

Mechanisms and emergent properties of social structure: the duality of actors and social circles

Keywords: network formation; social circles; social activity; bipartite networks; network mechanisms

Extended Abstract

In this work, we present a framework for investigating social structure that challenges the widely accepted role of preferential attachment and triadic closure as the primary mechanisms of network formation. To develop this framework, we draw upon Feld’s concept of social circles [1], Breiger’s concept of the duality of actors and groups [2], and Hinde’s concept of interactions and relationships [3]. The framework emphasizes that ties between actors emerge and evolve based on their participation in social circles and social events, which can be effectively represented using bipartite and projected networks. Through analyzing empirical and artificial networks, along with recent research findings, we argue that several important structural properties in networks, including tie strength, popularity and strength heterogeneity among actors, clustering, community formation, and segregation, arise from the interplay of homophily, overlap, and social activity – the last two are introduced and explored in this study. These mechanisms shape the bipartite network, and the resulting structural properties naturally manifest themselves in the one-mode projection. Our study demonstrates that the size distributions of social circles and social events have a significant impact on network structures by intertwining with the distributions of social activity. Additionally, we find that overlap increases segregation from a network perspective. The implications of this framework are far-reaching and can influence various social processes, ranging from social cohesion, tolerance, and child development to the spread of infectious diseases. Although offering a significant advance in understanding network formation, the framework raises several important ethical considerations. The ability to model the spread of phenomena based on social activity and event size distributions might help optimize disinformation campaigns or targeting vulnerable populations. In addition, by demonstrating that segregation is amplified by the overlap of social circles, it provides a powerful tool that could be misused to manipulate social structures. On the other hand, manipulating social structures can also be beneficial in promoting social cohesion [4].

References

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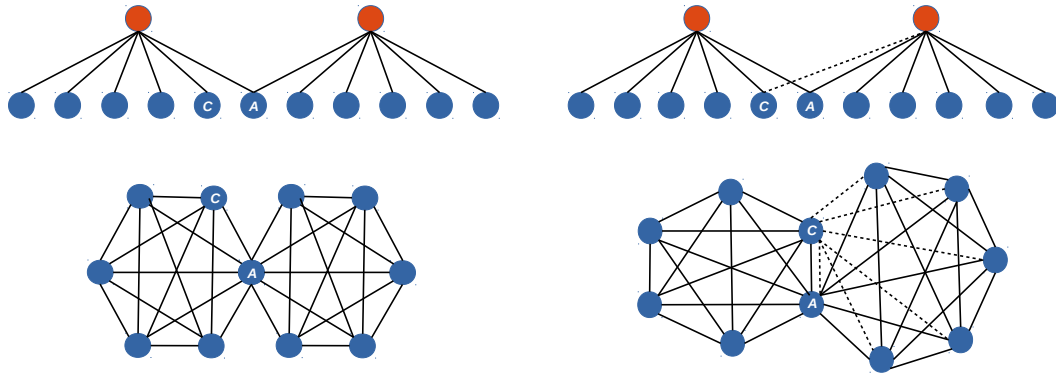


Figure 1: **Triadic closure decreases clustering.** The diagram of a toy social structure, with the bipartite network and its one- mode projection, showing how the closure of triplets can decrease clustering. Alice (A) intersects two social circles and invites Clara C to join the second circle, creating triadic closure. Before Clara joins the second circle (social structure on the left), there are 120 closed and 25 open triplets, resulting in clustering $C = 0.83$. After she joins the second circle (right), there are 165 closed and 40 open triplets, resulting in $C = 0.80$. In this case, the slight shift to the right in the social activity distribution has resulted in lower clustering.