STRUCTURAL AND FUNCTIONAL INTEGRATION IN CORTICAL NETWORKS

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In order to obtain a comprehensive picture of reality, brains need to combine (integrate) different types of sensory information (modalities). Mammalian cortex is known to be parcelled into several specialised regions connected by fibres forming a complex network. Here we study the cat cortical network [1] that is known to have modular and hierarchical structure [2]. By means of local graph theoretical measures, we have detected a set of cortical areas forming a highest hierarchical community responsible for integrating information from the different modalities. We also show that community detection methods based on the Newman modularity [3] would fail to detect such a community and we present a new definition of modularity, based on connection densities, to evaluate *overlapping* communities. The presence of this highest hierarchical community of cortical areas is corroborated from functional connectivity studies on the cat cortex presented in another poster [4]. Cortical areas do functionally organise into several independent components that go through a transition into a giant component (functionally 'integrate') only when those cortical areas expected from the highest hierarchical community are expressed.

[1] J.W. Scannell et al., *J. Neurosc.* **15(2)**, 1453-1483 (1995).
[2] C.C. Hilgetag et al., *Phil. Trans. R. Soc. Lond. B* **355**, 71-89 (2000).
[3] M.E.J. Newman and M. Girvan, *Phys. Rev. E.* **69**, 026113 (2004).
[4] L. Zemanová et al., "Hierarchical organisation of dynamical clusters in complex brain networks." Poster in this conference.