NAZARİYAT RESEARCH ARTICLE

Why Does a Thrown Stone Move? The Construction of Violent Inclination as Quality in Ibn Sīnā*

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Abstract: Aristotelian natural philosophy encountered a theoretical impasse in explaining the motion of projected bodies (discontinuous compulsory motion) due to the principle of contact between mover and moved. Islamic philosophers rejected an explanation that attributed a carrier role to air on the grounds of inconsistency. This article argues that Ibn Sīnā's theory of *violent inclination* (*al-mayl qasrī*), developed to overcome this crisis, constitutes a radical intervention into the ontology of motion. The study analyses how Ibn Sīnā differentiates his concept of *mayl* from the theory advanced by Yaḥyā al-Naḥwī (John Philoponus, d. 570). Whereas Philoponus construed the internal force as a transient power that exhausts itself, Ibn Sīnā redefined *mayl* as a permanent quality (*kayfiyya*) conjoined to the body and preserved by it. By arguing that motion would continue indefinitely in a void in the absence of external resistance, Ibn Sīnā demonstrates that inclination is intrinsically enduring. Consequently, he transforms motion from a temporary process dependent upon an external force into a qualitative state of being sustained by the body itself.

Keywords: Islamic Philosophy, Aristotle, John Philoponus, Ibn Sīnā, Forced Motion, Impetus Theory.

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Introduction

The subject of motion is among the issues occupying a central position within natural philosophy. The cause of a given object's sustained motion has remained a fundamental problem in natural philosophy from antiquity to modern science. Subsequent to Aristotle's investigation of the matter of motion within natural philosophy, his commentators and Islamic philosophers also addressed this subject, specifically within the framework of the causal nexus between the moved and the mover. The requirement of contact between the agent and the body for the continuity of motion does not pose a problem in the explanation of natural motions; however, the Peripatetic system faces a profound crisis and a philosophical impasse regarding the motion of a thrown stone or of an arrow shot from a bow.

This impasse originates from the Aristotelian physical principle that "everything that is moved is moved by another" (*omne quod movetur ab alio movetur*)[1], which necessitates a mover in constant contact with the moved object. While this principle appears consistent in natural motions or the motion of living beings, in the case of separate forced motion, the body should cease its movement the moment it is detached from the agent (*muḥarrik*), since the principle of motion vanishes as soon as contact is severed. However, empirical experience demonstrates that the body continues its motion. The thesis of *antiperistasis*, to which Aristotle appealed to explain this situation—suggesting that a medium, namely the air, transforms into a carrying force—was found inconsistent and rejected within the tradition of Islamic philosophy. In Aristotelian physics, air is a medium that offers resistance to the motion of a body. The air acting as both an obstacle resisting motion and an impulsive force enabling motion constitutes a logical contradiction.

This article argues that Ibn Sīnā's theory of *al-mayl al-qasrī* (violent inclination) constitutes a significantly more important, original, and constitutive step on the path toward the modern principle of inertia by diverging from the impetus theory of his predecessor, Yaḥyā al-Naḥwī (John Philoponus, d. 570), through the idea of the permanence of *mayl*. The study claims that Ibn Sīnā distinguished the concept of *mayl* from the model of a "self-exhausting temporary force" proposed by Philoponus;

1 For an investigation into the implications of this principle, see James A. Weisheipl, "The Principle Omne Quod Movetur Ab Alio Movetur in Medieval Physics," *Isis* 56, no. 1 (1965): 26–45, http://www.jstor.org/stable/228456.

instead, the study asserts that he reconstructed it as a permanent "quality" (*kayfiyya*) appended to the body, preserved by the nature of the body, and persisting in its existence unless encountered by an external obstacle (resistance).

Literature Review and the Position of the Problem

The theory of motion and Ibn Sīnā's doctrine of violent inclination (*al-mayl al-qasrī*) constitute a considerable field of debate within the history of Islamic philosophy and the history of science. When modern studies on the subject are examined, it is observed that researchers generally focus on the points of Ibn Sīnā's departure from Aristotelian physics of motion and his historical precedent regarding the modern principle of inertia.

Among the leading works in the Turkish literature that address the subject directly with current data is the 2025 research article by Karani Kağan Badem published in the journal *MetaScientia*. In this study, titled "The Historical Development of the Concept of Impetus: A History of Science Analysis Through Avicenna," Badem argues that contrary to the dominant historiography of science, Ibn Sīnā provided a consistent framework for explaining separate forced motion centuries before Buridan. By reading the concept of *mayl* in Ibn Sīnā through a formulation proportional to weight and velocity, the author points to a structure that anticipates Newton's second law.[2]

One of the most comprehensive works in terms of the comparative analysis of the subject is Esra Belgeli's master's thesis titled "Aristoteles, John Philoponus ve İbn Sînâ Fiziğinin Zorlamalı Hareket Üzerinden Karşılaştırmalı İncelenmesi." By addressing the historical trajectory of the problem of forced motion through the convergence of these three figures, Belgeli demonstrates in detail how Ibn Sīnā diverged from both Aristotle's medium theory and Philoponus' exhausting force approach. This study provides a significant common ground of inquiry for the triple comparison that forms the main outline of the current article.[3]

2 Karani Kağan Badem, "The Historical Development of the Concept of Impetus: A History of Science Analysis Through Avicenna [Impetus Kavramının Tarihsel Gelişimi: İbn Sînâ Üzerinden Bilim Tarihi Analizi]," *MetaScientia: Journal of the History and Philosophy of Science* [*MetaScientia: Bilim Tarihi ve Felsefesi Dergisi*] 1, no. 1 (2025): 33–51, doi:10.5281/ZENODO.15783856.

3 Esra Belgeli, "A Comparative Investigation of the Physics of Aristotle, John Philoponus, and Ibn Sīnā

Ayşe Betül Dönmez, who focuses on the physics of Ibn Sīnā, analyzed the definition of motion within the axis of the Aristotelian theory of potentiality and actuality in her master's thesis titled "İbn Sîna Felsefesinde Hareket Kavramı."[4] She analyzed the definition of motion within the axis of the Aristotelian theory of potentiality and actuality,[5] arguing that although Ibn Sīnā approached modern mechanics with his theory of impetus (*mayl*), his conceptual framework was still confined within the boundaries of the Peripatetic tradition.[6]

One of the most recent contributions regarding the ontological dimension of the subject is Mehmet Aydın's 2025 article titled "İbn Sînâ Felsefesinde Hareketin Varlığı ve Mahiyeti," published in the *Journal of Dokuz Eylül University Faculty of Theology*. Aydın states that, in investigating motion, Ibn Sīnā—unlike Aristotle—focused on the subject (*mawḍūʿ*) in which generation occurs and grounded the reality of motion in the external world through this subject.[7] This finding strengthens the idea that motion is not merely a process, but a perfection (*kamāl*) occurring upon the subject.

Regarding the debates on space and void as the ground where motion occurs, the article by Ömer Faruk Erdoğan titled "Fârâbî ve İbn Sinâ Felsefesinde Boşluk/Halâ Kavramı" stands out.[8] In it, Erdoğan demonstrated the relationship between the arguments Ibn Sīnā used while rejecting the idea of the void (*ḫalā'*) and the concepts of continuity of motion and resistance. Ibn Sīnā's inference that motion would be infinite in the absence of resistance is discussed in modern literature as a significant step on the path toward the principle of inertia.[9]

Through Forced Motion [Aristoteles, John Philoponus ve İbn Sînâ Fiziğinin Zorlamalı Hareket Üzerinden Karşılaştırmalı İncelenmesi]" (MA thesis, Fatih Sultan Mehmet Vakıf University, 2021).

4 For a recent study, see İzzet Gülaçar, *İbn Sina'nın Tabiat Felsefesinde Hareket* (Ankara: Elis Yayınları, 2022).

5 Ayşe Betül Dönmez, "The Concept of Motion in the Philosophy of Ibn Sīnā [İbn Sîna Felsefesinde Hareket Kavramı]" (MA thesis, Marmara University, 2009).

6 Dönmez, "The Concept of Motion," 7.

7 Mehmet Aydın, "The Existence and Quiddity of Motion in Avicenna's Philosophy [İbn Sînâ Felsefesinde Hareketin Varlığı ve Mahiyeti]," *Dokuz Eylül Üniversitesi İlahiyat Fakültesi Dergisi*, no. 62 (2025): 116–31, doi:10.21054/deuifd.1744608.

8 Ömer Faruk Erdoğan, "The Concept of Void/Nothingness in al-Fārābī and Ibn Sīnā Philosophy [Fârâbî ve İbn Sinâ Felsefesinde Boşluk/Halâ Kavramı]," *Journal of Islamic Research* 30, no. 1 (2019): 92–111, https://www.islamiarastirmalar.com/journal_article/farabi-ve-ibn-sina-felsefesinde-bosluk-hala-kavrami-the-concept-of-void-nothingness-in-al-farabi-and-ibn-sina-philosophy/.

9 On Ibn Sīnāian principles regarding the rejection of the void, see Erdoğan, "The Concept of Void," 103–9.

In Western literature, Fritz Zimmermann's study titled "Philoponus' Impetus Theory in the Arabic Tradition" emphasized the historical continuity in the transition of this idea to the Latin Scholastics by associating Ibn Sīnā's concept of *al-mayl* with Philoponus' concept of *rhopē*.[10]

Despite this richness, studies in the existing literature have concentrated more on the mechanical function or the historical trajectory of the concept of violent inclination than on the status of this concept within the category of quality in Ibn Sīnā's ontology. The solution this status brings to the problem of the continuity of motion has thus not been sufficiently discussed, particularly the attribute of permanence. Building upon Belgeli's historical comparison and Badem's and Erdoğan's physical analyses, this study proposes to reread violent inclination as an ontological "quality" appended to yet preserved by the nature of the body, rather than as a force consisting merely of a mechanical function. Furthermore, the study aims to position Ibn Sīnā's physics of motion within its original philosophical ground.

1. The Nature of Motion

The problem of motion, which lies at the centre of natural philosophy, primarily requires the definition of what motion is and in which categories it occurs. The Peripatetic tradition addressed motion as a process of becoming rather than a state. Indeed, according to Ibn Sīnā, motion is "the first perfection of that which is in potency insofar as it is in potency."[11] This definition indicates that motion is an intermediate realm of existence standing between a completed act and potency.[12]

10 Fritz Zimmermann, "Philoponus' Impetus Theory in the Arabic Tradition," in *Philoponus and the Rejection of Aristotelian Science*, ed. Richard Sorabji (London: University of London Press, 1987), 161–69.

11 Ibn Sīnā, *Al-Shifāʾ: Al-Ṭabīʿiyyāt: Al-Samāʿ al-Ṭabīʿī* [*The Healing: Natural Philosophy: Physics*], ed. Saʿīd Zāyid (Cairo: al-Hayʾat al-ʿĀmmah li-Shuʾūn al-Maṭābiʿ al-Amīriyyah, 1983), 81–82; Ibn Sīnā, *ʿUyūn al-ḥikmah*, 2. (Kuwait; Beirut [Lebanon]: Wakālat al-Maṭbūʿāt; Dār al-Qalam, 1980), 18. Ibn Sīnā adds the following to this definition elsewhere: "It is the emergence from potency into actuality. However, this emergence does not occur in a single instant." Ibn Sīnā, "Al-Risālah Fiʾl-Ḥudūd," in *Tisʿu Rasāʾil Fiʾl-Ḥikmah Waʾl-Ṭabīʿiyyāt* (Cairo: Dār al-ʿArab, 1984), 2:91–92.

12 For a detailed analysis of the subject, see Fevzi Yiğit, "The Potentiality-Actuality Theory in Avicenna [İbn Sînâ'da Kuvve-Fiil Teorisi]," *Bozok Üniversitesi İlahiyat Fakültesi Dergisi* 26, no. 26 (2024): 43–66, doi:10.51553/bozifder.1527477. See also İzzet Gülaçar, "The Theorisation of Motion in Ibn

In establishing the ontology of motion, Ibn Sīnā distinguishes between its reality in the external world and its construction in the mind.[13] According to him, motion is considered in two ways. The first is motion considered as a process extending from the beginning to the end (*bi-maʿnā al-qatʿ*). According to Ibn Sīnā, this framing is a mental construction. Since the past parts of motion have ceased to exist and the future parts have not yet come into being, motion does not exist as a whole in the external world. The second is motion considered in the sense of the intermediate state (*tawassuṭ*), which possesses the actual status of existence. Ibn Sīnā defines this state as a constantly renewed condition (*ḥālat al-mutawassiṭa*) between the starting and ending points, where the object is in neither pure potency nor pure act. This intermediate state is a single, unchanging attribute necessarily accompanying the moved object as long as the latter remains in motion.[14] Consequently, motion is an ontological state of becoming that resides in the object like a quality. This determination forms the origin of the thesis that violent inclination, to be discussed later, is a preserved quality in the object rather than a temporary impulsive force. Therefore, just like time, all parts of motion cannot exist simultaneously. In this sense, motion signifies a process.

When we turn from the definition of motion to its source, the fundamental distinction is the question of whether the principle of motion resides within or outside the body. In classical physics, this distinction gives rise to the categories of natural and forced motion. In the Aristotelian understanding of nature, every natural body possesses its own specific motion. This motion, which we term "natural," is not forced (*qasrī*) motion or a motion contrary to the nature of that body. However, when a situation contrary to the nature of the body occurs, the causal chain changes. If a body moves despite the absence of an ongoing natural motion, this is due to a non-natural cause; the resulting motion is termed "forced motion."[15]

Sīnā in the Context of the Relation Between Potentiality-Actuality [Kuvve-Fiil İlişkisi Bağlamında İbn Sînâ'da Hareketin Temellendirilmesi]," *Eskiyeni*, no. 56 (2025): 285–308, doi:10.37697/eskiyeni.1599631.

13 Aydın, "The Existence and Quiddity of Motion," 124–25.

14 Ibn Sīnā, *Al-Shifāʾ*, 83–85.

15 Aristoteles, *On the Heavens*, trans. William Keith Chambers Guthrie (London: Loeb Classical Library, 1986), 271.

This distinction is of vital importance for the positioning of the principle of motion. As Aristotle states in the *Physics*, that which carries the principle of motion within itself accidentally (*per accidens*), rather than being the principle of motion on its own, is the nature or the essence of the body.[16] In natural motion, the agent is the nature within the body. According to Aristotle, nature is the internal (*en*) source (*arkhê*, *aitia*) and cause of motion (*kineisthai*) or rest (*êremein*).[17] However, the situation differs if the source of motion resides in an agent acting upon the body from the outside, rather than in the nature of the body itself. According to the Aristotelian definition, if the starting principle of motion is not in the body itself but in an external agent, and the moved object does not contribute to this process through its nature, instead being subjected to it, the resulting motion is termed "violent" or "unnatural motion."[18]

Inheriting these distinctions from his predecessor, Ibn Sīnā subjects the principles of motion (*mabādi'*) to a more systematic classification based on the location and character of the source. According to his system, a body's principle of motion is either external or internal to its essence. If the principle is outside the body, this external agent is called a "compeller" (*qasīr*); the resulting motion, which is contrary to the nature of the body, is termed "violent motion" (*qasrī*). If the principle resides within the body, motion is divided into two categories according to the factor of will: if motion originates from the inherent structure of the body without will (through subjugation, *taskhīr*), the principle is nature (*ṭabī'a*),[19] and the motion itself is called "natural

16 Aristotle, "Physics," in *Complete Works of Aristotle*, vol. 1, *The Revised Oxford Translation*, ed. Jonathan Barnes, trans. Robert Purves Hardie and Russell Kerr Gaye, 6th edition, Bollingen Series LXXI 2 (Princeton; Chichester: Princeton University Press, 1995), 2: paras 192b10-15.

17 Richard Sorabji, "Nature and God: Two Explanations of Motion in Aristotle," in *Matter, Space and Motion* (London: Duckworth, 1988), 219.

18 Aristotle, "Physics," paras 254b12-15, p. 425. Based on Aristotle's remarks in *Physics* 8.4, Sorabji hesitates to state that any body moves alone with the principle of motion called nature. According to him, Aristotle expressed an idea here that could be understood as the exact opposite of his previous statements. Sorabji suggests that Aristotle, perhaps by agreeing with Plato's principle that every mover requires a mover, intended to create space for God's disposition over matter. Consequently, a stone does not fall merely by its nature without external assistance; rather, God is assigned a role as the cause of motion of the spheres moved by Him. This role inevitably manifests in sublunary beings. Sorabji, "Nature and God," 219.

19 According to Ibn Sīnā's definition in *al-Ḥudūd*: "Nature is the first principle of motion in that in which it is, essentially, and of rest likewise essentially. Generally stated, nature is the principle of every kind of essential change and essential permanence." Ibn Sīnā, "Al-Risālah Fi'l-Ḥudūd," 86.

motion."[20] If motion occurs accompanied by will and power, its principle is the soul (*nafs*), and the motion is thus identified as "psychic" (*nafsānī*) or "voluntary motion."[21]

Motion is thus examined within two primary categories in the works of Ibn Sīnā and Aristotle: natural and non-natural motion. Natural motion is the motion inherent in simple bodies themselves, while non-natural motion is termed "violent." Ibn Sīnā further elaborates this scheme based on the state of consciousness of the motion's source. He divides non-violent motion emanating from a mover into natural motion and psychic and/or voluntary motion.[22] Ibn Sīnā's account of motion thus contains three forms: natural motion, violent motion, and voluntary motion.

This theoretical framework around the source of motion is substantiated through the theory of elements (*al-ʿanāṣir*). According to Ibn Sīnā, the principle that moves living beings is their souls. The principle providing the motion of simple bodies (*al-ʿanāṣir*) devoid of will and consciousness is their nature. This natural theory refers to the four elements (*al-ʿanāṣir al-arbaʿah*) of which all bodies in the universe are composed. Each of these elements, by virtue of its nature, tends toward a specific position in the universe—technically termed its "natural place" (*al-ḥayyiz al-ṭabīʿī*). *Ḥayyiz* is the place appropriate to the body's nature, to which the body attempts to return when forcibly separated, and in which the body finds rest upon arrival.[23] Consequently, mo-

20 See Selime Çınar, "İbn Sînâ'da Doğa Kavramı" (PhD diss., Marmara University, 2023), 131 ff; Andreas Lammer, "Defining Nature: From Aristotle to Philoponus to Avicenna," in *Aristotle and the Arabic Tradition*, ed. Ahmed Alwishah and Josh Hayes (Cambridge: Cambridge University Press, 2015), 121–42, doi:10.1017/9781316182109.008.

21 Ibn Sīnā, *Al-Shifāʾ*, 29, 301–2; Ibn Sīnā, *ʿUyūn al-ḥikmah*, 18; For a more detailed analysis of this classification, see Gülaçar, "The Theorisation of Motion in Ibn Sīnā in the Context of the Relation Between Potentiality-Actuality [Kuvve-Fiil İlişkisi Bağlamında İbn Sînâ'da Hareketin Temellendirilmesi]," 293–94.

22 Ibn Sīnā, *ʿUyūn al-ḥikmah*, 29.

23 Ibn Sīnā grounds the ontological necessity of natural motion through the concept of *ḥayyiz* (natural place). According to his analysis in *al-Samāʿ al-ṭabīʿī*, natural motion is essentially a flight (*nafār*) from a location and a goal-oriented direction (*qaṣd*). This direction (the intended place) must have a boundary that physically exists and is pointable (*mushārun ilayh*). This natural boundary or place toward which the body tends by its nature, finds rest in upon arrival, and does not leave unless acted upon by an external influence is called *ḥayyiz*. He justifies the requirement of a direction/*ḥayyiz* for natural motion as follows: "Natural motion is to leave a direction and to tend toward a direction […] That which is left must be the opposite of that which is intended by nature. For natural leaving is a natural flight […] It is necessary that this direction toward which it tends be an existing thing […] and it must have a pointable position (*waḍʿ*)." Ibn Sīnā, *Al-Shifāʾ*, 127–29.

tion begins with the departure of the body from its natural *ḥayyiz* and terminates upon reaching it. Ibn Sīnā exemplifies this hierarchy in the following examples.

The definition of fire (*nār*). Its nature is a simple mass which is hot, dry, and moving naturally away from the center, in order to be firmly settled under the sphere of the moon [while]. The definition of air (*hawā'*). Its nature is a simple mass that is hot, moist, transparent, and delicate, moving to the place which is under the sphere of fire, and above the sphere of earth and water.[24]

Similarly, heavy elements tend toward the center: "Water (*mā'*). Its nature is a simple substance that is cold, wet, and transparent, moving toward the place which is under the sphere of air and above the sphere of earth,"[25] while earth is "a simple substance that is cold, dry, and moving toward the center, subsiding in it."[26]

Consequently, two of the four elements—fire and air—move upward by their nature, while the other two—water and earth—move downward, also by their nature.[27] The ultimate goal of the motion in each case is to reach rest. These motions continue until an element encounters no obstacle relative to other elements and finds its place in the universe. In Aristotelian cosmology, this situation limits the causes of motion. Thus, Aristotle explained the upward or downward motion of any body by virtue of its nature in three ways: first, the nature inherent to the body; second, the removal of that which prevents the continuation of motion (obstacle-remover); and third, the natural place of the rising or falling object.[28]

In conclusion, natural motion is the journey of a body back to its own natural place. Motion terminates once the journey is complete. Since the motions of every body in the universe are aimed at finding their specific natural places and thus continue until those places are reached, the state of rest constitutes the essential condition of the body. Ultimately, motion signifies a temporary process, as Aristotle af-

24 Kiki Kennedy-Day, *Books of Definition in Islamic Philosophy: The Limits of Words* (London: Routledge, 2003), 109.

25 Kennedy-Day, *Books of Definition*, 109.

26 Kennedy-Day, *Books of Definition*, 109.

27 Ibn Sīnā, *'Uyūn al-ḥikmah*, 31–32.

28 Sorabji, "Nature and God," 222.

firmed.[29] However, the explanation he required, based on temporality and natural place, loses its explanatory power when a body is thrown contrary to its natural place and continues to move despite the cessation of contact with its agent. This is the point of crisis at which Aristotelian physics reaches an impasse, a crisis that Ibn Sīnā would resolve through the theory of violent inclination.

2. The Theory of al-Mayl al-Qasrī

Investigations conducted concerning the source of motion within classical natural philosophy were established upon the distinction between how the moving principle manifests in animate versus inanimate beings. In the thought of Aristotle and Ibn Sīnā, the voluntary motions of animate beings are grounded through the concept of the soul (*psukhē*). For the principle of motion in inanimate bodies, a differing conceptual framework was required. To explain the motion of inanimate beings, Ibn Sīnā centred the theory of inclination (*mayl*), which signifies a tendency either inherent in the nature of the body or acquired subsequently. When a conceptual archaeology is performed, the roots of the theory of inclination are visible in the Greek concept of *rhopē*. Indeed, Yaḥyā al-Naḥwī frequently utilised this concept in his Aristotelian commentaries in the sense of "an impulsive force," which would later evolve into the technical term "impetus" within Latin Scholasticism.[30]

In Aristotelian dynamics, the weight or lightness of a body as the moving power and the density of the medium that offers resistance to the motion—that is, the resistance—are taken into account in accounting for the body's speed. However, in

29 Şahap Demirel, "İbn Sînâ ve Kasri Meyil Kuramı," in *Uluslararası İbn Sînâ Sempozyumu Bildirileri*, ed. Müjgân Cunbur and Orhan Doğan (Ankara: Kültür ve Turizm Bakanlığı, 1984), 354.

30 When the fundamental dynamics of Aristotelian physics are examined, the distinction between natural motion and forced motion is determinant. According to Aristotle, bodies that move naturally by their nature attempt to reach their natural places by means of the *rhopē* (inclination) inherent within them, as long as they are not in their natural places and no hindering or compelling effect acts upon them. The factor of speed in this process is associated with the weight of the body and the density of the medium. During natural motion—or to put it another way, when approaching the natural place—the speed of the body is an inverse function of its weight if the body moves downwards, its lightness if it moves upwards, and the resistance of the medium through which it moves. See Zimmermann, "Philoponus' Impetus Theory," 161 ff.

the case of forced motion, which is contrary to the nature of the body, these internal principles remain insufficient and the presence of an external influence, namely a mover (*muḥarrik*), becomes mandatory, since the motion of the body can only be realised through the influence of an external force.

In Ibn Sīnā's terms, *i'timād* or—by its common usage—*mayl*[31] signifies a physical orientation. According to Ibn Sīnā, *mayl* is an inherent quality (*kayfiyya*) or state that expresses the condition of resisting that which prevents the motion of a given body in a specific direction.[32] This definition is significant as it indicates an internal state possessed by the body during motion, providing a contrast to approaches that seek the cause of motion outside the body.

Proceeding from the foregoing, the fundamental problem to be emphasised under this heading is the question of how any thrown body continues its motion after separating from the initial mover (the hand or the bow, for instance). In the Peripatetic tradition, the answer to this question would be addressed in a process evolving from Aristotle's explanation centering the medium (air) to Ibn Sīnā's theory attributing an inherent quality (*al-mayl al-qasrī*) to the body.

2.1. Aristotle's View: The Transitiveness of the Medium and the Contact Paradox

Aristotle's natural philosophy is established upon a model of a finite universe.[33] In this universe, which is characterised by a total *plenum*, the existence of an absolute void (*kenon*) is rejected.[34] Consequently, encountering a vacuum stripped of matter at any point in the universe is impossible. Another fundamental component of this cosmological structure is the continuity of motion.[35] According to the Aristotelian theory of natural motion, if a body is subjected to a violent motion contrary to its

31 For a separate study on the subject, see Yasemin Holoğlu Akdoğan, "Erken Dönem Basra Mu'tezile Kelâmında İ'timâd Teorisi" (PhD diss., Marmara University, 2024).

32 Kennedy-Day, *Books of Definition*, 111; Jon McGinnis and David Reisman, *Classical Arabic Philosophy: An Anthology of Sources* (Indianapolis: Hackett Publishing, 2007), 171.

33 Aristotle, "Physics," paras 204a7-206a8.

34 Aristotle, "Physics," paras 213a12-214b11.

35 Aristotle, "Physics," paras 267a21.

own natural inclination, the presence of an external force acting continuously upon the body is mandatory for the realisation and persistence of this motion.[36]

In light of these principles, the question of how a thrown body continues its motion after departing from the hand constitutes one of the greatest impasses of the Aristotelian system. Aristotle did not utilise the concept of *rhopē* (the Greek equivalent of *mayl*) in his texts in the sense of a "moving quality," as Ibn Sīnā would later construct in his theory of *al-mayl al-qasrī*.[37] Nevertheless, in his attempt to explain this phenomenon, Aristotle pushed the boundaries of the system and discussed the subject through a specific problematic: the moment a body is released by the thrower, the contact between the mover and the body is severed. However, according to Aristotelian physics, the presence of a mover in continuous contact with the moved object is a prerequisite for the existence of forced motion.[38]

At this point, two possibilities emerge: either the body moves in a vacuum without the influence of an external force—which is impossible due to Aristotle's rejection of the void[39]—or there is another agent acting upon the body. Furthermore, the assumption of motion in a vacuum brings about a logical contradiction. According to Aristotle, in the absence of a medium offering resistance, a body must move with infinite speed. This situation implies the existence of infinite motion in a finite universe, which would require the body to be at the starting point and the destination (at infinity) simultaneously. This conclusion is absurd.[40]

36 Aristotle, "Physics," paras 241b34, 243a32-35; Badem, "The Historical Development," 34–36.

37 Aristotle uses the concept of *rhopē* (ῥοπή) in *On the Heavens* (*De Caelo*) and *Physics*. However, in Aristotelian terminology, this concept is not a moving power added to the body from the outside (*al-mayl al-qasrī/impetus*), but a tendency to move toward its natural place due to the weight or lightness of the body. For example, in *On the Heavens*, *rhopē* is used synonymously with weight (*barytēs*) in the sense of a scale pan tilting downward or the "downward momentum/inclination" of a body. See Aristotle, "On the Heavens [De Caelo]," in *Complete Works of Aristotle*, trans. John Leofric Stocks, paras 297a27, 308a29-33; Therefore, instead of being understood as a driving motor power causing motion, *rhopē* in Aristotle is understood as a manifestation of natural motion. See also Salih Günaydın, "Fahreddîn er-Râzî'nin Düşünce Sisteminde Mekân Kavramı" (MA thesis, Marmara University, 2013), 58.

38 Aristotle, "Physics," paras 166b31-35.

39 Aristotle, "Physics," paras 213a12-214b11.

40 Aristotle, "Physics," paras 266b7-23.

In summary, Aristotelian physics bases motion upon the ratio between a continuously present moving power and a resistance opposing the motion. Since there can be no resistance in a vacuum, motion is likewise impossible. Acceleration occurs through either the decrease of resistance or the increase of the moving power. Natural motion is the orientation of natural bodies (heavy ones downwards, light ones upwards) toward their natural places. Forced motion, in contrast, is the state in which the principle of motion resides in an external agent instead of the nature of the body; the body does not contribute to this motion by its nature but resists it. Projectile motion is a typical forced motion and, as a rule, thus requires the maintenance of material contact between the mover and the body.[41]

Although theories of impetus (acceleration/*mayl*) were discussed on an experimental basis in later periods, these concepts were a theoretical construct rather than an empirical fact in the classical period. Such theories of impetus express a speculative dynamic requiring a causal process and a moving power that can be exhausted, which dissipates at the end of the motion.[42] During projectile motion, the severance of the connection between the thrown body and the thrower is a situation difficult for Aristotle to explain, because the two fundamental axioms of his system (the impossibility of motion without force and the necessity of continuous contact) appear to contradict projectile motion's very possibility. Why does the body not stop after leaving the hand and instead continue its motion?[43] Since the initial mover (the hand) is no longer contiguous with the body, the motion of the body is theoretically impossible.[44]

To resolve this paradox, Aristotle proposes a mechanism in which the medium (air) through which the body is moving assumes an active role. According to him, when a thrown body leaves the hand, the force initially applied to the body moves not only the body but also the surrounding medium (air). When the thrower ceases to apply force to the body, the air, which has acquired the capacity to move, continues to carry the body. In this process, motion is transmitted successively from one layer of air to another. However, this motion is not infinite; whenever the power trans-

41 Marshall Clagett, "Some General Aspects of Physics in the Middle Ages," *Isis* 39, no. 1/2 (1948): 40, https://www.jstor.org/stable/226766.

42 Michael Wolff, "Philoponus and the Rise of Preclassical Dynamics," in *Philoponus and the Rejection of Aristotelian Science*, 126.

43 Aristotle, "Physics," paras 267a19-20.

44 Aristotle, "Physics," paras 266b31-34.

ferred to the air by the initial mover is defeated by air's own resistance, the motion terminates. Therefore, instead of the continuous influence of a single agent, there is a chain effect of successive movers (layers of air).[45]

In short, the Aristotelian solution is this: during *al-mayl al-qasrī*, the thrower transfers its power of moving to the medium (the air) in addition to acting directly upon the body. This power transferred to the air is a derivative of the force at the moment of throwing and satisfies the "continuous contact" condition between the body and the force via the intermediary air. Thus, after the body leaves the hand, it continues its motion by being pushed by the air. When the power of the medium weakens, the body reaches rest.

This Aristotelian theory is diametrically opposed to the principle of inertia in modern physics. While the principle of inertia accepts motion as a state preserved by the body, Aristotelian dynamics views motion as a process that must be nourished by an agent at every moment. Consequently, Aristotle designed motion not as a characteristic belonging to the nature of the body, but as a compulsion that must be maintained moment by moment by an external power. This ontological acceptance necessitated that the air surrounding the body intervene as a driving force applying continuous pressure for the thrown body to continue its motion.[46]

This theoretical impasse in Aristotelian dynamics' capacity to explain projectile motion—particularly due to the medium's ambivalent role—inevitably triggered a search for new explanations. Inconsistency within the system itself gave rise to the idea that the principle of motion should be sought in a power inherent to the body itself, instead of an external agent. The first thinker in the Islamic world to realise this epistemological break and to attempt to solve the Aristotelian "contact" impasse by carrying the source of motion into the body was Yaḥyā al-Naḥwī.

2.2 Yaḥyā al-Naḥwī's Theory of Impetus

Within the research on the history of philosophy, various interpretations exist regarding the intellectual identity of John Philoponus, known in the Islamic world as

45 Aristotle, "Physics," paras 267a1-16.

46 Moshe M. Pavlov, *Abū'l-Barakāt al-Baghdādī's Scientific Philosophy: The Kitāb al-Muʿtabar* (New York: Roudledge, 2017), 187.

Yaḥyā al-Naḥwī. While some historians position him as a Christian theologian, others evaluate him as a Neo-Platonist or an Aristotelian commentator.[47] Based on his stance on the physical theory in question, calling Yaḥyā al-Naḥwī a "non-Aristotelian Aristotelian commentator" appears a more reasonable way to express the originality of his thought. The system termed the "theory of impetus" or "theory of inclination" in the literature unfortunately contains certain gaps due to the loss of the eighth book of Yaḥyā al-Naḥwī's commentary on Aristotle's *Physics*.[48] It is highly probable that Yaḥyā al-Naḥwī established his most radical critiques regarding the nature of motion and outlined the final details of his theory in this lost section.[49]

Aristotle's view, which explains the motion of a body after it leaves the hand through the "transitiveness of the medium," has faced serious criticism from natural philosophers throughout history. According to Simplicius' (d. 560) account in his *De Caelo* commentary, although figures such as Strato (335–269 BCE) and Hipparchus (second century BCE) were pioneers of these critiques, the most systematic critique shaking the foundations of Aristotelian dynamics was voiced by Yaḥyā al-Naḥwī, a contemporary of Simplicius.[50] In addition to revealing the inconsistencies in Aristotelian physics, it was Yaḥyā al-Naḥwī who first constructed the theory of inclination on a consistent basis. [51] This theory constitutes a paradigm shift and a revolution in the history of science.[52]

47 Steven Harvey, "The Impact of Philoponus' Commentary on the Physics on Averroes' Three Commentaries on the Physics," *Bulletin of the Institute of Classical Studies* 47, no. Supplement 83, Part 2 (2011): 90.

48 In his *Commentary on Physics*, Philoponus states that he addresses several important points concerning Aristotle's unconvincing arguments about the void and non-natural motion, noting that these are located in the eighth book. John Philoponus, *Philoponus: On Aristotle Physics 4.6-9*, ed. Richard Sorabji, trans. Pamela Huby (London: Bloomsbury Publishing, 2014), 40.

49 Wolff, "Philoponus," 129.

50 Demirel, "İbn Sînâ ve Kasri Meyil Kuramı," 356.

51 It is not yet clear who first spoke about the theory of impetus. According to Samuel Sambursky, Hipparchus, and according to Shlomo Pines, Alexander of Aphrodisias were the first to refer to this theory. According to Henri Carteron, traces of this theory are first seen in the text *De Mechanica*. While J. E. McGuire notes the theory in Stoic thought that influenced Yaḥyā al-Naḥwī, Emil Wohlwill, Pierre Duhem, Richard Sorabji, and Michael Wolff maintain that Yaḥyā al-Naḥwī himself was the first to put forward the theory of impetus. Abel B. Franco, "Avempace, Projectile Motion, and Impetus Theory," *Journal of the History of Ideas* 64, no. 4 (2003): 525.

52 Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1996), 3:119.

According to Yaḥyā al-Naḥwī, the Aristotelian theory contains a series of flaws and lacks internal consistency. The first and most fundamental problem relates to the role of air: the claim that air carries the body after it leaves the hand is not convincing. Within Aristotelian physics, air is defined alternatively as a power aiding motion and as an obstacle creating resistance to impede motion. This dual role creates a theoretical ambiguity.[53] Apart from this fundamental contradiction, Yaḥyā al-Naḥwī lists other phenomena where the Aristotelian explanation remains insufficient: (i) the continuous acceleration of a body in free fall until it encounters an obstacle; (ii) the failure of speed to drop to zero at the moment force and resistance are equal; (iii) the increase in the speed of falling as weight increases; (iv) and most importantly, the continuation of the motion of an object thrown with *al-mayl al-qasrī*.[54] The focus of this study is this final point, to which the theory of impetus sought to provide a direct answer.

An examination of his *Commentary on Physics* reveals that Yaḥyā al-Naḥwī proposed a radical break from Aristotelian dynamics. Although his predecessors, such as Hipparchus and Synesius, touched upon the idea of impetus, Yaḥyā al-Naḥwī's theory is an original synthesis. He confronts the ancient impasse that had occupied minds for centuries: Why does an arrow continue to fly after leaving the bow? Or why does a stone maintain its motion despite the severance of contact with the hand that threw it?[55] Furthermore, why does a stone thrown upwards fall back to the ground after reaching its peak? All these questions are knotted within the problem of the severance of contact between the mover (agent) and the moved (patient).

Although the Aristotelian theory maintained its influence until the sixteenth century, Yaḥyā al-Naḥwī rejected this theory and substituted the concept of impetus in its place. According to Yaḥyā al-Naḥwī, an arrow leaving a bow is not pushed by the air; neither does it proceed by its own nature. The cause of motion is a kinetic power loaded onto the body by the person throwing it, which is "self-consuming" along the path. Yaḥyā al-Naḥwī defines this impulsive power as an "incorporeal motive

53 Richard Sorabji, "John Philoponus," in *Philoponus and the Rejection of Aristotelian Science*, 48.

54 Demirel, "İbn Sînâ ve Kasri Meyil Kuramı," 355–56.

55 Christian Wildberg, "John Philoponus," in *The Stanford Encyclopedia of Philosophy* (Winter 2021 edtion), ed. Edward N. Zalta, https://plato.stanford.edu/archives/win2021/entries/philoponus/.

energeia"[56]—comparable to the nature of light. When projectile motion is handled from this perspective, the role of the medium (air) changes completely. Contrary to Aristotle, for Yaḥyā al-Naḥwī, the medium serves exclusively as a resistance factor impeding motion rather than also a carrier facilitating it. This approach permits the theoretical possibility of motion in a vacuum. If the cause of motion resides within the body, an external medium is no longer a requirement.[57]

The Peripatetic tradition had designated the surrounding air as an intermediary contact element to solve the contact problem. Although various figures between Aristotle and Yaḥyā al-Naḥwī had discussed this theory, Yaḥyā al-Naḥwī fundamentally transformed the issue. He described the Aristotelian "air-pushing" theory as an unbelievable and imaginary construction[58] and instead took an incorporeal kinetic power (impetus) acting upon the thrown body as the primary basis.[59]

Regarding the motion of falling bodies, Aristotle defended the view that speed was directly proportional to weight and inversely proportional to the density of the medium. However, just as Galileo would do centuries later, Yaḥyā al-Naḥwī refuted this view on logical as well as observational grounds.[60] He preferred to utilise the concepts of upward and downward inclination to explain the direction of motion, noting that "the reason for the rise of a stone is the upward inclination transferred to it by the hand that threw it; the reason for its fall is due to the downward inclination that emerges as it moves away from its natural place."[61]

56 The concept of *enérgeia* generally corresponds to actuality or the state of completeness of a thing within the Aristotelian corpus. The term is far from describing the state of rest at the final point reached by a body when the principles of motion are examined. Since Aristotle defines motion as an "incomplete perfection," the actuality intended here does not indicate the moment motion terminates. Rather, this concept represents the actual execution of the body's displacement power and this power's continuity in action. In this respect, *enérgeia* assumes a technical character expressing the active display of the ability to move, which the body maintains because it has not yet reached its target. Chung-Hwan Chen, "Different Meanings of the Term Energeia in the Philosophy of Aristotle," *Philosophy and Phenomenological Research* 17, no. 1 (1956): 46, doi:10.2307/2104687.

57 Wildberg, "John Philoponus."

58 Philoponus, *Philoponus*, paras 214b28-640, 5; 41.

59 Clagett, "Some General Aspects of Physics," 40.

60 Wildberg, "John Philoponus."

61 Zimmermann, "Philoponus' Impetus Theory," 162.

This view indicates a deviation from the dominant Aristotelian framework. While Aristotle experienced hesitation regarding whether weight should be regarded as a source (cause) of motion, Yaḥyā al-Naḥwī transformed weight into an active concept positively affecting motion and reinterpreted the internal principle of motion (nature) in inanimate beings on the axis of impetus.[62]

The most striking of Yaḥyā al-Naḥwī's critiques is the thought experiment he constructs regarding air's mover role. He does not accept the idea that a body is carried by the displacement of air. Instead, he explains the process through the following steps: (i) the thrower provides the body with an acceleration of motion (impetus), (ii) the body moves faster than the thrower via this acceleration, (iii) the body continues its motion until this transferred kinetic power is exhausted.[63] To refute the Aristotelian view, Yaḥyā al-Naḥwī poses the following question: "When someone throws a stone, is what they do merely pushing the air, or giving a kinetic power to the stone?"[64] If a person cannot move the stone by merely pushing the air without touching it, the thesis that air carries that object becomes invalid. Why, then, is there any mention of contact between the hand and the stone via the medium of air?[65]

Furthermore, regardless of how forcefully air is applied behind a stone by means of bellows or air-producing instruments, it will be observed that the stone does not move in the slightest. If even a massive amount of air current (wind) is unable to launch a stationary stone, it is impossible for the small air current created by the hand to carry a heavy stone for several metres. According to Yaḥyā al-Naḥwī, this situation proves that it is not the air pushed by the hand that provides the motion of the body.[66]

Consequently, when the contact between the body leaving the hand and the thrower is severed, the remaining air alone cannot explain the motion. Taking all these factors into account, the transfer of an incorporeal power from the throwing hand to the thrown stone is mandatory. Just as light passes through transparent media and sunlight acquires a quality by passing through coloured glass, it is possible

62 Zimmermann, "Philoponus' Impetus Theory," 161–62.

63 Philoponus, *Philoponus*, paras 214b28-641, 8–12; 42.

64 Philoponus, *Philoponus*, paras 214b28-641, 12–15; 42.

65 Philoponus, *Philoponus*, 214b28-641, 15–18; 42.

66 Philoponus, *Philoponus*, 214b28-641, 18–28; 42.

for an incorporeal energy (impetus) to pass from the thrower to the body and reside there for a temporary period.[67]

By overcoming the contact obsession of Aristotelian dynamics and placing the principle of motion inside the body, Yaḥyā al-Naḥwī undoubtedly took a significant step. However, because the internal power he constructed possessed an accidental structure from an ontological perspective and was temporary by its nature, it was unable to establish the continuity of motion upon an absolute ground; a self-consuming power cannot provide the continuity required by inertia. At this point, it is necessary to introduce Ibn Sīnā, who would elevate inclination from merely a physical mechanism to something possessing an ontological status. Inheriting the idea of internal power from his predecessor, Ibn Sīnā would perform the critical intervention that would carry the theory to the threshold of modern physics by removing the disappearance of this power from the realm of internal necessity and attributing it to an external cause (resistance).

2.3. Ibn Sīnā's Theory of al-Mayl al-Qasrī

Ibn Sīnā's placement of inclination within the category of quality (*kayfiyya*) does not constitute a contradiction with *mayl*'s accidental nature; in Ibn Sīnā's ontology, although accidents require a subject (*mawḍūʿ*) to maintain their existence, it is not possible to state that all accidents are temporary by their nature. Certain accidents of the type of quality, such as shape or natural weight, possess the characteristic of being permanent (*bāqī*) in the body as long as an external opposing factor does not intervene. By defining inclination as a quality of this kind, Ibn Sīnā distinguished it from Yaḥyā al-Naḥwī's "self-consuming" (*fānī*) power model. Consequently, while inclination maintains its status as an accident, its disappearance is no longer an internal necessity and is instead a result of external resistance. By transforming the permanence of inclination into an existential state of the body, this approach opened the way to the principle of inertia.

According to Ibn Sīnā, "*al-mayl* is a quality residing in a body that enables it to resist whatever prevents its motion toward a specific direction."[68] In his *al-Samāʿ*

67 Philoponus, *Philoponus*, 43.

68 Ibn Sīnā, "Al-Risālah Fi'l-Ḥudūd," 95.

al-ṭabīʿī, Ibn Sīnā defines this concept as a preparatory principle or power enabling a body to orient itself toward its natural *ḥayyiz*. He establishes the ontological existence of *mayl* through the resistance perceived when an external influence acts upon a body and classifies *mayl*, based on its source, into natural (*al-mayl al-ṭabīʿī*), violent (*al-mayl al-qasrī*), and psychic inclination (*al-mayl al-nafsānī*). For example, the difficulty experienced during the transportation of a large and heavy stone from one place to another originates from the stone's resistance to the external force. According to Ibn Sīnā, this resistance does not arise merely from the body being a body, but rather from the natural inclination present within it, which seeks to maintain its position.[69]

Within Ibn Sīnā's thought, the concept of *mayl* possesses a broad spectrum of meaning that cannot be reduced to a single physical phenomenon. Ibn Sīnā categorized this term in three different ways according to the context: natural (*al-mayl al-ṭabīʿī*), violent (*al-mayl al-qasrī*), and psychic inclination (*al-mayl al-nafsānī*). For instance, when an individual holds a heavy stone in their hand, the pressure the stone applies toward the hand and its effort to pull the hand toward its own natural direction—downward—constitutes empirical evidence for a natural inclination. Conversely, impeding or changing the direction of a body moving toward its natural place (downward) by applying external power is an example of *al-mayl al-qasrī*.[70] The focus of this study is the theory of natural and violent inclination, which Ibn Sīnā detailed in the book *al-Samāʿ al-ṭabīʿī* (*Physics*).

Undoubtedly, Ibn Sīnā is the thinker who made the most original and systematic contribution to the theory of inclination in the history of Islamic philosophy. In his hands, the theory was taken from where his predecessor Yaḥyā al-Naḥwī left off, matured, and purified of its logical inconsistencies. Ibn Sīnā dedicates the fourteenth chapter of the *Physics* exclusively to this subject.[71] Here, he addresses rival theories attempting to explain projectile motion, demonstrates their insufficiency through critiques (*raddiyya*) directed at each, and subsequently presents his own solution.

69 For the definition of inclination as a preparatory power, the proof of its existence through resistance, and the mentioned example of the heavy stone, see Ibn Sīnā, *Al-Shifāʾ*, 313–18; For a contemporary interpretation, see also Jon McGinnis, *Avicenna* (Oxford: Oxford University Press, 2010), 79.

70 McGinnis, *Avicenna*, 79.

71 Ibn Sīnā, *Al-Shifāʾ*, 324–29.

The views evaluated or criticised by Ibn Sīnā in *al-Samāʿ al-ṭabīʿī* consist of four theories. It is possible to group these theories under two classifications related to the source of the violence acting on a stone after it leaves the hand: either something acting on the body from the outside or the body itself. While theories regarding external (*khārijī*) violence are the theories of pulling or pushing, violence originating from the body itself (*dākhilī*) might be something transferred to that body.

Something providing the motion of a body after it leaves the hand is either something pulling it or something pushing it. Alternatively, an external power or inclination might have been transferred to the body. This latter possibility is termed the force theory. Furthermore, according to the theory of *iʿtimād*, every motion in a body can generate another motion.[72]

2.3.1. Rejection of the Aristotelian Theory

The first view of violence originating from the body itself is the pulling theory (*jadhb*). This theory seeks the cause of motion in air circulation. As the thrown body cleaves the air, the air mass in front of it rapidly circulates to the back (*antiperistasis*) and applies a pushing force to the body from behind to fill the resulting vacuum. In other words, "the pushed air turns behind the thrown object and unites with a force applying pressure to the object in front," thereby facilitating motion.[73]

The second view, the pushing theory (*dafʿ*), assumes that the thrower pushes the air surrounding the body in addition to the body itself. Since air is by its nature more inclined than a body to accept being pushed and moved, it receives the power from the thrower more easily and carries the body within it while moving.[74] Thus, when a body is thrown into the air, a pushing power is applied to that body by the person throwing it. If this pushing originates from the body, it affects the air more signif-

72 In the fourteenth chapter, Ibn Sīnā discusses and criticises these alternative theories explaining projectile motion (the influence of air, motion being generated from motion, and violent inclination). Ibn Sīnā, *Al-Shifāʾ*, 324–29.

73 Ibn Sīnā, *Al-Shifāʾ*, 324; Avicenna, *The Physics of The Healing: A Parallel English-Arabic Text in Two Volumes*, trans. Jon McGinnis, Islamic Translation Series (Provo: Brigham Young University Press, 2009), 505.

74 Ibn Sīnā, *Al-Shifāʾ*, 324–25; Avicenna, *The Physics of the Healing*, 505.

icantly. As the air moves, it carries the body situated within it. This second theory represents Aristotle's view.[75]

Ibn Sīnā does not regard the pushing theory (*daf*ʿ) to be completely impossible. Indeed, the production of sound by the powerful air current blown by trumpets, the shattering of rocks by thunder, or the toppling of trees by storms indicate that air possesses the potential to move large objects.[76] However, the situation differs when it comes to projectile motion. It is not physically plausible for a thrown stone to travel such a distance merely by the pushing of the air behind it.

Conversely, Ibn Sīnā severely criticises the Aristotelian[77] pulling theory (*jadhb*). It is not possible for the air in front to turn back during projectile motion and for the forward-moving air to apply pressure from behind. The power by which the air in front turns back and applies pressure from behind the body—by merging with the forward-moving air that aids in carrying the body—is not clear.[78] According to Ibn Sīnā, this process gives rise to new questions rather than explaining the continuity of motion.

2.3.2. Yaḥyā al-Naḥwī and the Critique of the Force Theory

The first theory of violence originating from outside the body is Yaḥyā al-Naḥwī's force theory. According to this view, the mover (agent) transfers a force (*quwwa*) to the moved (patient). By virtue of this transferred force, the body continues its motion despite the resistance of the medium. However, according to Yaḥyā al-Naḥwī, this force is not permanent by its essence; it is conceptualised as a motive capacity

75 In the English translation of *al-Samāʿ al-ṭabīʿī*, McGinnis states in the relevant footnote that he could not find anything in Aristotle's *Physics* and *On the Heavens* regarding the first two theories (concerning violence originating from the body itself), specifically how air moves the body; nonetheless, Aristotle probably defends both views (*jadhb* and *daf*ʿ). Avicenna, *The Physics of the Healing*, 505, footnote 2.

76 Ibn Sīnā, *Al-Shifāʾ*, 325; Avicenna, *The Physics of the Healing*, 506.

77 As Sarnowsky states, the first two views criticised by Ibn Sīnā belong to Aristotle. See Jürgen Sarnowsky, "Concepts of Impetus and the History of Mechanics," in *Mechanics and Natural Philosophy Before the Scientific Revolution*, ed. Walter Roy Laird and Sophie Roux (Dordrecht: Springer Netherlands, 2008), 127, doi:10.1007/978-1-4020-5967-4_4.

78 Ibn Sīnā, *Al-Shifāʾ*, 325; Avicenna, *The Physics of the Healing*, 506.

granted temporarily to the body. The force in question weakens over time due to the resistance of the medium (air) that is contiguous with and surrounds the body, eventually becoming exhausted.[79]

In this conceptualisation, the presence of the transferred force is the cause of motion, just as motion itself is the process of this force's gradual exhaustion. Consequently, even in the absence of external resistance (air or friction), this power is inherently perishable (*fānī*), destined to dissipate according to its own internal limit from the moment it detaches from the initial agent.

That which is described here as being contiguous with the body is the air touching and surrounding it. This theory recalls the theory of natural inclination (*al-mayl al-ṭabīʿī*).[80] As the inclination weakens and the power of the surrounding air increases, the force initially transferred to the body is cancelled, and the thrown object begins to return toward its natural inclination.[81] That is, as the transferred *al-mayl al-qasrī* weakens, the natural weight of the body predominates, and the body begins to fall. This third view is the impetus theory defended by Yaḥyā al-Naḥwī, who departed from the Aristotelian line.

While Ibn Sīnā accepts this theory in principle, he finds Yaḥyā al-Naḥwī's explanations regarding the nature of force ontologically insufficient. Ibn Sīnā establishes his transformation of this theory upon the rejection of this self-consuming inclination structure. In Yaḥyā al-Naḥwī's model, the body is a passive carrier upon which force is exerted; Ibn Sīnā, however, elevates inclination to the status of a quality (*kayfiyyah*) that maintains its existence unless impeded by an external factor.

Ibn Sīnā asks: What is this power "loaned" to the body? Is it (i) natural, (ii) psychic, or (iii) an accidental force? It is impossible for this power to be natural. A body (for instance, the throwing hand) can impart a characteristic existing in its own nature (such as heat) to another, but it cannot impart its own nature (form). Fire can heat another object, yet it cannot impart its "form of fireness" without transforming

79 Ibn Sīnā, *Al-Shifāʾ*, 324; Avicenna, *The Physics of the Healing*, 505.

80 The concept of natural inclination (*phusikē rhopē*) also defended by John Philoponus expresses the power inherent in the body that enables the stone to fall. Pavlov, *Abūʾl-Barakāt al-Baghdādī*, 189. For al-Baghdādī's views on the subject and regarding the Peripatetic tradition, see Ferruh Özpilavcı, "Ebüʾl-Berekât el-Bağdâdîʾde Tabiat Felsefesi" (PhD diss., Marmara University, 2008).

81 Ibn Sīnā, *Al-Shifāʾ*, 324–25; Avicenna, *The Physics of the Healing*, 505.

that object into fire. Similarly, the upward motion of a stone is not natural. Therefore, the thrower cannot impart the nature of moving upward to the stone. This power must necessarily be an accidental (acquired) quality. A single body cannot possess the nature of moving downward (natural) and the nature of moving upward (acquired) simultaneously.[82]

Additionally, Ibn Sīnā makes an empirical correction regarding the force's intensity. According to Yaḥyā al-Naḥwī, the moment the transferred force is strongest is the beginning of the motion. However, practical observation (*tajribah*) indicates that the speed of a thrown body reaches its maximum in the middle of the motion, rather than immediately after leaving the hand. Consequently, the moment of highest force intensity is the middle of the motion, not the beginning.[83] In conclusion, Ibn Sīnā opposes the affirmation that this power is most strongly present at the very start of the motion. The theory, brought closer to physical reality through his empirical observation, indicates the exact opposite.[84]

2.3.3. Rejection of the Iʿtimād Theory Defended by the Muʿtazilite Theologians

In this section, the *iʿtimād* theory proposed by Muʿtazilite theologians is not reconstructed with every nuance developed in *kalām* literature. The objective here is to reveal how Ibn Sīnā understands the theory, as described in the fourteenth chapter of *al-Samāʿ al-ṭabīʿī* and upon which assumptions the theory was criticised. Consequently, the discussion is based on an Ibn Sīnāian representation of the "theological physical model," addressed by Ibn Sīnā within a polemical context, rather than the Muʿtazilite theologians' own terminological and doctrinal distinctions.[85] It should be specifically noted that this representation does not reflect the entirety of the internal differences within the theological tradition.

82 Ibn Sīnā, *Al-Shifāʾ*, 325; Avicenna, *The Physics of the Healing*, 506.

83 Ibn Sīnā, *Al-Shifāʾ*, 325; Avicenna, *The Physics of the Healing*, 506.

84 Sarnowsky, "Concepts of Impetus," 127.

85 For a summary of the Muʿtazilite theologians' views and specifically the differences of opinion within the Baṣriyyūn, see Osman Demir, "The Rope Pulled by Both Sides: The Issue of Impetus (Iʿtimād) in the Basra Muʿtazilite Tradition and Its Relation with the Theory of Generated Acts (Tawlīd) [İki Tarafından Çekilen İp: Basra Muʿtezile Geleneğinde İʿtimâd ve Tevlîd Ile İlişkisi]," *Eskiyeni*, no. 57 (2025): 562–65, doi:10.37697/eskiyeni.1599633.

I'timād theory, developed in the Basra Mu'tazilite tradition as the fundamental explanatory model for motion and resistance in the physical world, was conceptualised as an internal impulse or inclination explaining the interactions between and motions of objects. Within an atomistic conception of the universe, these theologians associated the settling of bodies in a space or their motion toward another direction directly with the accident of *i'timād*, which signifies a fundamental *ma'nā* (quality). Particularly, the Basra school maintained that *i'timād* generates motion through generation (*tawlīd*) by producing an impulse in the body. According to these thinkers, the downward fall of a heavy body is a result of the downward-oriented *i'timād* present in that body. Similarly, the motion of a thrown stone occurs by means of the violent (*qasrī*) *i'timād* transferred to it from the outside. The Mu'tazilites viewed motion as the sum of discrete and instantaneous accidents, asserting that the body must possess a new *i'timād* at every moment to maintain the continuity of motion.[86]

Ibn Sīnā, however, rejects this discontinuous explanation based solely on *i'timād*. In his words:

> There is a group who has maintained [a theory] of [i'timād] engenderment. They claimed that it is of the nature of motion that [another] motion be engendered after it, and of the nature of tendency that a tendency be engendered after it. They, however, did not deny that the motion ceases and then is followed by a state of rest, and then, thereafter, a motion is engendered as a result of the tendency. This really is the most atrocious of the accounts. [That] is because what is engendered inevitably is something that comes to be after not being; but whatever comes to be after not being has some originator that is a cause of the coming to be. Now, if that cause is a cause inasmuch as it exists, then the first motion must exist together with the second, whereas, if it is [a cause] inasmuch as it does not exist, there would necessarily always be some cause of the motion. If, despite that, the cause is the tendency's continued existence, then why do you allow a subsequent state of rest when the principle of the motion actually exists as it should and there is no obstacle to the motion, either from the mobile or in the distance [to be covered]? If the tendency also does not exist, the discussion about it is the same as the one about motion.[87]

86 Demir, "The Rope Pulled," 560–62; Holoğlu Akdoğan, "Erken Dönem Basra Mu'tezile," 25–35.

87 Ibn Sīnā, *Al-Shifā'*, 325–26; Avicenna, *The Physics of the Healing*, 507.

In this passage, which contains Ibn Sīnā's primary objections to *kalām* physics, the theory of *tawlīd* (generation)—a manifestation of the atomistic conception of physics invoked to explain projectile motion's continuity—is rejected on the grounds of ontological and logical inconsistency. The Mu'tazilite claim that *i'timād* and motion generate one another in the form of a series of instantaneous accidents is characterised by Ibn Sīnā as the "ugliest claim" and is regarded as a violation of the principle of causality. His fundamental objection rests upon the necessity of simultaneity between the cause (*'illa*) and the effect (*ma'lūl*). If a motion generates the motion succeeding it, the initial motion in the position of the cause must exist at the same time as the second motion that is the effect. However, the merging of these two moments is impossible within the perception of discrete time and space held by these theologians. Furthermore, the assumption that the first motion's absence generates the second motion gives rise to the paradox of reducing the source of existence to non-existence.

Additionally, Ibn Sīnā emphasises that those who substitute instantaneous accidents of *i'timād* for an internal inclination providing the continuity of motion remain unable to explain the phenomenon of rest (*sukūn*).[88] The assertion that motion stops and rest begins in the absence of an external obstacle to impede the body's motion, followed by the subsequent generation of motion again by *i'timād*, appears to posit a coincidental will. According to Ibn Sīnā, this contradiction between the continuity of *i'timād* and the interruption of motion results from *kalām* physics lacking the concept of the body's nature. Consequently, he redefines motion as a process exhibiting ontological continuity—resulting from nature and acquired inclination—rather than a sum of instantaneous leaps.

In summary, according to the theory of *i'timād*, motion is a chain reaction: the first motion generates a second motion (*tawlīd*), which then generates a third. The nature

88 On this subject, see Osman Demir, "In Track of Famous Doubt: The Discussion of the Moment of Rest in the Tradition of Ishārāt and the Contribution of Mu'ayyadzāda [Meşhur Şüphenin İzinde: İşârât Geleneğinde Sükûn Ânı Tartışması ve Müeyyedzâde'nin Katkısı]," in *2. Uluslararası Prof. Dr. Fuat Sezgin İslâm Bilim Tarihi Sempozyumu Bildiriler Kitabı*, ed. M. Cüneyd Kaya, Nihal Özdemir, and Gürsel Aksoy (Istanbul: Istanbul University Press, 2023), 311–21, doi:10.26650/PB/AA08.2023.002.024; Y. Tzvi Langerman, "Quies Media: A Lively Problem on the Agenda of Post-Avicennian Physics," in *International Ibn Sina Symposium Papers II May 22-24, 2008*, ed. Mehmet Mazak and Nevzat Özkaya (İstanbul: İstanbul Büyükşehir Belediyesi Kültür A.Ş. Yayınları, 2009), 53–67.

of motion is to produce the subsequent one by relying upon (*i'timād*) the previous motion; explaining motion as a continuous coming-into-being or creation fragments its continuity. According to the Mu'tazilites, a mandatory moment of rest must exist between every moment of motion for the subsequent motion to be generated, reducing motion to a sum of discontinuous moments. According to Ibn Sīnā, this atomistic approach requires a motion that is recreated at every moment and, consequently, an agent that intervenes at every moment. If motion is a continuous flow, the source of these intervening moments of rest remains unaccounted for. Unless an obstacle exists to stop the moving object, the existence of rest cannot be explained.

2.3.4. Ibn Sīnā's Ontological Intervention: Permanent Mayl as a "Quality"

Ibn Sīnā reconstructs the problem of motion's continuity as one of status within the realm of existence rather than in terms of a mere physical necessity. This reconstruction's most original junction is the placement of *al-mayl al-qasrī* into the class of quality (*kayfiyya*) among the Aristotelian accident categories. In Yaḥyā al-Naḥwī's model, impetus remained at the level of a temporary power transferred to the body from the outside and destined to dissipate by its nature. Conversely, Ibn Sīnā elevated inclination to the status of a permanent quality acquired by the body, which maintains its subsistence as long as it does not encounter an external resistance.

Defining inclination as a quality radically alters motion's ontology. Within Peripatetic ontology, although qualities require a subject (*mawḍū'*) to maintain their existence, they are not structures that consume themselves by nature. For instance, the shape or natural weight acquired by a body tends to remain fixed in that body unless a disruptive external factor intervenes. By including inclination in this category, Ibn Sīnā transformed motion from a process of the dissipation of a force into *a state of existence preserved by the body*.

Opposing Aristotle's view,[89] which defends the moving character of the medium based on the air pushing the body, Ibn Sīnā takes as a basis a mover power transferred to the body itself instead of to the medium. While Aristotle examines motion primarily as a process, Ibn Sīnā focuses on the subject (*mawḍū'*) or the agent in which

89 Ibn Sīnā, *Al-Shifā'*, 326–27; Avicenna, *The Physics of the Healing*, 508–9.

the motion occurs. This difference in approach constitutes the justification for why *al-mayl al-qasrī* should be sought as a quality in the body itself rather than in the air (medium). Indeed, if motion is a subject's existential state, the principle sustaining it (*mayl*) must be within the body.[90]

Following the aforementioned critiques, Ibn Sīnā rejects Aristotle's medium explanation and the Mu'tazilite *tawlīd* (generation) view. The explanation that appears most reasonable to him is Yaḥyā al-Naḥwī's theory of transferred power (impetus).[91] In this sense, it can be stated that Ibn Sīnā inherited Yaḥyā al-Naḥwī's theory in its broad outlines, and indeed transformed it. According to him, *al-mayl al-qasrī* is a permanent power that does not consume itself; its effect vanishes solely due to external factors. It appears that Ibn Sīnā was the first person to design an influence whose effect continues permanently for non-natural motions.[92]

This distinction carries vital importance. According to Ibn Sīnā, if a thrown body reaches rest (*sukūn*), the reason will be this permanent power's defeat by external obstacles rather than the exhaustion of the power itself.[93] Consequently, rest is realised only by virtue of an external cause.

According to Ibn Sīnā, an object's speed increases as it approaches its natural place. Thus, the body's natural inclination also increases. The slowing of an object's speed occurs only in projectile motion, because *al-mayl al-qasrī* continues to weaken as the distance between the mover and the object increases and the medium offers resistance against the force transferred to the body.[94]

To ground this view, Ibn Sīnā constructs a thought experiment regarding the void (k*halā*): like Aristotle, he defends the view that the void is physically impossible. However, his argument is as follows: If a void existed, no resistance would act upon the body. Since there is no resistance, the *al-mayl al-qasrī* in the body would never

90 Aydın, "The Existence and Quiddity of Motion," 118, 129.

91 McGinnis's numbering [3] also indicates this, although there are readings—such as Sarnowsky's—suggesting Ibn Sīnā considers his own theory present in his explanation as the most reasonable after this statement. Avicenna, *The Physics of the Healing*, 507.

92 Aydın Sayılı, "Ibn Sīnā and Buridan on the Motion of the Projectile," *Annals of the New York Academy of Sciences* 500, no. 1 (June 1987): 477, doi:10.1111/j.1749-6632.1987.tb37219.x.

93 McGinnis, *Avicenna*, 82.

94 McGinnis, *Avicenna*, 81.

decrease, and the body would move with the same speed forever. Because infinite motion is impossible in a finite universe, the void is likewise impossible.[95] This *reductio ad absurdum* proof is actually a negative formulation of the principle of inertia in modern physics. By associating the continuity of motion with the body's tendency to preserve the acquired quality (inclination), Ibn Sīnā constructed the metaphysical ground of the principle of inertia[96] within the Peripatetic tradition.

In summary, Ibn Sīnā's theory rests upon this basis: when a body is thrown, the mover constructs a foreign (*gharīb*) quality independent of the body's nature—namely, *al-mayl al-qasrī*. This inclination ensures the continuity of motion by maintaining its existence even after the body detaches from the initial mover. The foreign inclination in question is in constant conflict with both the body's natural inclination originating and the medium's resistance. The termination of motion occurs as a result of this external resistance or natural inclination prevailing over the *al-mayl al-qasrī*.[97] This change in ontological status elevated motion from being a momentary result of external compulsion to the level of a body's state. This founding junction within the Peripatetic tradition is the basis for the idea of the conservation of motion, which is the metaphysical precursor to the modern principle of inertia.[98]

95 McGinnis, *Avicenna*, 83.

96 Sayılı, "Ibn Sīnā and Buridan," 477.

97 Ayman Shihadeh, *Doubts on Avicenna: A Study and Edition of Sharaf al-Dīn al-Masʿūdī's Commentary on the Ishārāt*, Islamic Philosophy, Theology and Science, Texts and Studies 95 (Leiden: Koninklijke Brill, 2016), 91–92.

98 Sarnowsky, "Concepts of Impetus," 127. On the other hand, McGinnis attributes this view (or perhaps only a part of it) to Yaḥyā al-Naḥwī in his numbering for the translation of Ibn Sīnā's *Physics*. Avicenna, *The Physics of the Healing*, 507.

	Aristotle	Yaḥyā al-Naḥwī	Ibn Sīnā
Cause of Motion	Continuous contact with an external agent and the propulsion of the medium (air)	Incorporeal internal force transferred to the body (impetus)	Permanent inclination (quality) transferred to and preserved by the body
Role of Medium	Transitive agent that conveys motion and ensures continuity	External resistance factor that hinders the realisation of motion	Element of resistance that opposes motion and weakens inclination
Nature of Internal Power	Undefined (power resides in the medium).	Temporary power that is self-consuming	Permanent quality that subsists unless an external obstacle exists
Cause of Rest	Defeat of the power transferred to the air by the medium's resistance	Exhaustion of the internal force and prevalence of the medium's resistance	Defeat of *al-mayl qasrī* by external resistance or natural inclination

Conclusion

In the history of philosophy, the question "Why does a stone thrown into the air move?" has rendered visible the profound rift between the Aristotelian principle of contact and observable reality. Aristotle's attempt to bridge this rift by elevating the medium—namely, the air—to the position of an agent compromised the system's internal consistency. This conclusion resulted in an ontological paradox where air served simultaneously as an obstacle resisting motion and as an impulsive force enabling it.

As demonstrated in this study, Ibn Sīnā's theory of *al-mayl qasrī* possesses perhaps the most reasonable ontological ground among the historical solutions developed to overcome the paradox in question. Ibn Sīnā inherited the idea of "internal force" from his predecessor Yaḥyā al-Naḥwī, subjecting it to a structural transformation by rejecting the model of a "self-consuming temporary power." In Yaḥyā al-Naḥwī's model, motion is a temporary process that dissipates with the exhaustion of the internal element. In Ibn Sīnā's, motion exhibits a continuity that only terminates when it encounters external resistance.

Ibn Sīnā's *al-mayl qasrī* is a fundamental ontological intervention into the nature of motion, rather than merely a mechanical correction directed at Aristotelian physics. He elevated inclination from the level of a temporary force that diminishes over time—as envisioned by his predecessors—and instead redefined it as a permanent quality status maintained by the body. This change in ontological status implies that inclination does not require a continuous agent to maintain its existence; on the contrary, it preserves its existence unless hindered.

Indeed, the inference Ibn Sīnā developed within the context of debates on the void—stating that motion would be infinite in a medium without resistance—is the strongest logical proof that inclination is intrinsically a permanent quality. Ibn Sīnā liberated motion from being understood as a temporary process dependent upon an external power and transformed it into a state of being preserved by the body itself, thereby constructing the metaphysical foundation for the modern principle of inertia.

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