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David Hume and Copernicanism

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Abstract: The aim of this paper is to examine how much Hume knew about astronomy, in order to understand the reasons for his acceptance of Copernicanism. My contention is that Hume's positive reception of the Copernican system arises at least from the importance that he gives to three features that he attributes to the Copernican system: beauty, simplicity and uniformity. I also give some evidence that Hume had first-hand knowledge of some sections of Galileo's *Dialogo sopra i due massimi sistemi del mondo tolemaico e copernicano* (1632), where the "sole proofs" de the Copernican system are said to be found.

In his evaluation of the character of Francis Bacon, David Hume maintains that Bacon was "the great glory" of letters during the reign of James I and a "very estimable" author and philosopher. Nevertheless, he was said to be inferior to his Italian contemporary Galileo Galilei and perhaps even to the German astronomer Johannes Kepler. One strong reason, upon which Hume's judgment is based, is said to be the "positive disdain" with which Bacon rejected the Copernican system. In contrast, Galileo is said to have fortified Copernicanism with new proofs.[1] In eighteenth- century Scotland, Copernicanism was generally accepted as the adequate description of heavens. The establishment of the Copernican heliocentric theory was considered a great triumph of modern science over the Scholastic heritage. Supported by scientific heroes like Newton and Galileo, Copernicanism became a symbol of the progress of illustrated reason. Hume, a man of letters, shared this common view.[2]

The aim of this paper is to examine how much Hume knew about astronomy, in order to understand the reasons for his acceptance of Copernicanism. My contention is that Hume's positive reception of Copernicanism arises at least from the importance that he gives to three features that he attributes to the Copernican system: beauty, simplicity and uniformity. I also give some evidence that Hume had first-hand knowledge of some sections of Galileo's *Dialogo sopra i due massimi sistemi del mondo tolemaico e copernicano* (1632), where the "sole proofs" of the Copernican system are said to be found.

A Copernican education

Hume's interest in science and acquaintance with scientific theories has become a controversial matter of Hume scholarship. There is ample evidence, nevertheless, that Hume was really interested in science and had both direct and second hand knowledge of some of the most relevant scientific theories of his time.[3] In regards to astronomy, he shows a general awareness for the main components of the Copernican theory, so as for its confrontation with the Ptolemaic system. Hume mentions Galileo's "famous *Dialogues*" as a source where eminent proofs of the Copernican system are exposed.[4] Hume also shows awareness of the relevance of the works of Tycho Brahe and Johannes Kepler in the foundation of the new astronomical system.[5] Finally, he displays knowledge of the articulation of the Copernican theory with the Newtonian physics.[6]

Hume assumes that the astronomy of his time is a mature science which has arrived at its main results: "the bulk and figure of the earth have been measured and delineated, (…) the order and economy of the heavenly bodies subjected to their proper laws, and INFINITE itself reduced to calculation".[7] In the *Dialogues concerning Natural Religion,* Philo argues that the acceptance of the heliocentric theory has become so undisputed "that we are not commonly very scrupulous in examining the reasons upon which it is founded."[8] Cleanthes recognizes that the immediate evidence of appearances and our natural conceptions are paradoxically contrary to heliocentrism. However, natural philosophy has proved that the order of the celestial system

[1] D. Hume, *The History of England from the Invasion of Julius Caesar to the Revolution of 1688,* ed. William B. Todd , Indianapolis, 1983, V, 153-54. On Hume and Bacon's character see Wertz, S. K. «Hume and the Historiography of Science.» *Journal of the History of Ideas* 54, nº 3 (1993): 411-436; pp. 414-417)

[2] See Wilson, Curtis. *Astronomy and Physics.* Vol. 4, *The Cambridge History of Science. Eighteenth-Century Science*, ed. Roy Porter, 329-354. Cambridge: Cambridge University Press, 2003. On the heliocentric theory in Scotland see Wotton, Paul. «Science in the Scottish Enlightenment.» In *The Cambridge Companion to the Scottish Enlightenment*, de Alexander Broadie, 94-116. Cambridge: Cambridge University Press, 2003.

[3] Wertz,«Hume and the Historiography of Science», 419-420; Barfoot, Michael. «Hume and the Culture of Science in Early Eighteenth Century.» In *Studies in the Philosophy of the Scottish Enlightenment*, de M. A. Stewart, 151-190. Oxford: Oxford University Press, 1990; Force, James. «Hume's Interest in Newton's Science.» *Hume Studies* 13, nº 2 (1987): 166-21; Jones, Peter. *Hume's Sentiments: Their Ciceronian and French Context.* Edinburgh: Edinburgh University Press, 1982; Noxon, James. *Hume's Philosophical Development.* Oxford: Clarendon Press, 1973.

[4] D. Hume, *Dialogues concerning Natural Religion* (DNR), ed. N. Kemp Smith. Oxford: Clarendon Press, 1935, 151.

[5] On Tycho Brahe see Hume, "Of National Characters". In *Essays Moral, Political and Literary,* ed. E. F. Miller Indianapolis, 1987, 197; on Kepler, see Hume, *History of England,* V, 153.

[6] Hume, EHU, p. 14. During the courses attended at the University of Edinburgh, Hume probably read or at least knew the contents of Newton's *Principia.* See Wertz,«Hume and the Historiography of Science» 419.

[7] Hume, An Enquiry concerning the Principles of Morals, (EPM) p. 278.

[8] Hume, DNR, 151.

is so fully represented by the Copernican description, that "even monks and inquisitors are now constrained to withdraw their opposition to it."[9] Hence, a man that withholds his assent on the heliocentric system "having nothing particular to object to the arguments of Copernicus and Galileo for the motion of the earth" and just having adduced that these subjects are "too magnificent and remote to be explained by the narrow and fallacious reason of mankind" is simply ridiculous.[10] "The true system of the heavenly bodies is discovered and ascertained", claims Cleanthes. Skeptics are obliged to consider its evidence apart, "and proportion their assent to the precise degree of evidence which occurs."[11]

In the essay "The Skeptic", Hume opposes the stability of the "real world" to the variation of "human apprehensions". Human theories on the celestial order may be changing, but the reality of heaven is always the same: the sun is at rest and the earth moves around it.

> If I examine the PTOLOMAIC and COPERNICAN systems, I endeavour only, by my enquiries, to know the real situation of the planets; that is in other words, I endeavour to give them, in my conception, the same relations that they bear towards each other in the heavens. To this operation of the mind, therefore, there seems to be always a real, though often an unknown standard, in the nature of things; nor is truth or falsehood variable by the various apprehensions of mankind. Though all human race should for ever conclude, that the sun moves, and the earth remains at rest, the sun stirs not an inch from his place for all these reasonings; and such conclusions are eternally false and erroneous.[12]

A beautiful system

Hume evaluates the Copernican system from different perspectives. One of them takes into account the aesthetic value of the theory. Hume maintains that the Copernican system is more beautiful than the Ptolemaic. What does it mean for an astronomical system to be beauty? "Natural beauty", Hume tells us, is extremely similar to "moral beauty". In one sense, beauty is said to be "the power of producing pleasure". Particularly, natural beauty depends on "the proportion, relation, and position of parts." [13] In other sense, beauty is said to be the effect of that power in our mind, namely, the sentiment of pleasure actually felt by us.

Hume separates the intellectual activity of knowing nature from the sentiments of pleasure derived from that knowledge: "Beauty, whether moral or natural, is felt, more properly than perceived." [14] The recognition of beauty does not rely on our "understanding or intellectual faculties." It is a sentiment of complacency experienced by the mind, according to the nature of the object and the disposition of our organs. Thus, for example, Euclid described the geometrical properties of circle, but he did not talk about its beauty. That is possible because: "The beauty is not a quality of the circle. It lies not in any part of the line, whose parts are equally distant from a common center. It is only the effect, which that figure produces upon the mind, whose peculiar fabric or structure renders it susceptible of such sentiments. In vain would you look for it in the circle, or seek it, either by your senses or by mathematical reasonings, in all the properties of that figure."[15]

In a similar way, Hume compares the beauty experienced when we think about the astronomical systems: "A man may know exactly all the circles and ellipses of the COPERNICAN system, and all the irregular spirals of the PTOLOMAIC, without perceiving that the former is more beautiful than the latter."[16] The subjective feeling of beauty is not necessarily attached to the scientific knowledge of a theory. To have a distinct idea does not imply necessarily to feel its beauty. In order to be able to feel the beauty of the Copernican system, the astronomer not only should know the theory perfectly, he should also have a "delicacy of temper". Otherwise, he would remain insensitive to the aesthetic value of the system.[17]

Something more simple and natural

Other perspectives of Hume's evaluation of astronomical systems bear in mind two methodological values. On the one hand, he celebrates the simplicity of the Copernican system. In Part XII of the *Dialogues*, Philo maintains that the maxim "That Nature acts by the simplest methods, and chooses the most proper means to any end" is a great foundation of the Copernican system.[18] This system exceeds the Ptolemaic theory, which, assuming the maxim that Nature does nothing in vain, constructed an "intricate" explanation of celestial phenomena. According to Hume's reconstruction of the historical development of astronomy, the extreme geometrical complexity to which led geocentricism, "gave place at last to something more simple and natural"[19]. Thus, the Ptolemaic system followed an unacceptable methodological procedure: "To invent without scruple a new principle to every new phenomenon, instead of adapting it to the old; to overload our hypothesis with a variety of this kind, are certain proofs that none of these principles is the just one, and that we only desire, by a number of falsehoods,

[9] Hume, DNR, 137.
[10] Hume, DNR, 136.
[11] Ib.
[12] Hume,"The sceptic". In *Essays Moral, Political and Literary,* ed. E. F. Miller Indianapolis, 1987, 164.
[13] D. Hume, *A Treatise on Human Nature* (T) 301. On Hume's concept of beauty see Jones, Peter. «Hume's Literary and Aesthetic Theory.» In *The Cambridge Companion to Hume*, de David Fate Norton, 255-280. Cambridge: Cambridge University Press, 1993.
[14] Cf. Hume, EHU, 165.
[15] Hume,"The sceptic" 166. Cf. EPM, 263 which reproduces these fragments.
[16] Hume,"The sceptic" 166.
[17] Ibid.
[18] Hume, DNR, 214
[19] Hume, T, 282.

to cover our ignorance of the truth."[20] Such a censure is to be addressed not only to ancient astronomy but also to current moral philosophy, which, according to Hume, "is in the same condition as natural [philosophy], with regard to astronomy before the time of Copernicus."[21]

In fact, Hume claims that the development of the Copernican theory should be taken as an antecedent and model of the possibility of the science of human nature. Section I of the first *Enquiry* expresses Hume's hope that, like astronomy, moral philosophy can achieve its aim of describing the components of human mind and finding the general principles that explain all his operations. The preliminary age of Copernican astronomy could prove "the true motions, order, and magnitude of the heavenly bodies", from phenomena. This fortunate beginning was led to its consummation thanks to the new discoveries provided by the laws of Newtonian physics. The particular contribution of Newton (a philosopher) to astronomy is said to stem "from the happiest reasoning, to have also determined the laws and forces, by which the revolutions of the planets are governed and directed." [22] In Hume's historical narrative, astronomy seems to be distinguished from physics according to the following patterns: Copernican astronomy departs from phenomena and proves the existence of motion, order and magnitude in heaven; Newtonian physics departs from reasoning and determines the laws and forces that rule the celestial bodies.

The rule of uniformity

In Hume's historical reconstruction of the development of Copernicanism, Galileo plays a substantial role. This narrative of Galileo's scientific contribution to the triumph of Copernicanism is to be interpreted in the light of the central discussion of the argument from design developed in the *Dialogues*. In some passages of the debate between Cleanthes and Philo, Hume exhibits the methodological value of uniformity bestowed by the Copernican system. Restating an old argument, Cleanthes maintains that we learn from the common experience that the universe is like a machine constructed by a human artisan: its parts are adapted in terms of ends and means. From such an analogy of the effects we must conclude an analogy of their causes. We know certainly that the causes of human endeavors are intelligent and purposeful agents. In the same way, the analogy of the effects leads us to infer that the cause of the universe must be also an intelligent and purposeful agent, although superior to human contrivers, given the admirable complexity of his design.

As it is well known, the main strategy of Philo against Cleanthes' argument was to show the weaknesses of the particular analogy which grounds it. To Philo's first attack, Cleanthes counterattacks this way: if the argument of design is based on a weak analogy so is the Copernican explanation of the motion of the earth. There are no empirically known analogous effects, which could be compared to the Earth, in order to conclude what is the cause of the earth's motion. Consequently, if we follow Philo, we are forced to conclude in two equally ridiculous positions: to reject the existence of God and to reject the Copernican system. [23]

Philo's answer involves a defense of the analogical reasoning. In so doing, Philo keeps safe the validity of Copernicanism and, at the same time, maintains that it is supported by strong analogies: the earth is like the moon, like the other planets and like the satellites of the moon, Jupiter and Saturn. All of them revolve around a center, in the same way as the earth turns around the sun. On the contrary, Cleanthes' analogy between the universe and human artifacts is said to be too weak.[24]

In *The History of England,* Galileo is said to provide proofs of the Copernican system. In order to support this rationale of Copernicanism, Philo gives a sort of historical reconstruction of the genesis of the theory. Certainly, argues Philo, today no reasonable man would object the rational foundation of Copernican heliocentrism. But things were very different many years ago, when the influence of Scholasticism was still present. At that time, the first defenders of Copernicanism like Galileo "had the full force of prejudice to encounter, and were obliged to turn their arguments on every side in order to render them popular and convincing."[25] The foremost thesis against Copernicanism was the doctrine of the opposition between elementary and celestial substances. According to that distinction, both substances are absolutely antithetical in their essential qualities. Consequently, to refute the Ptolemaic theory, it was necessary to prove the similarities between the Earth and the celestial bodies.

Here Galileo, "that great genius, one of the sublimest that ever existed", appear on the scene. On this narrative, Galileo's intervention is presented as a conscious and cautious defense of Copernicanism against the Ptolemaic system. Philo summarizes Galileo's proofs of Copernicanism as follows:

1. "first [Galileo] bent all his endeavours to prove, that there was no foundation for the distinction commonly made between elementary and celestial substances."
2. " beginning with the moon, [Galileo] proved its similarity in every particular to the earth; its convex figure, its natural darkness when not illuminated, its density, its distinction into solid and liquid, the variations of its phases, the mutual illuminations of

[20] Ibid. Cf. "The Sceptic", p. 214: "When a philosopher has once laid hold of a favourite principle, which perhaps accounts for many natural effects, he extends the same principle over the whole creation, and reduces to it every phænomenon, though by the most violent and absurd reasoning. Our own mind being narrow and contracted, we cannot extend our conception to the variety and extent of nature; but imagine, that she is as much bounded in her operations, as we are in our speculation."

[21] Ibid.

[22] Hume, EHU, 14.

[23] Hume, DNR, 150.

[24] Hume, DNR, 150.

[25] Hume, DNR, 150

the earth and moon, their mutual eclipses, the inequalities of the lunar surface, etc."

3. "many instances of this kind, with regard to all the planets."
4. As a consequence, "men plainly saw that these bodies became proper objects of experience; and that the similarity of their nature enabled us to extend the same arguments and phenomena from one to the other."

Finally, Philo suggests that "this cautious proceeding of the astronomers"[26] should be imitated by theists in searching for a valid analogy in their defense of the argument from design. Cleanthes accepts the analogical reasoning which founds Copernicanism and claims that Copernicus and his followers needed to prove the similarity of celestial and terrestrial matter "because several philosophers, blinded by old systems, and supported by some sensible appearances, had denied that similarity [between celestial and terrestrial matter]."[27] The situation of natural theology is different, says Cleanthes, since the similarity between the world and a human artifact is "self-evident." Despite their disagreement on the particular analogy involved in the argument from design, it is manifest that Philo and Cleanthes agree in accepting Copernicanism and the Galilean analogy which is said to prove the Copernican system.

Hume reader of Galileo

Hume's account of the proofs of the Copernican system adapts the arguments of Galileo to Philo's argumentative needs. Some passages of Hume's narrative reveal a direct knowledge of the *Dialoghi.* There are two ample evidences on this regard. On the one hand, there are textual coincidences with the English translation by Thomas Salusbury (1661). The features that, according to Philo, Scholastic philosophy ascribes to the celestial bodies, are exactly the same that Salviati enumerates in a passage of the First Day of the *Dialoghi:*

> PHILO: But if we peruse Galileo's famous Dialogues concerning the system of the world, we shall find, that that great genius, one of the sublimest that ever existed, first bent all his endeavours to prove, that there was no foundation for the distinction commonly made between *elementary and celestial substances*. The schools, proceeding from the illusions of sense, had carried this distinction very far; and had established the latter substances to be *ingenerable, incorruptible, unalterable, impassible*; and had assigned all the opposite qualities to the former.[28]
>
> SALV.: So really it is, therefore leaving the general contemplation of the whole, let us descend to the consideration of its parts, which Aristotle, in his first division, makes two, and they very different and almost contrary to one another; namely the *Cœlestial, and Elementary*: that *ingenerable, incorruptible, unalterable, un-passible*, &c. and this exposed to a continual alteration, mutation, &c. Which difference, as from its original principle, he derives from the diversity of local motions, and in this method he proceeds" (my italics). [29]

On the other hand, Philo reproduces the same order of topics that Salviati exhibited in his discourse on the resemblances between the earth and the Moon. Thus, Philo mentions synthetically and orderly the resemblances that Galileo's spokesman describes more *in extenso*[30] through many pages of the *Dialoghi*, where the three interlocutors confront their opinions:

[26] Hume, DNR, 151.
[27] Hume, DNR, 152.
[28] Hume, DNR, 150, my italics.

[29] The System of the World in four Dialogues wherein the two grand systems of Ptolomy and Copernicus are largely discourse of (…) by Galileus Galileus Linceus, Inglished from the original Italian copy by Thomas Salusbury, London, William Leybourne, p. 6, my Italics. Cf. Galileo Galilei, Dialogo sopra i due massimi sistemi del mondo tolemaico e copernicano, a cura di Libero Sosio, Einaudi Editore, Torino, 1970, p. 12, "SALV.[…] Aristotile nella prima divisione fa due, e tra di loro diversissime ed in certo modo contrarie; dico, la celeste e la elementare, quella, ingenerabile, incorruttibile, inalterabile, impassibile, etc.; e questa, esposta ad una continua alterazione, mutazione, etc." (my italics).
[30] Galileo, Dialogues, ed. Salusbury, 48-53.