for example, (233+144)/233 almost equals 233/144, where a=233 and b=144. ... This is the same as the Fibonacci Ratio!

Euclid's "Mean and Extreme" ratio is the same as the "Golden Ratio!"

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4) The Golden Ratio (φ) — The "Never-Ending" Number

As Fibonacci numbers get bigger, the ratio of **one term to the previous term** gets closer and closer to the Golden Ratio, such as 6765:4181, which equals 1.61803396316...As a decimal, the Golden Ratio is **1.6180339...** (but the decimal keeps going forever). You can see it on your calculator: $(\sqrt{5} + 1)/2$!

This value is a **never-ending decimal**, meaning it can be approximated but never finished exactly.
📌 **Key number to remember: 1.6180339...** (keeps going forever)

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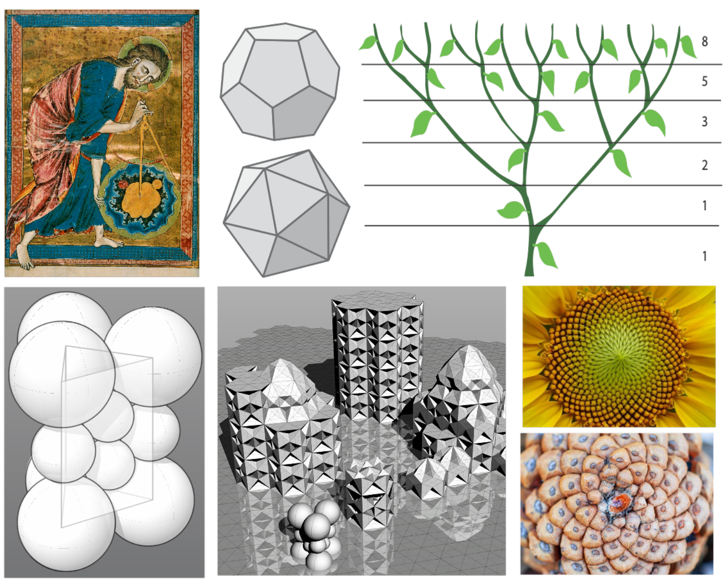
5) “Divine Proportion” (History + Meaning)

In 1494, **Luca Pacioli** (a friend of Leonardo da Vinci) renamed Euclid’s **“Mean and Extreme**” ratio the **“Divine Proportion.”**

This linked:

- **Geometric forms** (the **dodecahedron, icosahedron, the Golden Prism** & **Architecture**)
- **Natural growth patterns (**like the sequence of **leaves, sunflower, and fir cone**)
- **Fibonacci sequence** (converges upon the **Golden Ratio** at infinity)
- **Spiritual symbolism** (“divine architecture”). Painting by an unknown artist, French, 1250 CE. The compass points to the universe, showing its relationship to ‘divine’ geometry.



➡️ The “**Divine Ratio**,” the “**Golden Ratio,”** and the **“Mean and Extreme Ratio”** are the same.

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6) Important Note: Don’t “See What You Want to See”

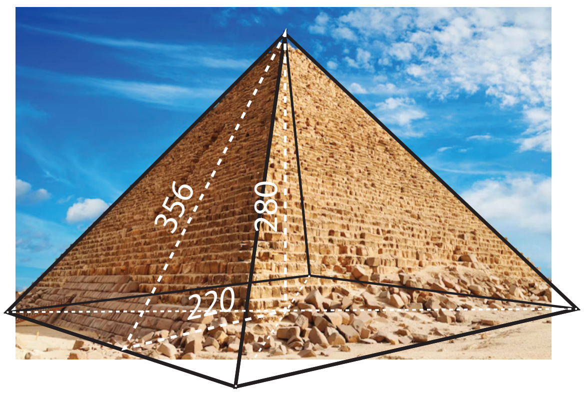
People have searched for the Golden Ratio in famous structures (the Parthenon, cathedrals, Stonehenge, and the Great Pyramid), but **claims can be exaggerated** or based on selective measurements.

Case Study: The Great Pyramid of Giza

Some enthusiasts compare pyramid measurements (like **356 to 220 Royal Cubits**) and say it "proves" the Golden Ratio—but the text argues this can be **wishful thinking** and concludes the Golden Ratio **does not appear** in the Great Pyramid as claimed.

*The **Royal Cubit** is the length of the elbow to outstretched fingertips plus the width of a hand.*

Cheops/Khufu, The Great Pyramid



When the ancient Egyptians measured the slopes of pyramids, they compared the height with the base of the slope triangle, in this case 280:220, which gives a slope of 14:11. Those who see the Golden Ratio compare the hypotenuse with the base, 356:220 = 178:110 = 89:55, which is approximately 88:55 = 8:5. Because 8 and 5 appear in the Fibonacci Ratio and because 8/5 = 1.6 and because 1.6 is close(ish) to the Golden Ratio decimal— the association is made. But it is not enough to then say the Great Pyramid has the 'Divine Properties' of the Golden Ratio!

***Pyramid Slope** was measured as the ratio between the **vertical and the base** of the 'slope triangle.' The **unit of measurement** was the "**seked**."*

🧠 **Quote to remember:**
"Trust in Allah but keep your camel tied." (Belief is not enough—check evidence!)

FAST VOCAB (Know These Words!)

- **Fibonacci Sequence**: number pattern where each term is the sum of the two before it.
- **Golden Ratio (φ)**: ratio approached by Fibonacci term ratios; never-ending decimal.
- **Mean and Extreme Ratio**: Euclid's name for the Golden Ratio relationship.
- **Self-similar / Nesting**: same proportional pattern repeated inside itself.

THINK LIKE A SCIENTIST (Evidence Check!)

Quick Questions

1. What makes the sunflower spiral counts good evidence of Fibonacci patterns?
2. Why can the Golden Ratio be *approached* but never fully written as a decimal
3. How does “nesting” in pentagons connect geometry to the Golden Ratio?
4. Why is it risky to “look for the Golden Ratio” in famous buildings?

ACTIVITY (Do This!)

Choose 2 (or complete all for extra credit):

1. Investigate whether attractive human face/body proportions match the Golden Ratio (see Luca Pacioli and Leonardo da Vinci’s Vitruvian Man connection).
2. Find Fibonacci numbers in nature (plants, shells, etc.).
3. Explain why you think the Golden Ratio is (or could be) part of “divine architecture.”
4. Research the author’s “Golden Prism” idea and how it applies to architecture.

EXIT TICKET (1 minute)

In 3–4 sentences:
Explain how a sunflower leads to Fibonacci numbers and how Fibonacci ratios connect to the Golden Ratio. Include one reason we should be careful about “finding” the Golden Ratio in famous structures.