Excerpts from *From the Closed World to the Infinite Universe*

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Handout by Brett Park

Spring 2021

Background

Alexandre Koyré

- Historian and Philosopher of Science
- Born in Russia in 1892
- Studied at University of Göttingen under Edmund Husserl and David Hilbert, then at Collège de France under Henri Bergson
- *From the Closed World to the Infinite Universe*, delivered as a lecture series in 1959 at Johns Hopkins, was a summation of his earlier work
- Koyré was critical of the positivist outlook on science, wanted to show science as aspiring towards a theoretical grasp of reality, not merely "saving the phenomena"

"The Significance of the Newtonian Synthesis"

Purpose: Describe and contextualize the dramatic shift in worldview surrounding the Newtonian revolution.

"I am convinced that the rise and growth of experimental science is not the source but, on the contrary, the result of the new theoretical, that is, the new metaphysical approach to nature that forms the content of the scientific revolution of the seventeenth century" p. 6

Shifting Perspectives

Absurdities Introduced

(a) the void (matterless, geometrized space)

(b) action at a distance (gravity)

Substitutions

Sidenote: When Koyré says that something substitutes X for Y, he means Y was replaced by X. I will use the typical convention.

(a) Quality for Quantity

(b) Becoming (change) for Being
Intepretations:

- Aristotle: numbers are static
- Invariants of motions: symmetries and conservation laws, or
- Force laws

(c) "Physical" conception of motion (causal?) for a mathematical notion (calculus)
Interpretations?

Unifications

(a) the Celestial and the Terrestrial

- Discarded the heirarchical, finite cosmos for a centerless, infinite one
- Universal laws (3 laws of motion and law of gravitation)

(b) Rest and motion

- 1st law applies to states of rest and motion
- Galilean relativity
- Caveat: Newton still retained a notion of absolute motion/rest

(c) the mathematical philosophy of Plato-Galileo and the corpuscular philosophy of Lucretius-Boyle

Divisions

(a) introducing the void allows Newton to separate "the discontinuity of matter and the continuity of space" p. 13

(b) divorced the world of science (as represented in quantity) and the world of sense perception (quality)

Post-Newton

Eventually, the absurd aspects of Newtonianism became accepted and mundane

(PK) Koyré describes a period of normal science following the Newtonian revolution:
"the leading physicists and mathematicians of Europe - Maupertuis, Clairaut, D'Alembert, Euler, Lagrange, and Laplace - diligently began the work of perfecting the structure of the Newtonian world" p. 17

Assessments of Newton's accomplishment

> "Nearer the gods no mortal may approach" - Edmund Halley
>
> "There being only one universe to be explained, nobody could repeat the act of Newton, the luckiest of mortals" - Joseph-Louis Lagrange
>
> "Nature and nature's laws lay hid in night;
> God said. Let Newton be! and all was light." - Alexander Pope

Further Trends

(a) secularization of science and scientists ("I do not need that hypothesis" - Lagrange)

(b) failed attempts to replicate Newton's success in higher sciences

- Locke's atomic psychology
- Adam Smith's economics

Gems

Clear mastery of the history

We know, for instance, that it is to Newton's insight and experimental genius – not *skill*: others, for instance, Robert Hooke, were just as skilled, or even more so than he – that we owe the idea of decomposition of light and the first scientific theory of spectral colors;[2] that it is to his deep philosophical mind that we owe the

ton (New York and London: Scribner, 1954).

[2] The production of spectral colors by crystals and drops of water, and the concomitant theory of the rainbow, has a long history and even prehistory behind it extending through the Middle Ages to antiquity. In the seventeenth century it had been studied chiefly by Marcus Antonius de Dominis, *De radiis visus et lucis in vitris perspectivis et iride tractatus* (Venice, 1611); by Descartes in "Dioptrique" and "Météores," essays appended to his *Discours de la méthode* (Leiden, 1637); by Marcus Marci, *Thaumanthias, liber de arcu coelesti deque colorum apparentium natura* (Prague, 1648); by F. M. Grimaldi, *Physico-mathesis de lumine, coloribus et iride* (Bologna, 1665); and especially by Robert Boyle, *Experiments and Considerations Upon Colours* (London, 1664), and Robert Hooke, *Micrographia: or some Physiological Descriptions of Minute Bodies made by Magnifying Glasses* (London, 1665). To Newton belongs not the discovery of the phenomenon, but (1) the application of exact measurements to its study and (2) its

explanation as a decomposition (and recomposition) of white light into its colored components by the prism, in contradistinction to the pre-Newtonian conception that explained the appearance of the spectral colors by a process of qualitative change suffered by white light in its passage through a prism. On the history of that question see Vasco Ronchi, *Storia della luce* (Bologna: Zanichelli, 1939; 2nd ed., 1952), and Roberto Savelli, "Grimaldi e la rifrazione," *Cesalpina*, 1951.

Heterodox

Koyré emphasizes the *metaphysical* aspects of scientific theorizing, rather than merely the empirical.

Small gripe: Needlessly Obscurantist

"Yet it is only by making changeless change proceed in timeless time that we can deal - effectively as well as intellectually - with such realities as speed, acceleration, or direction of a moving body in any point of its trajectory, or, vice versa, at any moment of the motion describing that trajectory." p. 11

Discussion Questions

1. Do we buy Koyré's thesis that the empirical was the effect and not the cause of "metaphysical" innovations?
2. Is Koyré's position different than Butterfields in important respects?
3. What precursor ideas can be found in Koyré?
4. Is there something in Koyré that is being overlooked in contemporary debates?