

Leibniz's Reduction of *Res Extensa* to *Res Cogitans*

1. Leibniz utilizes two sorts of argument to reject the plenum physics on which both Descartes' substance dualism and Spinoza's property dualism depend. The first argument reflects a 'bottom-up' strategy and consists mainly in a reinvention of the mathematical foundations of physics; the second argument reflects a 'top-down' strategy and consists mainly in a metaphysical analysis that reduces the concept of extended substance to absurdity.

2. *New Foundations*: Leibniz proposes to replace the basic units of physical reference (bits of matter/extension in motion) with what he calls "ratios of force" (energy). He thus rejects the following two postulates of Cartesian, Spinozist, and Hobbesian physics:

(A) The *plenum* is composed of discreta;

(B) The fundamental law of mechanics is the *Conservation of Momentum*.

[The overall quantity of motion in the universe remains constant over time: when something speeds up or increases in mass, something else slows down or decreases in mass.]

Leibniz proposes instead:

(C) The *plenum* is composed of continua;

(D) The fundamental law of mechanics is the *Conservation of Kinetic Action*.

3. Leibniz argues that the old physics fails to predict phenomena correctly; it implies that all motion is circular and instantaneous, when, in fact, observation records rectilinear, continuous motion. His point is that if bodies are the fundamental units of physical science and bodies are definable as discrete regions of space, then motion is the passage of a body through a definite number of intermediate places. But accelerated motion cannot be so described, since the velocity is continuously increasing at a given time, so motion doesn't happen in leaps, but continuously. "Body in motion" is just a derivative concept--the primary concept is *continuum of energy*. The units of physics are, then, infinitely small quanta of force: each unit is therefore a simple (not composite)--what Leibniz calls a *monad*.

4. *Substance*: Leibniz also argues, on metaphysical grounds, that substance must be simple: since no physical things are simple, no physical things are substances. In a letter to Arnauld, Leibniz offers the following analogy. Is an army a substance? One might think so; but in fact it is simply a number of soldiers interrelated in certain ways--the whole truth about the army can be expressed without residue in sentences of the form: $F(a_1, a_2, \dots, a_n)$. In general, true assertions about aggregates are similarly reduced to assertions about constituent parts. Concerning extension, Leibniz argues that anything with parts is an aggregate and that extended objects are, by definition, *pars ex partes*, and therefore aggregate: in Jonathan Bennett's phrase: "a diamond is on a par with a flock of sheep, but to scatter it, you have to bark louder." Extension must reduce, then, to simples.