Dynamic Causal Modelling and Structural Equation Models on fMRI Experiments. A Meta-Analytic Approach

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From the appearance of Bertalanffy's propositions for the study of the organization of the structure and dynamics of systems and as a result that the idea that the whole phenomena is more complex than the sum of its parts, has made this particular view of nature into a source of models to represent reality in analog form. The contributions from various fields of knowledge, ranging from Wiener cybernetics to Prigogine's Dissipative Structures have been used to generate options for the analysis of many phenomena. In recent years, these subjects have spread widely and have become to bring analysis and methodological advances in research in neuroscience brain connectivity. The problem is to capture network effects on neuronal activity and establishing analog models to show the structural relationships between brain locations. Many of these approaches, although based on some understanding of the complexity, still based on very concrete and specific statistics aspects such as Independent Component Analysis (ICA) estimates or models like Structural Equation Models (SEM).

These details lead us to the consideration of what has been called Quantitative & Computational Neuroscience as a field of methodological advances. Computational models can be found in all cognitive domains, but with results sometimes implausible around brain functioning. The objective of this contribution is to show some recent results derived from the use of the Structural Equation Models as statistical model to recognize the complexity and dynamic causal model to represent the connectivity of brain activities from *f*MRI paradigm and experimental designs.

For this purpose, we selected the works published in the last ten years have that applied SEM to study brain connectivity, analyzing the effect of the application of these models in such studies. Variables such as the number of ROI's, the parameter estimation techniques or the properties of the observed distributions, among others, have been analyzed by a meta-analytic approach.

Key Words: *f*MRI, Structural Equation Models, Dynamic Causal Modeling, Meta-Analysis