

# When Network Eigenvector Centrality Misbehaves: Some Lessons

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## ABSTRACT

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## 1. INTRODUCTION

Bonacich (1972) suggested that the eigenvector of the largest eigenvalues an adjacency matrix could make a good network centrality measure. Unlike degree, which weights every contact equally, the eigenvector weights ties with others according to their centralities. Eigenvector centrality can also be seen as a weighted sum of not only direct connections but indirect connections of every length. Thus it takes into account the entire pattern in the network. Important extensions were beta-centrality, which permits an assessment of power in negatively connected networks - networks in which one's own power is reduced by connection to powerful others (Bonacich 1987) – and to networks with negative as

well as positive ties in which a negative connection to a powerful other reduces ones power (Bonacich and Lloyd 2004). Many others have used eigenvector centrality and it continues to be refined and developed (Brundes and Cornelsen 2003; Estrada and Rodríguez-Velázquez 2005; Ruhnau 2000; Richards and Seary 2000).

However, there are situations in which eigenvector centrality and its variants either do not give any information or cannot be computed, and it is these situations that will be the topic of this paper. There are situations in which the eigenvector is identical to network degree and in which beta centrality misbehaves.

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