Temporal Network Analysis with Gephi

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The reason why the temporal dimension is so important in network analysis is that without the flow of time, most of the networks we study would not exist. This is even more true in the humanities and especially in history: all the events, individuals, and objects we model do not have their relationships simultaneously. An exchange of letters must take place over several years to form a network, a merchant ship takes several weeks to arrive at its port of destination, social relationships are woven over time and evolve, strengthen, and dissolve. Even if these examples are very simple, they allow us to measure the variety and complexity of temporal historical data. And if conceptualizing the temporal dimension of relationships is within the grasp of historians who manipulate these data, "a mismatch between methodology (data models and metrics) and available technology" can be observed (Conroy et al., 2019).

The question is whether the tools are lacking to represent time in historical networks, or whether on the contrary it is the technical skills and knowledge of the tools that historians lack to model their temporal data in a way that can be easily analyzed. In most cases, "we often tend to think of change in networks in terms of a series of snapshots" but it seems clear that "historical information is not naturally shaped as snapshots" (Lemercier, 2015). Is it because we know that software is good at producing snapshots? Or because we don't have the theoretical framework to "think" the temporal network in all its subtlety (Grandjean. 2020)?

We postulate that, as the modeling of historical data is always a reduction of its original complexity, there is no software that can perfectly render the temporality of relations. But we argue in return that most of the obstacles are perpetuated by users' misunderstanding of the tools that are available to analyze this temporality. This does not mean that we should limit ourselves to doing what the software offers by default for this type of question, knowing that these, and Gephi among them, can have a strong influence on our modeling and our research questions (Jacomy, 2021). But we can be aware of the possibilities they offer us and choose accordingly.

This contribution proposes an overview of the different ways to take temporality into account in the analysis and visualization of social networks with the open source software Gephi (Bastian et al., 2009). This very versatile software represents a good balance between ease of use for a beginner and robustness for an advanced user. Examples presented will include, but are not limited to:

- Producing snapshots of the same network at different times or time slices.
- Highlighting a situation at a given time in a whole network (superimposed).
- Using a slider to make the network evolve (nodes in a fixed or mobile position).
- Fixing the network according to a chosen spatialization or a "topography" of the studied object (when temporality applies to edges).
- Representing time as an axis (when temporality applies to nodes).

The examples can be presented as small tutorials that will complement a more general introduction to the software (Grandjean, 2015). We hope that this very concrete and technical contribution will enhance the equipment of those who feel too limited by their tools to engage in temporal network analysis.

References

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