

FORMALIZING THE MULTIDIMENSIONAL NATURE OF SOCIAL NETWORKS – A PERTURBATION ANALYSIS

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Individuals interact with conspecifics in different behavioral contexts. These contextual interactions do not exist in isolation however so far we have no way of integrating the social information these provide and we have to analyze interaction matrices independently. Here we introduce a new way to formalize a social network as a third-order tensor composed of a number of social interaction matrices between n individuals each representing a behavioral context. Using this formalization we could test whether social networks may be used by individuals to reduce uncertainty, allowing individuals to anticipate their ecological landscape; which includes conspecifics. While theoretical work can predict the influence of dominance hierarchy perturbation on conflict rate, little is known about the influence of such perturbation on relationships with the society as a whole. Here we show, using natural knockout experiments compared to proper controls, that stabilizing mechanisms exist in the wild. This shows that indeed changes in one interaction network, agonistic interaction matrix, leads to alteration in the other behavioral dimensions, grooming and spatial proximity interaction matrices, of the social network. Importantly, this natural experiment supports the hypothesis that social network reduce uncertainty for individuals. We estimated uncertainty of the social network using the joint entropy of interaction matrices and observed changes in non-manipulated interaction matrices lead to increase in interaction certainty. Our results also indicate that particular individuals exert a disproportionate influence on network stability.

Keywords: social network, behavioral context, entropy, social role