Replicators, Lineages and Interactors

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Smaldino argues that human groups can act as cohesive units to the extent that they can be considered interactors in an evolutionary model. To briefly review standard evolutionary theory, an evolutionary process requires three things — replicators, interactors and lineages. Replicators are entities that pass on their structure intact into successive generations. Interactors are entities that interact as a whole with their environment, leading to differential replication (selection). Lineages are entities that persist indefinitely whether in the same state or in one altered by the process of replication.

We believe that the Smaldino's discussion can be advanced by a more thorough analysis of the appropriate replicators and lineages for this model. In human cultural evolution, there are at least two sets of things that might form lineages. The first is a set of humans that interact at a specific location, for example a company or a village. The second is the components of the culture itself — for example, the set of ideas and practices that make up biology or physics. Obviously these two sorts of lineages will not always be perfectly aligned.

Cultural group selection by standard definition is about the first sort of lineage (sets of people at a location). However, the notion of memetics suggests that there may also be second replicator system - the lineage formed by the memes themselves. These might sensibly be expected to produce "emergent, group-level traits" and would be mostly independent of cultural group selection, although sets of people might well exploit its consequences as a defining feature of their group identity.

If we adopt the first option, we see that cultural group selection concerns the fraction of groups within a specific area that are of a specific type. However, this head-counting method of reckoning group selection does not map cleanly to what we would like to call adaptation — the thing that natural selection seeks to explain. For example, we would not want to say that Inuit culture is "less adapted" than Roman culture because there were at one point more Romans.

If we adopt the other option and refer to culture itself is the lineage, then the culture itself can evolve since the replicators are the ideas and practices that exist within that culture. However, if it is the culture that is the lineage, we cannot say that it evolves when it takes more territory, in the same way that a species does not evolve with more individuals. Adaptation is presently understood to be about changes in the frequency of replicators, not about absolute numbers of interactors. In sum, cultural evolution (changes of practices within a group) is necessarily a separate process from cultural group selection (changes of the frequency of group-types at a specific location).

We can illustrate these points with a spatial agent-based model of cultural accumulation of knowledge about food-processing skills (Čače and Bryson, 2007). In this model there are two variants of a species: free riders that exploit knowledge but never share it, and altruists who communicate knowledge with any other nearby agent (perhaps just by failing to conceal their food-processing skills). Knowledge enters the system at a fixed rate of chance discovery, such that each agent has a small chance of discovering a new food source in its own life. Because of constraints placed on lifespan and on the rate of communication, "communities" of neighbouring agents form with expertise in a small fraction of the available skills the environment affords, though this fraction is still larger than the maximum of one skill any agent might learn on its own. When two communities encounter each other by chance, there is a brief surge in population, as

both groups quickly learn about the super-set of their food-processing skills. But this process is not evolution, it is only a temporary advantage from happenstance exchange. Future generations cannot sustain the level of cultural accumulation because there is no meta-behavioural (e.g. deliberate teaching) acquisition of skills, nor any change in the biological factors (e.g. lifespan) that determined the likely number of items that can be transmitted from one generation to the next.

Nevertheless, as with most viscous spatial models of altruistic behaviour, there is adaptation in the biological sense. Altruists out compete free riders, because they are more likely to know about food sources, because they are more likely to live near knowledge sharers — their relatives. This is a simple function of being born by your mother and taking time to move, a process understood by Hamilton (1964) but sometimes overlooked in simplistic modelling (Sober and Wilson, 1998).

The upshot for Smaldino's target article is that we have slightly corrected his use of language, but have largely supported his main claim, including providing evidence in the form of a formal agent-based model.

References

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