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The illusion of households as entities in social networks

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Extended Abstract

In many studies of social connections in communities, towns, or villages, social networks are typically collected and analyzed at one of two representational levels: individual or household. There is therefore an important choice to be made in any study of such a social network: should the nodes represent individuals or households, and how should the relationships between the nodes be represented? In this work, we focus on interrogating this methodological choice.

Often, *household network* data is collected by first collecting the *individual network*, and then grouping those individuals (and their connections) together with those who live in the same household [e.g., 1, 2]. When household networks are constructed in this way, two key assumptions are implicitly made: (i) that an individual's social connections are shared and can be utilized by every other individual in their household, and (ii) that households are connected through individual relationships. In practice, the impacts of these implicit assumptions are not considered and thus individually-driven processes and relationships are conflated with household ones. Although both household and individual networks represent how the same set of people are connected to one another, the distinctions between these networks are nuanced.

We formalize these distinctions by bridging insights, tools, and observations from disparate fields in an effort to systematize recommendations for guiding the choice of which network to study. We draw on social science research ranging from within sociology, political science, and anthropology which have theorized, measured, and observed the assumptions and consequences of studying individuals and their relationships interchangeably with their respective aggregates.

In addition to highlighting theoretical distinctions, we quantitatively explore the differences between household and individual networks. We show a simple example showing that *heterogeneous random node aggregations* in an Erdős-Rényi random graph result in a network that is no longer Erdős-Rényi. We then consider how local metrics, seeding strategies, influence maximization, and centrality metrics substantively differ on the individual and household village social support networks from [1]. As one example, we consider how two commonly-used local network metrics, degree assortativity and average clustering coefficient, are substantively different. Notably, we observe relatively large and small average clustering coefficient on the individual and household networks, respectively. Similarly, we see that the household networks display disassortative mixing whereas the corresponding individual networks have positive degree assortativity. In the context of previous work on assortativity in social networks [3], it is surprising to find both assortativity and disassortativity on the same social networks represented at different granular representations. Clustering coefficient and degree assortativity have implications for the social health of a community [e.g., 4, 5] and for how a disease is sustained [3]. As such, we see that distinct conclusions are drawn depending on which network is considered, further indicating that *the choice of which network to study* has significant implications.

To assess when an individual or household network should be studied in a given context, we provide a systematic recommendation based on a series of *entitativity criteria* [6]. We ground these recommendations in theories and experimental observations studying how individuals interact within households and as aggregates, as well as how gender and power interact in household networks to distinguish between the types of connections most relevant in a given setting

[7]. We propose specific adaptations and extensions to the entitativity criteria of *proximity*, *similarity*, *common fate*, and *internal diffusion* as they relate to studying networks in the context of interventions and experimental goals, which we organize as a decision tree in Fig 1. In doing so, we relate the entitativity criteria to recommendations on how and when to collect and weight the relationships between individuals or households differently. We show how to evaluate the criteria in different settings by applying our set of recommendations to three different large-scale experimental network studies, [1], [8], and [2].

The focus of this work is to emphasize and improve a commonly made, but under-examined, methodological choice in social network analysis. By incorporating work from a broad range of disciplines, we aim to help researchers make a rigorous decision for how to align their research question with an appropriate social network, so that their subsequent analyses may be consistent with their research goals. As such, this work has impactful consequences for computational social scientists who study, collect, and develop quantitative methods for social network data.

References

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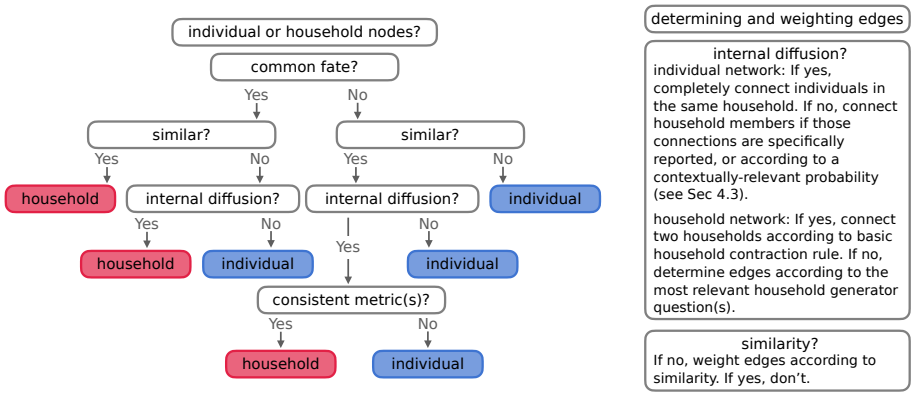

Figure 1: A contextual evaluation of a set of entitativity criteria to determine an appropriate level of node aggregation and suggest how to weight edges.