Toward an Understanding of the Neurofunctional Dissociation between Animal and Tool Concepts: A Graph Theoretical Analysis

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Abstract : Neuroimaging studies have shown that animal and tool concepts rely on distinct networks of brain areas. Animal concepts depend predominantly on temporal areas while tool concepts rely on fronto-temporo-parietal areas. However, the origin of this neurofunctional distinction for processing animal and tool concepts remains still unclear. Here, we address this question from a network perspective suggesting that the neural distinction between animals and tools might reflect the differences in their structural semantic networks. We build semantic networks for animal and tool concepts derived from Mc Rae and colleagues's behavioral study conducted on a large number of participants. These two networks are thus analyzed through a large number of graph theoretical measures for small-worldness: centrality, clustering coefficient, average shortest path length, as well as resistance to random and targeted attacks. The results indicate that both animal and tool networks have small-world properties. More importantly, the animal network is more vulnerable to targeted attacks compared to the tool network a result that correlates with brain lesions studies.
Keywords : animals, tools, network, semantics, small-world, resilience to damage
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