

MSE, Rolling MSE, and its Applications in Sound and Vibration

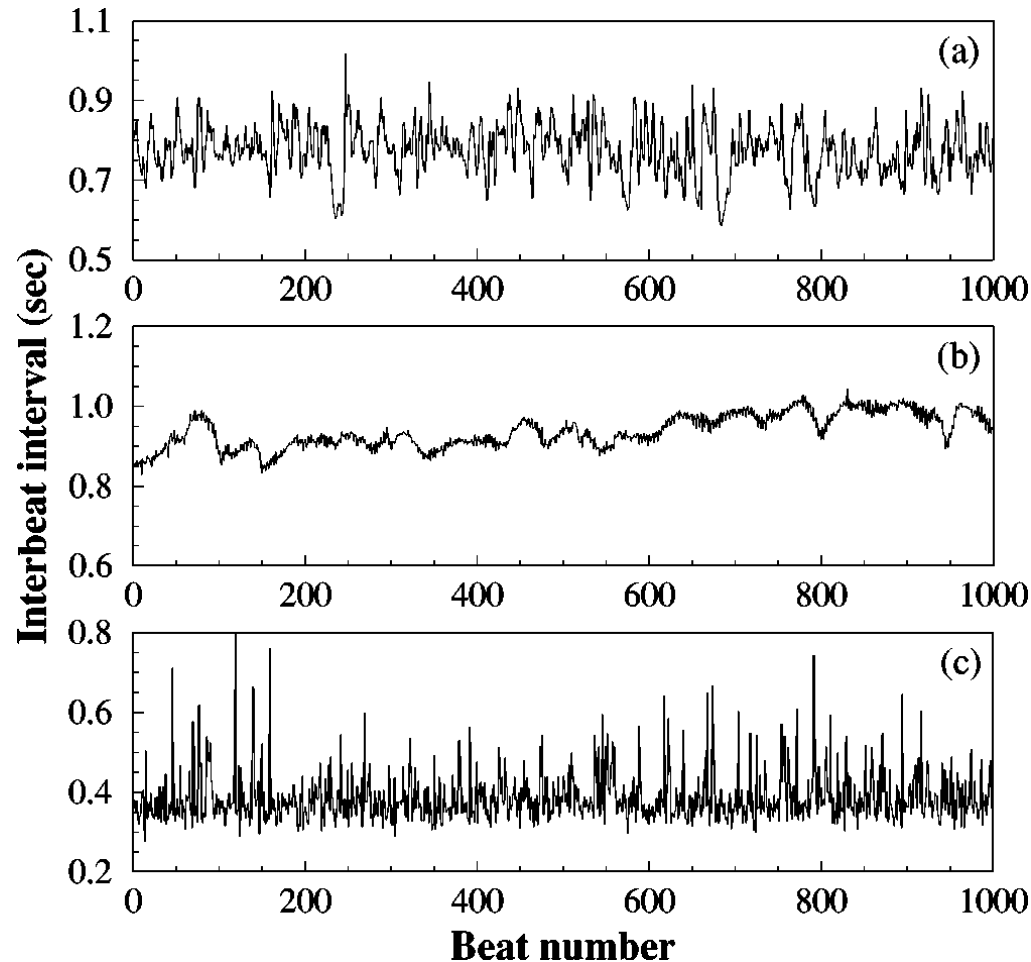
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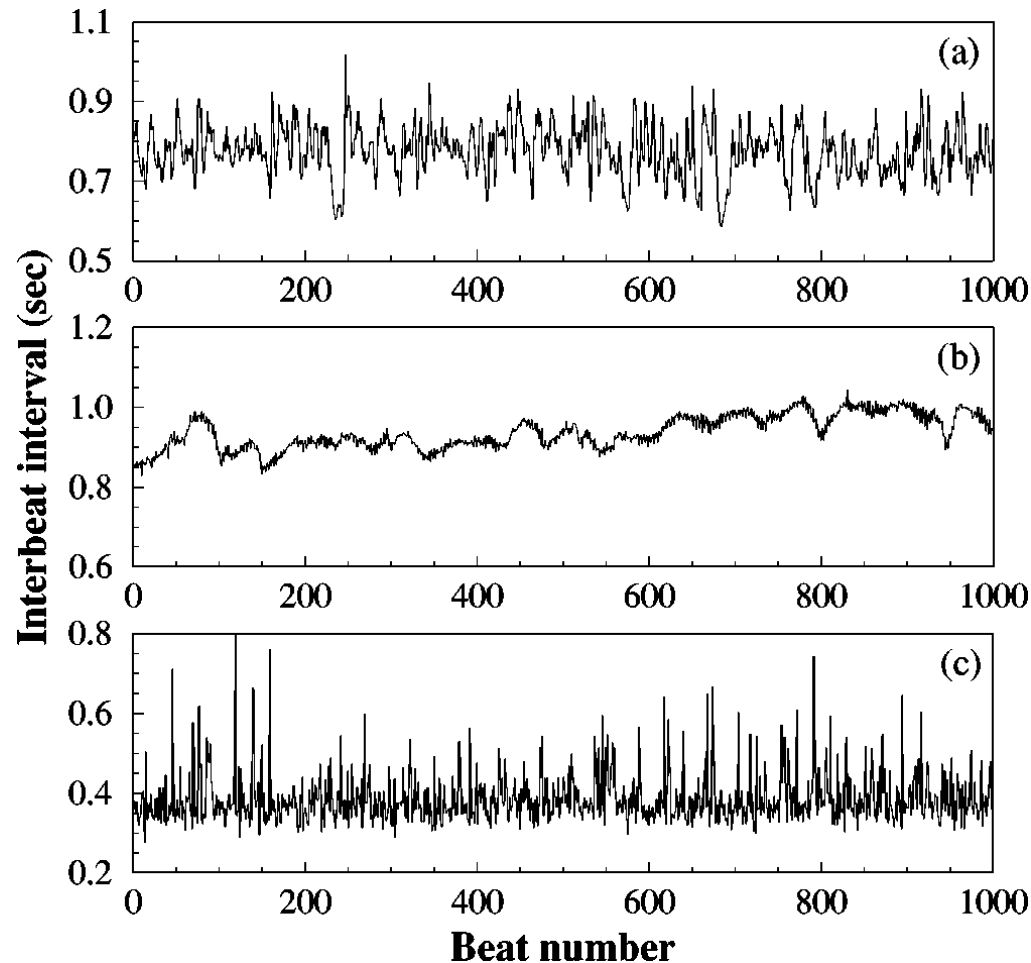
2010/4/22

What one is healthy?*



*Madalena Costa, Ary L. Goldberger and C.-K. Peng, 2005

Ordered vs. Disordered

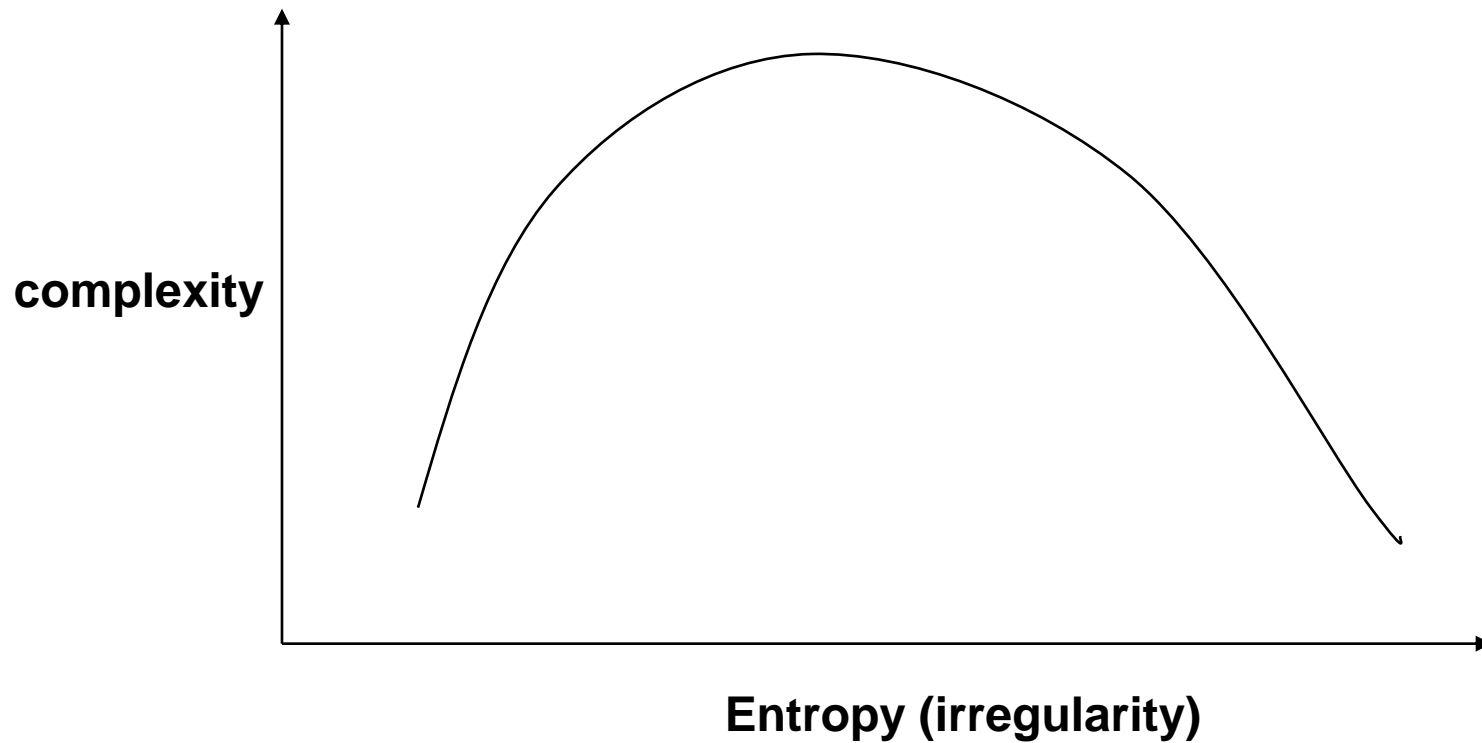


Healthy

Congestive
Heart Failure

Atrial Fibrillation

Complexity (health value) vs. Entropy

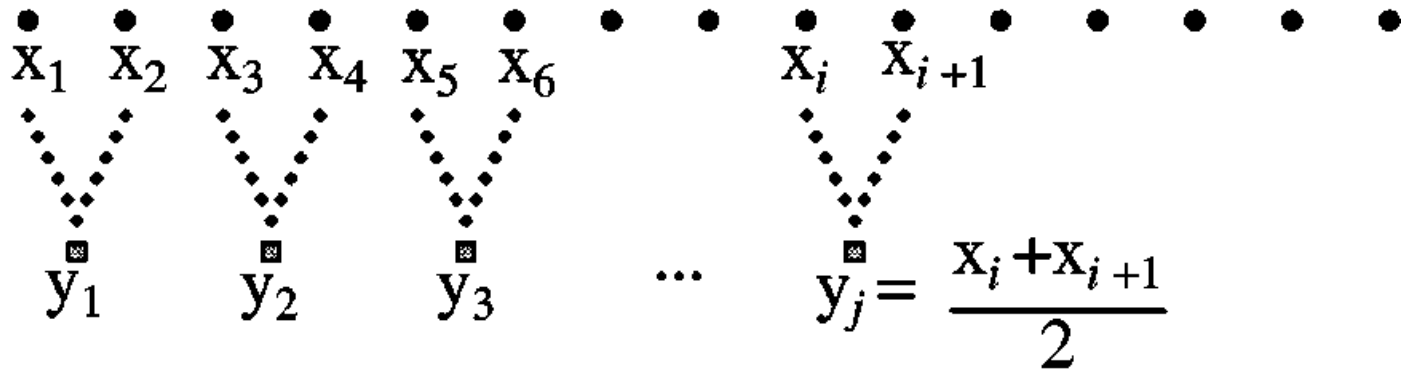


How to define complexity?

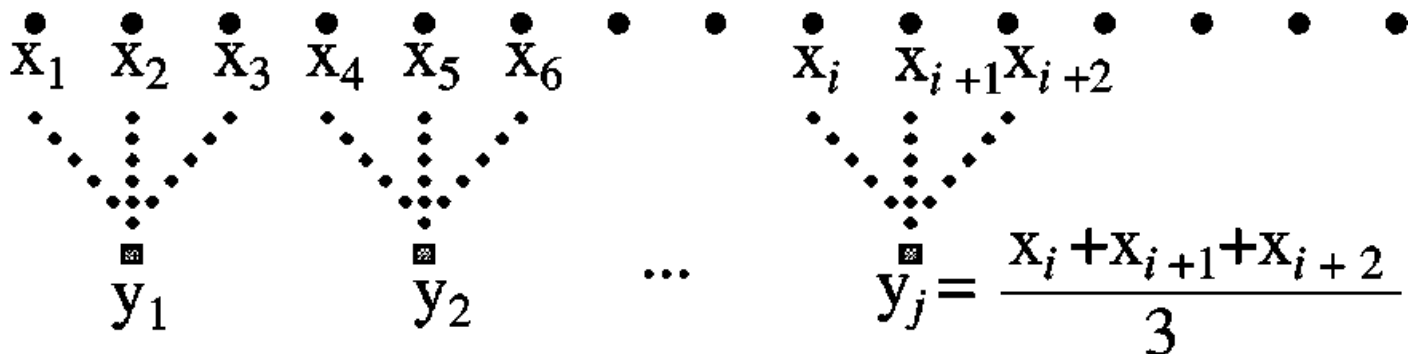
- Surface roughness of the Moon results in smooth look from the Earth. => Irregularity will be smoothed out through distant (scaled) perception.
- The irregular shape (fractal or self-similarity structure) of a tree remains the same in spite of distant or close look.
- Multi-Scale perception distinguishes the promethean system from irregularity.

Complexity: Multi-Scale Entropy*

Scale 2

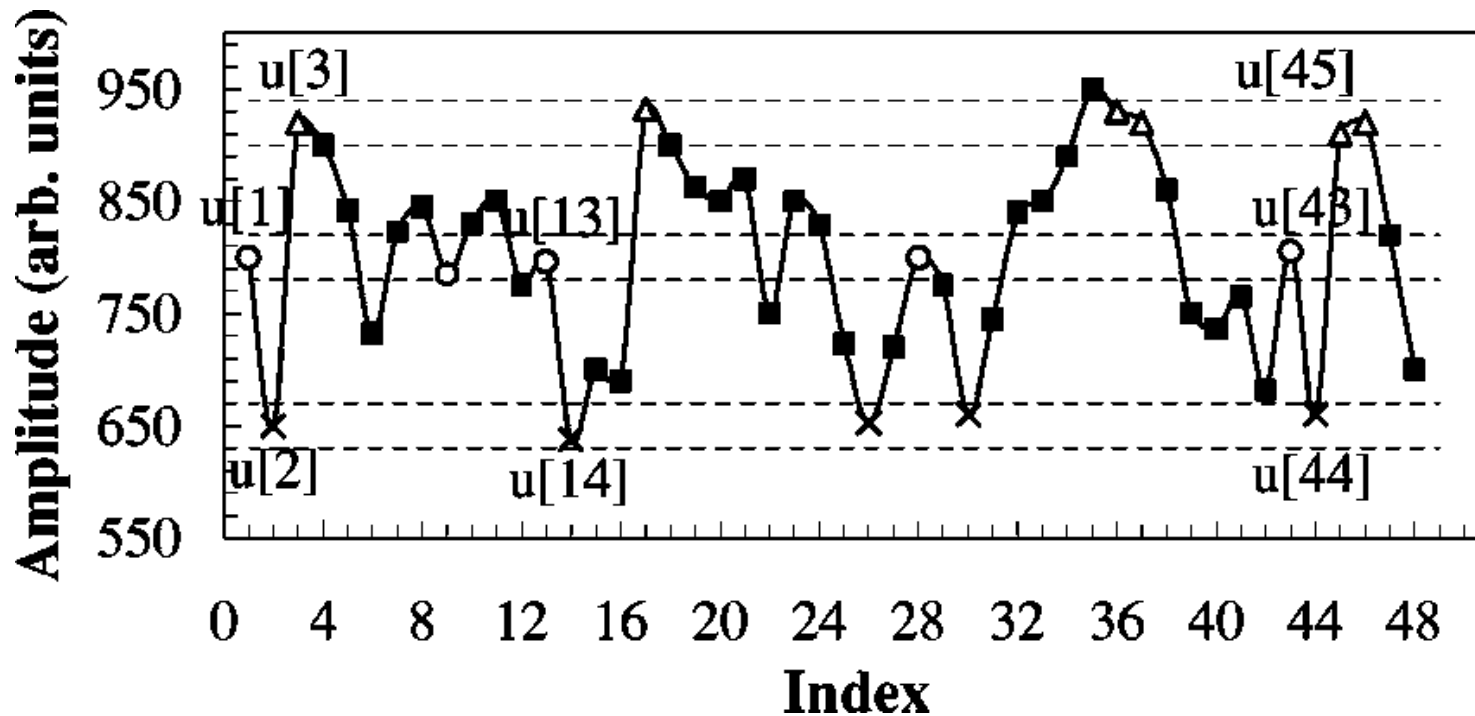


Scale 3



*Madalena Costa, Ary L. Goldberger and C.-K. Peng, 2005

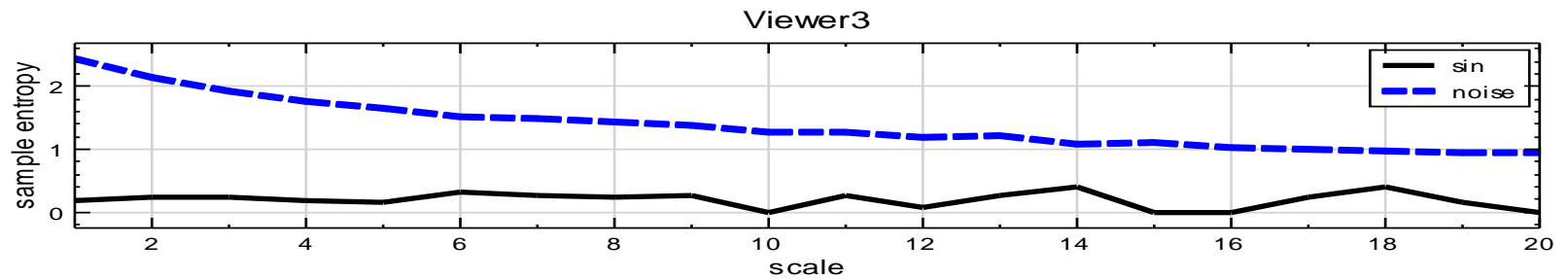
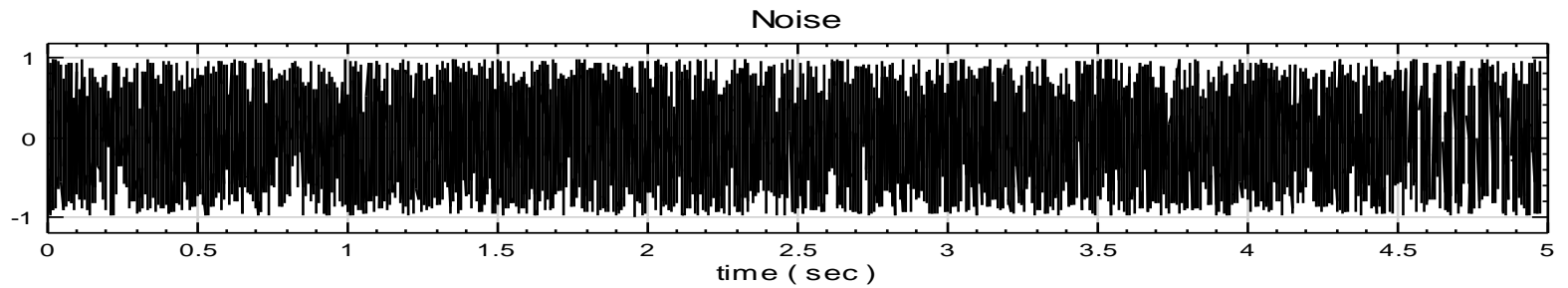
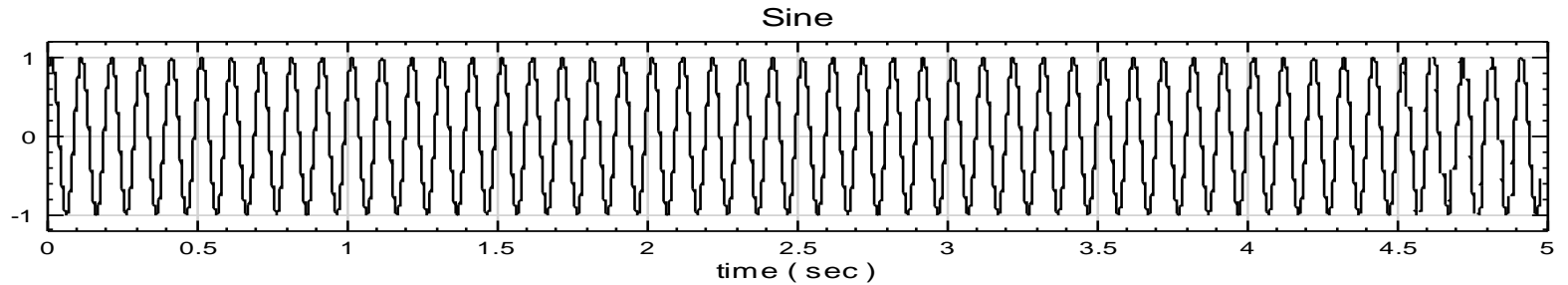
Sample Entropy: Measurement of self-similarity*



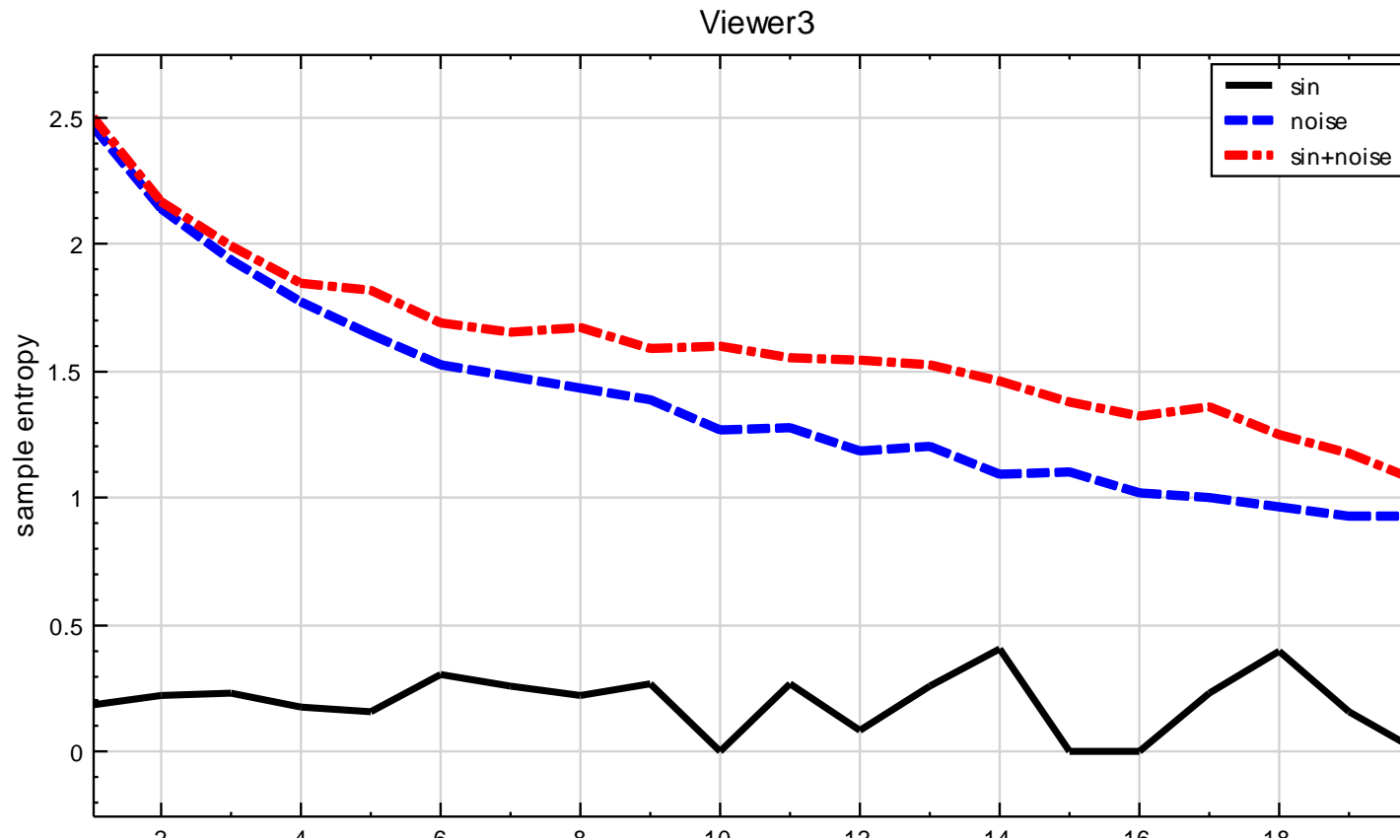
SE: the probability of which matching of two consecutive points suggests matching of three consecutive points.

*Madalena Costa, Ary L. Goldberger and C.-K. Peng, 2005

Order vs. disordered



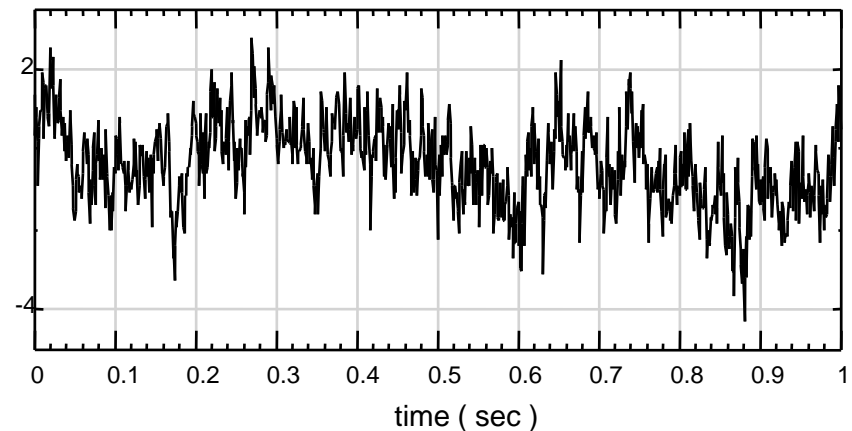
Mixed signal increases complexity



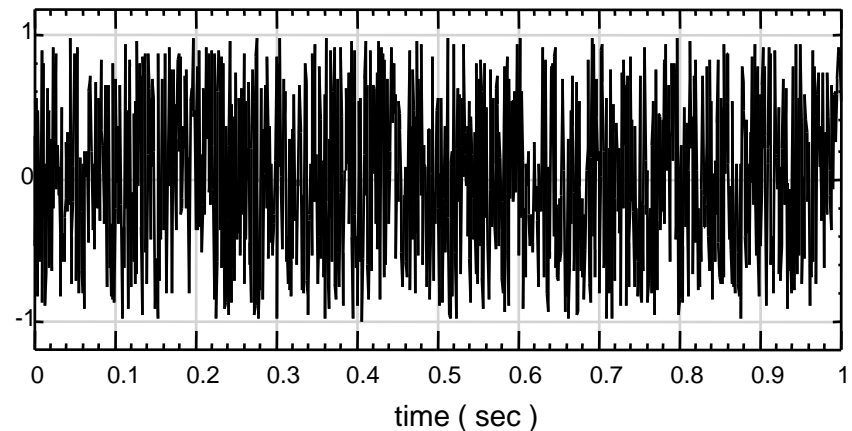
White Noise vs. Pink (1/f) Noise

- Pink noise
 - Correlated signal
 - Low frequency with high amplitude
- White noise
 - Uncorrelated
 - Amplitude the same whatever the frequency is

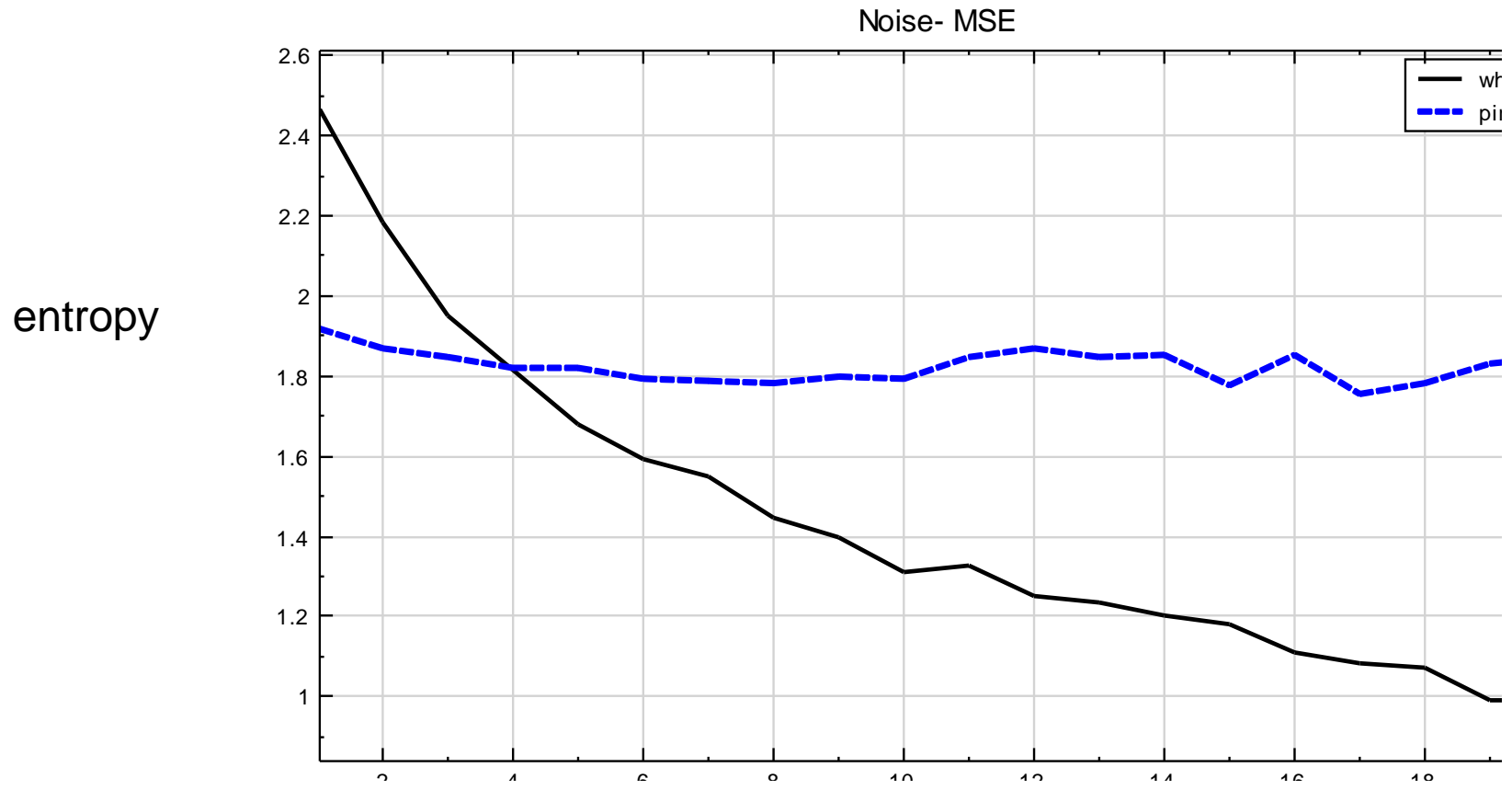
Pink Noise



White Noise

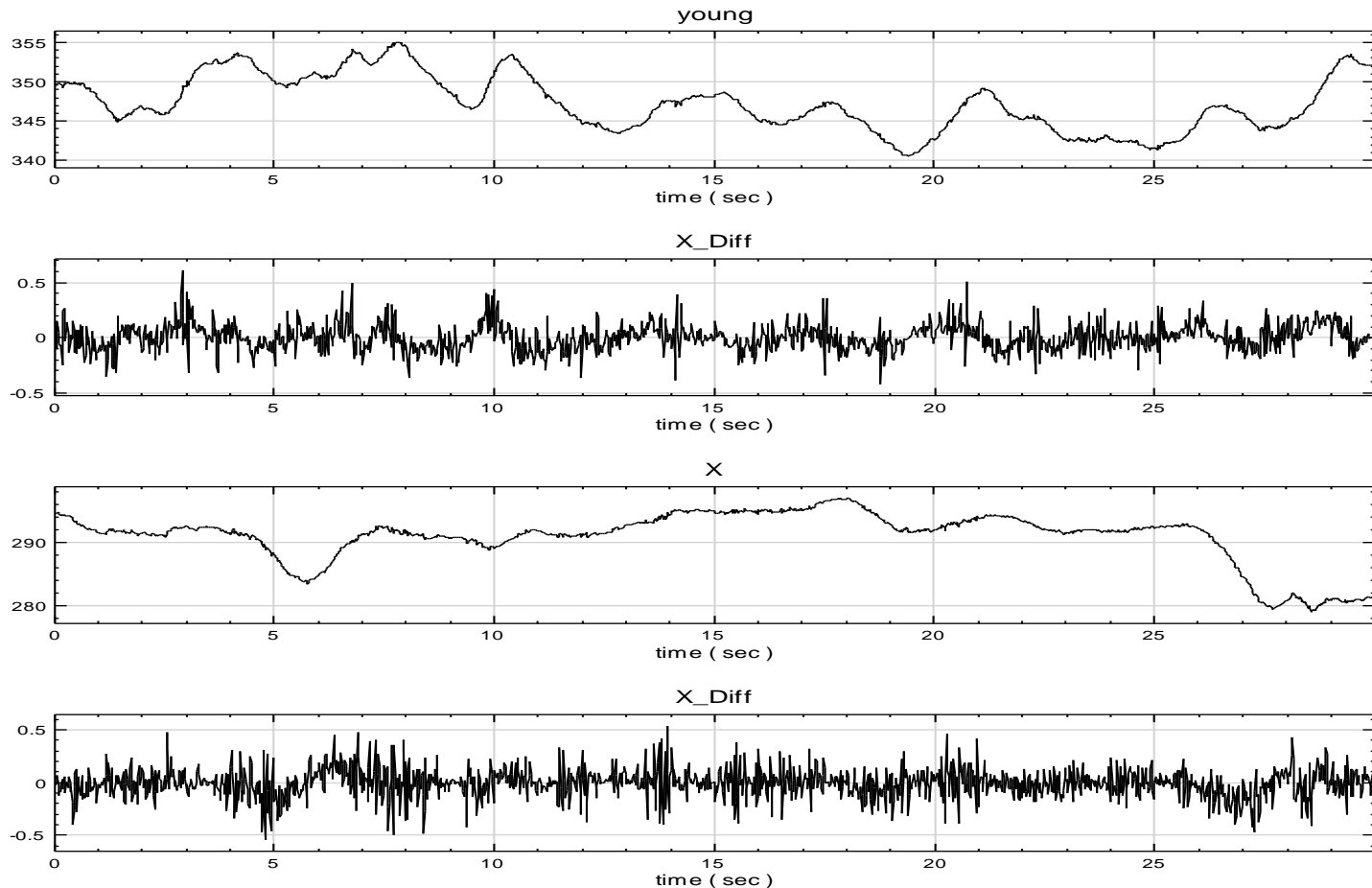


MSE: white vs. pink

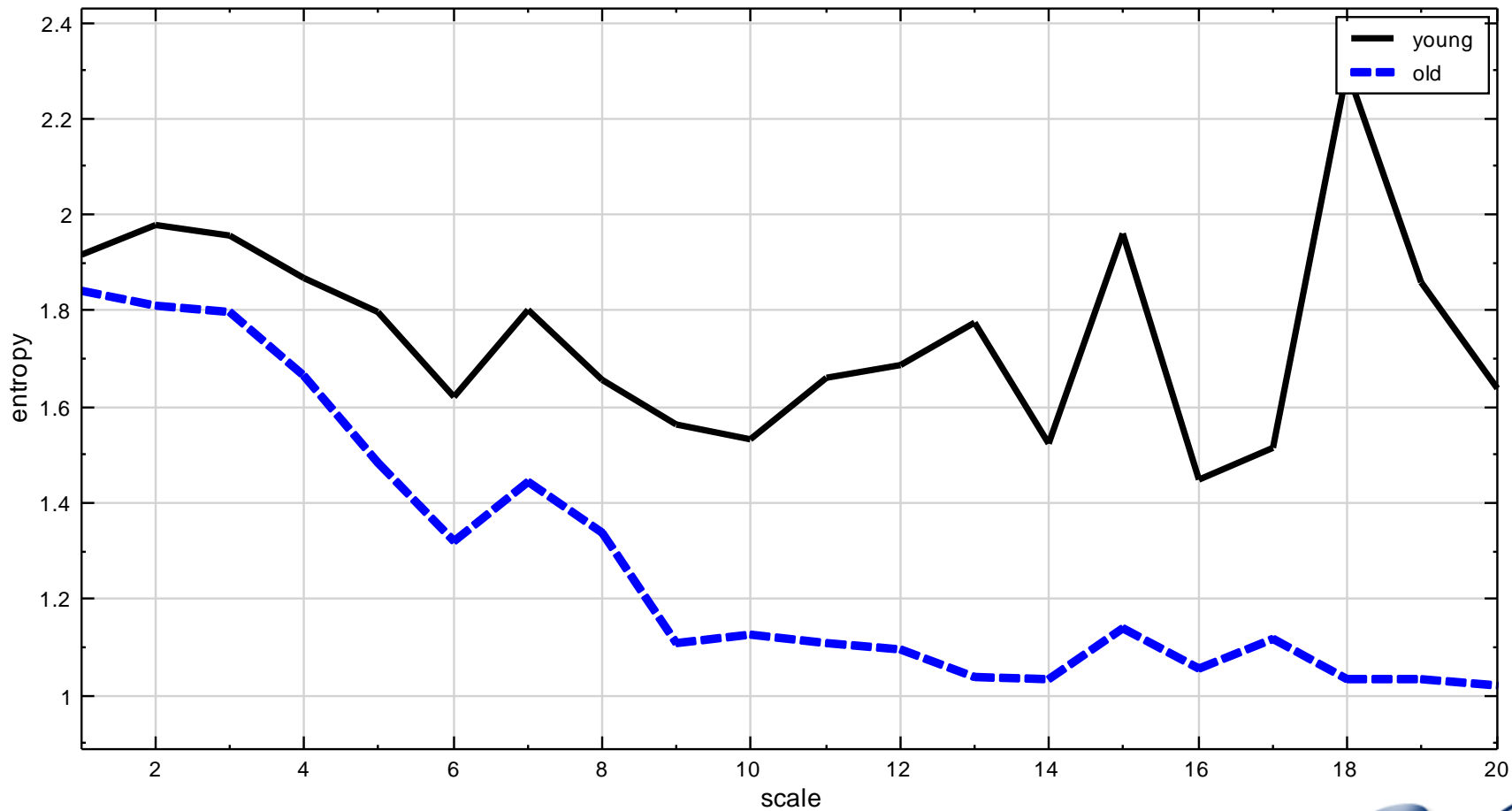


Center of Pressure Sway

COP Sway of the Young and the elderly

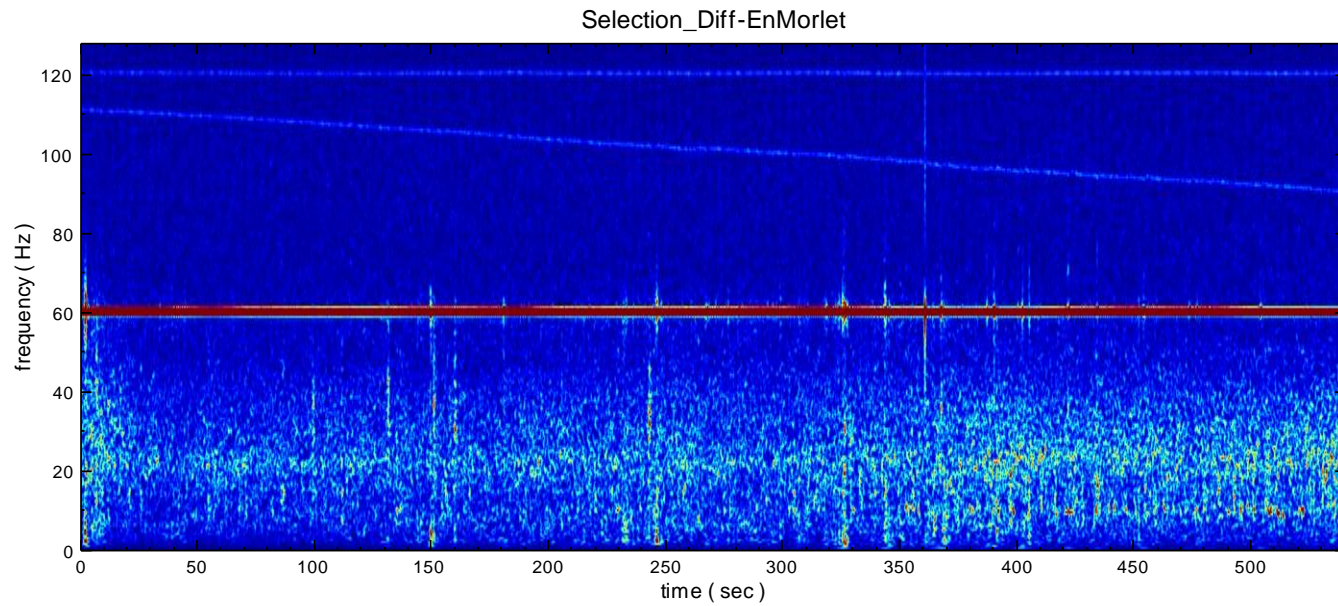
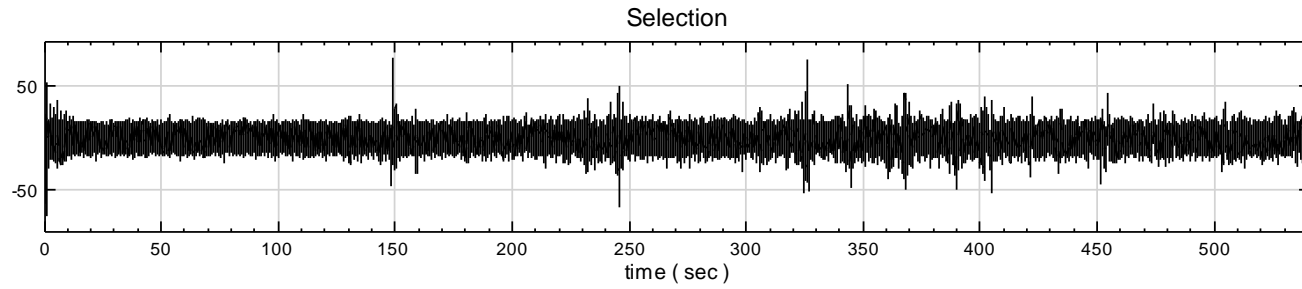


MSE Analysis of COP Sway



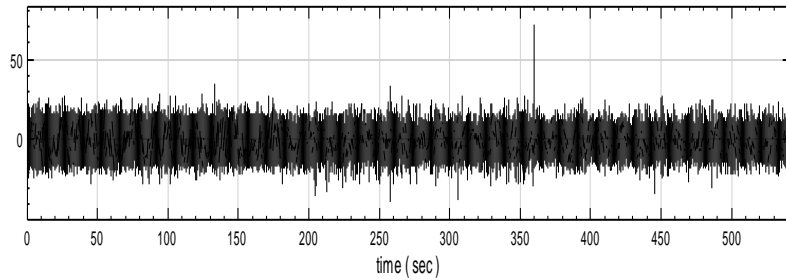
Increase of complexity in brain wave signal after days of meditation

b1

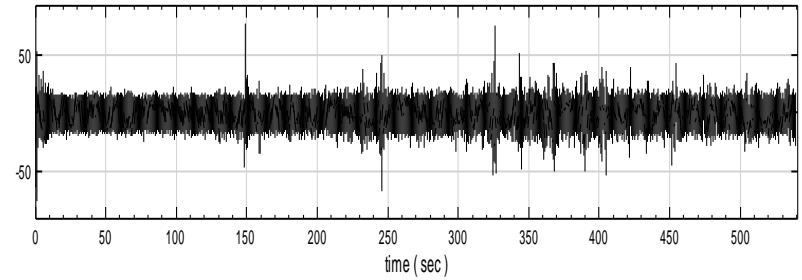


Bb1 vs b1

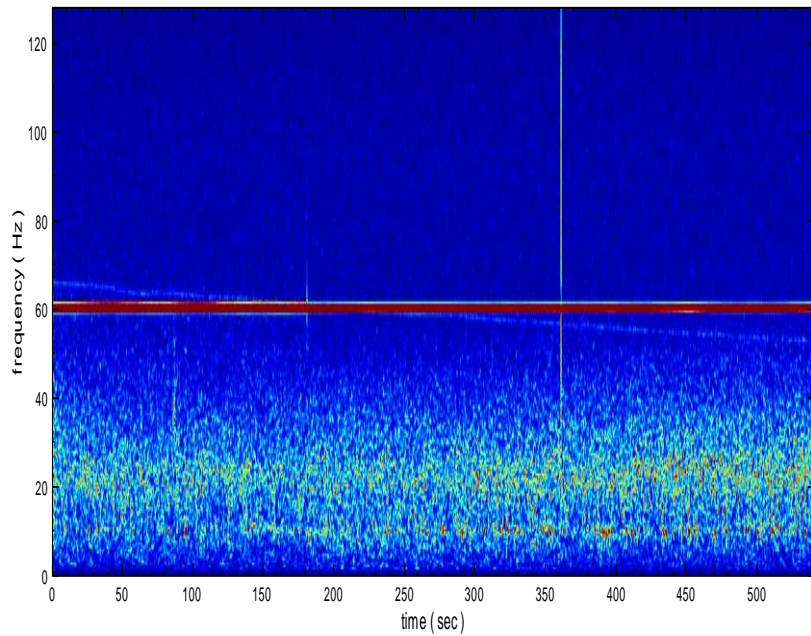
Selection



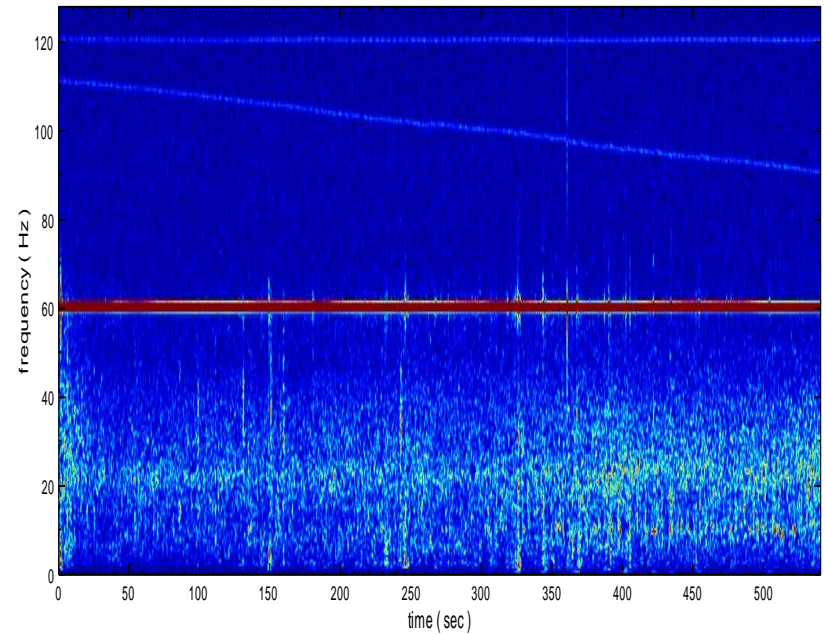
Selection



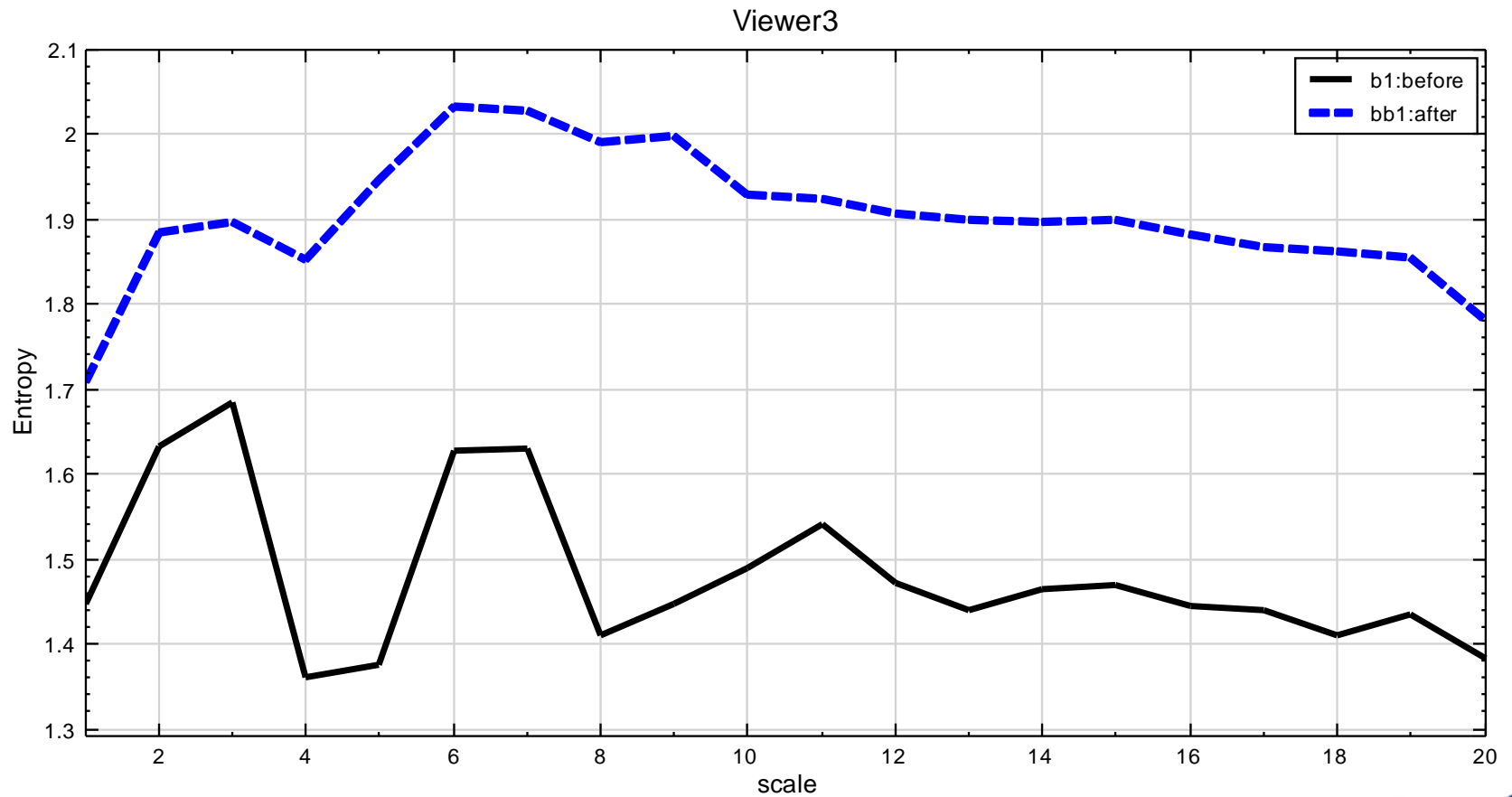
Selection_Diff-EnMorlet



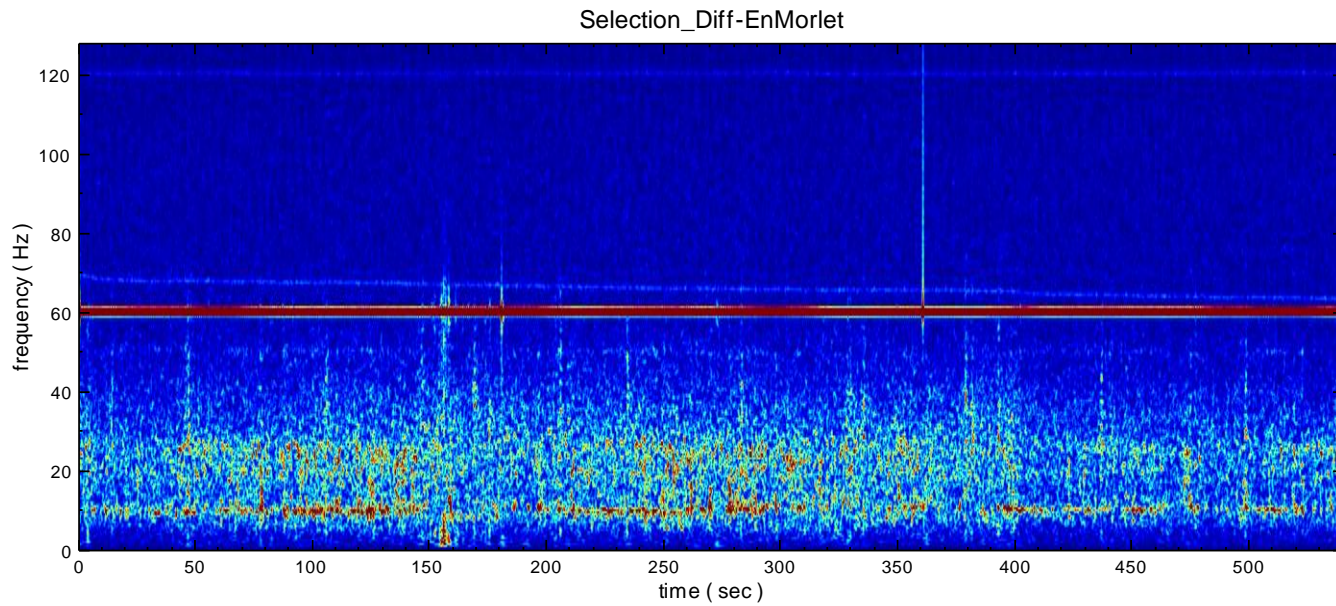
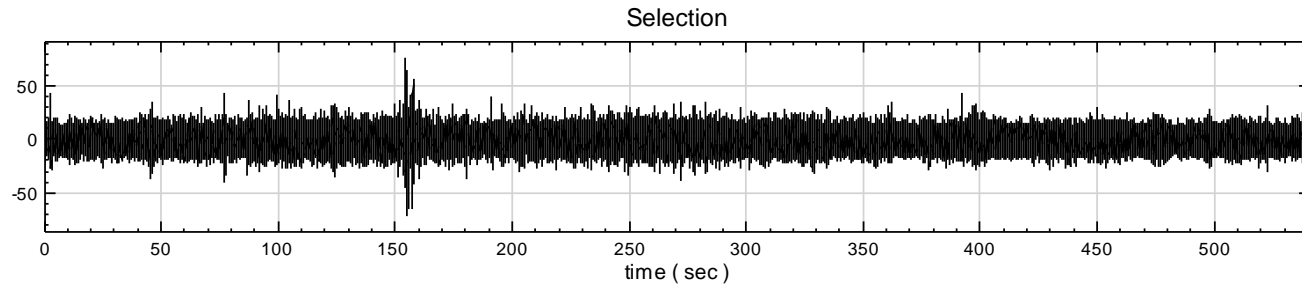
Selection_Diff-EnMorlet



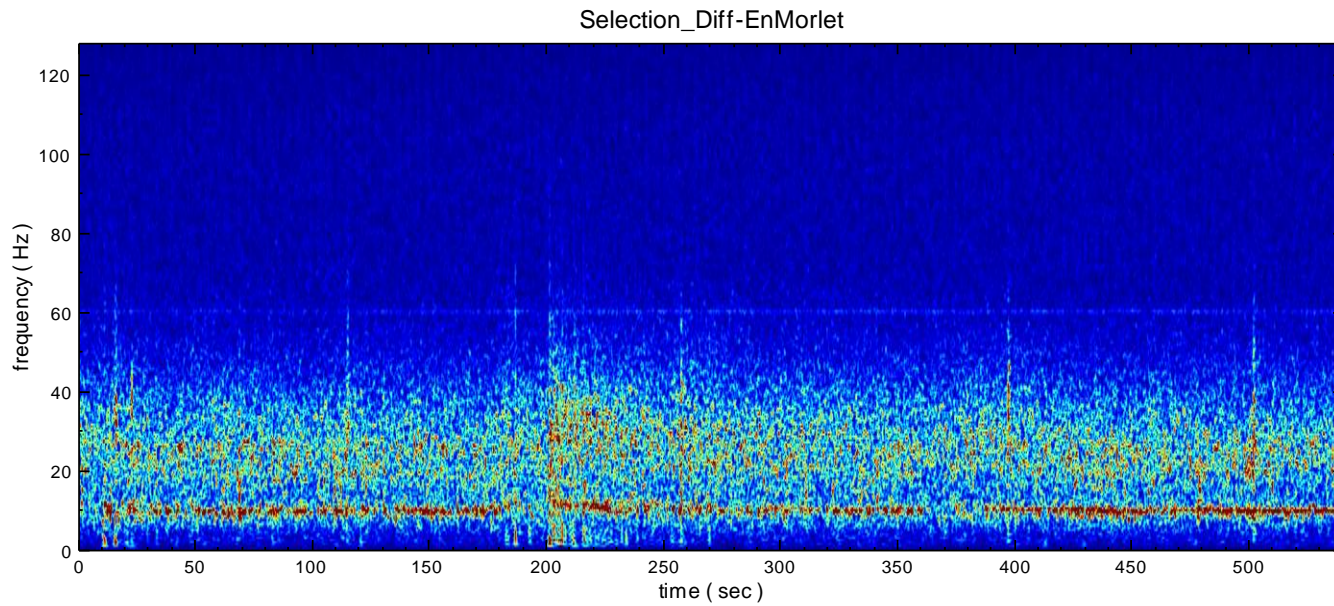
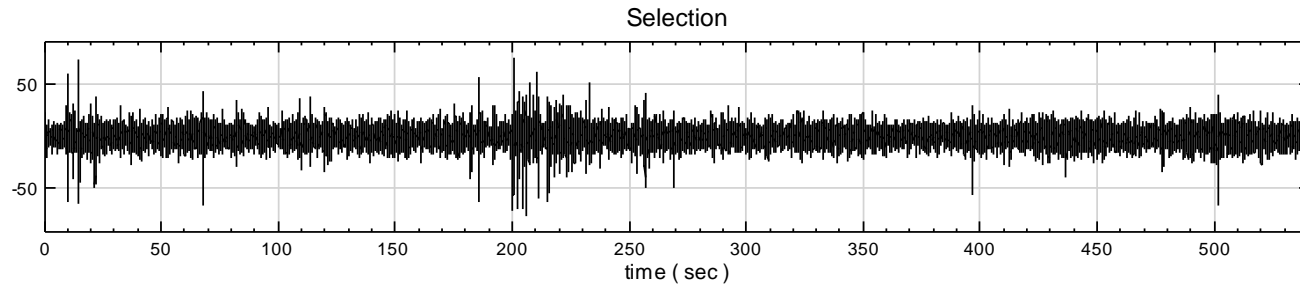
Complexity (MSE) Before and After Meditation



b17

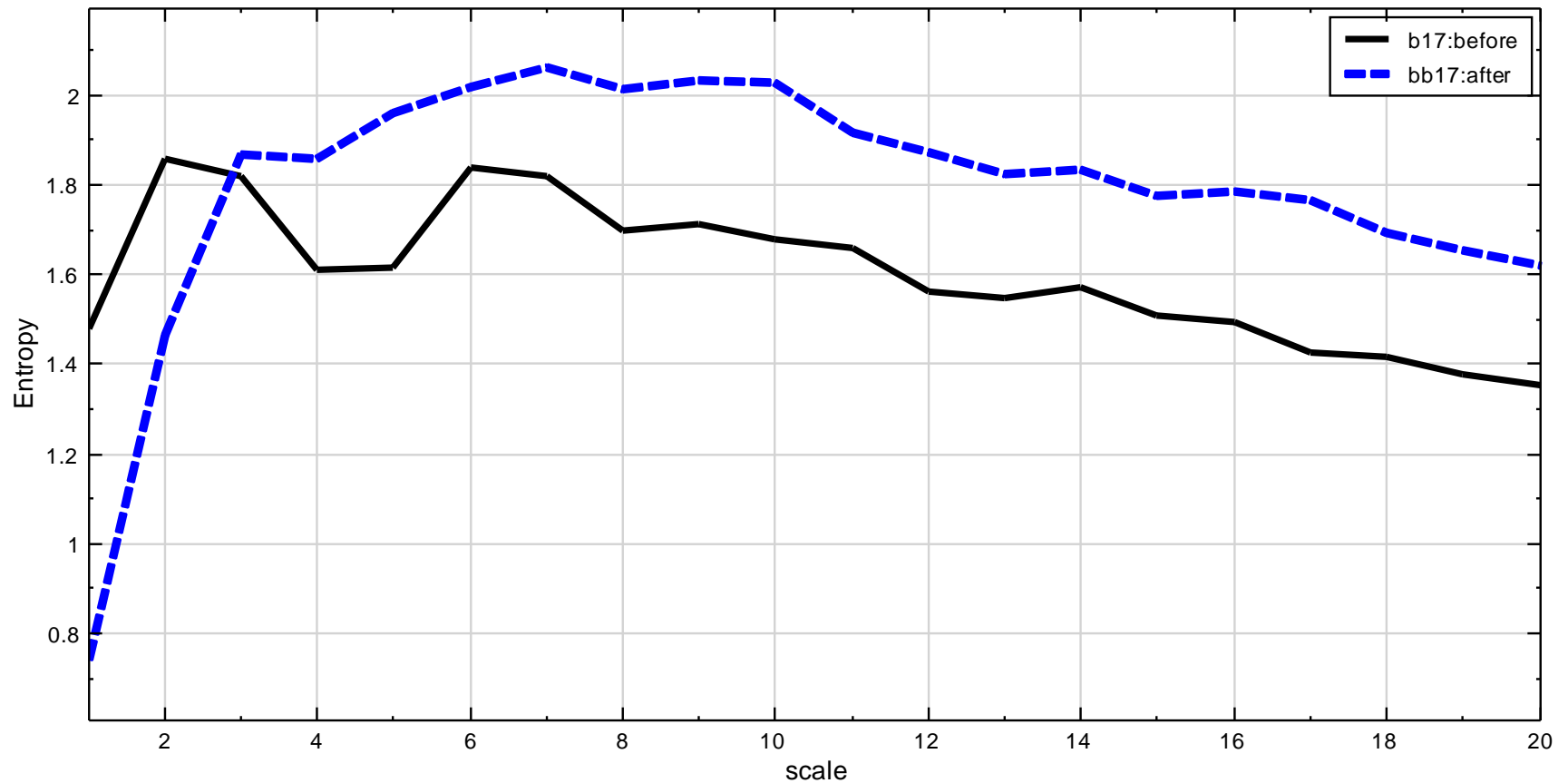


bb17

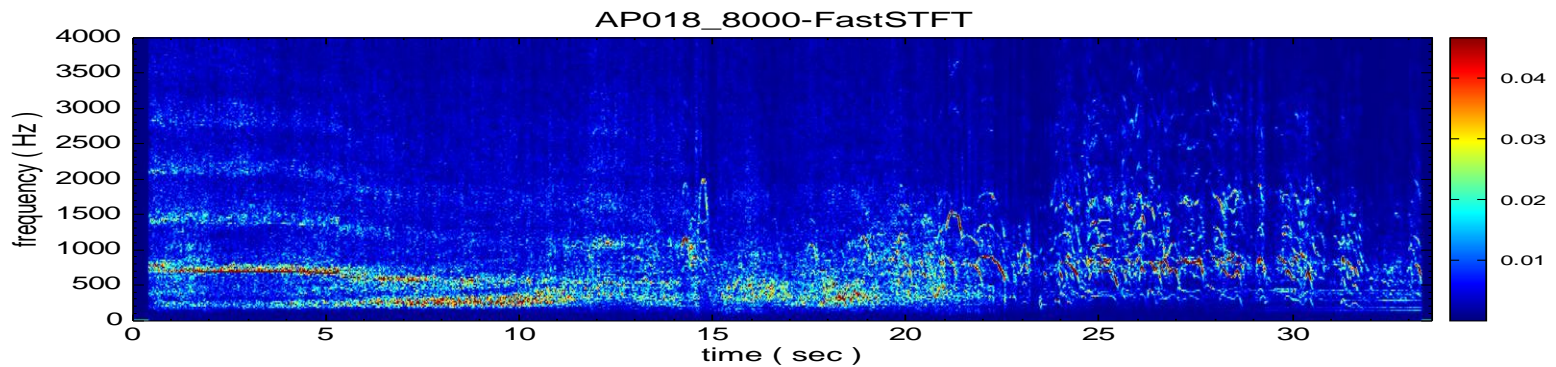
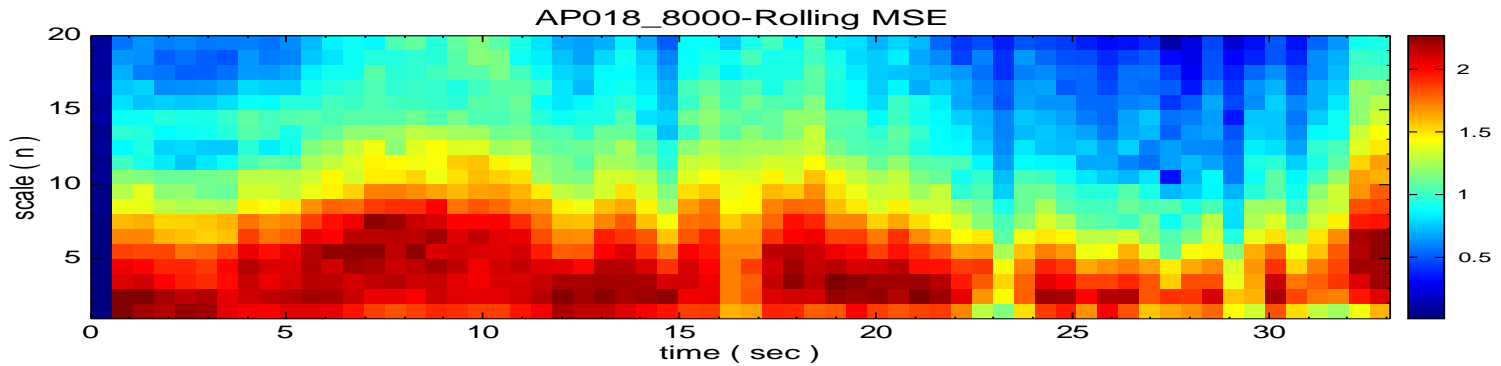
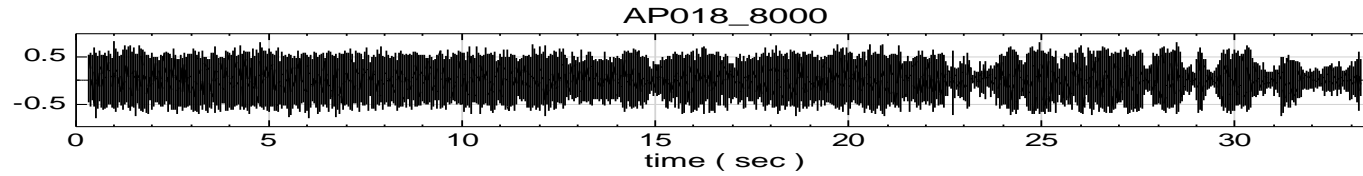


Complexity (MSE) Before and After Meditation

Viewer3



AP018-8000



Thank you

