

Dunbar's numbers and social structure: Models and experiments

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The analysis and modelling of social networks is a widely studied topic that has been carried out from the perspective of a variety of disciplines. Different models of social networks have been proposed across disciplines such as Statistical Physics and Computer Science [1], Economics [2, 3, 4], Statistics [5] or Sociology [6, 7]. These models have been used to study different properties like community structure, high clustering, degree correlations, small world, grannovet-erian, etc. In this work we will take all these features into account, but special attention is given to the structure of Ego networks proposed by Dunbar in the so called Social Brain Hypothesis [8]. According to this theory, human communities have a characteristic upper bound of approximately 150 individuals (*Dunbar's Number*). Furthermore, the ego networks have a structure of hierarchical inclusive layers with a scaling ratio close to three: 5, 15, 50 and 150¹. Although there is a large amount of experimental literature supporting this hypothesis [9, 10, 11, 12, 13] no model has been proposed so far that is able to explain it based on simple (and plausible) mechanisms.

In this communication we present a computational model intended to reproduce such hierarchical layering including *limited cognitive capacity* assumptions. Our model allows to identify social mechanisms that are relevant to the formation of realistic, circle-structured societies. In addition, we present results from data analysis of a large Facebook data set as well as of new experiments designed specifically to study such hierarchical structure.

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¹This sequence can be further extended to 500, 1500, etc. but those relationships lack a component of trust, reciprocity and obligation. See [8] for more information.

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