
MLS3: Expanding Multi-level Selection Theory to Capture Hierarchical Transition by Individuation

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Abstract

I expand current multi-level selection (MLS) theory to cover hierarchical transition (HT) by individuation. Current theory models HT from one- to two-level selective systems as a shift from MLS1 to MLS2 (Michod 1999; Okasha 2006; Godfrey-Smith 2009). On this model, whole (or 'collective') fitness emerges alongside part fitness via integration of parts. Recent work shows that HT can also occur via the individuation of parts within a whole (e.g., in filamentous fungi). On this model, part fitness emerges alongside whole (eventually 'collective') fitness via individuation of parts within the whole.

To accommodate this new HT form, I expand MLS theory to include a new stage, MLS3. This stage parallels MLS1 by including selection at only one level, but also allows for aggregate (or 'partitioned') fitness at a second level. In MLS3, the whole is the subject of natural selection, but in virtue of their role in whole-level fitness, parts are assigned a derivative part-level fitness. Hierarchical transition via individuation is modeled in terms of a shift from MLS3 to the MLS2 stage of current theory.

After introducing an expanded MLS framework, I show the formalization of MLS3 and HT via individuation using the Price equation, following Okasha's (2006) similar treatment of HT via MLS1-to-MLS2. I end with a discussion of major differences between the two approaches to MLS2, notably that the MLS3-to-MLS2 transition, unlike the MLS1-to-MLS2 transition, does not begin with within-system selection (the cooperation/conflict trade-off) but rather with a less formidable HT barrier (the delegation/determination trade-off).

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