The evolution of sharing networks under risk and uncertainty

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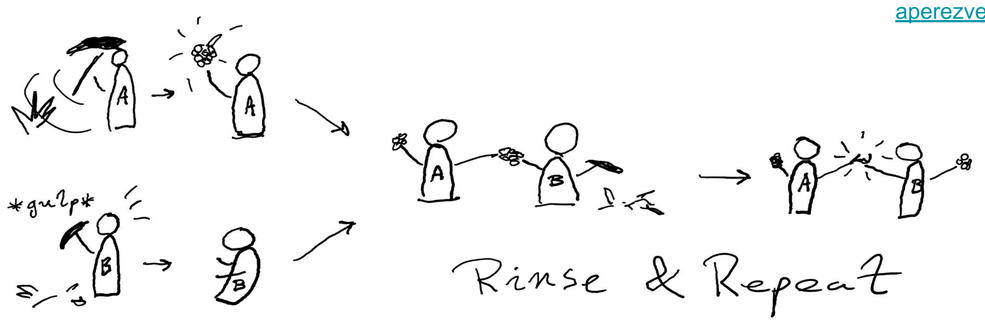
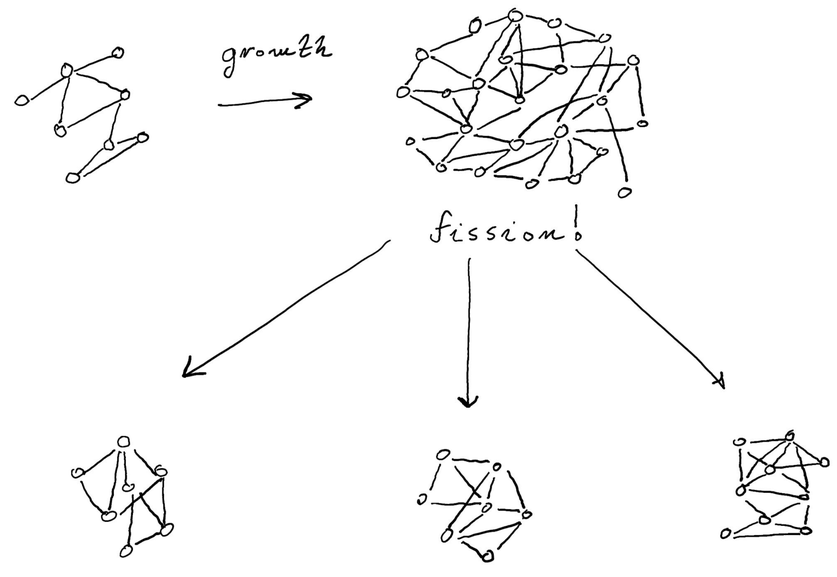
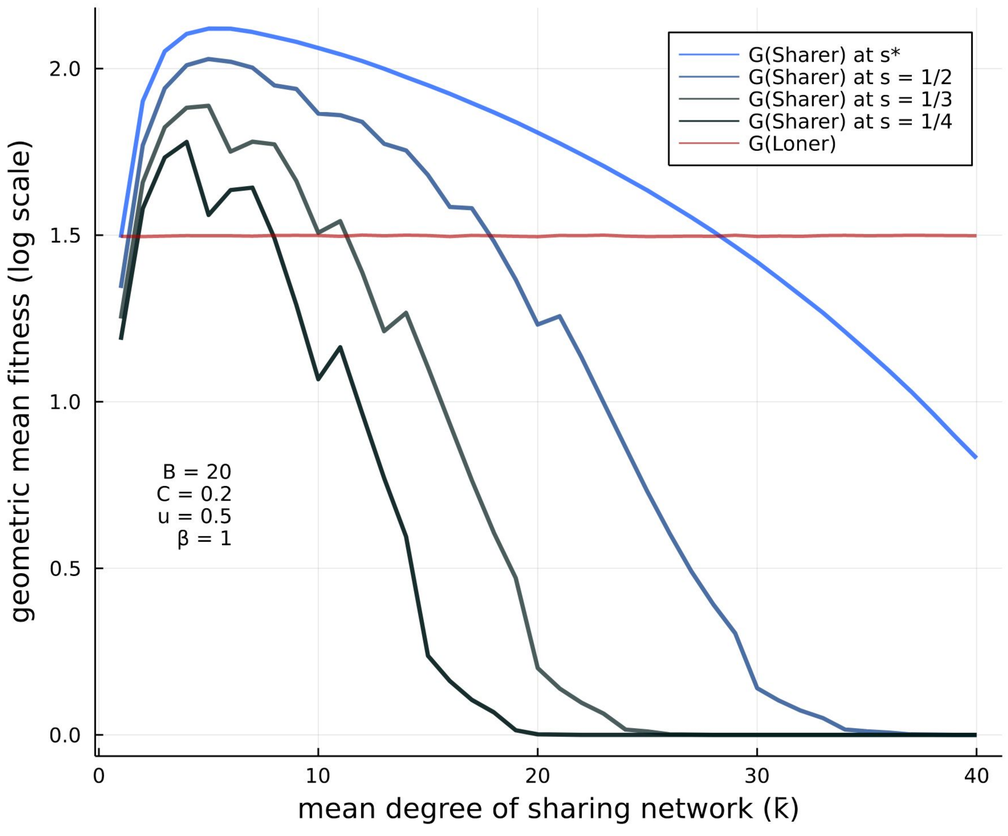


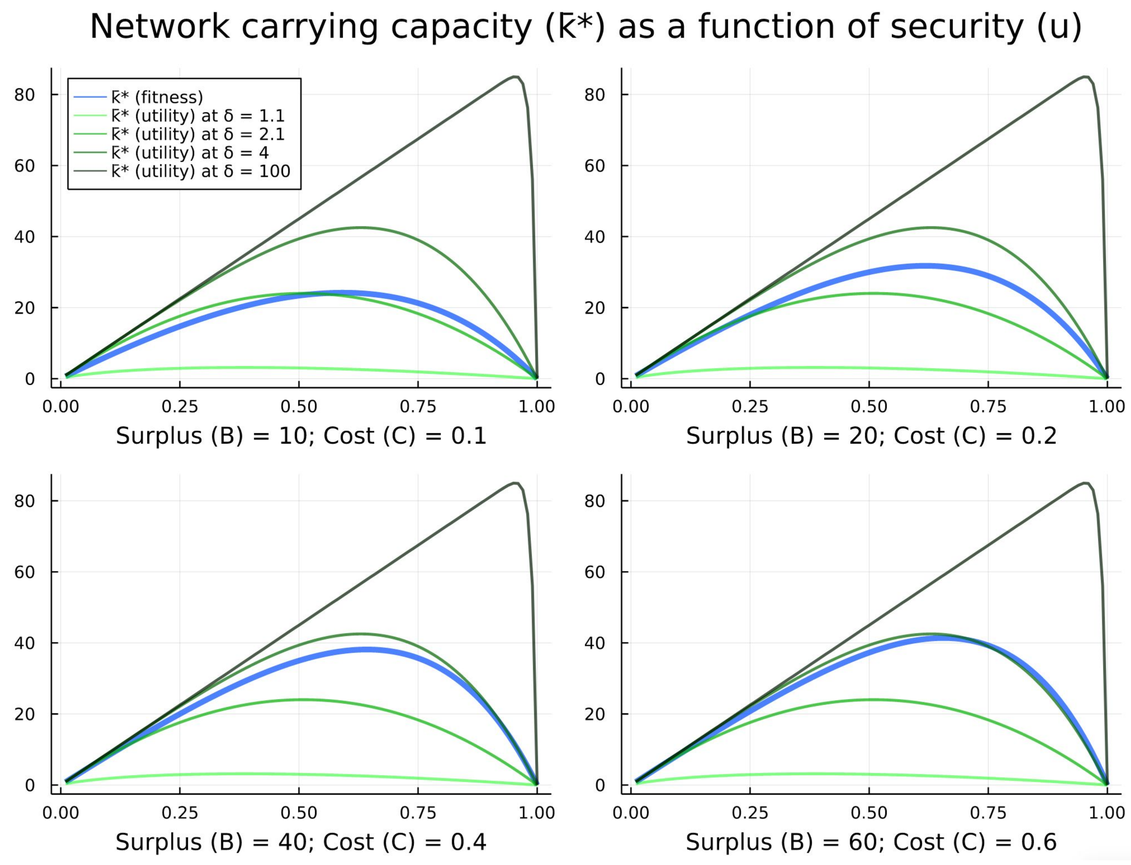
Foragers in a stochastic environment form normative sharing networks to share risky surpluses and reduce variance in returns. Connections are costly and sharing norms can be more or less intense. Reciprocal sharing is maintained by the normative group environment in which sharing happens, and foragers choose to abandon the network when they believe they will do as well (or better) on their own.

Fission events occur when the networks become overcrowded: sharers have so many connections on average that shared benefits get overtaken by costs and it becomes better to forage alone. A growing network reaching its carrying capacity fissions into several offspring networks that go on to grow and fission, spreading the culture of sharing norms and risk aversion.



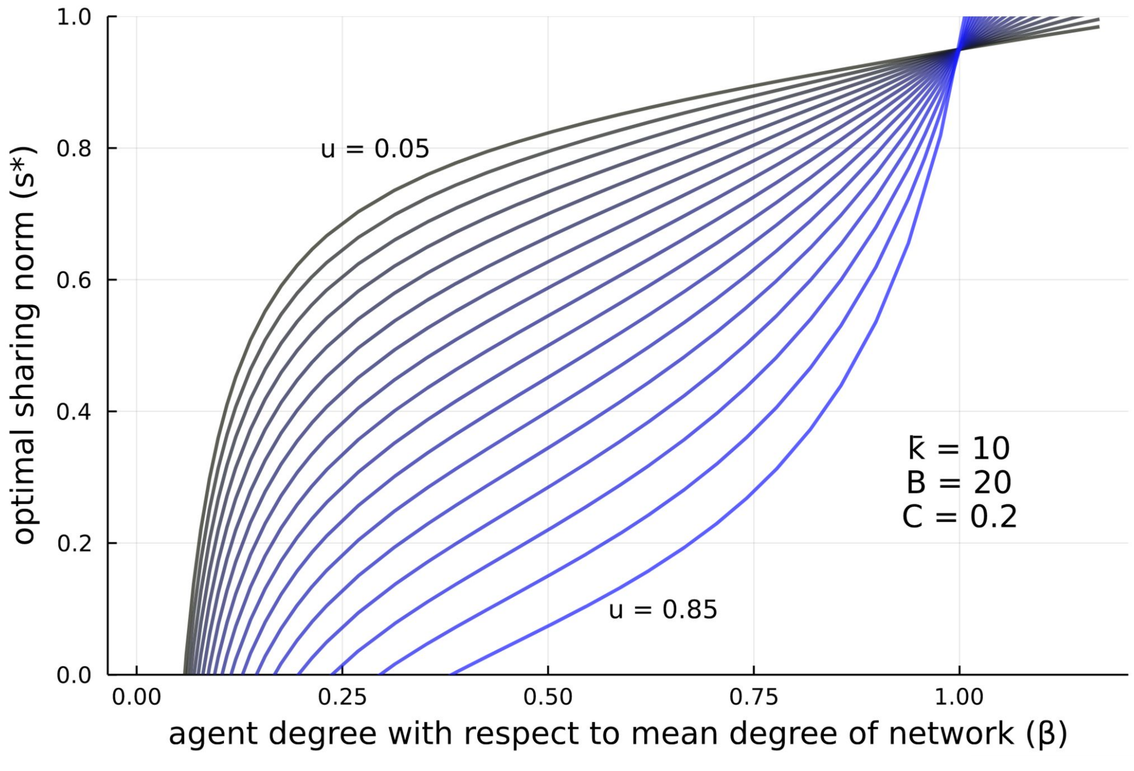
Networks of risk-averse individuals employing sharing norms can maximize fitness with respect to lone foraging in a multiplicative dynamic. **Growth and fission in a cultural group selection scenario leads to the co-evolution of risk aversion, high stable sharing norms and regularity in network structure.** Sharing can also drive the emergence exclusiveness in group membership.



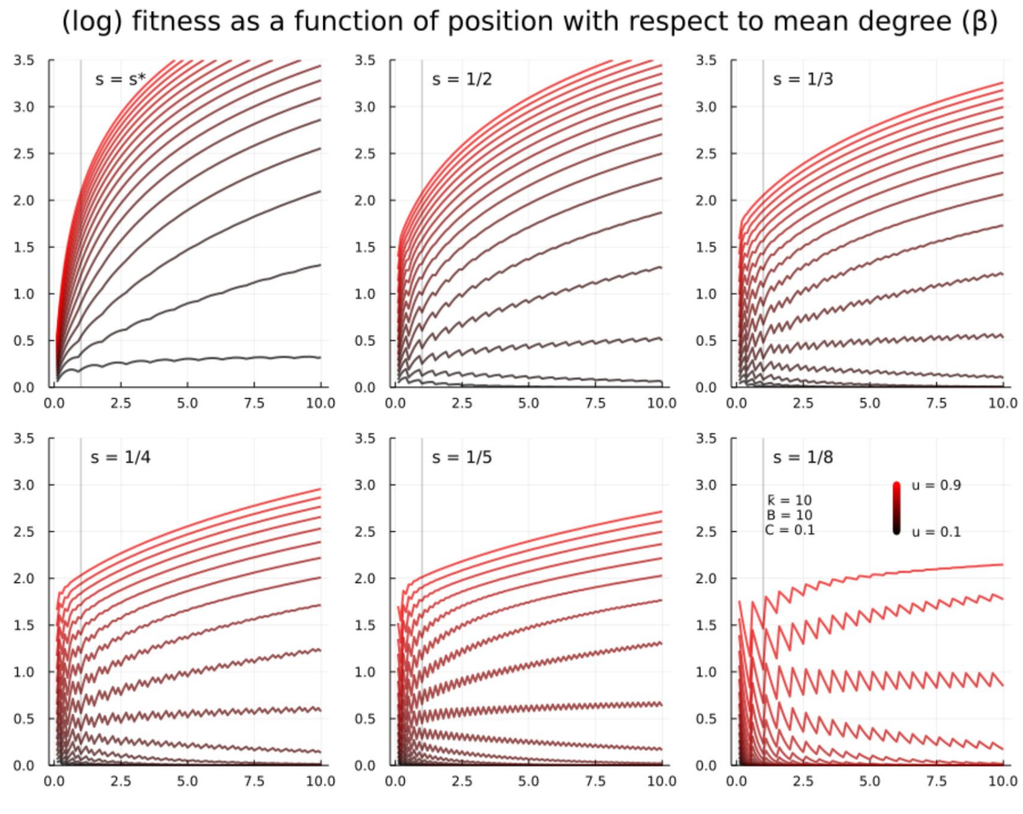


Higher productivity environments foster **higher risk aversion**, **higher sharing norms** and **can support more crowding in sharing networks before they fission**. Sharing networks can be their most crowded at the regions of **high uncertainty**.

Conflicts of interest in sharing norms are minimized as sharing networks approach full connectivity, and under conditions of high risk.



As long as surplus is high, higher levels of risk promote tolerance for degree inequality in sharing, while keeping sharing norms high.



High sharing norms smooth out fitness gains from variance reduction and lead to higher increases for above-average sharers, incentivizing competitive sharing.