Homophily and social dependence: Revisiting mechanisms of tie creation in social networks

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A number of network growth mechanisms have been suggested to explain how social connections are forged and severed over time. Among these mechanisms, a key role is played by homophily, namely the principle that similarity breeds connection. Homophily has been empirically documented in a variety of domains, including marriage, friendship, work advice, support, and information transfer. Among the various forms of homophily, cognitive homophily suggests that social interactions between individuals arise as a result of their similarity and convergence on the same ideas, beliefs, interests, and mental attitudes. While homophily boasts a long intellectual tradition in the social sciences, other studies have pointed in the opposite direction. For example, organisational ecologists and economists have suggested that similarity can lead to competition for scarce resources. According to this research tradition, competition among organizations using similar strategies, of similar size, and in geographical proximity with one another tends to be stronger than competition among dissimilar organizations. We extend the ecological argument to the cognitive domain, and examine the effects that cognitive similarity has on social interaction among individuals. To this end, we analyse how the cognitive similarity among users in an online forum affects the probability that they will communicate with one another. Our study draws on a dataset from an online social network of users from the University of California, Irvine, who posted messages to a variety of discussion groups. Based on the content analysis of the messages, we measure the cognitive similarity between all pairs of users in terms of the semantic distance between the words posted by users, regardless of which groups they belong to. Two users are cognitively but not socially connected when they post semantically related words, but do not share any group in the forum. We use cognitive similarities to construct the cognitive network, and examine its effects on whether and how social interaction unfolds over time. If homophily were the only force governing tie creation, we should expect some increasing function linking the probability of tie creation to cognitive similarity: people who are similar would be more likely to communicate with one another than dissimilar people. By contrast, our findings suggest that homophily seems to affect tie creation, but only up to a certain threshold, beyond which the effects of similarity seem to reverse. Users with highly similar beliefs, meanings, and interpretations are not likely to provide each other with the information they seek, and therefore direct their attention to other less cognitively similar partners. These findings thus suggest that there may be some other concurrent mechanism that combines with homophily to affect how relationships between users are created. In order to cast light on these reversed effects of homophily on tie creation, we propose a model that integrates homophily, social influence, and social dependence into a unified growth mechanism underpinning the evolution of a social network over time. Through a number of numerical simulations, we show how the model produces results that are consistent with the empirical findings. We discuss the implications of our model for research on homophily and, more generally, on the evolution of complex social networks.