DUALITY OF PSYCHOLOGICAL AND INTRINSIC TIME IN ARTWORKS

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TIME IN THE PLASTIC ARTS

- Etienne Souriau

- *Nothing is more dangerous for the exact and delicate understanding of the plastic arts (design, painting, sculpture, architecture, and minor arts) than the rather banal description "arts of space“, in contrast to the phonetic and cinematic arts (music, poetry, the dance, and to this group we must now add the cinema), characterized as "arts of time“.*

"ARTS OF SPACE" AND "ARTS OF TIME"

- *This contrast, subscribed to by a great number of aestheticians from Hegel to Max Dessoir, has its historic origin in the philosophy of Kant, particularly in the contrast he makes between the external senses, to which the form of space would be inherent, and the internal sense whose form would be time.*
- *… has often led to a real misunderstanding of the extent and the cosmic reach of the plastic arts, stripped of their temporal dimensions, and of their content according to that dimension.*

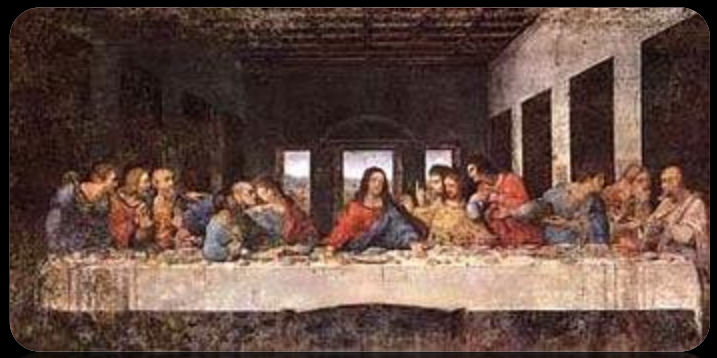
PSYCHOLOGICAL TIME

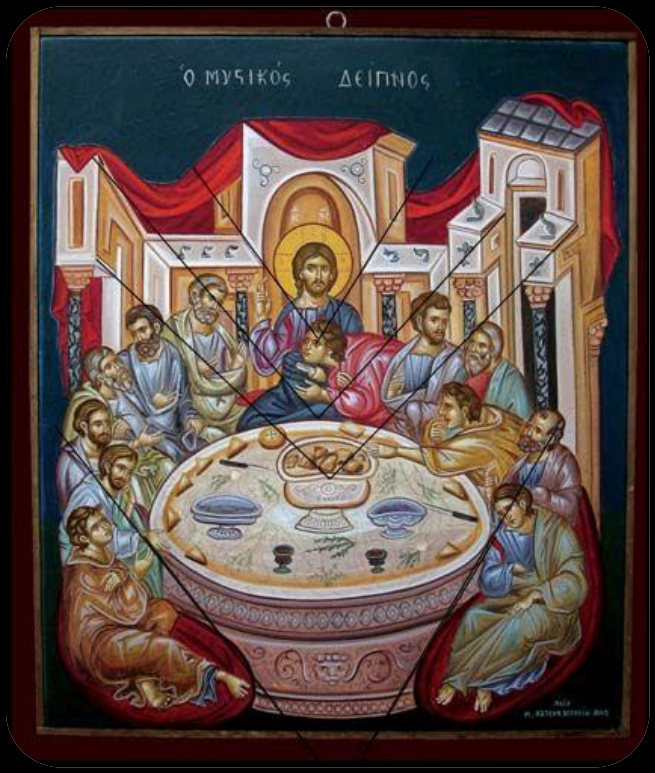
- *No doubt, the physical frame inclosing these successive aspects remains materially unchanging. No matter. The disc on which a musical composition is recorded also remains materially unchanging. The disc however is but an instrument for the orderly presentation of the work which itself is the structural law of the latter, and which governs the musical execution. One must see in the same way the movement of the spectator around the statue or the architectural monument as a plastic or view-absorbing execution, which unfolds in order the various aspects which are held within the physical frame, and which are the aesthetic reason for that frame as it was planned.*

INTRINSIC TIME

- *Every work of art creates its own universe. And whoever speaks of a universe speaks of a whole built upon a space-time network. This is as true of painting or architecture, of ceramics or of landscaping, as of music, poetry, or the cinema.*
- *There is no longer a question of a simple psychological time of contemplation, but of an artistic time inherent in the texture itself of a picture or a statue, in their composition, in their aesthetic arrangement.*

REVERSE PERSPECTIVE

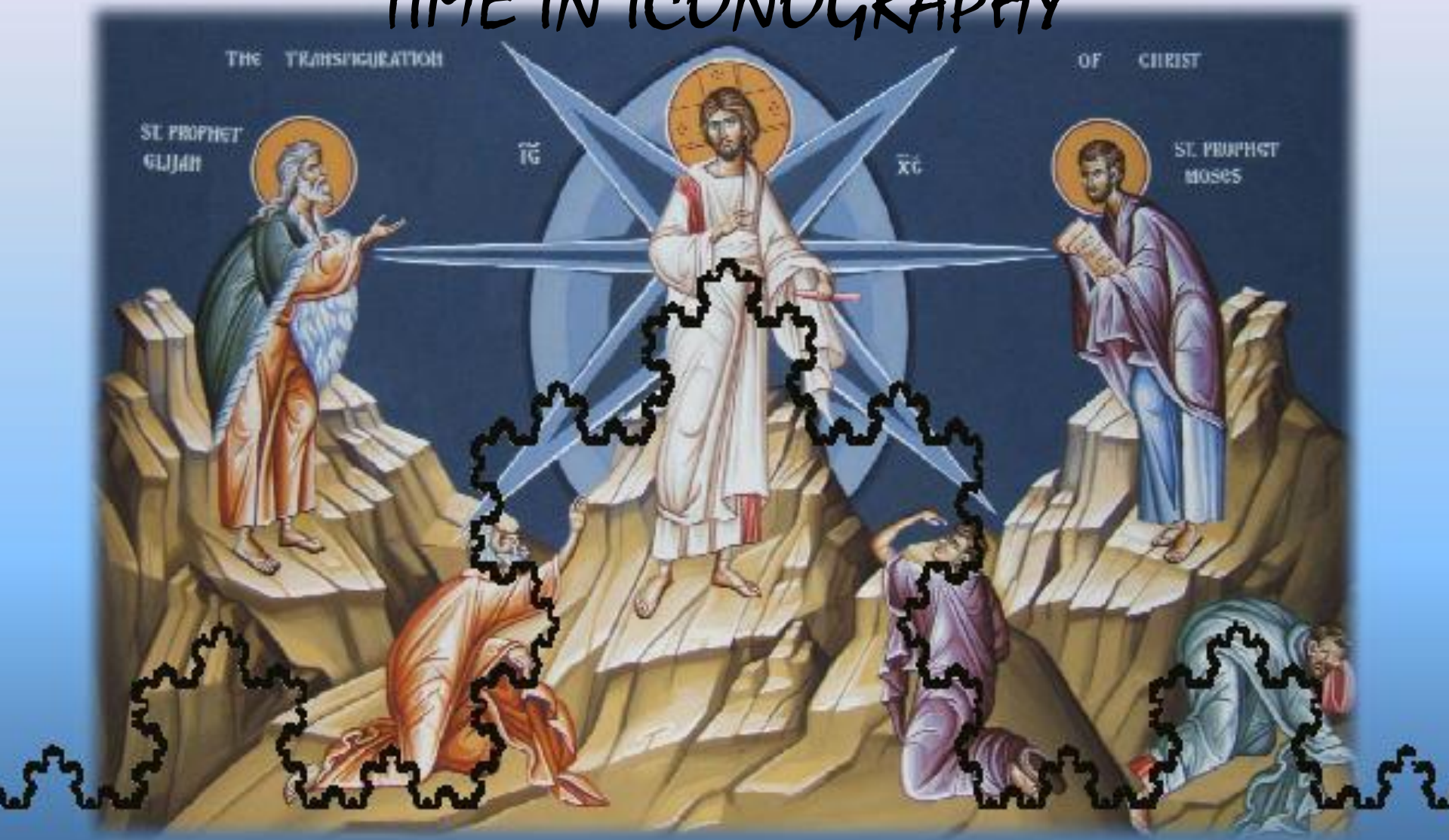




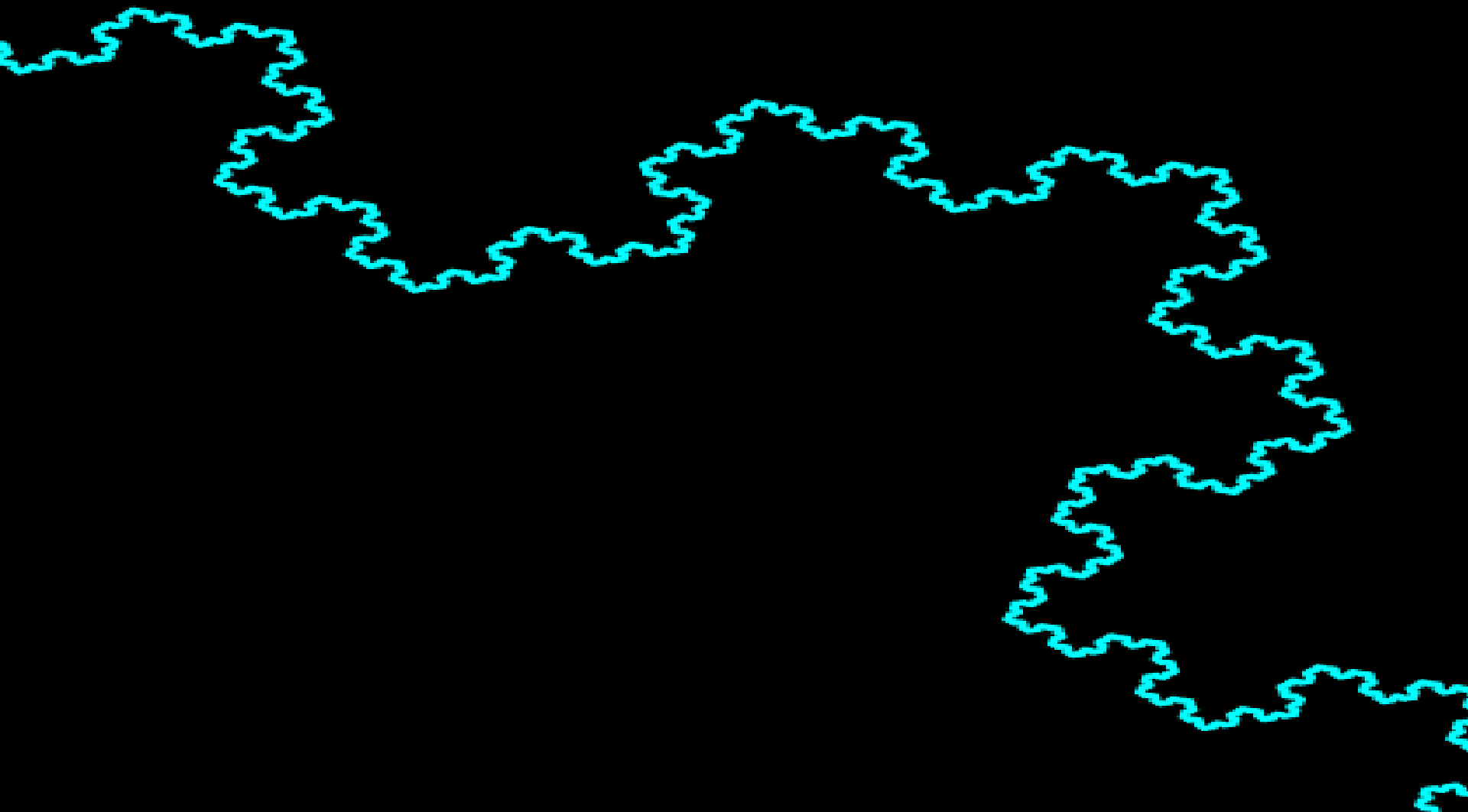
- Narrowing towards the interior
- Christ`s figure in the center
- Excluding time


THE TRANSFIGURATION OF CHRIST
ST. PROPHET ELIJAH
ΙC
ΧC
ST. PROPHET MOSES
TEMPORAL AXIS

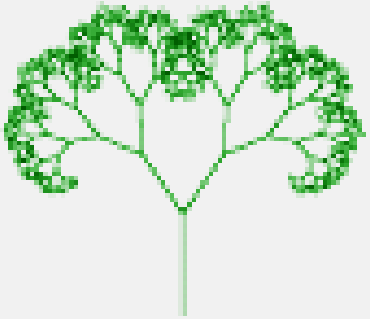
TIME IN ICONOGRAPHY

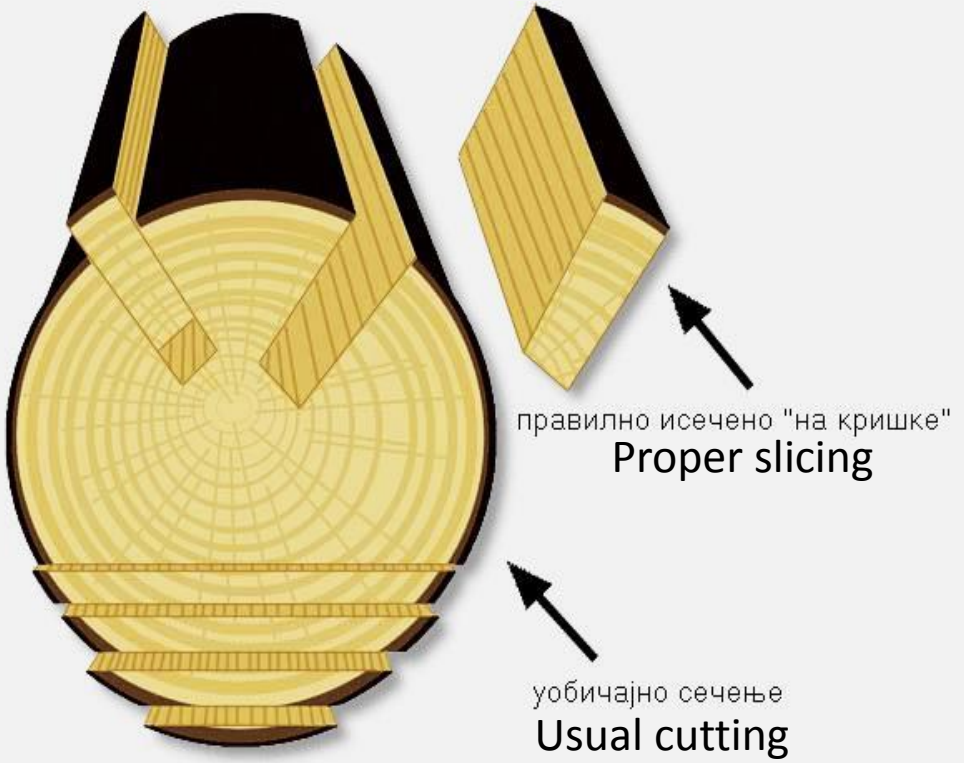


TIME IN FRACTAL GEOMETRY



TIME IN BIOLOGY



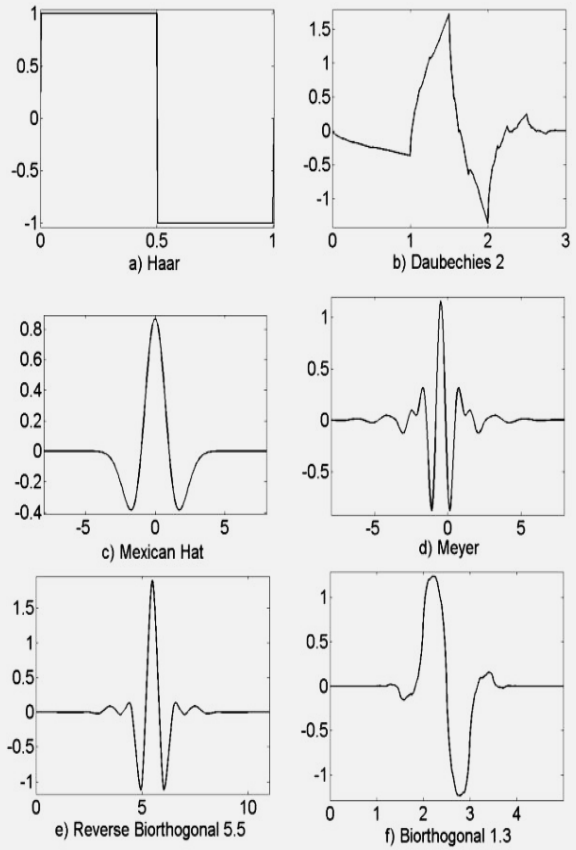


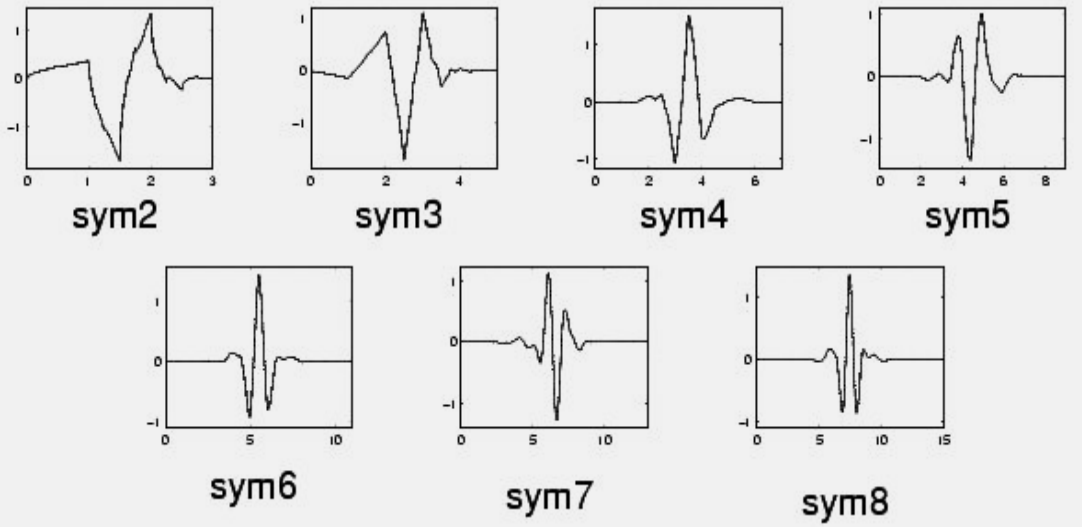
TIME IN COSMOLOGY

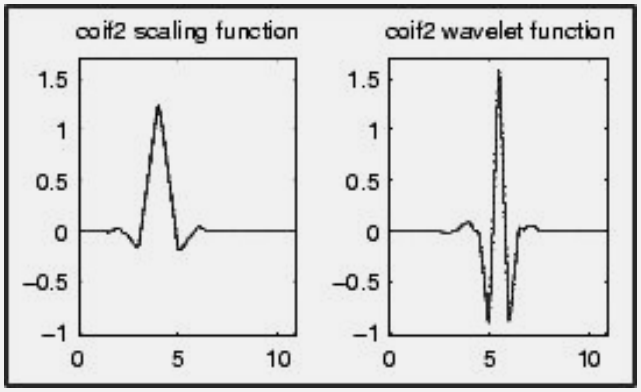
WAVELET DECOMPOSITION

- Signal space $L^2(R) = \{ f : R \to C \mid \int_{-\infty}^{+\infty} | f(x) |^2 \, dx < \infty \}$
- Music – default psychological timeline (space)
- Spatial and frequency domain concurrently
- Wavelet basis $\psi_{j,k}(x) = 2^{\frac{j}{2}} \psi(2^j x - k)$
  - j – dyadic scale, k – spatial position
- Signal decomposition $f = \sum_{j,k} D_{j,k} \psi_{j,k}$

VARIOUS WAVELETS







OPTIMAL WAVELET

- Signal representation in a basis $f = \sum_{j,k} D_{j,k} \psi_{j,k}$

1,0,0,0,0...

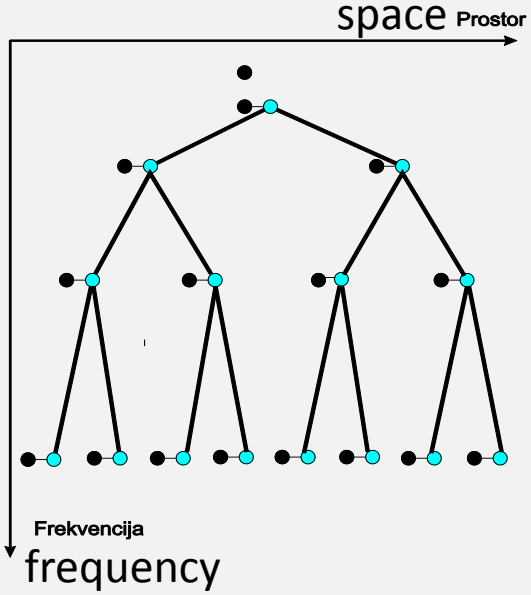
3,17,1,–5,33...

- Statistical complexity – minimal information required for optimal prediction (Peter Grassberger)
- Optimal representation – maximal complexity

HIDDEN MARKOV MODEL

$$j = 1,2,\ldots,n$$

$$k = 0,1,\ldots,2^{j}-1$$



$$f = \sum_{j,k} D_{j,k}\psi_{j,k}$$

$$\downarrow$$

$$S_j : \begin{pmatrix} \alpha & \omega \\ p_j^{\alpha} & p_j^{\omega} \end{pmatrix}$$

- *Statistical stationary process in spatial domain*
- *Coefficient interdependence is realized through Markov tree of hidden states only*

$$S = f(D)\,a.c. \Rightarrow H(S \mid D) \approx 0$$

$$H(D) = H(S) + H(D \mid S) = const$$

COMPLEX SYSTEM HMM

- Local causal state – hidden state variable
- Global causal state – joint hidden tree variable
- Local complexity – information of local causal state
- Global complexity – information of global causal state
- Self-organization – increase of local complexity
- Temporal domain – dyadic frequency axis (scale)

WAVELET BASIS EVOLUTION

- Evolution operator $Uf(x) = 2^{j/2} f(2^j x - k)$
- Exponential form $U = e^{tL}$

$$L = \ln 2(x - \frac{k}{2^j - 1})\partial_x \left[+ \frac{1}{2} \ln 2 I \right] = \ln 2(x - \tau)\partial_x$$

- Intrinsic time $t = j$
- Psychological time $0 \le \tau = \frac{k}{2^j - 1} \le 1$

$$U_\tau^t f(x) = f(2^t(x - \tau) + \tau)$$

$$U_\tau^1 : \psi_{j,k} \mapsto \psi_{j+1,2k+\tau} \approx \psi_{j+1,2k} \vee \psi_{j+1,2k+1}$$

SIGNAL EVOLUTION AND TIME OPERATOR

- Evolution operator $U_\tau^{t*} f(x) = U_\tau^{-t} = f(2^{-t}(x-\tau)+\tau)$

$$U_\tau^{-1} : \sum_{j,k} D_{j,k}\psi_{j,k} \mapsto \sum_{j,k} D_{j-1,\lfloor k/2 \rfloor}\psi_{j,k} \qquad U_\tau^{-1} : D_{j,k} \mapsto D_{j-1,\lfloor k/2 \rfloor}$$

- Time operator $T : \psi_{j,k} \mapsto j\psi_{j,k}$
- Uncertainty relations

$$[T, U_\tau^1] = U_\tau^1 \Rightarrow [L, T] = I$$

PROBABILISTIC DESCRIPTION

- Markov semigroup operator

$$W^{t*} = T^{-1} U_\tau^t T \qquad W^1 : D_{j,k} \mapsto D_{j+1,2k+\tau}$$

$$D_{j+1,2k} \vee D_{j+1,2k+1}$$

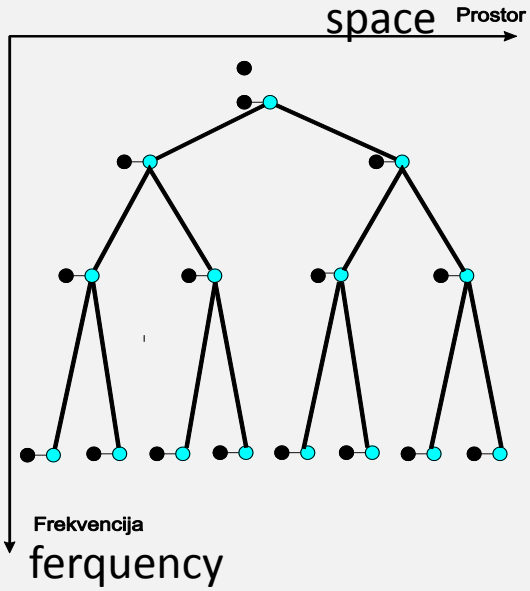
- Local causal state variables

$$W^1 : S_j \mapsto S_{j+1}$$

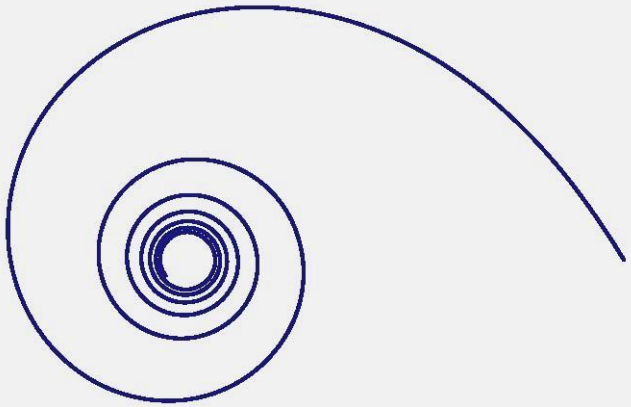
- Local complexity $C^t = \|W^t f\|\nearrow$

PSYCHOLOGICAL AND INTRINSIC TIME RELATIONSHIP

- Intrinsic time $t = j$
- Psychological time $\tau = \frac{k}{2^j - 1}$
- Putting $k = 1$ we get relation
- Temporal curve



$$\tau = \frac{1}{2^t - 1}$$



DUALITY PRNCIPLE

- Statistical stationary relation

$$H(D) = H(S) + H(D \mid S) = const$$

- Intrinsic time $t \nearrow \quad H(S) \nearrow H(D|S) \searrow$
- Psychological time $\tau \nearrow \quad H(D|S) \nearrow \; H(S) \searrow$
- Duality: self-organization – second law
  statistical complexity – free entropy
  intrinsic time – psychological time

ORIGINALS AND REPLICAS

- Charlotte Caspers

- The original artwork is more complex than a replica
- Self-organization occurs as a principle of creativity in art

THAT NIGHT I DECEIVED MYSELF

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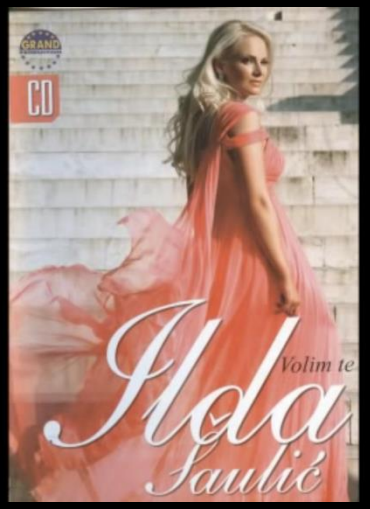

Гордана Стојићевић, 1982

Илда Шаулић, 2010

FAVOUR OF TEARS
- René François Ghislain Magritte

arXiv:1506.04356v1

Barber Museum of Fine Arts
Birmingham, UK

V.?.A

Musées Royaux des Beaux
Arts de Belgique, Brussels

CONCLUSION

- Psychological time – spatial domain
- Intrinsic time – frequency domain
- Time operator – deter. to prob. description
- Duality principle – psychological and intrinsic time
- Self-organization – local complexity increase
- Creativity in art - originality