Reply to Slater: Extracting the backbone of multiscale networks

In his Letter (1), P. B. Slater asserts that "The central problem of concern to Serrano, Boguña and Vespignani (2) can be effectively and elegantly addressed using a well-established two-stage algorithm that has been applied to internal migration flows for numerous nations and many other forms of 'transaction flow data'." This seems to suggest two facts. First, that his methodology has been proven to work in multiscale networks and, second, that his method is equivalent to ours.

Concerning the first point, we would like to point out that extracting the more relevant interactions in a complex network is a difficult problem, and the solution may depend on the specific aspects that define what is relevant. Which strategy is the most appropriate for a particular problem should be carefully judged, and one cannot exclude the possibility that a combination of different techniques may turn out to be the most appropriate. Even though the technique in ref. 3 had been tested on various datasets, it would have not prevented us from developing a new methodology that highlights the multiscale character of the system. Ultimately, however, the technique proposed by Slater has not been thoroughly tested on large-scale multiscale networks, and several technical issues should be addressed and clarified.

Slater's method (1) seems to present a number of technical problems when applied directly to sparse networks (lack of convergence, generation of spurious asymmetries when the original network is symmetric, etc.). This is exactly the case of multiscale networks which have many nodes of very low degree and strength coexisting with few others with high degree and strength. To the best of our knowledge, a systematic analysis of the method's performance in such cases has not been done yet and, therefore, the application of the method to sparse networks is still an open issue. Finally, we would like to comment on the importance of null models as a way to discern relevant signals out of noise. As described in ref. 3, there is not a clear proposal for a suitable null model to measure the statistical significance of the results.

Concerning the second point, the methodology proposed by Slater is conceptually different from ours and gives different results when applied in practice. In ref. 3, individual weights in the original matrix are globally normalized so that they can be compared on an equal footing. This global normalization makes hub's connections—nodes with high strength—become very weak in the normalized matrix (4). In our method, the perspective is always local, meaning that the normalization of the weights of the edges attached to a node is always considered in the reference frame of that particular node. Because of this, our method does not belittle connections based only on their global importance but on their relative importance. As a result, the extracted backbone contains nodes and edges from the whole spectrum, that is, we obtain a multiscale backbone of the original network.

In summary, although we are open to consider Slater's technique as an alternative methodology for the selection of the backbone of multiscale networks, we believe that the claim for an effective and elegant solution to the problem should be put forward along with an in-depth analysis of Slater's technique on a set of standard multiscale networks and a thorough comparison of the results with respect to ours and other methods, as we have done in our paper.

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The authors declare no conflict of interest.

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