

Why so many shapes resemble the golden ratio: Vision, cognition and locomotion as a single design in nature

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ABSTRACT

Shapes with length/height ratios (L/H) close to $3/2$ are everywhere, and give the impression that they are being “designed” to match the golden ratio ($\phi = 1.618$). Here I show that these shapes emerge as part of an evolutionary phenomenon that facilitates the flow of information from the plane to the brain, in accordance with the constructal law of generation and evolution of design in nature. The time required by the eyes to scan a rectangular area $L \times H$ is minimal when the shape is $L/H = V_L/V_H$, where V_L and V_H are the horizontal and vertical scanning speeds. This special shape is such that the time for scanning long and fast (L/V_L) is the same as the time for short and slow (H/V_H). I also show that V_L/V_H is approximately $3/2$, and that consequently $L/H \sim 3/2$. This natural evolutionary design is an integral part of the universal constructal design that facilitates the flow of the biosphere, hydrosphere and atmosphere on earth. Vision, cognition and locomotion are features of a single design for movement of animal mass with easier and easier access in time, all over the globe.

Keywords: golden ratio, constructal law, vision, cognition, locomotion, big history, design in nature, animal design

1. IMAGES THAT BREATHE AND FLOW

I am used to making my drawings to look almost square, a little wider than tall. The first thought is that this comes naturally because of my training. At age 10, in art school my drawing