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A Brief Note on David Berlinski's book "Newton's Gift".

In the year 2000, David Berlinski published a book on Newton from the point of view of a modern mathematician and logic. Insofar as the book concentrates on Newton's philosophy of nature to be found in Newton's scientific and philosophical masterpiece, the "Philosophiae naturalis principia mathematica" of 1687, one may well doubt if Berlinski really meets the true message. Contrary to Berlinski's view, the mathematical foundation of the theory of motion that Newton presents there is evidently not the analytical logic of arithmetic, of algebra, and of the calculus differentialis, but rather the synthetic geometry of Euclid. Even when only slipping through Newton's book, the reader meets with lots of geometric diagrams, which appear enigmatic, as they are not based on coordinates. Moreover, no trace of the calculus differentialis, which provides the algorithm of mechanics as treated in textbooks, appears in Newton's foundation of the theory of motion. Newton himself is absolutely explicit on Euclidean geometry to provide his mathematical tool, in his 1686 "Preface to the reader" which Berlinski doesn't mention. Nor does Berlinski pay attention to the fact that Newton in the Principia, Section I of Book I, according to the title of this section presents "The method of first and last ratios of quantities, by the help of which we demonstrate the propositions that follow". The method introduced is so evidently geometric, as the term "ratio" belongs to Euclidean geometry (see Euclid, Book V), and extends to "comparing with each other indeterminate quantities of different sorts" in the *Scholium* to *Lemma X* of this section, i.e. to the *proportion theory of incommensurables.* Historians of science do know that Newton, the older he grew, the more he praised the power of ancient geometry, and its superiority over the analytic method, calling it the method "of the bunglers in mathematics".

Besides this failure of Berlinski to comply with Newton's devotion to Euclidean geometry, however, the critical reader finds some other dubious points in Berlinski's book. In the following, I shall show some of them, concentrating (1) on Berlinski's "Introduction", (2) on his "Note to the reader" and on the head of his chapter one, and (3) on his presentation of Newton's Second law of motion in chapter 8 (p.100/101).

(1) Berlinski's introduction to his book produces the following doubts.

1. Berlinski begins praising Newton's findings in "the disciplines of rational and celestial mechanics", in the discovery of the calculus etc., which results in the statement: "By showing that a mathematical investigation of the physical world was possible, he made that investigation inevitable."

"The mathematical investigation of the physical world": Is it really "possible", and *by which* mathematical means *exactly*? Berlinski certainly knows that it is at least still an open question if arithmetical analysis and Aristotelian logic do refer to physical reality *at all*. "Geometers" in the 17th century were sure that *only the rediscovered synthetic geometry of the Ancients*, especially the geometric theory of proportions, links mathematics to physical reality. Read Galileo's "Discorsi" of 1638; read there the chapter "fifth day" which was added to Galileo's book in its Florence edition of 1674. Read what the author of great works on arithmetic (!), John Wallis, wrote when he published a work on the theory of motion in 1671, 16 years befo-

re Newton's Principia. Wallis's book is entitled "Mechanica sive de motu tractatus *geometricus*" (my italics). Most significantly, this title shows that Wallis knew very well not arithmetic, but geometry to provide the proper tool *for the theory of real motion*. Treating the theory of proportions, and especially the proportionality of incommensurable quantities, Wallis says: "Universalem hanc propositionem praemittendam etiam duxi, quoniam viam aperit, qua, ex pure mathematica speculatione, ad physicam transeatur, seu potius hanc et illam connectit." This is: The demonstrated *geometric proportionality of incommensurables* (my italics) opens the way that leads from pure mathematical speculation to the physical reality, and thus connects mathematics and physics.

2. In the next paragraph, Berlinski warns Newton's mechanics off the field of general truth, banishing it into "its proper domain of application". This might in some way be correct provided modern physics were all true, but not so from Newton's, and from the viewpoint of his contemporaries. Newton's philosophy of nature didn't refer to any "proper domain of application", but to the indivisible general truth of nature itself, expanded from "atoms" to the infinite universe, implying even the consideration of the existence of God, not as an hypothesis, but *empirically* founded, i.e. based on "phenomena" (Scholium generale of 1713).

3. Somewhat later Berlinski expresses his belief that it was "in very large measure the *Principia* that … brought mathematical physics into existence". Clearly he links *modern* mathematical physics with the *Principia.* To what extent this may be true, is perhaps illuminated by the fact that *nearly no modern physicist has read, much less studied* the *Principia,* the study of which today is not a part of any education in physics all over the world. Even Albert Einstein, in an interview with I. Bernard Cohen, two weeks before he died, confessed never to have really delved deeper into Newton's teaching (Scientific American vol. 193 nr. 1 July 1955, p. 68 ff.).

4. Berlinski continues by quoting the well-known clockwork metaphor to describe "the Newtonian universe". This assertion is a really serious mistake, because it misleads the reader with respect to basic tenets of Newton's philosophy. In fact, the said metaphor correctly describes *the view of Newton's philosophical antipode Gottfried Wilhelm Leibniz*. This German philosopher in the footsteps of Descartes was *a deist* who taught that God may well have created the world in the beginning, but as a perfectly working machine, or clockwork, which should not require any further assistance, or mending by its creator. Consequently, this view results in believing that God does not any more interfere with his creation, leaving it go by itself a fully determined way. Newton held the very opposite *indeterministic* "theist" view of God's omnipresence and continuing intervention, and present government over the world, clearly expressed e.g. in his Scholium Generale of 1713.

5. In the same paragraph, Berlinski speaks of the "universal force of gravitation" as "propelling itself through space". This expression misleads the reader to the widespread belief of gravity to be something that should have a central body as its source, and from there should be instantaneously "propelled" through space. As a consequence, one would infer, then, that Newton held the view of "instantaneous action at a distance". But this view, even though it is generally held, is not true. There exists Newton's letter to Dr. Bentley of Feb. 1692/3, where he calls action at a distance "so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it." And Newton's definitions of the centripetal force, given in the Principia, Book I, def. 5-8, show clearly that he conceived the force of gravity as a *local activity*, existing in the gravitational field spread in space around central bodies, i.e. as sort of a (necessarily immaterial) *local field strength* (so says it

correctly e.g. Howard Stein, in "The Cambridge Companion to Newton" (I. B. Cohen and G. E. Smith eds.), Cambridge 2002, p. 287).

6. In the next paragraph, by referring to the present "physicists searching for the unified theory that … would explain the properties of matter in all of its manifestations", the author Berlinski implicitly shows his adherence to the materialistic philosophy of science, which aims at the explaining of, say, "everything", by means of active "properties of matter". The "terms of the search", says he, "are Newton's terms". But this is not true. Science today believes in the power of matter to move "by itself", to generate new forms "by itself", to evolve and organize "by itself". But Newton held the opposite view (based on experience!) of matter to be *absolutely passive*, incapable to perform *anything whatsoever* "by itself". This Newton's authentic view is already present in his First law of motion. Here he states that a body always only by forces *external to it* will be caused to change its state of motion or rest; and it is clear from Newton's *dualistic Platonic philosophy* that these forces are *not* conceived as active powers *of matter*, but rather as *immaterial entities of their own*. One should note, by the way, that it was Immanuel Kant who, in a book of 1786, entitled "Metaphysische Anfangsgründe der Naturwissenschaft", for the first time published the philosophy of nature in a fully materialistic way, *attributing forces of attraction and repulsion to matter*, and consequently also attributing to matter itself explicitly that active property of acting through empty space "at a distance" which Newton, as quoted above, had called "so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it."

7. On the next page, Berlinski describes Newton's universe as "a closed physical system", asserting that "whatever happens takes place as the result of causal interactions between material objects". All of this misses Newton's point. Newton's universe is the place where God perpetually is present everywhere, and acts – so it is evidently an "open system". Whatever happens here, doesn't happen as a result of "interactions between material objects", but rather it is generated by creative immaterial causes, the so-called "forces of nature", generating (as a result of spirit-matter interaction) the material phenomena to be observed, and also by the immaterial *creative will* of living beings (see the Scholium generale) as well as by the omnipotent will of God.

8. What Berlinski then says concerning the "laws of nature" as being "not themselves a part of nature", as existing "beyond space and time", and gaining purchase "by an act of imagination and not observation", has again really nothing to do with Newton's true teaching. One must only read the explanations Newton himself added to his Laws of motion, in order to understand that they are truly based *on observation alone*. Consequently these laws *are* very certainly "parts of nature", existing in space and time, and revealing the rational intelligence of that great Being that created the world according to them.

So far for Berlinski's "Introduction".

(2) Berlinski's "Note to the Reader" first makes the informed reader stumble over an awkward typing error, as Berlinski quotes "Richard West*ph*all" (my italics). No further comment. However, something must be said of Berlinski's remark of "Newton's ideas and the mathematical language that he used". *What* ideas? *What* language? Berlinski, If he knew Newton's authentic teaching, could have told the reader in short about his hero's *theocentric* ideas, and *geometric* language – which language was then taken to be the language of the "book of nature", as Galileo had stated it already in 1623, that is: *the language of God.*

Another evident error is found in the heading of Berlinski's chapter 1. It is said there that Newton was born *in the same year that Galileo died*. This is not true. Galileo died on Jan. 8, 1642 (Gregorian calendar). Newton was born on Dec. 25, 1642 (Julian calendar), which is Jan. 4, 1643 (Gregorian calendar). For this I refer to Richard Westfall (!), Never at Rest, Cambridge 1980, p. 40. Maybe the error stems from the correct idea that Newton was born *within less than a year* after Galileo's death.

(3) Ten minor and major errors, or mistakes, contaminate the first 6 pages of Berlinski's book, as has been shown above. There are some more. The most important one is to be found on p. 100/101, where Berlinski asserts that Newton's Second law of motion, in his Latin "mutationem motus proportionalem esse vi motrici impressae", would read, "in ordinary English, that force is the product of mass by acceleration." Everyone who knows a little Latin will understand that this is not true. The formula F = ma, introduced into rational mechanics only by Leonhard Euler in 1750 (cf. Max Jammer, Concepts of Mass in Contemporary Physics and Philosophy, Princeton NJ. 2000, pp. 5; 12; 17), is not a "law of motion" in Newton's sense, but only a *tautology* (so says also David Berlinski, in his recently published interview with Christopher A. Ferrara); and as a tautology, it lacks any explanatory power, and of course it lacks the power of Newton's second law, as a law of generating causality, which shows the true mathematical description of a spirit-matter interaction.

The late famous American historian of science, I. Bernard Cohen, together with the late Anne Whitman, in 1999 published "A new Translation" of Newton's *Principia*, containing also "A Guide to Newton's *Principia*" from Cohen's hand. In this Guide, on p. 295/6, Cohen refers to a book which the famous late astrophysicist S. Chandrasekhar had published in 1995, entitled "Newtons *Principia* for the common reader". Chandrasekhar had presented an allegedly true rendering of Newton's teaching into the language of arithmetic, logic and the calculus. What says Cohen of Chandrasekhar's work? It is "an essentially nonhistoric work… Readers should be warned that Chandrasekhar disdainfully and cavalierly dismisses the whole corpus of historical Newtonian scholarship, relying exclusively (and quoting extensively from) comments by scientists, many of whose statements on historical issues are long out of date and cannot stand the scrutinity of critical examination. He falls into traps which an examination of the historical literature would have helped him to avoid, such as … the form in which Newton expresses the second law. Chandrasekhar incorrectly equates Newton's 'change in motion' (or change in quantity of motion or in momentum) with mass × acceleration".

Unfortunately, all the same must also be said of Berlinski's book. This is the more regrettable since a true and correct representation of "Newton's Gift" would have shown an absolutely striking actuality of Newton's thought with respect to the most vivid public discussions concerning the scientific value of e.g. the theory of evolution (which is based on the materialistic concept of active matter, contra Newton), on the idea of "Intelligent Design" (for which Newton, if correctly understood, could serve as the most reliable and convincing advocate), and on the still questioned compatibility of science and religion, which to demonstrate was certainly one of Newton's main ends; by truly respecting Newton's words it can be shown that he succeeded. One should well remember that Newton's amanuensis Samuel Clarke, 300 years ago, preached the Newtonian philosophy of Nature from the pulpit of St. Paul's Cathedral in London, as *the only philosophy that is compatible with Christian faith*. Why *compatible*? Well – because they both do refer to truth, that is: to God.

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