Is Motion One Of The Three Eternal Properties of Atoms? I.E. Are The Three Properties Shape, Size, and MOTION?

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4. Motion

Surprisingly, atoms never stop moving, even within a compound object, since the medium through which they move is void, which can offer them no resistance. More surprisingly, for the same reason they move at a vastly greater speed than any familiar motion through an obstructive medium such as air; even than sunlight, which is seen to spread from horizon to horizon virtually instantaneously (Lucretius II 142–64). More surprisingly still, they all move at equal speed, since in a vacuum, unlike air, there is no resistance from the medium to slow down the lighter ones more than the heavier ones (Letter to Herodotus 61). In stating all these claims, Epicurus is accepting paradoxical consequences of the hypothesis that void exists, consequences which Aristotle had drawn (Physics IV) in the belief that they were sufficiently absurd to discredit the hypothesis. Moreover, the equal speed of atoms was confirmed by another objection Aristotle thought he had found to atomism (Physics VI 2): if there is a minimal magnitude, there can be no differences of speed, because then in the time the faster object took to travel one minimum the slower one would, impossibly, have to travel less than one minimum. Epicurus welcomed this argument, along with the conclusion Aristotle thought absurd, because his theories of void and minima now offered two independent grounds for the same conclusion, that atoms move at equal speed.

The apparent lack of fit between these findings about atoms and the variable speed of macroscopic motions is explained as follows (Letter to Herodotus 62). Even in a compound object the individual atoms are perpetually moving, but in tight and regular cyclical patterns which make the complex as a whole stable. Phenomenal differences of speed, say between two runners, represent merely the aggregate motions of the atoms in each over an observed period of time.

There are three causes of an atom’s motion. The first is its own weight, interpreted as an inherent tendency to move downwards (see §8). The second is collisions with other atoms, which can deflect an originally downward motion along any number of new rectilinear trajectories, thus generating the patterns of motion of which compounds are born.

The third cause of atomic motion is the ‘swerve’ (*parenklisis*), whereby an atom may shift from its rectilinear trajectory onto an adjacent one – a displacement sideways by a distance of one

minimum (there being no smaller distance). This happens ‘at no fixed place or time’, meaning that the occurrence of a swerve is causally undetermined. The theory, derided by Epicurus’ opponents but now recognized as comparable in its implications to modern quantum indeterminism, looks like a drastic solution requiring a drastic problem. Two such problems are recorded (Lucretius II 216–93). First, since all atomic motion starts out as vertical and equal in speed, without a swerve no collisions would ever have started, and hence no world could have been formed. It may be doubted whether this was a sufficiently pressing problem to motivate an abandonment of universal causality: given the infinite past history of the universe,Epicurus had no need to posit a very first collision; in which case every collision could have been explained as the effect of previous ones. The second problem seems to have been the real motivation of the swerve: if all atomic motion is causally determined, free will becomes impossible (see §12).

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