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06. Aristotle and his influence on later philosophy

## **The influence of Aristotle in Epicurus' Modification of Atomic Physics**

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### **Introduction**

It is known that Aristotle of Stagira criticized the atomic theory of Democritus of Abdera while Epicurus of Athens accepted it with some changes. Ancient critics of Epicurean physics, such as the platonist Cicero, as well as modern thinkers, such as the young Hegelian Karl Marx, Carlo Giussani, Cyril Bailey, David Furley, David Sedley, Don Fowler and Walter Englert, all claimed that Epicurus had introduced the swerve movement of atoms (παρέγκλισις, clinamen)<sup>1</sup> with the intention to account for the natural basis of free will.

Here I will oppose this claim that treats Epicurus like a rhetorical intentionalist and I provide evidence that Epicurus had a naturalistic scientific mind like Aristotle. I suggest that Epicurus used his empirical method of Canon in order to address Aristotle's criticisms of Democritus' atomic physics and thus he introduced weight and swerve movements of atoms.

### **Epicurus studied both Democritus and Aristotle**

According to Diogenes Laertius, Epicurus studied philosophy with the Aristotelian Praxiphanes and with the Democritean Nausiphanes<sup>2</sup>. Therefore, we may infer rather safely that Epicurus learned both Democritus' atomic physics and Aristotle's arguments against it.

### **Critisms of Cicero**

In the 1<sup>st</sup> century BC, the Roman orator and skeptical Platonic philosopher Cicero heavily criticized Epicurus' atomic physics in his work “About the Ends of Goods and Evils”<sup>3</sup>. The Roman philosopher claimed that Epicurus was not an original philosopher and that his atomic physics was copied from Democritus. In the following sentences, contradicting himself, Cicero wrote that Epicurus had changed Democritus' atomic theory in some ways so it became even worse. Cicero asserted that Epicurus introduced arbitrarily both the movement of atoms due to their weight and the unexpected swerve movement (παρέγκλισις, clinamen) which was uncaused according to the Athenian philosopher. Cicero maintained that the latter thesis of Epicurus was “unworthy of a philosopher” and gave no reason why the Athenian philosopher came up with these changes of atomic physics departing from Democritus' teachings.

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1 Lucretius “De rerum natura”, II.243-250

2 Diogenes Laertius 10.13

3 Cicero “De finibus bonorum et malorum”, I vi.17-19

## Aristotle's influence on Epicurus

While Cicero failed to mention the reason why Epicurus had changed Democritean atomic physics, some other philosophers observed that it was due to Aristotle's influence. The orator and eclectic Aristotelian paraphraser Themistius (317-c.390) wrote that Epicurus responded to Aristotle's criticisms on atomic physics<sup>4</sup>. The same was mentioned by the Neoplatonic philosopher Simplicius (c.490-c.560), in his commentary work "Aristotle's Physics" ("Αριστοτέλους Φυσικά" Z 1 init. f. 216c). Simplicius observed that Aristotle had criticized several aspects of the atomic theory of Democritus and Leucippus, so in response to these criticisms Epicurus changed some points to accommodate Aristotle's correct objections ("και πολλαχού μεν την Δημοκρίτου δόξαν και Λευκίππου ό Αριστοτέλης διήλεγξεν και δι' εκείνους ίσως τους ελέγχους προς το άμερές ένισταμένους ό Επίκουρος ύστερον γενόμενος, συμπαθών δε τη Δημοκρίτου και Λευκίππου δόξη περί των πρώτων σωμάτων, απαθή μεν έφύλαξεν αυτά, το δε άμερές αυτών παρείλετο, ως δια τούτο υπό του Αριστοτέλους ελεγχομένων"<sup>5</sup>).

Therefore, it was well known to some ancient philosophers that Aristotle had influenced Epicurus' changes of Democritean atomic physics. There are several amendments that Epicurus made in response to the criticisms of Aristotle, as extensively discussed in recent decades (see for example Furley<sup>6</sup> and Englert<sup>7</sup>). It would be interesting to focus particularly in the two movements of the atoms mentioned by Cicero, namely due to weight and swerve, and understand the reason why Epicurus introduced them.

## The weight and swerve movements of atoms

Aristotle in "De caelo" ("Περί ούρανοῦ" III.2, 300B 8-17) stated that Democritus had claimed that the atom acquires forced motion after colliding with other atoms, but the atomist had never mentioned any initial natural movement of the atom, prior to forced movement ("Διό και Λευκίππω και Δημοκρίτω, τοις λέγουσιν αεί κινείσθαι τα πρώτα σώματα εν τω κενώ και τω απείρω, λεκτέον τίνα κίνησιν και τις κατά φύσιν αυτών κίνησις. Ει γαρ άλλο υπ' άλλου κινείται βία των στοιχείων, αλλά και κατά φύσιν ανάγκη τινά είναι κίνησιν εκάστου παρ' ην η βίαιος εστιν. Και δει την πρώτην κινούσαν μη βία κινείν, αλλά κατά φύσιν. Εις άπειρον γαρ είσιν, ει μη έσται κατά φύσιν κινούν πρώτον, αλλ' αεί το πρότερον βία κινούμενον κινήσει")<sup>8</sup>.

Aristotle went on suggesting that before any initial collision of atoms, all atoms had to have the same natural movement towards the same direction (also in "Φυσικά"<sup>9</sup>) "Physics" IV.8 215a 1-6) and since there can be no direction in infinite space, thus the atomic theory was wrong. It seems that Epicurus accepted Aristotle's theoretical criticism as logically sound and therefore in response he introduced as natural movement of the atoms their downwards movement due to their weight. Furthermore, in order to facilitate the first collisions of atoms falling in parallel lines Epicurus introduced their unpredictable and random swerve movement. Thus, Democritean

4 Themistius "Physics" 184.9 = Usener 278

5 Simplicius "Aristotle's Physics" Z 1 init. f. 216c

6 Furley D.J. (1967) "Chapter 8: Aristotle's criticisms and Epicurus' answers", 111-130

7 Englert W.G. (1987) "Chapter III: The swerve and Epicurean physics", 27-62

8 Aristotle "De caelo" III.2, 300B 8-17

9 Aristotle "Physics" IV.8 215a 1-6

atomic physics was further changed to Epicurean atomic physics in response to Aristotelian criticism.

### **How Epicurus came up with the weight and swerve movements of the atoms**

The point of interest is how Epicurus came up with the weight and swerve movements of the atoms. Most modern scholars (including Karl Marx, Carlo Giussani, Cyril Bailey, David Furley, David Sedley, Don Fowler and Walter Englert) have argued that the random movement of the atom, namely the swerve (παρέγκλισις, clinamen), was introduced by Epicurus in order to allow for human free will. This view that treats Epicurus as an intentionalist intellectualist is heavily influenced by the Kantian approach. Immanuel Kant in “Critique of the pure reason” (1781) discussed the two main philosophical lines, namely the Intellectualismus (Intellectualism, Rationalism) exemplified by Plato and Leibnitz, and Sensualismus (Empiricism, Sensationalism) exemplified by Epicurus and Locke. Their method of approaching the truth was different. Platonic intellectualism used logic (under the name “science”) which claimed to be involved with universal concepts, while Epicurean empiricism used naturalism, namely empirical observation of nature. This Kantian distinction of “science” versus naturalism may surprise a modern scientist but it should be mentioned that Kant wrote his essays over two decades before John Dalton measured the weight of “atoms” of elements, like hydrogen, oxygen and carbon (1803) proving that Epicurus' atomic physics was correct. It is well known that since then, in the last two centuries science has advanced through empirical and experimental observation.

The Kantian approach to science was by logic alone, therefore most modern scholars have treated Epicurus as a rational intentionalist claiming that the Athenian philosopher introduced the weight movement of the atom, in order to subsequently introduce the swerve which allowed free will. This approach mistakes Epicurus for an intentionalist sophist and fails to view him as he truly was, namely an objective naturalist. I will argue that Epicurus subjected Aristotle's criticism to the empirical testing of his naturalistic method Canon.

### **Epicurus the natural scientist**

Not only Epicurus was not an unscientific intentionalist, but he was rather a serene observer of nature, as his writings attest. Epicurus was an advocate of scientific knowledge of nature as a means for enlightenment of people (“τὸν ἡδὺν γεννᾶ βίον νήφων λογισμὸς καὶ τὰς αἰτίας ἐξερευνῶν πάσης αἰρέσεως καὶ φυγῆς καὶ τὰς δόξας ἐξελαύνων ἐξ ὧν πλεῖστος τὰς ψυχὰς καταλαμβάνει θόρυβος”<sup>10</sup>). The Athenian philosopher taught that the study of nature (φυσιολογία, “physiology”, science in modern terminology) is an important means for happiness, eudaimonia (ευδαιμονία) of people. He mentioned that he was dedicating all his energy in the study of nature in order to bring tranquility in his life: “I recommend constant activity in the study of nature and this way more than any other I bring calm to my life” («παρεγγυῶν τὸ συνεχῆς ἐνέργημα ἐν φυσιολογίᾳ καὶ τοιοῦτῳ μάλιστα ἐγγαληνίζων τῷ βίῳ»)<sup>11</sup>.

As several Epicurean texts attest, Epicurus did not trust the myths (“Only the myth must stay away from us”, «Μόνον ὁ μῦθος ἀπέστω»<sup>12</sup>), the dialectic method (“The Epicureans reject

10 Epicurus “Letter to Menoeceus”: Diogenes Laertius 10.132

11 Epicurus “Letter to Herodotus”: Diogenes Laertius 10.37

12 Epicurus “Letter to Pythocles”: Diogenes Laertius 10.

dialectic. Because it suffices for physicists to promote their thoughts according to words that correspond to natural things”, «Την διαλεκτικήν ως παρέλκουσαν αποδοκιμάζουσιν. Αρκεί γαρ τους φυσικούς χωρείν κατά τους των πραγμάτων φθόγγους»<sup>13</sup>) and the rhetoric method (“It is useless, because it is so obvious, to continuously demonstrate that sciences do not change in various locations while rhetoric seems altered in different countries and cities”, «Ματαία δε, εναργής ούσα, και η ταύτη συνεχής απόδειξις η καταξιούσα μεν μη μεταβαλλείν τας επιστήμας τοις τόποις, την δε ῥητορικήν αλλοίαν αποφαίνουσα κατά χώρας και άστη»<sup>14</sup>).

Elsewhere Epicurus mentions that “we should not study nature with empty axioms and arbitrary laws but as phenomena require. Because our life does not need illogical and foolish opinions, but it needs tranquility”<sup>15</sup>. Epicurus was the advocate for multiple theoretical explanations of a phenomenon, if enough observational data were not available: “When someone accepts an explanation and dismisses another one, while they both explain a phenomenon, it is obvious that he both distances him/herself from naturalistic/scientific approach and retreats to myths”<sup>16</sup>.

Epicurus claimed that only the unbiased observation of nature could enlighten and free the human mind, so as to facilitate tranquility and happiness. That is why he created the Canon, a method of inquiry according certain criteria of truth, mainly based on observation by sensual perception (following Aristotle) and inference by analogy.

### **Movement of atoms due to weight**

The most important criterion of truth according to Epicurus' Canon is observation with senses. In my view, Epicurus probably experimented with solid objects (it is known that his contemporary for twenty years in Athens head of Lyceum Strato of Lampsacus did experiments<sup>17</sup>) and observed that all of them fell downwards due to their weight. Since all visible composite bodies have weight, therefore, according to the analogy principle of the Canon, atoms as “uncut” material bodies have also weight. Therefore, Epicurus introduced the movement of atoms due to their weight (“η κάτω δια των ιδίων βαρών φορά”) downwards with the same velocity in void in parallel lines (“και μην και ισοταχείς αναγκαίον τας ατόμους είναι, όταν δια του κενού εισφέρωνται μηθενός αντικόπτοντος”<sup>18</sup>), as he discussed in the Letter to Herodotus.

It is important to notice in the above mentioned passage that Epicurus does not mention the swerve movement of atoms. Neither he refers to the clinamen in any other passage of his extant works<sup>19</sup>. The fact that Epicurus did not mention the atomic swerve in his synopsis of

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13 Diogenes Laertius 10.31

14 Philodemus “On rhetoric” II 105

15 Epicurus “Letter to Pythocles”: Diogenes Laertius 10.87

16 Epicurus “Letter to Pythocles”: Diogenes Laertius 10.87

17 See discussion of Hero “Pneumatics” in Farrington “Greek Science: Its Meaning for Us”.

18 Epicurus “Letter to Herodotus”: Diogenes Laertius 10.61

19 In order to accommodate the reference of clinamen by Epicurus, Bailey suggested an unconvincing reconstruction of a severely fragmented section of “Letter to Herodotus”: Diogenes Laertius 10.43

physics (the letter to Herodotus) means that he had not thought about it at that time. This fact alone is strong evidence that Epicurus did not intentionally introduce the weight and random movements of atoms, in order to account for free will.

### **Epicurus' use of Canon**

In my view, all existing evidence suggests an evolution in Epicurus' thinking, as it happens with all scientists who try to base their theories to the facts. Initially, he probably experimented with visible solid objects and noticed that all of them without exception fell down, therefore Epicurus analogically inferred that all invisible bodies like atoms as well had weight and their natural movement was downwards. That thought satisfied the particular Aristotle's criticism regarding the initial natural movement of atoms before collision, therefore Epicurus was content for some time. During that period he probably wrote the letter to Herodotus.

At that time, Epicurus had accepted collision movement of atoms discussed by Democritus and had proposed weight movement of atoms. The two movements corresponded respectively to Aristotle's forced motion (παρά φύσιν) and “passive” natural motion (αρχή του πάσχειν)<sup>20</sup>. Aristotle had also written about an “active” natural motion (αρχή του κινεῖν και του πονεῖν) that characterize living organisms<sup>21</sup> and about random accidental events (συμβεβηκός)<sup>22</sup>. At least in the initial stage of his evolving theory, Epicurus had not included those Aristotelian concepts in his own atomic physics.

Consequently, Epicurus realized that if atoms initially moved downwards with the same velocity in void in parallel lines, then they would not collide. Therefore, Epicurus had to introduce an unpredictable chance movement of atom, the swerve (παρέγκλισις, clinamen), so that first collisions might have happened in random instances. The swerve was Epicurus' original concept as several authors attest, including Cicero<sup>23</sup> and Diogenes of Oenoanda<sup>24</sup>.

### **The swerve and free will**

By introducing a natural cause of pure chance, Epicurus was able to explain the observed occurrence of free will (ἐφ' ἡμῖν). The random and unpredictable movement of atoms obliterated the deterministic and fatalistic views that both the atomist Democritus and other philosophers like Zeno of Stoa believed in. Using the Canon Epicurus had observed that people had free will, but as an atomist he had to explain this with a mechanism that involved atoms. The self-originated chance movement of the atoms was that mechanism that justified the uncaused break of the deterministic chain of causes and allowed free will of humans liberating them from merciless necessity. Chance, according to Epicurus, was not the cause of free will but simply allowed it to exist.

Epicurus was against the myth of fate (destiny, εἰμαρμένη) because he maintained that “it is better to follow the myth about gods than to be a slave of the destiny of the physicists (physical philosophers): for the former suggests a hope of gods' forgiveness, in return for honor, but the

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20 Aristotle “Physics” VIII.4

21 Aristotle “Physics” VIII.2 252 b 17-28

22 Aristotle “Physics” II 4-6; Aristotle “Metaphysics” VI.2 1026 b 24-35

23 Cicero “De finibus bonorum et malorum”, I vi.18-19

24 Diogenes of Oenoanda fr. 54.3

latter has an inevitable necessity” (ἐπεὶ κρείττον ἦν τῷ περὶ θεῶν μύθῳ κατακολουθεῖν ἢ τῇ τῶν φυσικῶν εἰμαρμένη δουλεύειν· ὁ μὲν γὰρ ἐλπίδα παραιτήσεως ὑπογράφει θεῶν διὰ τιμῆς, ἡ δὲ ἀπαραίτητον ἔχει τὴν ἀνάγκην)<sup>25</sup>. Epicurus disagreed with determinist atomist Democritus and agreed with empiricist Aristotle. Using the same observation methodology, Aristotle and Epicurus came up with the same conclusion, namely that everything occurs either due to necessity, or due to chance, or due to our own agency. Aristotle wrote about necessity (ἐξ ἀνάγκης)<sup>26</sup>, chance (τυχόν, συμβεβηκός)<sup>27</sup>, and our own will (εφ' ἡμῖν, εκούσιον)<sup>28</sup> and in accordance Epicurus wrote that some things happen due to necessity, others due to chance, other are up to our own agency (“ἃ μὲν κατ' ἀνάγκην γίνεσθαι, ἃ δὲ ἀπὸ τύχης, ἃ δὲ παρ' ἡμᾶς”)<sup>29</sup>.

In conclusion, Epicurus evolved atomic physics in response to Aristotle's criticisms of Democritean theory. By using his Canon which involved observation with the senses and inference by analogy, Epicurus agreed more with Aristotle whose empirical method he used and whose positions regarding chance and free will he accepted distancing himself from earlier atomist Democritus.

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25 Epicurus "Letter to Menoeceus": Diogenes Laertius 10.134

26 Aristotle "Metaphysics" V,1027a8-11

27 Aristotle "Metaphysics" V,1025a25 and V,1027a8-11

28 Aristotle "Nicomachean Ethics" III.v.6, 1113b21-22: "εἰ δὲ ταῦτα φαίνεται καὶ μὴ ἔχομεν εἰς ἄλλας ἀρχὰς ἀναγαγεῖν παρὰ τὰς ἐν ἡμῖν, ὧν καὶ αἱ ἀρχαὶ ἐν ἡμῖν, καὶ αὐτὰ ἐφ' ἡμῖν καὶ ἐκούσια"

29 Epicurus "Letter to Menoeceus": Diogenes Laertius 10.133