

Motion, Its Origins, and Its Ends

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Natural Philosophy – Physics
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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*)

“Whatever is Moved is Moved by Another”

- *Quidquid movetur ab alio movetur.*
- We know what motion is, but what causes it?
 - Motion is the
 - fulfillment of potency insofar as it's in potency.
 - education of form out of matter.
- What actualized the new form?
 - Efficient cause
- Why was it actualized?
 - Final cause (teleology)

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“Whatever is Moved is Moved by Another”

- Efficient and final causes are *extrinsic*.
 - *Intrinsic* causes are matter (potency) and form (act).
- Either a thing moves itself (is alive) or another moves it.
- Absolute necessity of outside mover:
 - Neither matter (potency) nor form (act) can individually account for itself.
 - ∴ extrinsic agent responsible for matter-form composites.
 - Potency cannot actualize itself without an extrinsic agent.

“Whatever is Moved is Moved by Another”

- True self-movement violates principle of non-contradiction.
- Newton's deist metaphor: universe a wound-up clock.
 - Or archer's initial impulse to an arrow is all that's needed for its movement
 - Galilean-Newtonian physics: Once there's motion, it's useless to seek a cause of the motion, a mover.
- Movement requires a mover (motor cause) as long as the motion endures.

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Motor and the Moving Thing are in Contact

- Hume: cause extrinsic to effect, latter not pre-contained in former
- Action at a distance (*actio in distans*)
 - Empirical physicists who support *actio in distans*: Faraday, Maxwell
 - Philosophers who support it: Bolzano, Kant, Leibniz
 - Quantum theory (e.g., the EPR paradox) and statistical physics appear to support it.
 - Bohr atom: Electrons jump in atoms (viz., discontinuity).
 - Radioactive decay: Matter moves suddenly.

Motor and the Moving Thing are in Contact

- From Descartes onwards, there is “a tendency to make a cause interior to the effect.”
 - Meyerson: “inquiring mind tends to identify cause and effect”
 - Empiriological physicists identify (equate) cause and effect with equations.
 - e.g., $F=m \times a$ says that a force of magnitude F causes acceleration of magnitude a of an object with mass m , or *vice versa*.
 - e.g., $distance = rate \times time$
 - Do distance, rate, and time mutually cause each other?

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Motor and the Moving Thing are in Contact

- Third alternative: motor cause neither overlapping (interior) nor separated by distance (*actio in distans*), but *contact*
- *Actio in distans* presumes a vacuum, but true vacuums cannot exist.
- Also, forms of mobile things are finite, so they cannot “reach out” of themselves.
 - Matter is limited.

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Empiriology Tends to Favor Evolution

- Is motion eternal? Would that eternity explain motion?
- Is matter eternal?
 - Greco-Arabic Aristotelians: “No!”
 - St. Thomas says that God could create eternal matter and that we cannot prove scientifically whether matter is eternal. It must be held on faith. Cf. *De Æternitate Mundi*.
 - Western Latin Platonists: “Yes!”
- Theories of cosmology: Laplacian Nebular Theory, Planetesimal Hypothesis, Tidal Theory

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Empiriology Tends to Favor Evolution

- Evolution more problematic in philosophical than empiriological physics.
 - In philosophical physics, evolution involves *affirming the consequent*.
 - If A is a man, then A is mortal.
 - But A is mortal.
 - ∴ A is a man.
 - Another example:
 - If evolutionism is true, the “data measured in empiriological physics can be organized into a system.”
 - But “the data can be organized into such a system.”
 - ∴ “evolutionism is true.”

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There is a Prime Mover

- Cosmogony: the study “of the creation or generation of the universe.” (*Oxford Eng. Dict.*)
- If empiriological physics is evolutionary, we must seek certainty elsewhere.
- Empiriological physics cannot account for novelty.
 - It’s either evolutionist or equalitarian.
- Two principles:
 - *Quidquid movetur ab alio movetur*.
 - There cannot be an infinite regression of movers.
 - ∴ ∃ an Unmoved Mover (Prime Mover or First Cause).

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There is a Prime Mover

- Creation is a dependence of moved things on the Prime Mover.
 - Known only by Revelation that the Prime Mover did not create any *ens mobile* from all eternity.
- Creation is “*ex nihilo sui et subjecti*,” viz., the production of something out of nothing.
 - This is not motion or mutation.
 - Even prime matter is created.

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“Every Agent Acts for an End”

- Final or telic causes
 - Remember, *telos* is Greek for “end.”
- Final causes determine purpose or aim.
- Philosophical physics alone studies all four causes:
 - Formal: answers “What?”
 - Material: answers “Out of what?”
 - Efficient: answers “Whereby?”
 - Final: answers “Why?” or “Wherefore?”

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“Every Agent Acts for an End”

- Variants on “Every agent acts for an end:”
 - “Nature does nothing in vain.”
 - “Nature acts for the best.” etc.
- “Every mover *tends into* a goal.”
 - Intention
- There is no pure dynamism in the world.
- Ex.: If a free-falling rock doesn’t have a tendency to approach the center of the earth, then why does it?

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“Every Agent Acts for an End”

- If changeable things didn’t have a tendency to one specific end, they “would blow up.”
 - We observe a mostly ordered, not chaotic universe.
 - a *cosmos*, not a *chaos*
- Mechanism denies teleology.
- Nature still purposeful even if we don’t know the reason.

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Finality Implies Laws of Nature

- We know a nature by its tendencies, motions.
- What is a “law of nature”?
 - Is it something imposed onto or found within natural things?
 - V. E. Smith defines it as “A nature’s penchant toward a fixed end under a given set of conditions.”
 - The “natural law” applies to man.
- In general, “nature” and “law” are equivalent.
 - Something “obeying its law” is fulfilling its nature.

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Finality Explains the Order of Nature

- Hume: causality \Leftrightarrow ordered sequence
 - \therefore disorders in nature \Rightarrow violation of principle of causality.
- Empirical physicists call generalizations of measured facts laws.
- Some empirical physicists say the goal of physics is to predict the future.
- A physical law is similar to natural law
 - It “is a generalization of a measured fact.”

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Finality Explains the Order of Nature

- Measurement alone cannot predict the future; it merely states a fact.
 - Measurement is only about quantity.
- Pierre Duhem defined a “physical law” as “*des relations symboliques*” (“of symbolic relations”).
- How do the four causes relate to “the issue of determinism or uniformity”?
 - Form and matter must be determinate in inorganic things.
 - Aristotle: “Matter is finalized by form.”

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Change is Extrinsic to Nature

- But there are violations of natural laws! Viz., the natural end isn't always attained.
 - e.g., volcanoes erupt, rocks can fly upwards, trees can grow sideways, cacti can be mutated, etc.
- Empirical physics says:
 - No dualism in nature
 - It can account for either determinism or disorder, not both.
- "Fortune is a subdivision of chance."

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Change is Extrinsic to Nature

- What is chance?
 - V. E. Smith's definition: "A chance occurrence ... [is] an event which happens beyond the intentions of whatever produced it."
- Chance events by definition lack a final cause.
- We will study chance more in detail when we get to chapter 8 of V. E. Smith's book.

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References

- V. E. Smith's *Philosophical Physics*
 - Please read ch. 3 (Motion, Its Origins, and Its Ends).
 - We will send out a scanned PDF of this required reading.
- Further reading:
 - Meacham, Francis X. *Efficient Causality in Aristotle and St. Thomas* (Washington, 1940), *passim*.
 - Simon, Yves R., *Prévoir et savoir (Prediction & Knowledge)* (Montreal, 1944), ch. 1.

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