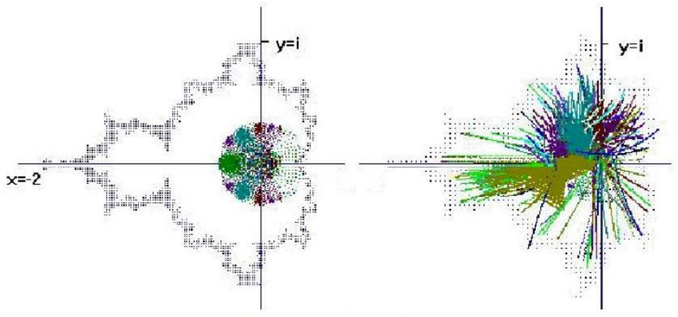
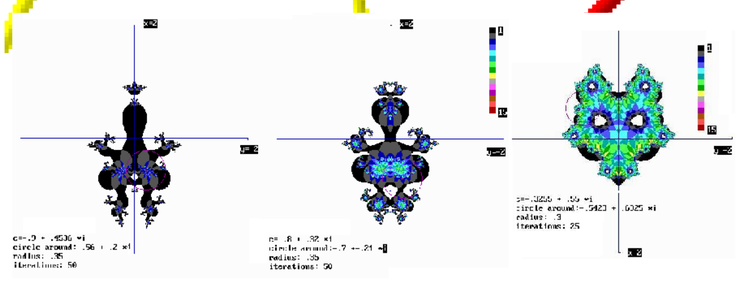
hyperacuity, pattern recognition and binding problem- what fractals may tell us

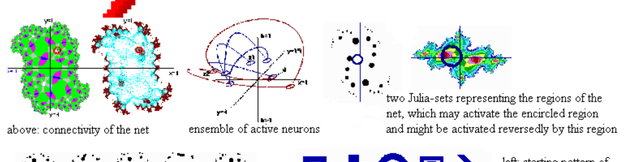
thomas kromer, center for psychiatry südwürttemberg
thomas.kromer@t-online.de



A central structure of the Mandelbrot(1) set in two (and three) dimensions, efferent projections of the upper half



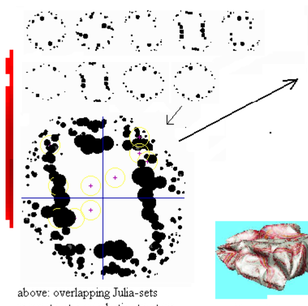
pattern-recognition and -reconstruction – binding problem and connectivity



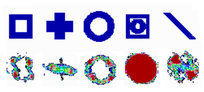
above: connectivity of the net

ensemble of active neurons

two Julia-sets representing the regions of the net, which may activate the encircled region and might be activated reversedly by this region

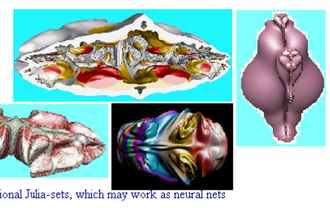


above: overlapping Julia-sets reconstruct a quadratic structure

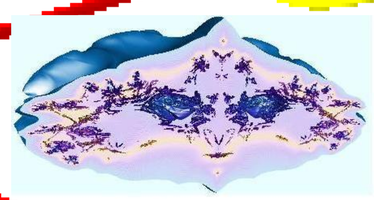


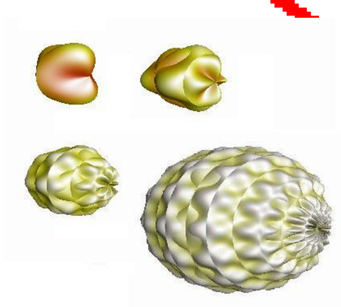
left: starting pattern of activity

reconstructed patterns



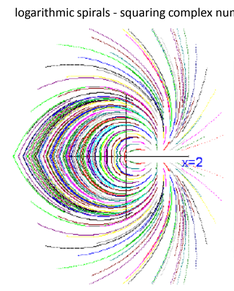
Threedimensional Julia-sets, which may work as neural nets

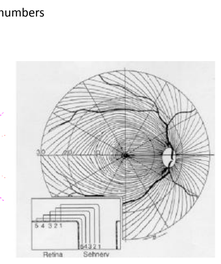




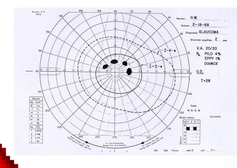
morphogenesis

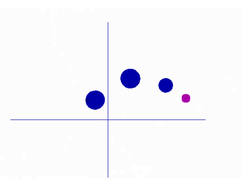
logarithmic spirals - squaring complex numbers





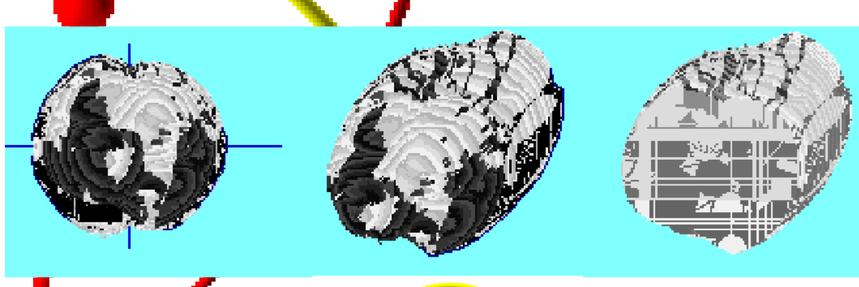
From: M.B.Shields, G.K. Kriegelstein, „Glaukom“, Springer, Berlin, 1993

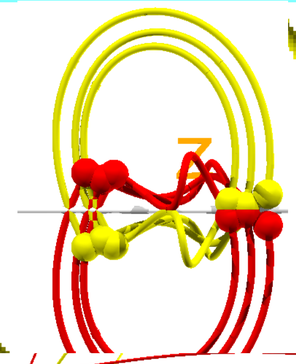




center of simulated lesion: x=0,8; y=0,22,

radius: 0,043, resulting „scotoma lacunare“





hyperacuity, three closely adjacent neurons(blue circle) project to clearly separated neurons(green circle)

Mandelbrot, Benoît B.; Freeman, W. H. (1983). *The Fractal Geometry of Nature. San Francisco: W.H. Freeman.*
Kromer T , “Biomorph Neural Networks Based on Fractal Algorithms”,Computational Intelligence, proceedings/ 6th Fuzzy Days, Dortmund, Germany, 1999. B. Reusch (ed.). Springer 1999, (lecture notes in computer science; Vol. 1625, pp 603-614)
Kromer T, Tomography in fractal neural networks; lecture notes in computer science 2206(2001)pp 917-923