The Science of Mobile Being (part 2)

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O Creator ineffable, who of the riches of Thy wisdom didst appoint three hierarchies of Angels and didst set them in wondrous order over the highest heavens, and who didst apportion the elements of the world most wisely: do Thou, who art in truth the fountain of light and wisdom, deign to shed upon the darkness of my understanding the rays of Thine infinite brightness, and remove far from me the twofold darkness in which I was born, namely, sin and ignorance. Do Thou, who givest speech to the tongues of little children, instruct my tongue and pour into my lips the grace of Thy benediction. Give me keenness of apprehension, capacity for remembering, method and ease in learning, insight in interpretation, and copious eloquence in speech. Instruct my beginning, direct my progress, and set Thy seal upon the finished work, Thou, who art true God and true Man, who livest and reignest world without end. Amen.

(St. Thomas Aquinas *Oratio ante studium*)

Empiriological physics does not attain being.

- 2nd Law of Thermodynamics
  - Many equivalent formulations of it; here are two examples:
    - Heat cannot pass from a cold to a hot body.
    - Things in nature do not spontaneously become more ordered without an input of work.
      - The parts of a broken glass do not spontaneously reassemble into a whole glass.
  - Does it prove causality or presuppose it?
- Law of Inertia
  - Does it show that moving things tend to be constantly in flux (á la Heraclitus) or that change is an illusion (á la Parmenides)?
    - Viz., does this the law of inertia imply empiriological physics studies *ens mobile* like philosophical physics?

Empiriological physics does not attain motion.

- Zeno argued motion is impossible
  - Diogenes disproved this simply by walking!
- Henri Poincaré and Bertrand Russell, e.g., thought that empiriological physics is the description of the world via *differential equations*.
  - In other words: calculus!
    - Newton, in his *Philosophiæ Naturalis Principia Mathematica*, & Leibniz co-invented

Empiriological physics does not attain motion.

- Functions relate one quantity to another. E.g.:
  - $Y = F(x)$
    - F is a function.
    - x is the independent variable.
    - Y is the dependent variable.
  - They in no way imply one quantity causes another
    - ∵ correlation doesn't necessarily imply causation.

Empiriological physics does not attain motion.

- Concept of a *limit* is very important in calculus.
- V. E. Smith's definition of *limit*: "y is a limit of x if, when x increases indefinitely, the difference between y and x gradually becomes smaller than any assignable value."
- Examples:
  - If # of sides of a regular polygon $\to \infty$, then the limit of the polygon is a circle.
  - If the function $N(t)$ is how much radioactive material you have at time t, limit of $N(t)$ as $t \to \infty$ is 0.
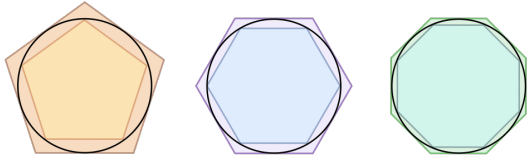
Empiriological physics does not attain motion.

- Archimedes computed π to be the limit of the areas of polygons with increasing numbers of sides.
  - π is the ratio of any circle's circumference to its diameter.
  - π ~ 3.1415926....

Empiriological physics does not attain motion.

- Let y be a function of x, so $y = f(x)$.
- Δx = a small change in x.
- Δy = a small change in y.
- Calculus measures the *limit* of this *ratio*:
  - $(\Delta y / \Delta x)$ as $\Delta x \to 0$.
  - This limit is the *derivative of f with respect to x*.
- Equations with derivatives are called differential equations.

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- Derivatives tell about instantaneous rates of change of one quantity with respect to another.
  - "But quantity is not motion; change is not a ratio or relation."
    - It isn't a succession of events
    - or potency becoming act insofar as it is in potency.
- Remember: Mathematics is the 2nd degree of abstraction.
  - Boethius: "Mathematics does not deal with motion…for it investigates forms of bodies apart from matter…and therefore apart from movement."

Philosophical physics does not suppose the empiriological.

- Empiriological physics evolves rapidly over time.
- Philosophical physics studies what follows from being and motion.
- Empiriological physics ignores being and motion.
  - It assumes whatever is meaningful is measurable.
- Being cannot be measured because there is nothing outside of being to which to compare it.

MOTION AND ITS PRINCIPLES: Motion is given in experience.

- Parmenides thought motion is an illusion.
- Heraclitus thought everything was in flux.
- St. Thomas says in his First Way of proving God's existence: "It is certain, and evident to our senses, that in the world some things are in motion."
- Distinction: *mutatio* (change proper) and *motus* (continuous, successive change)
  - Will be important later.

Motion is not deducible.

- Aristotle: motion is known by induction.
- Can we deduce motion from something more known? Is anything more known in nature than motion?
  - Can the more evident be proven by the less evident?
- Motion cannot be measured because motion is not quantity.
- The static can only be known in reference to the moving.

Motion is determined by act and potency.

- How is motion defined?
- It's definition more difficult than its discovery.
- Parmenides & Zeno (Eleatics) versus Heraclitus
  - We will discuss Zeno's argument later because it deals with infinity.

Motion is determined by act and potency.

- Parmenides argued motion is impossible, an illusion:
  - Being is; non-being is not.
  - There cannot be anything between being and non-being, and motion is the passage from being to non-being or *vice versa*.
  - Nothing can come from being because it already is, and nothing can come from nothing, either: *ex nihilo nihil fit*.
  - Therefore, motion is impossible.

Motion is determined by act and potency.

- Heraclitus denied being and thought everything is in motion.
  - Fire represented something always changing.
  - So did the flow of time.
  - E.g.: No man can swim in the same stream twice.
- Aristotle reconciled Parmenides's and Heraclitus's views.
  - Act = existence
  - Potency = capacity to be actual

References

- V. E. Smith's *Philosophical Physics*
  - Please read finish ch. 1 (The Science of Mobile Being) and begin ch. 2 (Motion and Its Principles).
    - We will send out a scanned PDF of this necessary reading.

- Next time we will see how motion is a mixture of act and potency.