UNIVERSIDADE DE LISBOA
CENTRO DE MATEMÁTICA E APLICAÇÕES FUNDAMENTAIS
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Mês de: Julho 2007

SEMINÁRIOS DE ANÁLISE

Dia 19 de Julho (quinta-feira), às **15h30**, na Sala B3-01

Logic, Rationality, Mathematics, Language, Existence. Which one is fundamental?

Nicolás F. Lori

(CMAF)

Abstract:

Logical and rational might often be considered synonymous, but a more careful analysis reveals they are more complementary than synonymous (possibly even opposites). An application to neuroscience is used as example of the difference between logical and rational. A brief description on what neurons do will attempt to make clear that neither local nor rational are necessarily natural; implying that determinism is also not intrinsically natural.

Different concepts of determinism were considered during the 18th and 19th century. At the beginning of the 20th century, quantum mechanics put serious doubts in the validity of determinism. At the end of the 20th century and even recently, the work of Zurek and others have clarified in what way quantum mechanics is different from classical physics. A major result of Zurek´s quantum Darwinism explicit use of information was the obtaining of the "collapse" of the wave function without the Copenhagen approach need to postulate that "collapse" which in Dirac notation is:

$$\sum_k \left[|a_k|^2 |s_k\rangle\langle s_k||A_k\rangle\langle A_k| + \sum_{\sim k} a_k a^*_{\sim k} |s_k\rangle\langle s_k||A_{\sim k}\rangle\langle A_{\sim kk}| \right] \longrightarrow \sum_k |a_k|^2 |s_k\rangle\langle s_k||A_k\rangle\langle A_k| \longrightarrow |s_{17}\rangle\langle s_{17}$$

with state $\{|s_{17}\rangle\}$ having a probability $|a_{17}|^2$ of occurring.

Quantum Darwinism's stated balance between ontological and epistemological is needed for its self-sufficiency, and it might therefore be a form of dealing with the mathematical formalism self-sufficiency conflict between consistence and completeness described in Chaitlin´s information-based approach to Gödel´s incompleteness theorem.

Quantum Darwinism enables an understanding of which quantum effects are dissipated at biological temperatures and which effects are not. With this knowledge it is possible to determine for how long the deterministic approximation can be considered as being valid for the trajectories of a Brownian molecular system. For water molecules of mass m_W and radius R_W, the determinism duration is: $t_{\mathrm{det}} = 2\ ^{-1} m_W R_W^2$. The value of t_{det} is smaller (it would be enough to be of the same magnitude order) than the typical time between impacts;

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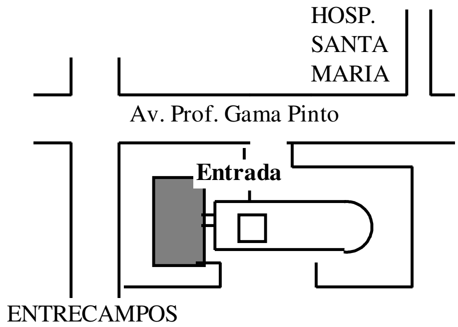

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implying water Brownian motion impacts at biological temperatures is truly random (not pseudo-random).

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