

Division of labor, skill complementarity, and heterophily in socioeconomic networks

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Abstract

Constituents of complex systems interact with each other and self-organize to form complex networks. Empirical results show that the link formation process of many real networks follows either the global principle of popularity or the local principle of similarity or a tradeoff between the two. In particular, it has been shown that in social networks individuals exhibit significant homophily when choosing their friends or collaborators. We demonstrate, however, that in populations in which there is a division of labor, skill complementarity is an important factor in the formation of socioeconomic networks and an individual's choice of collaborators is strongly affected by heterophily. We analyze 124 evolving virtual worlds of a popular "massively multiplayer online role-playing game" (MMORPG) in which people belong to three different professions and are allowed to work and interact with each other in a somewhat realistic manner. We find evidence of heterophily in the formation of collaboration networks, where people prefer to forge social ties with people who have professions different from their own. We then construct an economic model to quantify the heterophily by assuming that individuals in socioeconomic systems choose collaborators that are of maximum utility. The results of model calibration confirm the presence of heterophily. Both empirical analysis and model calibration show that the heterophilous feature is persistent along the evolution of virtual worlds. We also find that the degree of complementarity in virtual societies is positively correlated with their economic output. Our work sheds new light on the scientific research utility of virtual worlds for studying human behaviors in complex socioeconomic systems.

Keyword: Complex networks, Collaboration, Virtual worlds, Utility

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