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How Communicative Pressure Shapes Social Networks: An Agent-Based Model of Language-Network Co-Evolution using the Naming Game

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Abstract

In cultural evolution, empirical data and models highlight the key role of demographic factors like population size and network structure in cumulative cultural evolution (Dereux & Mesoudi, 2020). However, few studies have explored the co-evolution of cultural and demographic structures (Smolla & Akçay, 2019). Therefore, we extend Falandays and Smaldino's (2022) agent-based model with dynamic directed networks. Agents played the Color Naming Game (Baronchelli et al., 2010), learning linguistic and color categories and mappings between. Based on communicative success and Bayesian learning, agents adjust network connections, driving the co-evolution of cognitive, linguistic, and demographic structures. We varied initial network structure, population size, and constraints on cognition, communication, and life cycle. Our findings indicate that pressures for shared language shape the emergence of networks that facilitate the learnability and transmissibility of shared language, and that the equilibrium network structure depends on initial conditions and the balance of constraints on the system.