



The evolutionary paradigm and its classical roots

Chaos and the Emergence of Order in Evolutionary Cosmology: Two Classical Accounts

Primordial chaos may precede the Universe, and all its objects and its laws—up to the basic constituents of matter and the laws of physics. Or mathematics itself. All of these "timeless" realities may turn out to be contingent—the result of an evolutionary process.

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The evolutionary cosmology proposed by Roberto Mangabeira Unger and Lee Smolin in *The Singular Universe and the Reality of Time* (2015) is a high bid for the preeminence of cosmology as the ground and basis of science, over against physics. This amounts to an overthrowing of the Newtonian paradigm as it has been unwittingly perpetuated by the "new" physics of the twentieth century. Both Newtonian and Einsteinian physics assume a body of laws of nature, and of basic constituents of nature, which is eternal, outside time, preexisting change and ruling it. The preeminence of time and evolution (and of cosmology) above physics would lead us, instead, to assume the preeminence of change, and to admit the variability both of the laws of physics, at least in the crucial cosmogonic events, and of the basic constituents of nature. We may thus speak of [an emerging evolutionary paradigm in physics and cosmology](#).

Note that Darwin's theory of biological evolution scrapped the notion of eternal kinds in Nature at the level of biological species, but it did not apply beyond its intended scope, living beings. Laplace's cosmology and Lyell's geology likewise showed that astronomical bodies may be subject to history and evolution. They did not however deny the eternity of such kinds of natural "bodies" as the elementary particles, however conceived, nor to the basic laws of their interaction.

Unger and Smolin raise the stakes, arguing that radical and universal evolutionism leaves no place "outside time" for any such laws or kinds to reside. Everything is subject to time, and therefore even the basic principles of order, not to mention the elementary constituents of nature, are historical and contingent, the product of evolution, rather than the visible script of a transcendental catalogue of kinds.

The Singular Universe and the Reality of Time is an important volume in the philosophy of science, and I warmly encourage its reading. Its reconceptualization has far-reaching consequences for our current notions of science, of natural laws and phenomena, of physics and of mathematics—even mathematics, yes, because nothing escapes this radical overhauling of the role of time. Mathematical realities are by definition outside time. In Unger and Smolin's view, this would make them into a technique for dealing with the world from a certain perspective, and would demote mathematics from its current ambitious position as "God's grammar" or as the privileged key to the structure of the universe. Mathematics, instead, may be a misleading cognitive instrument when applied beyond its proper scope—an example would be the use of the mathematical notion of infinity in conceptualizing and representing cosmological critical events such as the Big Bang or black holes. Such extreme events would be misrepresented by a mathematical fiction such as infinity, giving rise to the current notion of Singularity—which according to Unger and Smolin is mistaken, and involves scientific research in unresolvable paradoxes as well as unnecessarily limiting the scope of scientific research.

But I digress. I wanted to quote a passage of Unger and Smolin's book and show the way it compares to some more classical conceptions in cosmology, which (leaving out the creationist implications) may lead to a reassessment of the classical paradigm in some of its radical evolutionary implications.

Here, in pre-scientific and pre-philosophical language, is an account of the relation between the present universe and the early universe. This account accords with what we know about the history of the universe. It suggests why the mutability and the stability of the laws of nature may be a feature of this history. It shows how the same processes that give rise to the stability may also produce the mutability.

The mutability of the laws of nature ceases to contradict their stability, and begins to complement it, once we place both the stability and the mutability in the context of a historical view. It is only when we treat the stability and the mutability of the laws of nature without regard to the historical character of the universe that they appear to contradict each other.

Imagine the present, cooled-down universe, in comparison to the universe in its fiery and formative stage, as a living corpse: with limited kinetic energy, temperature, and degrees of freedom, with an established structure, and with enduring regularities—the laws of nature. Yet there was a time, of extreme density and temperature, when the distinction between states of affairs and regularities was unclear (a time that can be described alternately as one of law-giving or of lawlessness), when the present division of nature into well-defined constituents was not yet established, and when the phenomena were excited to much higher degrees of freedom than those enjoyed by the living corpse. The unexplained values of the dimensionless constants or parameters of nature may have their origins in the process by which this formative moment gave rise to the ensuing regularities and structures.

This rudimentary account—a stylized interpretation of certain central features of the history of the universe, such as contemporary cosmology represents it—distinguishes between relatively brief and formative moments of extreme density, kinetic energy, and temperature and the relatively long periods, subsequent to these moments, of lesser density, kinetic energy, and temperature, in which a universe is worked out. We have increasing reason to think that these formative moments of extreme density and temperature, resulting in a new universe, recur. (Roberto Mangabeira Unger, in Unger and Smolin 2015, 267-68)

Compare now a classical account, ultimately deriving from Greek cosmology, via Lucretius, as assimilated and retold (with the creationist additions which I am now asking to mentally delete) by the Christian tradition in which the universe is not eternal and *everything in Nature* has an origin—even the basic ingredients of nature, even the most basic laws and regularities. In Abraham Cowley's epic *Davideis* (c. 1640) we find an excursus on the role of music (read Pythagorean harmony, law or proportion) in the Universe. To my mind it reads, in some respects, like a versification of the previous passage from Roberto Mangabeira Unger:

*Tell me, O Muse (for thou or none canst tell
The mystic powers that in blest numbers dwell,
Thou their great nature knowst, nor is it fit
This noblest gem of thine own crown to omit),
Tell me from whence these heavenly charms arise;
Teach the dull world t'admire what they despise.
As first a various unformed hint we find
Rise in some godlike poet's fertile mind,
Till all the parts and words their places take,
And with just marches verse and music make,
Such was God's poem, this world's new essay;
So wild and rude in its first draught it lay;
Th' ungoverned parts no correspondence knew,
And artless war from thwarting motions grew,
Till they to number and fixed rules were brought
By the eternal mind's poetic thought.
Water and air he for the tenor chose,
Earth made the base, the treble flame arose;
To th' active moon a quick brisk stroke he gave,
To Saturn's string a touch more soft and grave.
The motions straight and round and swift and slow
And short and long were mixed and woven so,
Did in such artful figures smoothly fall,
As made this decent measured dance of all.
And this is music: sounds that charm our ears
Are but one dressing that rich science wears.
Though no man hear't, though no man it rehearse,
Yet will there still be music in my verse.*



We find here an account of Chaos preceding not just the present objects and forms in the universe, but preceding order and law itself. Laws, in Cowley's view (mentally bar, I insist, the "Godlike creative mind" designing the creation) are emergent—they are produced in the course of creative evolution, just as the "elements" themselves. Note that while Cowley's view may seem naively creationist from the standpoint of twentieth century science, science under this paradigm might seem equally naive in assuming that its own elements (e.g. "iron", "carbon", "protons", "quarks") and its own laws ("the speed of light", "the law of gravitation") as well as any regularities, might be basic preexisting conditions and constants, exempt from emergence and evolution, rather than created and emergent (i.e. contingent) productions themselves, the result of the "chaotic" interaction of "thwarting motions".

In an earlier post I already compared Cowley's passage to the cosmological account presented in Andrew Lange's Segre Lecture, ["How Did the Universe Begin"](#). That is, we are not dealing here with matters of specific wording and mere coincidence, but with a persistently returning perspective on the nature of the universe, of order and of its necessary change—an evolutionary perspective which will keep returning because it reflects some of our deepest insights about the universe and its transience. It is also, not surprisingly, a recurring template in our perception and cognition of events, patterns and stable objects. There is still much insight to be gained from an approach to evolution which combines the insights of physical science, evolutionary theory, narratological approaches, and cognitive

poetics.

[La Falacia Cosmológica y la Falacia Modélica](#)

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