LETTER TO THE EDITOR – JOURNAL HEAD & FACE MEDICINE –

ON BIOLOGICAL AND GEOMETRIC STRUCTURE INITIATION

Self-similarity can represent the evolution of face-denture ratios and be used to question Pi (π).

SUMMARY: Through considerations of the self-similarity of fingers, it is possible to derive the struction number [S] $S = 1.08207\ldots$ and a structure initiation number [s] $s = 3.14141\ldots$. These constants can explain evolutionary changes in tooth size and in the jaw, and enable a fundamentally new understanding of the causes of structural facial deformities.

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LETTER (MARCH 14, 2015): For many years, the self-similarity of fingers has been used to represent the **integer dimensions 0 to 9** (decimal system), although only the outer two phalanges appear self-similar: The fingers themselves are constructed from three bones; the thumb from just two. Only the two palms are each composed of five self-similar metacarpal bones (see Fig. a).

Figure a: The self-similar bones of the fingers and thumbs.

The longest-known **non-integer dimensions** [D] ($D = ln2/ln3$; *Cantor fractals*) correspond to the relative size of the smallest possible self-similar straight lines that result from a division of a straight line (length L = 1) with continual further diminution of only two of the three partial lines (see Fig. b) [1].

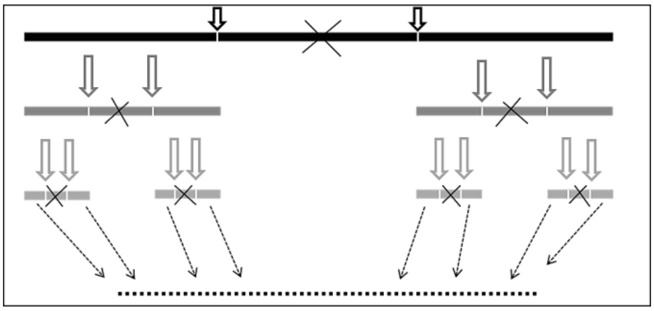

Figure b: The formation of a Cantor dust from a straight line of length L = 1.

In the case of the middle finger, there are research papers that specify the ratio of the outermost finger bone to the middle finger bone as $^2/_3 = 0.666\ldots$ [2]. The outcome of a corresponding verification measurement for the value $^2/_3$ – in this case on my right middle finger bone – was a ratio value of 0.622.… This tends more towards ln2/ln3 = **0.630…** than to 0.666…, however, leading to the conclusion that, in light of the following considerations, external randomised studies should be carried out (see Fig. c).

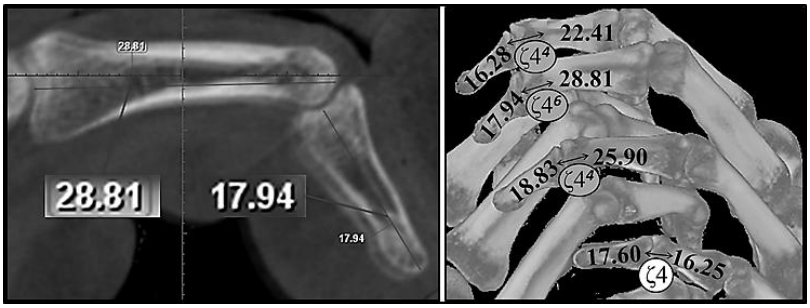

Figure c: The outermost finger-bones: 17.94/28.81 = 0.622… or 28.81/17.94 = 1.605… ≈ $\zeta 4^6$ [*ζ4; Riemann Constant*].

If ***D*** is transcended to $\boldsymbol{D^2}$ with the exponent ***2*** [*2 = ln(n²)/ln(n) (with n>1); "2" = smallest integer Hausdorff dimension*], the theoretical result is the dimension of a pluripotent cell unit, which can be influenced by higher-order factors. If $\boldsymbol{D^2}$ were to be multiplied by the **Euler number** [e] ($e = \lim_{n\to\infty}(1+{}^1/_n)^n = 2.718\ldots$; "e" = base rate of natural growth), the hypothetical result is a structuring dimension [***S***] (*S* = $D^2 * e$ = ***1.08207…; referred to here as the struction number***) for all self-similar structures with naturally limited growth. A cephalometric double-blind study comprising over 15,000 evaluated data confirmed this hypothetical bio-logical-mathematical transcendence of ***S*** in the tooth size ratios of self-similar teeth and in facial types that have changed as a result of evolution (see Fig. d) [3].

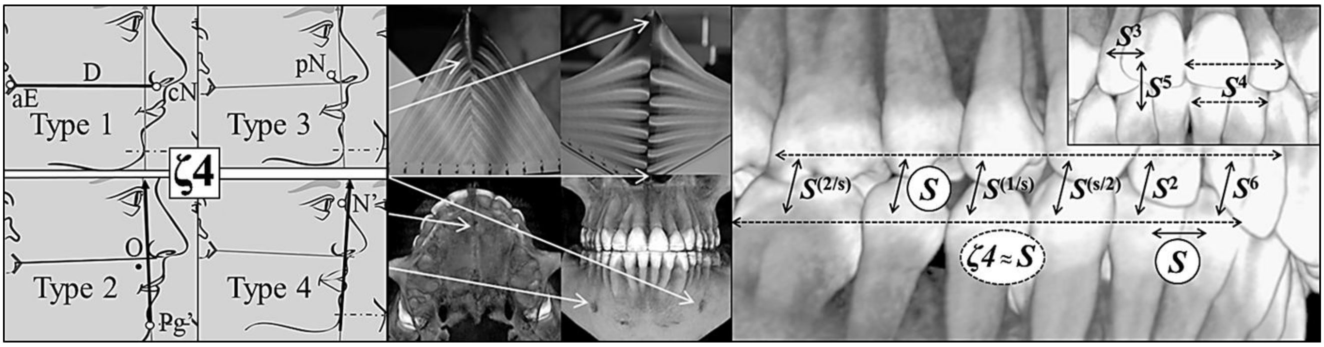

Figure d: ζ4 distinguish face types and ***S*** matches with <1% deviation to tooth sizes relations.

These astounding numeric relationships deserve further investigation because they are an easy-to-use key for the representation of the speed of convergence in human structural development. For example, **S** corresponds to the arithmetic boundary between the **tenth** and **eleventh** partial sum of the zeta-4 function (ζ4) if **S,** $\boldsymbol{\zeta 4_{(n\to 10)}}$ as well as $\boldsymbol{\zeta 4_{(n\to 11)}}$ is rounded to the fifth place ($\zeta 4_{(n\to 10)} \approx 1.08204$; $\zeta 4_{(n\to 11)} \approx 1.08210$): $\zeta 4_{(n\to 10)}$ **+ 0.00003** = *S = 1.08207* = $\zeta 4_{(n\to 11)}$ **– 0.00003.** Evolutionary structural optimisation results in the decimal system, which is the basis of all research.

If a cartilage unit cell were hypothetically to have the same surface curvature as a ball, then it would come into tangential contact with adjacent lines (*1*), surfaces (*2*) or volumes (*3*). Such a ***contact continuum*** [K] can be dimensioned arithmetically: ***K*** = $1^2 + 2^3 + 3^4$ = 1 + 8 + 81 = ***90.***

A naturally grown "ball of bone" would then take the dimension [***Q***] (*Q = S ∗ K = 97.386…; referred to here as the quality number*). An example of a bone ball is the orbit (from the Latin orbis "circle"). If ***Q*** is retroactively evenly distributed over four initiation dimensions (four because: three finger bones + one metacarpal bone), then a structure initiation number [**s**] is revealed ($s = Q^{1/4}$ = ***3.14141...****; referred to in abbreviated form as* ***Si***), which is only **0.005...**% smaller than **Pi** (*π = 3.14159..., circle constant*).

[1] Lorenz, W.E. *Fraktalähnliche Architektur – Einteilung und Messbarkeit*. Dissertation. Universität Wien. 2013.

[2] Plöger, P. *Eine prospektive Studie zum Vergleich zweier Osteosyntheseplattensysteme im Bereich der operativen Versorgung von Kollumfrakturen.* Dissertation. Universitätsklinikum Münster. 2010, Abb. 28. S. 51.

[3] vom Brocke, M. *STRUKTION – Die harmonische Relativitätstheorie*. Verlag Inspiration Un Limited, London/Berlin. 2015.