Averroes' Physics: A Turning Point in Medieval Natural Philosophy by Ruth Glasner

Oxford/New York: Oxford University Press, 2009. Pp. x + 229. ISBN 978–0–19–956773–7. Cloth $75.00

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The Muslim philosopher Averroes played a major role in the reception of Aristotle's philosophy in the Latin West. In referring to him as to the 'Commentator', the Scholastics themselves recognized Averroes' authority as an interpreter of Aristotle, the 'Philosopher'. It is indeed on Averroes' extensive word-by-word commentaries, translated into Latin in the first quarter of the 13th century, that the Scholastics relied in trying to understand the obscure and very compressed works of Aristotle (even more obscure in their Latin translation than in the original Greek). Averroes not only provided a literal explanation of Aristotle's texts but was also very alert to the exegetical and doctrinal problems raised by them, often comparing different solutions presented by other commentators and then expressing his own view. Although Averroes' main concern was to offer his solutions as those which capture the genuine intention of Aristotle, it was already clear to the Scholastics that on many controversial issues, far from being a faithful interpreter of Aristotle, Averroes went well beyond what Aristotle actually said and could have intended. What is not at all clear, and in fact very hard to assess, is whether Averroes had his own philosophical agenda, distinct from that of Aristotle, which he somehow followed in his interpretation of Aristotle. Did Averroes modify Aristotle's philosophy and in what direction?

In her book Ruth Glasner addresses this difficult question, focusing on the case of natural philosophy, and gives a positive answer. While for Aristotle the basic structure of the physical world was continuity (bodies, motions, space, and time are all continua),

ISSN 1549–4497 (online) ISSN 1549–4470 (print) ISSN 1549–4489 (CD-ROM)
Aestimatio 7 (2010) 79–89

Averroes supported an atomistic view of bodies and motions, relegating continuity to the abstract realm of geometry. Glasner's expression for Averroes' new physics is 'Aristotelian Atomism', where the adjective 'Aristotelian' indicates that the atomism advocated by Averroes originated from internal tensions and ambiguities in the Aristotelian corpus and that, unlike the atomism of Epicureans and that of Muslim theologians, it was not in conflict with other fundamental aspects of Aristotle's thought, e.g., on causality. That the 13th-century Scholastics developed an Aristotelian atomistic theory of natural bodies—the theory of *minima naturalia*—is well known to historians of science, who have pointed out its significance for the early modern thought on matter and motion. In Glasner's view, however, they have neglected the contribution of Muslim philosophy and in particular of Averroes, assuming that the immediate origin of the theory of *minima naturalia* is to be found in some remarks by Aristotle himself. On the contrary, Averroes did give a fundamental contribution and in fact developed this atomistic theory farther than many Scholastics philosophers.

In addition to arguing for the atomistic character of Averroes' new physics, Glasner also advances a much more general and fascinating conjecture, namely, that 'the motive force behind Averroes' "Aristotelian atomism" was his aspiration to find a sound scientific foundation for indeterminism' [173]. As Glasner presents this issue, while Averroes was keen to support the indeterminist stance of Muslim theologians as opposed to the determinist one of Muslim philosophers (e.g., Avicenna), he was not happy with the lack of scientific foundation of both Greek (Epicurean) and Muslim indeterminism, which resulted from their denial of causality. Both Greek and Muslim indeterminists assumed that the physical world had an atomic structure and that only an atomic structure and not also a continuous one is compatible with indeterminism; they also assume, however, that this structure was not subject to causal laws. It is with this latter assumption that Averroes was deeply dissatisfied. As a good Aristotelian, he was convinced that a scientific account of reality cannot be achieved without causality. This is why in his view atomism had to be provided with a solid basis in the Aristotelian theory of causality.

Investigation into Averroes' new physics is made very difficult by the nature of his writings. He did not devote a specific treatise to the presentation of his own ideas in natural philosophy. His innovative

views have to be retrieved from his commentaries on Aristotle's works, especially his three commentaries on Aristotle's *Physics*—the short, the middle, and the long commentary—where the explicit task of Averroes was to elucidate Aristotle's thought. Accordingly, Averroes' program is, in Glasner's words, an 'innovation by way of exegesis' [3]. It is not only the exegetical component as such that complicates the task of discovering the innovations introduced by Averroes. There is also the fact that the three *Physics* commentaries are extremely complex writings. As Glasner herself and other scholars have established, Averroes revised all three of them and more than once, so that they exist in different versions. The complexity of the textual tradition of Averroes' *Physics* commentaries cannot be neglected in the retrieval of his new physics. It is only through a comparative study of the extant versions of all three *Physics* commentaries that Glasner was able to unearth Averroes' new physics. Accordingly, before passing to the presentation of Averroes' new physics, in the first part of her book Glasner gives a detailed overview of the textual tradition of these writings. Although, as Glasner indicates, this part of her study may not be of immediate interest to historians of science, I think that it is of great methodological relevance for the historians of science too. It shows that accurate and deep textual studies are in some cases indispensable to discovering and assessing philosophical ideas.

The most salient sections of the first part of the book are those devoted to the different versions of the three *Physics* commentaries. For the short commentary (dated before 1159, and the only one extant in the original Arabic, and also extant in a Hebrew translation dated around 1250), there is direct evidence provided by the manuscripts of an early version (version A, written before 1159) and a late revision (version B, written after 1186) for the beginning of the first chapter of book 8. The Hebrew translation suggests that Averroes had modified version A too, possibly more than once, before writing the final version B. For the middle commentary (dated 1170, and extant in two Hebrew translations dated 1284 and 1316 respectively, and in the 16th-century Latin translation from the Hebrew), there is evidence of two versions of book 8, chapter 2. The two versions A and B of the middle commentary correspond to the two versions A and B of the short commentary, and are found in the 1284 and 1316 Hebrew translations respectively. The long commentary (commonly dated 1186, and extant in the 13th-century Latin translation

by Michael Scotus and in a 14th-century Hebrew translation) was the one most heavily revised, as the significant differences between the Latin and the Hebrew translations show. Glasner distinguishes two patterns of revision:

- editing, that is, brief additions and modifications, and
- rewriting, that is, more substantial revisions like the replacement of whole paragraphs by new ones and the addition of long passages.

The case of the long commentary is complicated by the fact that the two versions of which these revisions are witnesses do not correspond precisely to the distinction between the Latin and the Hebrew translations: editing and rewriting are present in both translations, although cases of editing are more numerous in the Hebrew, while long additions are more frequent in the Latin. The fact that no complete manuscripts of the original Arabic text have survived makes it impossible to attempt a precise reconstruction of how the two versions were transmitted in the Latin and Hebrew translations. Glasner's conjecture is that the two versions derive from one single manuscript of the Arabic text, transmitting the revisions of the new version in the margins and leaving copyists (and perhaps translators) to decide which of these marginal insertions to incorporate into the main text. This seems a sound hypothesis and Glasner gives some illuminating examples in its support. The significant extension of the revisions makes it possible, however, to individuate some distinctive features of the late stratum of the long commentary. According to Glasner, these are:

- the formal introduction to the commentary (present only in the Hebrew translation), a stylistic element which was adopted especially in the school of Alexandria in the fifth and sixth centuries;
- more extensive application of logic to natural science and in particular of syllogisms to formalize Aristotle's arguments (more frequent in the Hebrew translation); and
- significant use of the *Physics* commentary by Alexander of Aphrodisias.

It is this last feature that for Glasner is the more illuminating one. She suggests that what inspired Averroes in revising his long commentary was exactly his reading of Alexander's commentary.

What textual evidence does this complex system of revisions of the three *Physics* commentaries provide for Averroes' new physics?

In dealing with this question, Glasner focuses on Averroes' discussion of three arguments concerning motion: the 'succession argument' (*Phys.* 8.1); the 'divisibility argument' (*Phys.* 6.4); the 'moving-agent argument' (*Phys.* 7.1). The sections corresponding to these three arguments were heavily revised in all three *Physics* commentaries. Also, these sections show a similar exegetical pattern, the 'turning point pattern', as Glasner labels it. Averroes first points out that earlier commentators found difficulties in Aristotle's argument. He declares that he himself had initially followed the commentators and been puzzled by the argument. After a period of hesitation and intensive study the turning point occurred to him: he came to realize that the difficulties raised by the commentators did not reflect genuine problems; rather, they derived from a misunderstanding of Aristotle's intended meaning of the argument. Accordingly, he proposes a new interpretation which in his view avoids the difficulties found by the commentators and at the same time reflects the true meaning of Aristotle. These three turning points and the three new interpretations associated with them are the textual evidence for Averroes's new physics that Glasner presents. The second part of her study mainly consists of three chapters devoted to the three turning points respectively.

The first turning point, which is about the succession argument, is the most fundamental one, since in Glasner's view the innovation that Averroes intends to introduce with it is the 'breakdown of determinism'. The succession argument is presented by Aristotle in the opening chapter of book 8 in establishing the thesis of the eternity of motion. The point of the argument is that before any change there must have been a previous change. The argument seems to apply to temporally finite changes, that is, to changes in the sublunar world, and thus shows that sublunar changes are chained. Glasner argues that the relevant question for the issue of determinism is whether Aristotle means that the sublunar changes are essentially chained or only accidentally chained. If sublunar changes are essentially chained, then every change in the chain is determined by the changes preceding it; whereas there is no such determination in an accidental chain. There is not a clear-cut answer to this question in Aristotle's presentation of the argument. In *Physics* 5.2, however, he seems to deny an essential links between changes, making the explicit statement that

change of change is possible only accidentally. The Greek commentator Philoponus points out that Aristotle's view in *Physics* 5.2 is in contrast with the succession argument of *Physics* 8.1, thus implying that the succession argument shows that sublunar changes are essentially chained. Averroes at first defended the succession argument against Philoponus' objection. It is this defense that characterizes the early version (version A) of all three *Physics* commentaries. At a certain stage, however, Averroes re-examines the succession argument and gives a radically new interpretation of it (henceforth, interpretation B, following Glasner). The outcome of interpretation B is that the succession argument applies not to sublunar changes but to the first celestial motion, and proves that this motion is eternal. It is an argument *per impossibile*: the first celestial motion must be eternal because otherwise it would have been preceded by another motion, and this contradicts the assumption that the celestial motion is the first motion.

The most authoritative Scholastic commentator, Thomas Aquinas, dismissed interpretation B of Averroes as completely false (*omnino falsum*) because it contravenes both the actual words of Aristotle in *Phys.* 8.1 and the whole plan of *Physics* 8, given that Aristotle explicitly addresses the question of the eternity of the first motion later in that book. Aquinas seems to be right: it is hard to see how interpretation B can capture Aristotle's intention, despite Averroes' claim to the contrary. It is a departure from Aristotle's intention and not a faithful exegesis. It is a great merit of Glasner's approach to try to reconstruct the assumptions behind interpretation B and make sense of it. A crucial assumption is that sublunar changes are only accidentally and not essentially chained, though their succession is necessarily eternal, i.e., not interrupted. This latter condition implies that the sublunar changes are contiguous one to another. Contiguity, however, cannot be guaranteed by the accidental nature of a sublunar chain. It is guaranteed by the continuity of the celestial motion on which sublunar processes ultimately depend. As Glasner herself admits, the idea of a vertical order according to which the persistence of sublunar processes depends on the eternity of the celestial motion is not at all new. It is already suggested by Aristotle and commonly repeated throughout the Aristotelian tradition. She points out, however, that Averroes uses this idea to make a very innovative *negative* point, namely, that the persistence of the sublunar world cannot be

derived from considerations of the horizon, that is, from the causal structure of the chain of sublunar changes: it is not the case that the existence of a sublunar change is determined by the changes preceding it, as the succession argument seems to suggest. It is with this negative point that Averroes wants to rule out a deterministic reading of Aristotle's argument. In support of her reconstruction of interpretation B, Glasner adduces the suggestion that on this issue Averroes closely follows Alexander, who had used the idea of a vertical order against the determinism of the Stoics. Glasner also maintains that Aristotle's distinction between contiguity and continuity is very relevant to Averroes' indeterministic campaign. In her view, Averroes associates continuity to necessity and contiguity to possibility/contingency, and then posits that true continuity and, hence, necessity is possible only in the celestial region; whereas ordered sublunar changes are simply contiguous and not also continuous, failing in this way to have a deterministic structure. As has been pointed out earlier, this association is the crucial ingredient of Glasner's conjecture about the link between the three new ideas she ascribes to Averroes. However, it is not supported by adequate textual evidence and is not in itself very convincing. In particular, note that according to Aristotle any chain or collection of changes, just in virtue of the fact that it consists of numerically distinct changes, is not continuous; but the position of numerically distinct changes seems to leave the question of whether they are deterministically connected or not totally open.

The second turning point, which concerns the divisibility argument of *Physics* 6.4, introduces Averroes' innovation about the structure of motion, the 'breakdown of motion', in Glasner's words, that is, the breakdown of Aristotle's view that motion is continuous and its replacement with the view that motion is contiguous. In a first approximation, motion conceived as continuous is a homogeneous interval-like entity while motion conceived as contiguous is a heterogeneous entity such that the structures of the whole and of its parts are different. The divisibility argument belongs to Aristotle's discussion of the continuity of motion and establishes the divisibility of the body subject to motion (the mobile). This conclusion is inferred from the premise that during a change the mobile is partly in the initial state of the change (the *terminus a quo*) and partly in the final state of the change (the *terminus ad quem*), which implies that the mobile

has parts and, hence, that it is divisible. This argument has puzzled Aristotelian commentators of all eras because it does not seem to be valid in the case of instantaneous changes, typically generation and corruption, and some qualitative changes such as the illumination of a house (one of Averroes' examples). The body subject to an instantaneous change is indeed divisible but the premise of the divisibility argument only applies to temporal changes. Averroes reports the solutions attempted by Alexander, Themistius, and Avempace. He declares that for a long time he had followed the solution of Avempace but he has now come to abandon it. The general idea of his new solution is that instantaneous changes are not proper counterexamples to the divisibility argument because they are not proper (*per se*) changes but rather accidental changes. Only temporal changes are *per se* changes, whereas instantaneous changes are accidental changes because they are ontologically dependent on temporal changes: they occur as end points of temporal changes. For example, the illumination of a house is the end point of the temporal motion of a candle, and the substantial change from water to ice is the end point of the qualitative temporal change of cooling water. Averroes further describes a temporal change followed by an instantaneous change as a change such that its end point is of a different genus from that of the temporal change itself (e.g., the motion of a candle is a local motion, while the illumination of a house is an alteration). In Glasner's view, this description is the most compelling evidence offered by Averroes' new solution to the divisibility argument for the turning point from the continuous/homogeneous view to the contiguous/heterogeneous view of motion: a change followed by a change of a different genus is not a homogeneous entity but a heterogeneous one.

Glasner is aware that this evidence is not conclusive. One obvious problem is that nothing in Averroes' text suggests that all changes are heterogeneous in the way defined. On the contrary, Averroes explicitly distinguishes two kinds of *per se* change:

(1) those whose end points are of the same genus and
(2) those whose end points are of a different genus.

Glasner, however, maintains that for Averroes every change should be conceived as a heterogeneous entity and relies on other sections of Averroes' discussion of motion to substantiate this claim and also to arrive at a more precise understanding of the structure of motion as

contiguous entity. A major ingredient of Glasner's reconstruction is Averroes' position on the ontological status of motion in *Physics* 3—a position very well known to historians of Scholastic natural philosophy for its centrality in the Scholastic debate. Averroes introduces a distinction between a reductionist view and a realist view of motion. In the reductionist view, motion is not a thing in itself totally distinct from the formal determinations successively acquired by the mobile body during a change, whereas in the realist view motion is such a distinct thing. These two views were often referred to by the Scholastics as the flowing form (*forma fluens*) and the flow of a form (*fluxus formae*) views respectively. Averroes sides with the *forma fluens* view, that is, the reductionist view. He claims that the *forma fluens* view is the true one, whereas the *fluxus formae* view, although it is suggested by Aristotle in the *Categories*, does not reflect Aristotle's genuine thought. Glasner finds this distinction between two ontologies of motion very relevant to her project because she believes that while motion conceived as *fluxus formae* is basically a homogeneous/continuous entity, motion conceived as *forma fluens* is a heterogeneous entity. Indeed, the association between *fluxus formae* view and continuity is explicitly made by Averroes. Also, it is not immediately clear how the *forma fluens* view can be translated into a continuity theory of motion. Can then the *forma fluens* view be associated with the alternative theory considered by Glasner, that of the contiguity of motion? Glasner tries to argue for a positive answer. It is puzzling, however, that she does not take into account a serious obstacle to the association of the *forma fluens* view with the contiguity theory of motion. The description of motion as a contiguous/heterogeneous entity in the turning point of *Physics* 6 is in contradiction with the kind of reductionism that Averroes explicitly advocates in his presentation of the *forma fluens* view in *Physics* 3: the heterogeneous change of *Physics* 6 is such that its end is of a different genus from the change itself, whereas motion as *forma fluens* is an entity of the same genus as the form that is its end point (with an example of Averroes *ire ad calorem est calor quoquomodo*), that is, an entity homogeneous to its final form. Accordingly, the *forma fluens* view is echoed in the turning point of *Physics* 6, but it is associated with the other class of *per se* changes distinguished by Averroes, namely, (1) those whose end points are of the same genus as that of the change.

The third turning point, which is about the moving agent argument of *Phys.* 7.1, introduces the 'breakdown of physical body', that is, the breakdown of Aristotle's view that natural bodies are continuous, i.e., divisible *ad infinitum*, and its replacement with an atomistic view according to which natural bodies are composed of minimal parts (*minima naturalia*). The moving agent argument in which Averroes' innovation most explicitly appears does not belong to Aristotle's theory of continuity but to the causal account of motion; and it establishes the conclusion that everything which is moved is moved by something else, a fundamental step in Aristotle's proof of the existence of an immobile mover. The relevant part of the argument is the premise that a body moved essentially (*per se*) is such that its motion comes to an end if the motion of one of its parts comes to an end. The idea underlying this premise is that a body essentially moved has such a strong unity that it can only move as a whole. What is the physical entity to which this strong unity belongs and to which essential motion can be attributed? This is the controversial question for Averroes.

As Glasner argues, the main source of Averroes in this controversy is Alexander's *Refutation of Galen's Treatise on the Theory of Motion*, which was available to him in Arabic translation. Alexander argued that the physical entity to which essential motion is to be ascribed is the simple body, which he regards as a true homoeomer, that is, a body such that its parts are of the same nature of the whole and, hence, not other than the whole. Galen criticized Alexander's conclusion that in simple bodies parts are not other than the whole, pointing out that also in these bodies there is a distinction between a whole of parts and only a part, and provided a more careful analysis of what essential motion is. While Alexander did not provide a definite answer to the question about the physical subject of essential motion, Averroes does provide it and, in Glasner's view, by doing so, he pursues Alexander's ideas.

Averroes formulates his answer in terms of the first moved entity, and maintains that the first moved entity in a natural body is the minimal part of it. For example, in the case of water, the first moved entity is the minimal part of water, that is, a part of water so small that no smaller part can take on the form of water. In Averroes' view, these minimal parts do exist in fact in a natural body: they are actual particles, so to speak, and not simply theoretical limits to division.

Averroes is aware that positing minimal parts of natural bodies is in conflict with Aristotle's view that natural bodies are continuous, that is, infinitely divisible so that any given part can be further divided. He tries to resolve this contrast by distinguishing between a natural body considered *qua* natural and a natural body considered *qua* continuum/quantity: considered *qua* natural a natural body contains minimal parts, but considered *qua* continuum is infinitely divisible. This exegetical strategy is also common among Scholastic supporters of the theory of *minima naturalia*. As Glasner rightly emphasizes in her assessment of this strategy, in Averroes' reading Aristotle's theory of the continuum turns out to be valid only for the abstract realm of geometry and not also for the physical world. On the other hand, the atomistic structure of the physical world proposed by Averroes is still deeply Aristotelian in that the minimal units are essential units composed of matter and form and subject to natural motion.

Of fundamental importance for tracing Averroes' intellectual biography is to establish when exactly the three turning points occurred. Glasner carefully investigates this difficult issue. Especially in the case of the first and second turning points, the middle commentary and the long commentary provide conflicting evidence and give rise to two possible accounts: the turning points occurred either

(1) when Averroes was writing the middle commentary, that is, around 1170 or
(2) when he was writing the long commentary in the 1180s.

Glasner's very well argued conclusion is that (2) is more plausible.

Glasner's book is an ambitious attempt to establish the innovative character of Averroes' natural philosophy, but I think that it is only partially successful. It does show that Averroes, like many 13th-century commentators after him, rejected the Aristotelian assumption that natural bodies are continuous and replaced it with an atomistic theory. It fails to show convincingly, however, that Averroes had an analogous atomistic view of motion and that his atomism was inspired by a concern to find a scientific basis for indeterminism. Despite these shortcomings, Glasner's investigation has the great methodological merit of being based on an extensive and detailed study of the very intricate textual tradition of Averroes' commentaries on Aristotle's *Physics*.