‘Law of Large Numbers’ adaptive dynamics model

This model investigation is hoped to approximate the behavior of my Δa_{ij} model (in my dissertation). Here, rather than generate small i.i.d. changes to a values directly we use a complex phenotype in each agent to generate nearly independent direct and indirect effects.

Let each population i be described by phenotype vector $u_i \in \mathbb{R}^k$ for some (sufficiently large) k. Using a random non-symmetric square matrix M we let $a_{ij} = u_i^T M u_j$. Then as u_i and u_j change,

$$\Delta a_{ij} = \Delta u_i^T M u_j + u_i^T M \Delta u_j + \mathcal{O}(\Delta u^2)$$

while

$$\Delta a_{ji} = \Delta u_j^T M u_i + u_j^T M \Delta u_i + \mathcal{O}(\Delta u^2).$$

In particular, the contributions of Δu_i to each of these values appear to be independent, since the (m, n) element of M is independent of the (n, m) element. I guess I can't rule out that the u vectors might converge to a space where these things become correlated, but I'll believe it when I see it.

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