Using visualization to understand language change in social networks

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In this study, we successfully replicated a computational model presented in a prior study (Fagyal, Swarup, Escobar, Gasser, & Lakkaraju, 2010), which has proposed a degree-biased voter model (DBVM) to simulate language change in social networks, focusing on the role of hubs and loners in the community. There were eight linguistic variants which could spread in a bi-directional closed network and each agent in the network would choose a neighbour to update its linguistic variant. The selection rule was that a higher in-degree leads to a higher chosen probability. In the DBVM, the establishment of novel variants could be observed after language diffusion. However, the observation method used in Fagyal et al. (2010) was only a time series analysis.

Here, we use an interactive visualization technique to display the process of language diffusion for understanding network roles better. As shown in Figure 1, each node stands for an agent and its size indicates its in-degree. Additionally, each colour represents a different linguistic variant and each edge shows a connection between neighbours. With time going by, the spread of linguistic variants can be observed clearly in space. Initially, eight variants were uniform and random (Figure 1a). After competing, some variants (in indigo, aqua) could establish the norm alternately on the basis of different chosen probability (Figure 1b-1d). This visualization suggests that loners play a key role in language change, in line with an empirical study in Belfast's Protestant enclaves (Milroy, 1987): loners serve as variant-keepers and innovators in social networks.

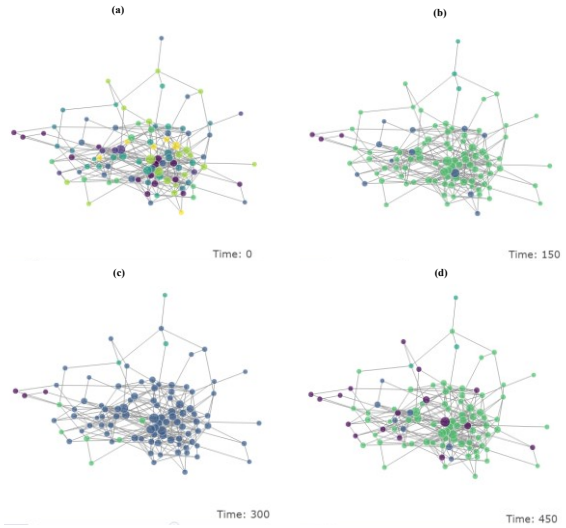

Figure 1: (a) *t*=0, eight colours of linguistic variants were assigned uniformly and randomly to nodes; (b) *t*=150, aqua variants were dominant in networks, however, loners still keep indigo and purple variants; (c) *t*=300, indigo variants turned into dominators due to loners and possibilities, aqua variants became endangered; (d) *t*=450, indigo variants tailed away, aqua and purple variants came back again.

References

Fagyal, Z., Swarup, S., Escobar, A. M., Gasser, L., & Lakkaraju, K. (2010). Centers and peripheries: Network roles in language change. *Lingua, 120*(8), 2061-2079.

Milroy, L. (1987). *Language and social networks*. Oxford: Basil Blackwell.