

Discussion

Darwinian Dynamics Implies Developmental Ascendency

A Matter of Competing Metaphysics

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Ao’s argument that “Darwinian Evolution Implies Developmental Ascendency” rests on the assumption that physical and biological processes can be adequately explained from the bottom up, by reducing the processes to the activities of components that are treated as discrete objects manifesting Newtonian dynamics. In this perspective, “natural selection . . . links variation and stochasticity to the ability of a system to reach the best places in its enormous functional space during the course of its evolution.” Furthermore, this “principle has been generalized to cover all dynamical biological processes that are based on replication paired with heritability, and in which developmental processes are special cases.” Developmental Ascendency (DA) rejects such reductionism however, and provides an alternative explanation for system-level change, which typically follows a trajectory that becomes decreasingly dependent (and increasingly constraining) on the behavior of individual components within the system. Such trajectories can indeed be modeled as an increase in fitness or as a peak in an adaptive landscape; however, whereas these Darwinian models treat “functional space” (the agency of selection) as an external boundary condition, from the perspective of DA it is intrinsic to the developmental process. Moreover, since change at any level occurs within the context of a higher-

level system (or *ecology*) that is itself developing, developmental processes are not special cases, but rather a generic property, of dynamical biological processes (as well as abiotic ones).

What is at stake here is not a matter of absolute truth, but of competing metaphysics. It is generally accepted that Darwin made every effort to describe his theory within the Newtonian framework (Depew and Weber 1995). In good Newtonian fashion, he took careful pains to separate the object of his attention (the organism) from the effective agency of change (natural selection). Furthermore, this separation allows for the description of fitness in terms of a landscape of tractable dimension. In fact, it has been argued that Fisher and Wright have effectively recapitulated the mathematics of Boltzmann and Gibbs (Depew and Weber 1995), and Ao’s own work further generalizes the dynamics of Fisher and Wright. Under the Newtonian framework with its assumption of atomism, Ao’s conclusion that autocatalysis cannot appear until the elements of the autocatalytic cycle are in place is consistent, and his criticism would thereby seem warranted.

As noted above however, the theoretical construct advocated by Coffman is not proceeding out of the Newtonian metaphysic. This approach rests more upon process philosophy, wherein events, rather than objects, constitute the fundamental elements upon which description of the universe is built. This alternative metaphysic posits a rich and deep universe of stochastic events that cannot be plotted on a landscape of tractable dimension. It does not assume that events occur in isolation independent of each other. It postulates that fundamental agency resides in configurations of processes, such as autocatalytic ones—in absence of any necessity to decompose the agencies into atomistic elements. Finally, it accepts the constraining influence of historical processes upon current process.

This alternative metaphysics has been called “process ecology” by Ulanowicz (2006, 2007), and it is implicit in the DA described by Coffman. The need for such an alternative to the conventional Newtonian foundations resides in the inability of the latter to accommodate the striving implied

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in the Darwinian “struggle for life.” Building upon process ecology illuminates a pathway to the natural origin of life, and abrogates Sisyphean attempts to conjure up life out of inert, dead materials. It points to mutuality as the primary cosmological dynamic and places competition as a subsidiary outcome made necessary by the finitude of resources. In short, the alternative metaphysics accommodates the processes of life far more comfortably than do the remnants of Newtonian thinking. Furthermore, it does so while remaining wholly within the realms of the natural and the rational.

It should be noted that what Ao calls Darwin’s word equation, “Evolution by Variation and Selection,” rests quite comfortably within the framework provided by process ecology. It’s just that the selection involved has not been artificially separated from the object upon which it works, as conventional assumptions would demand. Rather, selection is viewed as an emergent property of process ecology engendered by DA,

which therefore provides an appropriate context for Darwinian process.

Unfortunately, the metaphysics of process ecology is in its infancy and is yet known to but a miniscule fraction of biologists. Although Ao’s criticism seems reasonable within the confines of conventional assumptions, we believe that these assumptions are highly problematic, and indeed block the way toward a deeper understanding of evolution.

References

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