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THE PHYSICAL THEORY OF KALĀM

Atoms, Space, and Void in Basrian Mu'tazilī Cosmology

BY

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cal problem faced by historians of Presocratic cosmology who also do not have texts from the formative period of Hellenistic cosmology.[1] Historians of Presocratic cosmology have, to a large degree, been successful in charting the development of Presocratic cosmology because of their conjecture of its underlying research program. They have therefore been able to analyze the extant fragments of the Presocratics within the context of this hypothetical research program and hence they have succeeded in directing their attention to problem areas which are intrinsic to their subject matter. Moreover, historians of Presocratic cosmology have been able to rely on the strong foundation laid by the study of later figures like Plato and Aristotle whose works not only provide much of the information of the views of the Presocratics but also reveal to us the fundamental questions which constituted the Presocratic research program. An analogous two-step approach to the study of the development of *kalām* cosmology would be to uncover the research program of *kalām* cosmology and study the cosmology of the later period which is represented by the newly rediscovered texts, in order to then place the surviving fragments from the early period of *kalām* cosmology in their proper problem context. While this book fits within such a broadly conceived research program, its immediate goal is far more modest. It focuses on one component of *kalām* cosmological speculation, namely physical theory. In particular, it aims to reconstruct the theories of space, void, and matter of the fourth and fifth/tenth and eleventh century *mutakallimūn* on the basis of the newly available texts and then to offer some tentative suggestions on the general structure of these theories in the earlier period of the third/ninth century.

At this juncture, it may be appropriate to sketch the place and role of cosmology in *kalām*. The discipline of *kalām* is usually considered to be the equivalent of theology. While there can be no doubt that the aim of *kalām* is primarily theological,[2] *kalām* does, strictly speaking, differ from theology (at least as 'theology' is commonly understood) in several respects. One of these is its subject matter which includes several topics, for example logic, epistemology, cosmology, and anthropology which properly belong to philosophy (in its classic and broadly construed sense). This feature of *kalām* is found not only in the early period but also in the late period. For example, of the six sections which constitute the classic and much commented *kalām* text *Mawāqif*

[1] The analogy between early *kalām* and the Presocratic philosophers was suggested to me by A.I. Sabra. It has also been recently made in D. Gimaret, "Pour un rééquilibrage des études de théologie musulmane," *Arabica*, 38(1991), 12.

[2] Richard Frank, "The Science of *Kalām*," *Arabic Sciences and Philosophy*, 2(1992), 7-37.

by 'Aḍud al-dīn al-Ījī (d. 756/1355), only the fifth and sixth sections are exclusively devoted to the theological topics of God and Prophecy while the other sections deal with epistemology, ontology, accidents, and bodies. Because the practitioners of *kalām* (namely, the *mutakallimūn*) regarded their discipline to be a philosophical metaphysics,[3] they were the intellectual rivals of the *falāsifa* (the practitioners of *falsafa*) who were the representatives of the Neoplatonized Aristotelian tradition in the Islamic milieu. The *falāsifa*, who considered themselves to be the true philosophers and heirs to the Hellenic intellectual tradition, viewed the rival discipline of *kalām* with extreme disdain and considered it to merely be an apologetic in service of the religion of Islam.[4] This characterization, which has unfortunately been adopted by several modern students of Islamic intellectual history,[5] fails to take into account the actual historic context within which *kalām* was pursued. Moreover, it disregards the perspective of the *mutakallimūn* themselves and ignores the non-theological aspect of their writings, which, in the early period was significant.[6] In order, then, to emphasize the philosophical and cosmological content of *kalām*, the Arabic terms *kalām* and *mutakallim* (plural *mutakallimūn*) will be used here in place of the somewhat misleading 'theology' and 'theologian'. Correspondingly, the Arabic terms *falsafa* and *faylasūf* (plural *falāsifa*) will be used to denote the discipline and practitioners of the Neoplatonized Aristoteleanism of medieval Islam instead of 'philosophy' and 'philosopher', for theology (*ilāhiyyāt*) was one of the subject which was discussed in their system.

The *mutakallimūn* distinguished between two aspects of *kalām*. The first of these, which was based solely on reason, deals with 'obscure', 'subtle', or 'difficult' (*laṭīf/daqīq/ghāmiḍ*) questions while the second deals with 'major' (*jalīl*) questions.[7] The major questions are those

[3] Ibid., 36.

[4] See for example al-Fārābī (d. 339/950) in his *Iḥṣā' al-'ulūm*, ed. 'U. Amin, (Cairo,1968), 131.

[5] For example, L Gardet and G, Anawati, *Introduction a la théologie musulmane*, (Paris: J. Vrin, 1948), 309-315. Cf. J. van Ess, "Early Development of *Kalām*," in *Studies on the First Century of Islamic Society*, ed. G. Juynboll, (Carbondale, Illinois: Southern Illinois University Press), 110 and 'A. Badawī, *Histoire de la Philosophie en Islam, I: Les Philosophes Théologiens*, (Paris: J. Vrin, 1976), 309-315.

[6] The fourth/tenth century bio-bibliographer Ibn al-Nadīm (d. 385/995) has preserved the titles of the works of the third and fourth/ninth and tenth century *mutakallimūn* in his *Fihrist*, ed. R. Tajaddud, (Teheran,1971). I have categorized these works in my, "Kalām and Hellenistic Cosmology: Minimal Parts in Basrian Mu'tazilī atomism," (Ph.D. diss., Harvard University, 1991), 37-40.

[7] In his division of sciences, the litterateur Abū Ḥayyān al-Tawḥīdī (d. 414/1023) states: "*Kalām* is divided into the subtle part (*daqīq*) which is undertaken solely on the basis of reason and into the part which deals with major questions (*jalīl*) which depend on revelation" (*Kitāb adab al-inshā' fī al-ṣadāqa wa al-ṣadīq*, (Cairo,1323 A.H.), 192).

CHAPTER ONE

BACKGROUND: PHYSICAL THEORY IN KALĀM

A. KALĀM AND COSMOLOGY

During the last three decades, a wealth of previously unavailable texts by the Mu'tazilī *mutakallimūn* of the fourth and fifth centuries A.H./tenth and eleventh centuries A.D. have come to light. The rediscovery of these texts provides us with a somewhat clearer picture of the intellectual world of the Mu'tazilīs for our previous picture had been based almost entirely on hostile sources. From the perspective of the emergence and formation of the discipline of *kalām* in the later second and early third/later eighth and early ninth centuries, these newly rediscovered texts are already quite late. The world of the early practitioners of *kalām*, who established the subject-matter, range, and scope of this new discipline, was quite different from the world of their followers just a century and half later. These 'founding fathers', as it were, lived in the shadow of centuries of Hellenistic influence on the central lands of the Middle East; influence which had deeply penetrated the intellectual and religious life of this region. Through their inevitable contact with the representatives of these Hellenized intellectual traditions, the founders of *kalām* encountered, confronted, and reacted to ideas whose origins distinctly or remotely lay in the major Hellenistic systems of Antiquity, and inevitably even used some of these ideas in their own analyses and formulations of the problems which constituted the subject-matter of *kalām*. Quite naturally, this encounter with Hellenism shaped the content and the program of the nascent discipline of *kalām*. This is particularly evident, as we shall see in further detail, in the cosmological speculations of the founders of *kalām*. As a result, much scholarship has been devoted to this early period, and for just reason. But this has been to the detriment of the study of the somewhat later period which is represented by the newly rediscovered texts.

The situation is complicated by the fact that no texts from the earlier formative period have survived and our information must all be gleaned from fragments preserved in later texts. However, we are then faced with a methodological problem when we try to reconstruct the *development* of *kalām* cosmology which is similar to the methodologi-

questions in which disagreement leads to the formation of sects or heresies, for example the question of leadership (*imāma*) after the death of the Prophet Muhammad differentiates the Shi'a from the Sunnīs.[8] The 'subtle' questions, on the other hand, do not lead to the formation of sects and, in fact, disagreement between a teacher and student on these questions is quite common. The topics covered by the 'subtle' questions deal mostly with cosmological concerns which, broadly speaking, consist of the problem of the nature and attributes of the things which constitute the world, the problem of the nature of man, and the problem of causation. These are the topics which are covered in most of the non-theological writings of the *mutakallimūn* of the third/ninth century. Moreover, these topics predominate in the enumeration of the 'subtle' questions, as well as in their presentation, for example in the *Maqālāt* of Abū al-Ḥasan al-Ash'arī (d. 324/935) and the *Awā'il al-maqālāt* of Shaykh al-Mufīd (d. 413/1022). These topics also predominate in the early *kalām* accounts of the cosmological doctrines of Dualists and Natural Philosophers.

The first cosmological problem in this list, namely, the problem of the nature and attributes of things is central to the cosmological enterprise of *kalām*, for it provides the foundation for the *kalām* discussion of cosmology (and indeed of other topics covered by *kalām*). Three theories of the nature and attributes of things are found in early *kalām*, all of which have their origins in the Hellenistic philosophies of Late Antiquity. They are clearly discernible in the earliest *kalām* accounts of the doctrines of the Dualists and 'Natural Philosophers' (*dahriyya*, *ahl al-ṭabā'i'*, *aṣḥāb al-hayūlā*). These are: (a) the doctrine that things or bodies are constituted out of a bundle of accidents; (b) the doctrine that things or sensible bodies are constituted out of a bundle of interpenetrating corporeal bodies; and (c) the doctrine that bodies are constituted out of atoms and inherent accidents. According to the adherents of the first doctrine (*aṣḥāb al-a'rāḍ* namely, Ḍirār ibn 'Amr (d. 200/815), Ḥafṣ al-Fard (fl. ca. 195/810), and al-Ḥusayn al-Najjār (d. ca. 220-230/835-845)) the created world consists only of accidents, and therefore the objects of the world are constituted out of the bundle of accidents which define their attributes and properties.[9] The adherents

[8] Abū al-Ḥasan al-Ash'arī (d. 324/935) divides his book *On the Doctrines of the Muslims* (*Maqālāt al-islāmiyyīn wa ikhtilāf al-muṣallīn*, ed. H. Ritter, (Wiesbaden: Franz Steiner, 1963)) into the section on the major questions which deals with the Muslim sects and their different beliefs, the section on the 'subtle' questions which is concerned with bodies, atoms, accidents, causality, etc., and the section on the differences between the Muslims regarding the predicates and attributes of God.

[9] Josef van Ess, *Theologie und Gesellschaft im 2. und 3. Jahrhundert Hidschra*, 3 vols. to date, (Berlin and New York: Walter De Gruyter, 1991-), III:37-42.

of the second doctrine (namely, Ḥishām ibn al-Ḥakam (d. 179/795?), al-Aṣamm (d. ca. 200/815), Ibrāhīm ibn Sayyār al-Naẓẓām (d. ca. 220-230/835-845) and his followers) held instead that the created world consists only of bodies and therefore its objects are constituted out of a bundle of interpenetrating corporeal bodies which define their properties and attributes.[10] Finally, the adherents of the third doctrine, which was to become widely accepted by the *mutakallimūn* of later periods, held that the created world consists of corporeal atoms and incorporeal accidents which inhere in atoms, and that the properties of objects arise both from the intrinsic nature of the atoms which constitute them and from the accidents which inhere in them and also from the combination of these atoms with their inherent accidents to form larger units, for example their combination to form a living composite which is the human body. It is clear from this brief description of these three doctrines of the nature and attributes of things that physical theory lies at the core of these three competing formulations.[11]

The third doctrine of the nature and attributes of things, namely atomism, came to predominate *kalām* cosmology and is indeed, in the Islamic intellectual tradition, the hallmark of *kalām* cosmology. In some ways, though not all, the cosmological rivalry which existed in Greek Antiquity between the Atomists on the one hand, and the Stoics, Neoplatonists, and Peripatetics on the other hand—the rivalry which David Furley has labeled the "Cosmological Crisis of Classical Antiquity"—continued to be played out many centuries later in the Islamic milieu with the *mutakallimūn* taking the side of the Atomists, while the *falāsifa*, who were the torch-bearers of Neoplatonism and Peripatetism, took the opposing side.[12] The link between the Peripatic and Neoplatonist traditions of Classical and Late Antiquity and the *falsafa* of the Islamic world by way of translations of Greek philosophical and scientific texts into Arabic is well-known. In the main, the cosmological doctrines of the *falāsifa* remained close to their Peripatetic and Neoplatonic origins. The situation is radically different for the other side, that is, the *mutakallimūn*. We have no evidence of any direct link between the *mutakallimūn* and their Greek Atomist predecessors by way of translations into Arabic. There is neither mention nor any hint of such translations in the historical and literary sources. Moreover, even though the atomism of the *mutakallimūn* shares many features with Greek Atomism and is in this respect subject to similar

[10] Ibid., I:355-358, II:398-492, III:331-355.

[11] Dhanani, "Minimal Parts," 37-119.

[12] David Furley, "The Cosmological Crisis in Classical Antiquity," *Proceedings of the Boston Area Colloquium in Ancient Philosophy: Volume II*, ed. John J. Cleary, (Lanham: University Press of America, 1986), 1-19.

counter-arguments by opponents of atomism, it is also, in several important aspects, unlike Greek Atomism.

The question of the origins of *kalām* atomism and its links with Greek Atomism has been the primary focus of most twentieth century research into *kalām* physical theory.[13] This narrow focus has limited the examination of *kalām* atomism to the early period of the development of *kalām*. Such a research program is beset by several methodological difficulties, the most challenging of which is the paucity of sympathetic accounts of early *kalām* atomism. As I have noted above, the present study proposes a different approach, that is, to reconstruct the physical theory of the fourth to sixth/tenth to twelfth century *kalām* and, in particular the doctrines of the Basrian Mu'tazilī *mutakallimūn* and then to use this to shed light on the views of the earlier *mutakallimūn*. As we shall see, the results of the study of this later *kalām* atomism can help solve some of the puzzles associated with early *kalām* atomism, in particular the hypothesis that atoms in early *kalām* were unextended and point-like.

B. A HISTORICAL SKETCH OF THE MAJOR FIGURES OF *KALĀM* UNTIL THE FIFTH/ELEVENTH CENTURY

During the fourth and fifth/tenth and eleventh centuries, when the extant *kalām* texts were written, the *mutakallimūn* can be categorized into at least four groups: the Basrian Mu'tazilīs, the Baghdadī Mu'tazilīs, the Ash'arīs, and the followers of al-Mātūrīdī (d. 331/942). The last group, being confined mostly to Transoxania, does not seem to have played a major role in the development of *kalām* in the central heartlands of the Muslim world of the time.[14] The three other groups are not only geographically proximate to each other being situated in the central heartlands, but more importantly, they are genetically linked to each other. They therefore, to a large degree, share a common vocabulary and analytical structure, at the very least in their discussion of cosmological questions. These three groups, in particular the Mu'tazilīs, are the subject of the brief historical sketch which is presented here. This sketch is further confined to persons, schools, and sources which are relevant to the discussion of the development of *kalām* cosmology

[13] The classic discussion is Shlomo Pines' *Beiträge zur islamischen Atomenlehre*, (Berlin,1936). Harry Wolfson discusses *kalām* atomism in "Chapter VI: Atomism" in his *The Philosophy of Kalam*, (Cambridge: Harvard University Press, 1976), 466-517. See also Carmela Baffioni, *Atomismo e Antiatomismo nel Pensiero Islamico*, (Naples: Instituto Universitatio Orientale, 1982).

[14] W.M. Watt, "The Problem of al-Mātūrīdī," in *Mélanges d'Islamologie*, ed. Pierre Salmon, (Leiden: Brill, 1974), 266-269.

until the fifth/eleventh century and are therefore mentioned in this book. A further limitation is that this sketch is almost exclusively confined to the teacher-disciple relationships between the various persons who are mentioned in the ensuing chapters.[15]

The Mu'tazila are generally regarded as the founders of the discipline of *kalām*. They trace the beginning of their movement to the separation of Wāṣil ibn 'Aṭā' (d. 131/748) and 'Amr ibn 'Ubayd (d. 144/761) from the circle of al-Ḥasan al-Baṣrī (d. 110/728) over the question of whether a grave sinner should be considered to a believer or an unbeliever. Wāṣil asserted that the grave sinner was neither, but was in an intermediate position (*manzila bayna manzilatayn*). He then withdrew from the circle to another pillar in the mosque and was followed by 'Amr ibn 'Ubayd and others. Al-Ḥasan then remarked, "Wāṣil has withdrawn (*i'tazala*) from us."[16]

The subsequent historical development of this group in both its social and intellectual dimensions is clouded in obscurity. It seems to have initially been a popular missionary movement. But about fifty years later, during the reign of the early Abbasids, several Mu'tazilīs, who trace their origins through their teachers to Wāṣil and 'Amr were active. By the time of the Caliph Hārūn al-Rashīd (r. 169-193/786-809), the Mu'tazilīs, under the leadership of Abū al-Hudhayl al-'Allāf (d. 226/841 in extreme old age) and Bishr ibn Mu'tamir (d. 210-226/825-840) formed into the 'schools' of Basra and Baghdad respectively.[17] This generation and the immediately preceding generation of Ḍirār ibn 'Amr (d. 200/815), al-Aṣamm (d. ca. 200/815), and Hishām ibn al-Ḥakam (d. 179/795?) are in large part responsible for initiating the *mutakallimūn*'s dialogue with Hellenistic cosmology, and are the founders of the three cosmological tendencies of early *kalām*.[18] Hence, Ḍirār held that accidents alone constitute the created world and therefore bodies were composed out of a bundle of accidents, while Hishām and al-Aṣamm held the Stoic-inspired view that corporeal bodies alone constitute the world and therefore all objects, including

[15] To date, a comprehensive history of *kalām* remains to be written. Josef van Ess has embarked on this daunting enterprise for the second and third/ninth and tenth centuries in his not yet completed *Theologie und Gesellschaft*.

[16] Watt, *The Formative Period of Islamic Thought*, (Edinburgh: Edinburgh University Press, 1973), 209. However, this account poses several historical problems (see Ibid., 209-217; van Ess, "Mu'tazilah," *Encyclopedia of Religion*, X:220-221).

[17] Watt, *Formative Period*, 217; van Ess, "Mu'tazilah," X:221. The Basra-Baghdad allegiance is a primary classification criterion in later historical biographies, for example Ibn al-Murtaḍā's *Ṭabāqāt al-Mu'tazila*, ed. S. Wiltzer, (Beirut,1961).

[18] Ḍirār and al-Aṣamm are not typically Mu'tazilī and were kept at a distance by the later generation (van Ess, "Mu'tazilah," X:221; Watt, *Formative Period*, 189-195, 226-228). Hishām ibn al-Ḥakam was Shī'ī and a member of the Shī'ī *imām* Ja'far al-Ṣādiq's circle (Watt, *Formative Period*, 186-189).

secondary qualities like color, taste, etc. were either simple corporeal bodies or a number of interpenetrating corporeal bodies. On the other hand, Abū al-Hudhayl and Bishr ibn Mu'tamir were atomists and held that the created world was constituted out of atoms and accidents, and that accidents are inherent in atoms.

The early Baghdadī Mu'tazilīs had a close affiliation with the ruling Abbasids, continuing the tradition of the early missionary movement. Among the immediate students of Bishr ibn Mu'tamir are Thumāma ibn Ashras (d. ca. 213/828), Abū Mūsā al-Murdār (d. 226/840), and Aḥmad ibn Abī Du'ād (d. 240/854). In the heyday of Mu'tazilī supremacy, Ibn Abī Du'ād was appointed chief *qāḍī* by the Caliph Mu'taṣim (r. 218-227/833-842) shortly after his accession. In this capacity, Ibn Abī Du'ād presided over the inquisition (*miḥna*) of 218-234/833-848, in which the Mu'tazilī doctrine of the createdness of the Qur'ān became the criterion to distinguish between orthodoxy and heterodoxy. In this position, he was responsible for the trial and imprisonment of the traditionist and jurist Aḥmad ibn Ḥanbal (d. 241/855) in 219/834.[19] The inquisition came to an end during the reign of the Caliph al-Mutawakkil (r. 232-247/847-861) when Ibn Abī Du'ād was dismissed in 237/852 and the Mu'tazilīs were removed from the court. As a result, the main concerns of the Baghdadī Mu'tazilīs switched from the problem of the relation of God's Essence and his Attributes, the status of the unbeliever, and the nature of the Qur'ān to the question of God's relation to the world and His creative activity.[20]

Al-Murdār's student Ja'far ibn Ḥarb (d. 236/850) was in turn, the teacher of al-Iskāfī (d. 240/854) who also subscribed to the view that bodies are the only constituents of the world. Ja'far was also the teacher of 'Īsā ibn al-Haytham al-Ṣufī (fl. ca 236/850). Ja'far ibn Ḥarb and another one of the students of al-Murdār namely, Ja'far ibn Mubashshir (d. 234/848-9), are the teachers of Abū Mujālid al-Baghdādī (d. 268/882). 'Īsā and Abū Mujālid are in turn, the teachers of Abū al-Ḥusayn al-Khayyāṭ (d. after 300/912), who is the author of the earliest surviving *kalām* text, namely the *Kitāb al-Intiṣār*, which is a defense of the *kalām* cosmological and theological doctrines which had been attacked by the renegade Mu'tazilī Ibn al-Rāwandī (d. ca. 298/910).[21]

[19] H. Laoust, "Aḥmad ibn Ḥanbal," *Encyclopaedia of Islam*, new ed., 1:273; K.V. Zetterstéen and Charles Pellat, "Aḥmad ibn Abī Du'ād", *Encyclopaedia of Islam*, new ed., 1:271.

[20] J. van Ess, "Abū al-Ḥusayn al-Khayyāṭ," *Encyclopaedia of Islam*, new ed., 4:1162.

[21] Abū al-Ḥusayn al-Khayyāṭ, *Kitāb al-Intiṣār*, ed. A. Nader, (Beirut: Imprimèrie Catholique, 1957). This is the standard Mu'tazilī evaluation if Ibn al-Rāwandī. However, Josef van Ess has recently argued for a reevaluation of this account (see his, "Lecture à rebours de l'histoire du Mu'tazilisme," *Revue des Études Islamiques*, XLVI-XLVII(1978-9), XLVI:164-191. The surviving fragments of Ibn al-Rāwandī have been gathered together in

Ibn al-Rāwandī had written several works against the Mu'tazilīs, in particular their arguments for the temporal creation of the world, their discussion of Divine Justice, their polemic against Manicheanism, and, as we shall see later, their arguments in support of atomism. His contemporary, the physician and *faylasūf* Muḥammad ibn Zakariyā' al-Rāzī (d. 313/925) was also critical of *kalām* doctrines and also became the target of *kalām* polemic against the *falāsifa*. Ibn al-Rāwandī's and al-Rāzī's critique of *kalām* doctrines herald the end of this first period of Mu'tazilism.

The Basrian Mu'tazilīs, in contrast, derive their school designation from the fact that their leader Abū al-Hudhayl spent the greater part of his life in Basra. This intellectual giant also seems to be responsible for the adoption of atomism by *kalām*. Abū al-Hudhayl's student and nephew, Ibrāhīm ibn Sayyār al-Naẓẓām (d. ca. 220-230/835-845), however, was one of the most virulent *kalām* opponent of the adoption of atomism. His objections and arguments against atomism continued to engage the mind of atomists of later generations, as we shall see below in the fifth chapter on the epistemological grounds of atomism. Moreover, al-Naẓẓām, following in the footsteps of Hishām ibn al-Ḥakam and al-Aṣamm, held the Stoic-inspired view that bodies were the only constituents of the created world. As a result, his views on the properties and attributes of secondary qualities like sound and color, as well as their change, were in conflict with the views of the other *mutakallimūn*.[22] Many works by al-Naẓẓām's student the litterateur Abū 'Uthmān al-Jāḥiẓ (d. 255/868) survive. Of particular interest is his *Kitāb al-Ḥayawān*, in which many of the cosmological views of al-Naẓẓām and his contemporaries are recorded. Another student of Abū al-Hudhayl is Abū Ya'qūb al-Shaḥḥām (fl. later half of the third/ninth century). His doctrine that non-existent objects (*ma'dūm*) are 'things' in so far as they are possible objects had several repercussions for the ontological and epistemological doctrines of following generations of *mutakallimūn*.[23]

The second phase of the Mu'tazila was initiated by Abū 'Alī al-Jubbā'ī (d. 303/915) of the Basrian Mu'tazila and Abū al-Qāsim al-Balkhī (d. 319/931) of the Baghdadī Mu'tazila. The designations of 'Basra' and 'Baghdad' now gradually come to denote characteristic doctrines and no longer refer to geographic origin. Thus al-Balkhī only studied in Baghdad, but spent most of his life in Balkh. In contrast Abū

'Abd al-Amīr al-As'am's *Ibn al-Riwandi's Kitab Fadihat al-Mu'tazilah*, (Beirut and Paris,1975-77).

[22] See J. van Ess, *Theologie und Gesellschaft*, III:309-369.

[23] See below, Chapter Two, note 34.

'Alī al-Jubbā'ī, and later his son Abū Hāshim continued to be located in Basra, but by the end of the fourth/tenth century, 'Abd al-Jabbār and his circle of students were located in Rayy.

Van Ess has called this second phase the 'scholastic phase' of Mu'tazilism.[24] The choice of this phrase, which carries negative connotations of sterility, is unfortunate, particularly in the area of the discussion of cosmological questions. If the analogy of the early *mutakallimūn* with the Presocratics is valid, then this phase in the history of *kalām* would be analogous to the time of Plato and Aristotle. Just as these philosophers, reacting to the aftermath of the Eleatic challenge to the Presocratics undertook the analysis of the epistemological and terminological aspects of cosmological problems and then developed their own solutions to these problems in the context of broad philosophical systems, Abū 'Alī al-Jubbā'ī and his son Abū Hāshim al-Jubbā'ī (d. 321/933) also, reacting to the challenge of Ibn al-Rāwandī and the rise of *falsafa*, initiated the formation of systems with some measure of unity after the epistemological and terminological analysis of problems which had been discussed by their predecessors. The massive enterprise of the Jubbā'īs can be gleaned from the surviving texts of their followers.[25] Their reexamination of these problems, in particular, the problems of physical theory, led to the coinage of new terms, the adoption of new doctrines, and the transformation of previous doctrines. This sets apart the physical theory of *kalām* of the fourth and fifth/tenth and eleventh centuries from the physical theory of the earlier period of the third/ninth century. The focus of this book, then, is on the physical theory of the later period and its relationship with the physical theory of the earlier period. Since, however, the al-Jubbā'īs based their discussion of physical theory within the context of their epistemological and logical views, an overview of the latter is indispensable for the investigation of the former. Thus the discussion of the physical theories of the Basrian Mu'tazilī *mutakallimūn* will be preceded by an overview of Basrian Mu'tazilī epistemology and logic in the next chapter.

Unlike the situation of the Basrian Mu'tazilīs, texts by the Baghdadī Mu'tazilīs have not been preserved and we are not therefore in a similar position to evaluate Abū al-Qāsim's contribution to the problems

[24] van Ess, "Mu'tazilah," X:223. Watt calls it the "Silver Age of Mu'tazilism" (*Formative Period*, 297).

[25] Gimaret has examined the bibliography of the al-Jubbā'īs in his, "Matériaux pour une bibliographie des Gubbā'ī," *Journal Asiatique*, 264(1976), 277-332.

posed by his predecessors.[26] But his interest in methodology and hermeneutics can be attested on the basis of the titles of his now lost works. Moreover, his friendship with Abū Zayd al-Balkhī (d. 322/934), who had been a student of the *faylasūf* al-Kindī (d. 256/870), may have led to the adoption of some elements of *falsafa* cosmological doctrines, for example the denial of the vacuum and support for a theory of 'natures'. We know of al-Balkhī's views on these and other subjects from Shī'ī sources sympathetic to the view of the Baghdadī Mu'tazilīs, for example Shaykh al-Mufīd (d. 413/1022), and from reports preserved in Basrian Mu'tazilī sources in the course of their polemic with their Baghdadī brethren.[27] From these sources, it is clear that Abū al-Qāsim was an important figure who occupied the same place in the Baghdadī Mu'tazilī tradition as was occupied by the Jubbā'īs in the Basrian Mu'tazilī tradition.

Another important contemporary figure is one of Abū 'Alī al-Jubbā'ī's star pupils, Abū al-Ḥasan al-Ash'arī (d. 324/935). In 300/912-3, al-Ash'arī broke away from the Mu'tazila to join the camp of the traditionists (*ahl al-sunna*) who considered Aḥmad ibn Ḥanbal as their champion. Al-Ash'arī then used the formal structure and analytical methods of the Mu'tazila to present the theses of the traditionists. However, al-Ash'arī's opposition was primarily to the theological tenets of the Mu'tazila, in particular their rationalistic view that God is incapable of performing certain actions because He would then be unjust. Nevertheless, a large portion of the cosmological doctrines of the Mu'tazila was incorporated into his teaching for they have no bearing on such theological questions. Consequently, the Ash'arīs and their Mu'tazilī contemporaries share the same cosmological framework and deal with similar cosmological problems in their works. Of al-Ash'arī's preserved writings, his *Maqālāt al-islāmiyyīn wa ikhtilāf al-muṣallīn* is a rich and indispensable source for the doctrines and views of the *mutakallimūn* of the third/ninth century.[28]

To the later generations, these four figures, namely, Abū 'Alī al-Jubbā'ī, Abū Hāshim al-Jubbā'ī, Abū al-Qāsim al-Balkhī, and Abū al-Ḥasan al-Ash'arī stand like giants. Abū 'Alī and Abū Hāshim came to be regarded as the 'leaders' of the Basrian Mu'tazila, while al-Balkhī was regarded as the 'leader' of the Baghdadī Mu'tazila. Their status was

[26] J. van Ess, "Abū'l-Qāsem al-Balḵī al-Ka'bī," *Encyclopaedia Iranica*, I:359-362. The only surviving work by al-Balkhī is his *Maqālāt* which has been partially edited by Fu'ād Sayyid in his edition of 'Abd al-Jabbār's *Faḍl al-i'tizāl*, (Tunis,1974), 63-119.

[27] Muḥammad ibn al-Nu'mān al-Mufīd, *Awā'il al-maqālāt fī al-madhāhib wa al-mukhtārāt*, ed. F. al-Zinjānī, (Tabriz,1951).

[28] See above note 8. Al-Ash'arī's bibliography has been reconstructed by Gimaret in his, "Bibliographie d'Ash'arī: Un réexamen," *Journal Asiatique*, 273(1985), 223-292.

such that they overshadowed the earlier personalities of their schools. In this context, the designation 'Basrian Mu'tazilīs' represented the followers of Abū 'Alī and Abū Hāshim, while the designation 'Baghdadī Mu'tazilīs' represented the followers of al-Balkhī. This designation has also been adopted here, and references to the Basrian and Baghdadī Mu'tazilīs are to the followers of Abū 'Alī and Abū Hāshim al-Jubbā'ī, and al-Balkhī respectively.

The later veneration of these four figures is not without merit. In the case of the Basrian Mu'tazilīs, the Jubbā'īs conducted a re-examination of the epistemological and logical foundations of the doctrines of Mu'tazilī *kalām*, which, as we shall see, had repercussions for their cosmological views. Moreover, the father and the son sharply disagreed over many questions, including these very epistemological and logical foundations, which led to differences on the approach to cosmological problems. These differences posed problems for their followers who were forced to select between the different positions advocated by the father and his son. In general, Abū Hāshim's approach was favored, but in some notable instances Abū 'Alī's view was adopted. However, in some cases, these followers dissented from the positions of both Abū 'Alī and Abū Hāshim. The influence of the Jubbā'īs permeated beyond the Basrian Mu'tazilīs and their rivals among the Baghdadī Mu'tazilīs and the Ash'arīs were forced to discuss cosmological problems in the terminology and to a lesser degree, the logical system which the Jubbā'ī's had initiated.

In the present context, Abū Hāshim's disciple Abū 'Alī al-Khallād (fl. ca. 330/941) and the latter's disciples Abū Isḥāq ibn al-Ayyāsh (fl. ca. 360/970) and Abū 'Abd Allāh al-Baṣrī (d. 367/977) need to be mentioned. Their differences with the views of Abū 'Alī and Abū Hāshim are recorded in the texts. Ibn al-Ayyāsh and al-Baṣrī are, in turn, the teachers of Qāḍī 'Abd al-Jabbār (d. 415/1025).

Our extant Basrian Mu'tazilī sources are from this period, that is the end of the fourth and the fifth/end of the tenth and the eleventh centuries. It is the rediscovery of sixteen of the twenty volumes of 'Abd al-Jabbār's *Mughnī* ([The Book] which makes [other books] Superfluous) as well his other works which has made it possible for us to get a glimpse of the activity of the Basrian Mu'tazilī *mutakallimūn*.[29] In addition, several works by 'Abd al-Jabbār's students have also been preserved. These include the *Sharḥ uṣūl al-khamsa* (Commentary on the *Five Principles* [by Abū 'Alī al-Khallād]) of his Zaydī disciple Aḥmad ibn Abū Hāshim al-Qazwīnī, known as Mānkadīm Shishdev (d. 425/1034), which is in large part a summary of the contents of the *Mughnī* and the *Al-Tadhkira fī aḥkām al-jawāhir wa al-a'rāḍ* (On the Properties of Atoms and Accidents) of Ibn Mattawayh (fl. first half of fifth/eleventh century), both of which have been recently rediscovered, as well as the *Masā'il al-khilāf bayna al-baṣriyyīn wa al-baghdādiyyīn* (Disputed questions between the Basrian and Baghdadī Mu'tazilīs) of Abū al-Rashīd al-Nīsābūrī (fl. first half of fifth/eleventh century) which has been available since the beginning of the century, but which can now be better understood in the light of these other texts, as well as his recently rediscovered *Ziyādāt al-sharḥ*.[30]

Two of these texts, namely the *Tadhkira* of Ibn Mattawayh, and the *Masā'il al-khilāf* of al-Nīsābūrī are devoted solely to cosmological problems and are the major Basrian Mu'tazilī sources for the following chapters. These two texts, in addition to the *Sharḥ al-tadhkira* by an anonymous author of the sixth/eleventh century (this is a commentary on Ibn Mattawayh's *Tadhkira* which elucidates the sometimes terse presentation of Ibn Mattawayh) are the major sources which have been utilized to reconstruct the physical theory of the Basrian Mu'tazilīs.[31]

As has been mentioned above, similar texts by the Baghdadī Mu'tazilīs have not survived. However, because of his adoption of some aspects, in particular the cosmological aspects, of their doctrine, the Shī'ī author Shaykh al-Mufīd has preserved many of their views in his *Awā'il al-maqālāt fī al-madhāhib al-mukhtarāt*. This work has been utilized to ascertain the views of the fifth/eleventh century Baghdadī Mu'tazilī perspective on physical theory.

Like the works of his contemporaries, al-Ash'arī's major works have not survived. His views have however been gathered together by Ibn Fūrak (d. 406/1015) in his *Mujarrad maqālāt al-Ash'arī* (The pure doctrines of al-Ash'arī [himself]). For the cosmological views of the fifth/eleventh century Ash'arīs, in particular al-Bāqillānī (d. 403/1013)

[29] 'Abd al-Jabbār al-Hamadhānī, *al-Mughnī fī abwāb al-tawḥīd wa al-'adl*, (Cairo,1960-1969), idem, *al-Majmū' al-muḥīṭ bil-taklīf*, eds. J.J. Houben and D. Gimaret, (Beirut: Imprimèrie Catholique, 1965-1991). The first three parts of the *Mughnī* have not survived. The first part probably included a discussion of atoms, bodies, and accidents (see J. Peters, *God's Created Speech: A study in the speculative theology of the Mu'tazilī Qāḍī l-Quḍāt Abū l-Ḥasan 'Abd al-Jabbār bn Aḥmad al-Hamaḍānī*, (Leiden: Brill, 1976), 30).

[30] Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, ed. 'A. 'Uthmān, (Cairo,1965). For the attribution of this work see Gimaret, "Les *Uṣūl al-khamsa* du Qāḍī 'Abd al-Jabbār et leur commentaires," *Annales Islamologiques*, 15(1979), 47-96; Ibn Mattawayh, *al-Tadhkira fī aḥkām al-jawāhir wa al-a'rāḍ*, ed. S. Luṭf and F. 'Awn, (Cairo,1975). This is a partial edition of the sections on the atom and sensible accidents only. The full text is found in MS Ambrosiana C104; Abū al-Rashīd al-Nīsābūrī, *Masā'il al-khilāf bayna al-baṣriyyīn wa al-baghdādiyyīn*, ed. M. Ziyādeh and R. al-Sayyīd, (Beirut,1975) (this edition supersedes the previous edition by Biram); idem., *Ziyādat al-Sharḥ*, ed. M. Abū Rīdā, published as *Fī al-tawḥīd*, (Cairo,1969).

[31] *Sharh al-tadhkira fī laṭīf al-kalām*, MS Teheran Dānishgāh 514.

and al-Juwaynī (d. 478/1085), we have the latter's partially preserved *al-Shāmil fī uṣūl al-dīn* (The comprehensive [book] on the principles of religion).[32]

The above mentioned texts by the *mutakallimūn* of the fourth and fifth/tenth and eleventh centuries have, in the following chapters, been supplemented by the texts of their contemporary critics, for example the *faylasūf* Ibn Sīnā (d. 428/1037) and the Andalusian jurist Ibn Ḥazm (d. 456/1064) as well as texts by later figures from the *kalām* and *falsafa* traditions.

[32] Ibn Fūrak, *Mujarrad maqālāt al-Ash'arī*, ed. D. Gimaret, (Beirut,1987); Abū Bakr al-Bāqillānī *Kitāb al-Tamhīd.*, ed. R. McCarthy, (Beirut,1957); Abū al-Ma'alī al-Juwaynī, *al-Shāmil fī uṣūl al-dīn*, ed. 'A. al-Nashshār, (Alexandria,1969). See also, Daniel Gimaret, "Un document majeur pour l'histoire du kalām: Le *Mujarrad maqālāt al-Ash'arī*," *Arabica*, 32(1985), 185-218.

CHAPTER TWO

AN OVERVIEW OF EPISTEMOLOGY, THE THEORY OF ATTRIBUTES AND THE THEORY OF ACCIDENTS

The cosmological questions—What are the ultimate constituents (*dhawāt*) which make up the world? What are their attributes (*ṣifāt*) and their properties (*aḥkām*)?—cannot be considered in isolation from the fundamental epistemological questions they raise, namely, how do we know that such and such are the ultimate constituents? and, how do we arrive at the knowledge of the attributes and properties of these ultimate constituents? The epistemological foundation of cosmological inquiry has been long recognized, and was even acknowledged by the Presocratics. Indeed, the Eleatic criticism of the early Monist cosmologists is primarily made on epistemological grounds. It is not therefore surprising to find a fundamental concern with foundational epistemological questions in the cosmological discussions of Mu'tazilī *kalām* texts. An overview of Mu'tazilī epistemology is therefore essential for the study of their cosmology.

A. IBN MATTAWAYH'S CLASSIFICATION OF WHAT IS KNOWN

Ibn Mattawayh begins his work on the properties or properties of atoms and accidents *(Al-tadhkira fī aḥkām al-jawāhir wa al-a'rāḍ)* with a classification of all knowledge. He states:

> Know that the totality of the objects of knowledge (*al-ma'lūmāt ajma*) must be divisible [into classes formed] by repeated denial and affirmation (*'an qismatin tataraddadu bayna l-nafyi wa l-ithbāti*).[1]
>
> Thus, it (i.e. an object of knowledge) either has the attribute (*ṣifa*) of existence (*wujūd*) [in which case it is denoted by the term 'existent'

[1] The objects of our knowledge which are being classified here are the objects which constitute the world, as it will become clear later. They are, in the strict sense, objects about which we know something, namely that they have some property or other. For example, our knowledge that God, who is an object of our knowledge, has the property 'Eternal'.

For the use of argument by division on the basis of denial and affirmation see Peters, *God's Created Speech*, 72-74.

(*mawjūd*)][2] or it does not have the attribute of existence, in which case it is denoted by the term 'non-existent' (*ma'dūm*).

Moreover, the object which has the attribute of existence either acquires this attribute at [some] initial moment (*awwal*), or does not acquire it at an initial moment. This division is similar to the former division.

The object of knowledge which does not have an initial moment of existence is none other than the Eternal One (*al-qadīm*) Himself, may He be magnified and glorified. Discussion (*kalām*) about Him and His attributes is separate (*yanfaridu*) from discussion of the other objects of [our] knowledge. We cannot combine Him with them in discourse (*dhikr*), God is too exalted for this.

The term 'created' (*muḥdath*) denotes an object of knowledge which has some initial moment of existence. What is created can be [further] divided into that which, when it exists, occupies space (*yataḥayyazu*), and that which does not occupy space when it exists.[3] The former is the atom (*jawhar*), while the latter is the accident (*'araḍ*), even though what we have stated here is not its [true] definition.[4]

There is [only] one kind (*jins*) of atom. There is no need therefore to mention its divisions as in the case for the accident which consists of [different] types (*anwā'*) and kinds (*ajnās*).

The totality of objects (*al-jumla*), which, as a result of proof (*dalīl*), have been affirmed to be accidents, are colors, tastes, odors, heat and cold, humidity and dryness, the accidents of location (*akwān*), adhesion (*ta'līf*), force (*i'timād*),[5] pain (*alam*), sound (*ṣawt*), life (*ḥayāh*), the power of autonomous action (*qudra*), instinctual desire (*shahwa*) and instinctual loathing (*nifār*), willing (*irāda*) and aversion (*karāha*), conviction (*i'tiqād*) and opinion (*ẓann*), reason (*naẓar*), and ceasing to exist (*fanā'*).[6]

[2] The emendation "[in which case it is denoted by the term 'existent']" has been made the editor of the text but is not found in MS Ambrosiana C104, 1v.

[3] For the meaning of the term *mutaḥayyiz*, namely, 'the object which occupies space', see below, Chapter Three, 62-65.

[4] Namely, the accident is not defined as 'the entity which does not occupy space when it exists'. See below, 38-42.

[5] In the words of Ibn Mattawayh, "*I'timād* is an entitative accident (*ma'nā*) which makes the substrate in which it inheres push against (*mudāfi'an*) whatever it is touching when all obstacles are removed" (*Tadhkira*, 530). Depending on the context, *i'timād* can therefore be understood variously as pressure, force, impetus, or tendency to move (see also Peters, *God's Created Speech*, 135-137; Richard Frank, *Beings and their Attributes: The Teaching of the Basrian School of the Mu'tazila in the Classical Period*, (Albany: State University of New York Press, 1978), 194; Hans Daiber, *Das theologisch-philosophische System des Mu'ammar ibn 'Abbād as-Sulami (gest. 830 n. Chr.)*, (Beirut: Franz Steiner), 304-306; van Ess, *Theologie und Gesellschaft*, III:324-331).

[6] Ibn Mattawayh, *Tadhkira*, 33-34. Ibn Mattawayh's anonymous commentator adds that 'Abd al-Jabbār had also enumerated the objects of our knowledge in a summarized fashion in some of his works saying, "they are God, atoms and accidents." The commentator also adds that there are twenty two kinds of accidents (he mentions the same list as above) whose existence can be established (*ithbāt*) by means of a proof (*dalāla*), but that there are others which cannot be proved to exist, namely, the accidents of inability (*'ajz*), unawareness (*sahw*, *nisyān*), death (*mawt*), and perception (*idrāk*) (*Sharḥ al-tadhkira*, 2v). The Mu'tazilīs, Abū al-Qāsim al-Balkhī of the Baghdadī school and Abū 'Alī al-Jubbā'ī of the Basrian school both held that inability, unawareness, and shunning

Succinctly put, this classification, which is based on division on the basis of three criteria, namely the criteria of existence, temporal origin, and spatial occupation, maintains that our knowledge is knowledge of objects which do not exist[7] and knowledge of objects which exist. Objects which exist consist of God who is eternal, and atoms and accidents which have a temporal beginning. Furthermore, atoms (and the bodies they constitute) occupy space, while accidents, of which there are twenty-two kinds, do not.

There are two preliminary observations that can be made about this classification:

(1) This ontology in which the objects of the world comprise God, atoms, and accidents, is, at this fundamental level, a sparse ontology. In this system, these three ontological entities have to bear the explanatory burden for all the phenomena of the world, whether they be physical or psychological, as well as for the relationships between them, for example the relationship of cause and effect, and even for divine activity. As we shall see later, the *kalām* theory of attributes and the theory of accidents, in particular the properties (*aḥkām*)[8] of each specific accident (as indeed the properties of the atom), are highly developed and play a major role in the explanation of such phenomena. Some very brief illustrations of this include:

(a) God, who, as the Basrian Mu'tazilī *mutakallimūn* hold, has the primary attributes of being Eternal (*qadīm*), Alive (*ḥayy*), Knowing (*'ālim*), having the Power of autonomous action (*qādir*), and Existent (*mawjūd*) (by 'primary attributes' I mean predicates which are true at all times). On the other hand, His acts of willing (*irāda*) or aversion (*karāha*), and therefore His commands and His speech, are temporal, and therefore created, accidents.[9]

(*i'rāḍ*) were accidents, while the former also included doubt (*shakk*) in his list of accidents (al-Nīsābūrī, *Masā'il*, 250, 338, 341, 365).

The Ash'arī position, as put forth by al-Juwaynī, holds that the true nature of an object is its status as an object which exists and not, as the Mu'tazilīs hold, its status as an object of knowledge as is illustrated by Ibn Mattawayh's classification here. The Ash'arīs deny that 'objects which do not exist' can be said to be objects (see below, note 34). Their classification, therefore, is of objects which exist (*mawjūdāt*) and these comprise of objects which have some first initial moment of existence, which are therefore created, and that which does not have an initial moment of existence, namely God who is eternal. Created objects further consist of objects which require a substrate in which they inhere, namely accidents, or objects which do not need a substrate, namely atoms. Atoms are homogeneous. The number and types of accidents are not listed (al-Juwaynī, *Shāmil*, 139-142, 153-156).

[7] For the various possible senses of 'objects which do not exist', see below, note 34.

[8] For the use of this term, see below, 35-37.

[9] For the application of the attributes 'Eternal', 'Alive', 'Knowing', 'having the Power of autonomous action', and 'Existent' to God see below, note 57.

(b) The more familiar areas of human experience are also explained within this framework. As Ibn Mattawayh's classification shows, the *mutakallimūn* have only one type of substance, or, more properly, material substrate, that is, the atom and therefore, by extension, the bodies which are composed by the adhesion of an aggregate of atoms. The Basrian *mutakallimūn*, unlike their *falsafa* counterparts, do not have a non-material soul in their ontology to explain phenomena which are linked with animate beings. In the *kalām* system, this task falls upon accidents which, for this reason, play a large role in the description of the psychological phenomena of thought, will, instinctual desire etc., as well as of action.

A very bare outline of this is—the *mutakallimūn* hold that atoms can adhere together to form larger aggregates, namely, bodies. But when a body has a certain makeup or structure (*binya*), namely, the structure of the human or animal body, it becomes possible for the accident of life to inhere in every one of its component atoms, which in turn lays the foundation for the inherence of accidents of the autonomous power of action, willing, knowledge, instinctual desire etc..[10] However, unlike the inherence of color in a particular

The temporal nature of God's acts of willing is clear from 'Abd al-Jabbār's statement, "Our teachers Abū 'Alī and Abū Hāshim, may God have mercy upon them both, and all of those who followed them, believed that [a] God is a real willing agent (*murīdun fī l-ḥaqīqatī*); and [b] that He becomes a willing agent after not having been a willing agent when He performs an act of willing; and [c] that He wills by means of a temporally created act of willing (*bi-'irādatin muḥdathatin*); and [d] that it is impossible that He wills essentially (*li-nafsihi*; literally that He wills because of His Self), or by means of an eternal act of willing; and [e] that His act of willing is not located in a substrate (*lā fī maḥallin*)" (*Mughnī*, VI pt. 2:3). For the definition of accident and God's act of willing, see below, 38-42 and note 75.

[10] In the volume on man's moral responsibility (*taklīf*) of the *Mughnī*, 'Abd al-Jabbār reports many of the views of the *mutakallimūn* of the third to fifth/ninth to eleventh centuries on the nature of man. The view of the Basrian Mu'tazilīs is therein presented as, "What our teachers (*shuyūkhunā*) have held regarding this subject is that the living agent who has the autonomous power of action (*al-ḥayy al-qādir*) is this constituted individual (*al-shakṣ al-mubnā*), [or] this particular structure (*al-binya al-makhṣūṣa*), by means of which he is differentiated from the rest of the animals. Command or prohibition, praise or blame, are directed to this constituted individual. Even though he is living and has the autonomous power of action only as a result of accidents (*ma'ānī*) which inhere in him, this does not enter into the definition" (*Mughnī*, XI:311).

That the accident of life can only inhere in atoms which are part of a specific structure is clear from Ibn Mattawayh's statement, "The accident of life, even though it exists in a single substrate (*maḥall wāḥid*) requires that its substrate have a specific structure (*al-binya al-makhṣūṣa*). Thus it is impossible for it to exist in any substrate whatsoever as is the case for the accident of color, location, etc." (*Tadhkira*, MS Ambrosiana C104, 126r).

The accident of life inheres in each of the atoms of this particular structure. According to al-Nīsābūrī—"It is impossible for a single atom to be alive. Rather, many atoms must be present, so that it is possible for them to form a structure. These many atoms, in order to be alive, require many accidents of life. The reason for this is that it is impossible for

atom, these accidents of the autonomous power of action, willing, knowledge, etc., cannot be said to belong to any one particular atom which forms the human body, but rather are said of the human body as a whole (this is therefore given the term '*al-jumla*', meaning the composite whole). The constituted body as a whole is thus like the atom, insofar as the inherence of accidents like knowledge is concerned.[11] These accidents, then, in conjunction with some others, explain animate actions, as well as actions of voluntary agents.

(c) The final illustration of the explanatory power of the *kalām* theory is its explanation of the human ability to interact with the external world and to act as an agent therein. For example, a teacher causes knowledge in a student, or a man causes pain in another by striking him, or a man puts a stone into motion by throwing it. *Kalām*

one accident of life to exist in many atoms. Each atom needs to have the accident of life inhere in it so that the whole is alive" (*Ziyādāt al-sharḥ*, 106-107; see also *Sharḥ al-tadhkira*, 107v).

The emphasis in *kalām* is on man as a moral agent, and therefore the analysis of the nature of man occurs in discussions of man's moral responsibility (see Richard Frank, "Several Fundamental Assumptions of the Basra School of the Mu'tazila," *Studia Islamica*, XXXIII(1971), 5-18; 'Abd al-Jabbār's ethical system has been discussed in George Hourani, *Islamic Rationalism: The Ethics of 'Abd al-Jabbār*, (Oxford: Clarendon Press, 1971)). A preliminary analysis of the living composite, from an ontological perspective can be found in Frank, *Beings*, "Chapter 2: The Ontological Structure of the Living Composite: Some General Notions," 39-52. I have adopted Frank's rendition—'the autonomous power of action' for *qudra*.

[11] Ibn Mattawayh states, "This is the attribute (i.e. of being alive) which makes the [composite] whole like a single entity (*kal-shay'i l-wāḥidi*) for, as a result of the specification of the [composite] whole by this attribute [of life] it becomes possible for the [composite] whole to possess attributes which arise from the atoms as a whole and not from individual atoms, for example, [the attributes of] being knowing, having the power of autonomous action, willing, being averse, etc." (*Tadhkira*, MS Ambrosiana C104, 122r).

The functioning of the composite whole as a single unit is also clear in al-Nīsābūrī who states, "Even though acts of willing and aversion do not inhere in a single substrate they have properties of as if they were inherent is a single substrate because their properties derive from the composite whole. Since their properties derive from the composite whole it is as if they were inherent in a single atom" (*Ziyādāt al-sharḥ*, 104).

Ibn Mattawayh's commentator states, "Those accidents which can be both a condition (*sharṭ*) as well as depend on some condition (*mashrūṭ*) are like knowledge and life, because life is the condition for the existence of knowledge, and knowledge depends on [this] condition. Another example is life and the [specific] structure (*binya*) [of the human body], for, the [specific] structure is the condition for the attainment of life, and life depends on this condition" (*Sharḥ al-tadhkira*, 3r). This shows the dependency of life on the specific structure that is the human body, as well as the consequent dependency of knowledge on the existence of life.

The commentator also states, "The accidents which depend on a [specific] structure are all of those whose property (*ḥukm*) belongs to the composite whole (*jumla*), and these are like the power of autonomous action, knowledge, instinctual desire and instinctual loathing, willing and aversion, etc." (*Sharḥ al-tadhkira*, 2v).

in particular Basrian Mu'tazilī *kalām*, would seek to explain these actions in terms of the accidents of willing, knowledge, and the power of autonomous action which belong to man, and to combine these with their theory of causation (*tawlīd*), in which, secondary or indirect causation is the result of engendering an accident in the other object, be it the man who is taught or hurt, or the stone which is thrown. Thus a man can, through his power of autonomous action, create the accident of force (*i'timād*) which can then engender the motion of a stone which can then generate pain if it strikes someone.[12]

These illustrations reveal the complex manner in which these three primary ontological entities interact in the system of the *mutakallimūn*. These entities have to account not only for physical phenomena, but also for animate, psychological as well as divine phenomena. It is clear, then, that what we have in *kalām* is a system of explanation which endeavors to account for *all* phenomena, and not only phenomena of interest from a purely theological perspective.

(2) The second observation which may be made regarding Ibn Mattawayh's classification is that in spite of the fact that this introductory classification is primarily of objects which exist in the world, its emphasis is not on these objects as such, but on their status as objects of our knowledge (*ma'lūmāt*). This forms the starting point for Ibn Mattawayh's ensuing discourse on the properties of atoms and accidents, which is the subject for the rest of his work. It is therefore clear that he sets the importance of the theory of knowledge for cosmology, as indeed for all topics discussed by *kalām*, at the outset of his work.[13] Moreover, this theory of knowledge provides the conceptual framework for the Basrian Mu'tazilī *kalām* theory of attributes, as we shall see later.

[12] "Accidents can also be classified into those which are causes (*sabab*) and which fall under the domain of secondary causation (*tawlīd*), and those which do not fall under this domain, do not produce an effect, and are not therefore causes. The former consist of the following types of accidents: the accident of location, force, and reason. The latter, namely those which are not causes consist of the rest of the accidents.

Accidents can also be classified into those which result from a cause (*musabbab*), and those which are not thus caused. Accidents which are caused are the accidents of location, force, sound, adhesion, pain, and knowledge" (*Sharḥ al-tadhkira*, 3r).

[13] Most surviving *kalām* works, regardless of their partisan affiliation, begin with a discussion of the theory of knowledge, namely, what is knowledge, how is it acquired, the different kinds of knowledge, and the conditions for its acquisition. However, since Ibn Mattawayh's work is on the properties of atoms and their accidents, and since knowledge is itself an accident, it is not treated at the beginning of the work, as one finds in other *kalām* texts, but rather it finds its place in the discussion of accidents which belong to the living composite, namely man. This later section of the *Tadhkira*, which deals with accidents of the living composite, has not yet been published but can be found in MS Ambrosiana C104.

B. An Overview of the Basrian Mu'tazilī Theory of Knowledge

The Basrian Mu'tazilīs, as indeed all the *mutakallimūn*, were epistemological realists. They were convinced that the ultimate constituents of the world are real and concrete (and not ideal and theoretical) entities. They also maintained that it is possible for us to have true knowledge of these constituent entities and of their properties. Such a realist epistemology pits *kalām* directly against the skeptical view that knowledge of objects, as they are in themselves, is impossible. Indeed, this realist epistemology lies at the heart of *kalām*'s refutation of skepticism.

The fourth and fifth/tenth and eleventh century Mu'tazilī version of this epistemology is found in 'Abd al-Jabbār's refutation of skepticism in volume twelve of the *Mughnī*, which is devoted to reflection and knowledge (*al-naẓar wa al-ma'ārif*),[14] as well as in his denial of the possibility of the vision of God (*ru'yat al-bārī*) (which is the subject of volume four of the *Mughnī*), regardless of whether this vision is to be in this world or in the hereafter. In the course of arguing that God can never be visually perceived, 'Abd al-Jabbār is drawn to discuss visual illusions, which had been the basis of the Skeptical argument against the veracity of visual perception in Antiquity, and thereby of knowledge gained as a result of such perception, and by extension, of all perceptive knowledge.[15] 'Abd al-Jabbār rebuts this Skeptic argument and strongly defends the veracity of perception.[16]

[14] 'Abd al-Jabbār, *Mughnī*, XII:41-68. The three chapters included herein are "The refutation of the doctrine of those who deny [the existence of] real [external] objects (*haqā'iq*)" namely skepticism, "The refutation of the doctrine that the true nature (*ḥaqīqa*) of all objects depends on what one believes it to be (*mā ya'taqidu l-mu'taqidu*)" that is relativism, and "Another chapter which is connected with what we have discussed previously." These chapters are analyzed by Marie Bernard in her *Le problème de la connaissance d'après le Muġnī du Cadi 'Abd al-Ǧabbār*, (Algiers,1982), 69-88.

[15] Visual illusions form the fifth of the ten modes of Ancient Skepticism (Julia Annas and Jonathan Barnes, *The Modes of Skepticism: Ancient Texts and Modern Interpretations*, (Cambridge: Cambridge University Press, 1985), ch. 5, 99-109). Annas and Barnes observe that the Ancient Atomists, particularly the Epicureans, "presented the most systematic attempt to meet problems of this sort: they denied that we really are presented with conflicting appearances" (Ibid., 106). Rather, errors occur "because we do not stick to appearances but impose 'an additional judgment' on them" (Ibid., 105; see also, Stephen Everson, "Epicurus on the truth of the senses," in *Companions to Ancient Thought 1: Epistemology*, ed. Stephen Everson, (Cambridge: Cambridge University Press, 1990), 184-203). The *mutakallimūn*, on the other hand, accept that we are presented with false appearances and therefore attempt to explain why they arise ('Abd al-Jabbār, *Mughnī*, IV:70-79, paraphrased in A.I. Sabra, *The Optics of Ibn al-Haytham: Books I-III On Direct Vision*, vol. II, *Introduction, Commentary, Glossaries, Concordance, Indices*, (London: The Warburg Institute, 1989), 107-111).

[16] 'Abd al-Jabbār, *Mughnī*, IV:60-74. For the Basrian Mu'tazilīs, these accounts of 'Abd al-Jabbār in the *Mughnī* can be supplemented with Mānkadīm Shisdev's analogous discussion of the impossibility of the vision of God (*Sharḥ uṣūl al-khamsa*, 232-277), the passing comments on perception whilst discussing the nature of the atom by Abū Rashid

Perception and the attributes of objects

"Perception," 'Abd al-Jabbār states, "cannot but represent (*lā yata'allaqu*)[17] the perceived object (*shay'*) as the object really is (*'alā mā huwa bihi*). Therefore, perception is a source (*ṭarīq*) of knowledge (*'ilm*)."[18] This is a strong claim for the veracity of knowledge of perceived objects. In fact, 'Abd al-Jabbār continues, when someone perceives an object, he is convinced that the object is actually just as he has perceived it to be, and he (or his soul) is at rest regarding this conviction. It is impossible for him to remove this conviction (*i'tiqād*) about the nature of the object from himself, whether as a result of suspicions (*shubah*) or doubts (*shukūk*).[19]

As a result, the *mutakallimūn* classify perceptive knowledge as immediate or necessary knowledge (*'ilm ḍarūrī*). It is, as such, opposed to the only other class of knowledge which was recognized by the Mu'tazilīs, namely, mediate or acquired knowledge (*'ilm muktasab*). For example, our knowledge of God is, in their view, mediate because it is acquired as a result of reflection (*naẓar*).[20] The Basrian Mu'tazilīs also consider knowledge of our own internal states, for example our consciousness of presently being angry or fearful etc., as well as our innate knowledge of the principle of non-contradiction, for example that two contraries cannot be true of the same subject, or that a body cannot be in two places as the same time, to be immediate knowledge.

al-Nīsābūrī (*Masā'il*, 29-36) as well as his more direct discussions on knowledge and reason (Ibid., 287-352), and the sections on perception, knowledge, and reason by Ibn Mattawayh in his *Tadhkira* (which remains unpublished but can be found in MS Ambrosiana C104) and the corresponding sections in the anonymous commentary on this work (*Sharḥ al-tadhkira*, 154r-192r).

[17] The verb *ta'allaqa* and its verbal noun *ta'alluq* play an important role in the discussion of causation. The primary meaning of these terms is 'being attached to something' or 'being stuck to something' and thus is used to convey the relationship between two objects. In the present context of perception, the intended meaning is clear, that is, the relationship between perception and the object of perception, which, in my view, is best rendered into English by the verb 'to represent', namely how perception represents the object of perception to the perceiver.

[18] 'Abd al-Jabbār, *Mughnī*, IV:70. 'Abd al-Jabbār recognizes that perception can sometimes be confused, as in the case of illusions. But he holds that when the perceiver is of sound mind (*'āqil*) and no source of confusion (*labs*) is present, that is to say there are no impediments to sound perception, then perception must represent the object as it really is and therefore be true (Ibid., XII:59).

[19] Ibid., IV:70. The definition of knowledge as a conviction in which the self (or soul (*nafs*)) is at rest was formulated by Abū Hāshim and was adopted by his followers. It was even adopted by some Ash'aris (Bernard, *Le problème*, 291-300).

[20] 'Abd al-Jabbār, *Mughnī*, XII:65-66, 67; Bernard, *Le problème*, 137-141. Al-Jāḥiẓ who is notorious for having held the view that man's knowledge of God was innate, is an exception to this (see Georges Vajda, "Le connaissance naturelle de Dieu selon al-Gāḥiẓ critiquée par les Mu'tazilites," *Studia Islamica*, XXIV(1966), 19-33; see also 'Abd al-Jabbār, *Mughnī*, XII:316-332).

It follows then, that perceptive knowledge is as valid as our existential knowledge of our own internal states, and our *a priori* knowledge of logical principles like non-contradiction, both of which belong to the class of immediate or necessary knowledge.[21]

Even though the *mutakallimūn* were epistemological realists, they considered our perceptive knowledge of a perceptible object to be knowledge of some of its aspects, or to use their terminology, of some of its 'attributes' and therefore by implication, the object as it is in itself can never be completely known by perception alone. The *kalām* theory of the attributes of objects therefore forms the link between the object as it is in itself and our knowledge of it arising as a result of perception. As 'Abd al-Jabbār puts it, the knowledge of the object of perception (*shay'*) which the perceiver acquires corresponds to the manner of its perception. "He can only perceive the object, when it exists, by its most specific attribute (*'alā akhaṣṣi awṣāfihi*), because, when it exists it must have attributes. Perception does not acquire knowledge of them [all], save for the attribute which derives[22] from the essence (*dhāt*)[23] of the perceptive object, for example, the occupation of space (*taḥayyuz*) of an atom or the fact that [the accident] black (*al-sawād*) is characterized by a particular visual appearance (*hay'a*) which delineates it from other objects."[24] Thus it is clear that the perceptible

[21] Shishdev Mānkadīm, representing the Basrian Mu'tazilī view, defines immediate knowledge as "knowledge which arises within us not as a result of our own effort, and which we cannot, in any manner whatsoever, deny" (*Sharḥ uṣūl al-khamsa*, 48).

[22] Reading *tarji'u* for *yarji'u*.

[23] The term *dhāt*, as it is used by the *mutakallimūn*, cannot be rendered into English by a single term because it encompasses the concepts of 'essence', 'object', 'what it is in itself', and 'self'. I have thus chosen the appropriate English rendition for the context in which *dhāt* occurs. The signification of *dhāt* and the problems which it raises in the *kalām* context are discussed in more detail below, 29-33.

[24] 'Abd al-Jabbār, *Mughnī*, XII:61. The term *hay'a*, which I have here translated as 'visual appearance' occurs in Ibn Mattawayh's discussion of color as follows, "Color is the visual appearance (*hay'a*) by means of which a body is perceived" (*Tadhkira*, 247). Ibn Mattawayh's commentator further states that the true natures (*ḥaqā'iq*) of colors are their visual appearances (*Sharḥ al-tadhkira*, 42r). Therefore color is that particular visual property of being black, or white, or any color whatsoever, which to the sense of vision is an 'appearance' which is either black, or white, or some other color. Each of these colors is a visually distinct appearance because it represents a distinct object of perception, namely a particular color. The mathematician Ibn al-Haytham (d. 432/1040), on the other hand, has a different conception of the term *hay'a*, which he takes to be the visual perception of the bodily shape of an object (A.I. Sabra, *The Optics of Ibn al-Haytham*, II:171). This use of *hay'a* to denote shape is akin to the use of *hay'a* in cosmological texts to denote the large-scale structure or 'shape' of the universe.

The *kalām* usage of the term *hay'a* is further exemplified in al-Nīsābūrī's *Masā'il* when he discusses the objection of opponents who "believe that it is impossible for the atom to exist and yet be invisible. Further," these opponents claim, "it cannot be visible save as an appearance (*hay'a*), and this visual appearance must be one of the colors. For this reason," they claim, "we must conclude that it is impossible for the atom to be with-

objects of the world may have many attributes, but the true object of perception is 'the most specific' of these attributes. In other words, the attribute by means of which we perceive an object is the attribute by which this perceptive object is differentiated from all other classes of perceptive objects. Consequently, this specific attribute is unique to every particular class of perceptive objects and is the defining attribute for this class.[25] If we were to perceive an object by an attribute which was not its defining attribute, then the veracity of perception would not be guaranteed and perception would lead to ignorance, for we would have failed to recognize the object.[26] In the case of the atom, which is a standard example used by the *mutakallimūn*, this specific attribute is its attribute of occupying space. It follows then, that any further knowledge of an object, such as 'it exists', is mediate and is acquired secondarily as a consequence of the primary knowledge of the object which results from the immediate perception of this specific, and as such, differentiating attribute. In the words of 'Abd al-Jabbār, "As a result of perception, we know that the perceived object exists, even though perception does not [specifically] represent this attribute.

out color." To this objection al-Nīsābūrī replies, "Your statement that it is impossible for the atom to be visible save as a visual appearance [of color] is a contested claim (*da'wā fīhā tanāzu'ūn*). On the contrary, someone who considers it possible for the atom to be without color accepts that the atom may not be seen as a visual appearance [of color]. If it is said: We cannot conceive (*lā natasawwaru*) of the visual perception (*ru'ya*) of the atom save as a visual appearance [of color], and if this is the case, your assertion is untrue—We say to him: This is also a [contested] claim. Rather, it is possible to conceive of its visual perception, without it being a visual appearance [of color] insofar as it [i.e. the atom] may be seen in a manner which falls short (*muntaqiṣ al-ḥāl*) of the perception of something which is colored. Moreover, it is not necessary to deny [the existence of] something which we cannot conceive, for we cannot conceive of most of the accidents which we affirm to exist, nor can we conceive of God, even though we are capable of affirming His existence. Furthermore, if it were impossible to see the atom save as a visual appearance [of color], then it would necessarily follow on the basis of the argument (*dalīl*) which we have presented that it is possible for the atom to exist, even though its visual perception is impossible because it is without color" (al-Nīsābūrī, *Masā'il*, 72; see also idem, *Ziyādāt al-sharḥ*, 118, 165). The sense in which the visual perception of the colorless atom falls short is perhaps clarified by the comment that its visual perception when colored is more intense (*yaqwā 'alā l-idrāk*) than when it is colorless (*Ziyādāt al-sharḥ*, 167). It is clear, however, that, 'visual appearance' is the primary feature of color, that is of being red or green or black etc., and has nothing to do with bodily shape as one would initially suppose.

[25] "Know that what causes similarity (*alladhī yu'aththiru fī l-tamāthul*) is the object's essential attribute (*al-ṣifatu l-dhātiyyatu*) or what is entailed by the object's essential attribute (*al-muqtaḍātu 'an ṣifati l-dhāti*)" (al-Nīsābūrī, *Masā'il*, 36). "By means of perception we acquire knowledge of the perceived object through the attribute, by virtue of which, the object is differentiated from other objects, because perception is the source of knowledge of the similarity and difference [between perceptible objects]" (al-Nīsābūrī, *Masā'il*, 30-31; see also his *Ziyādāt al-sharḥ*, 34-35, 71). For the Basrian Mu'tazilī view of the essential attribute of objects see below, 34-35.

[26] al-Nīsābūrī, *Masā'il*, 31.

However, since the attribute by means of which the object is perceived cannot be realized without the existence of the object, it follows that we must acquire knowledge that it exists."[27]

The theory of attributes

Even though particular discussions of whether X is an attribute of an object, and if so, what kind of attribute it is, are commonplace in the texts of the Basrian *mutakallimūn*, no adequate discussion of the general theory of attributes survives. The first three volumes of 'Abd al-Jabbār's *Mughnī*, in which this subject must have been discussed at length in the context of discussing the attributes of God, are lost.[28] We therefore have to reconstruct the Basrian Mu'tazilī theory of attributes on the basis of the discussions of the attributes of particular objects. This reconstruction must, in the present state of research, remain tentative and even inadequate in some places, for, only the bare outlines of the theory of attributes can be discerned and we are unable to answer many of the problems which the reconstruction raises.[29]

The overview of the Mu'tazilī *kalām* theory of perception, which has been presented above, is one way to begin to approach the reconstruction of the general theory of attributes. This theory of perception entails that an object (*dhāt* or *shay'*) has attributes (*ṣifāt*), one of which is its most specific, and, as such, differentiating attribute. This specific attribute is, in the case of perceptible objects, the true object of perception. Objects may have other attributes which are known mediately as a consequence of knowing this most specific attribute.[30] The case of the atom provides an illustration and a point of reference:

[27] 'Abd al-Jabbār, *Mughnī*, XII:61. The view that the attribute of existence is a different attribute, and is not identical to the attribute by means of which an object is differentiated from other objects (i.e. the attribute entailed by the essential attribute of the object discussed below, 35-36), was not unanimously held by the Basrian Mu'tazilīs. Thus Abū Isḥāq al-Naṣībī (a contemporary of 'Abd al-Jabbār; both of them studied with Abū 'Abd Allāh al-Baṣrī (see 'Abd al-Jabbār, *Faḍl al-i'tizāl*, ed. F. Sayyid, (Tunis,1974) 378)) held that, in the case of the atom, its attribute of occupying space was not an attribute distinct from its attribute of existence, but that these were one and the same attribute (Ibn Mattawayh, *Tadhkira*, 59, 73; *Sharḥ al-tadhkira*, 6v; and al-Nīsābūrī, *Masā'il*, 37).

[28] The "Section on Attributes" (*bābu l-ṣifāti*) is mentioned several times in the surviving sections of the *Mughnī* (e.g. V:205). The corresponding sections in al-Nīsābūrī's *Ziyādāt al-sharḥ* and Shishdev Mānkadīm's *Sharḥ uṣūl al-khamsa* do not furnish adequate material to reconstruct the general theory of attributes.

[29] The most comprehensive study to date of the Basrian Mu'tazilī theory of attributes is Richard Frank's *Beings and their Attributes*. He too notes the tentative and restrictive nature of our understanding of the theory of attributes so far (*Beings*, 6-7).

[30] Obviously not all objects are perceptible and therefore immediately known. The most obvious example of this (for *kalām*) is God (there is an extensive discussion of why God cannot be known immediately in Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 51-60; for the use of the terms *dhāt* or *shay'* for God see below, 29). In such cases, our

When an object (*dhāt*) is affirmed [to be a possible being] (*thabatat*)[31] by some source of knowledge (*ṭarīq*),[32] its attributes must also be affirmed

source of knowledge of the existence of the non-perceptive object is an argument or indication (*dalāla*), and this in turn is of two kinds: The first is based on the properties (*ḥukm/aḥkām*) of the object, while the second, which applies in the case of God, relies on its activity (*fi'l*) (Ibid., 89; *Sharḥ al-tadhkira*, 6r, 114v; and below, note 33).

[31] The term *thabata(t)* and its cognates (*ithbāt*, etc.) can, in the *kalām* context, have two distinct meanings. The first is its normal meaning of affirming or establishing that something is true, for example affirming that A is an attribute of the object X, or that the attribute A differs from the attribute B. This is the sense of *thabata* when we affirm that the atom has the attribute of occupying space.

The second sense of *thabata*, which is also found in *kalām* texts is the specialized use which I have rendered above by the unwieldy phrase as 'to affirm to be a possible being'. This sense of *thabata* needs to be contrasted with the term *wujūd* and its cognates (*mawjūd*, etc.). The act of affirming that something is a possible being is the logical act of affirming the proposition that this object is an object which we, on the basis of some epistemological grounds, believe may exist in the world, whether or not it presently exists (see also below, note 34). Needless to say, this sense of *thabata* applies only to objects *dhawāt*) and not to their attributes or characteristics.

To affirm that an object is a possible being is to present an argument for its possible existence. The object, whose possible existence is thereby affirmed, then belongs to the class of objects, which, like atoms, colors, tastes, acts of will, acts of thought, etc., are not properties or attributes, but are beings in their own right, and are, as such, the primary subjects of which properties and attributes are predicated (Frank, *Beings*, 37, n. 49). In our example of the atom, the ground for affirming its possible existence is said to be perception (see note 30 above for the grounds for affirming the possible existence of non-perceptive objects). Other examples include the accident of annihilation for which the ground for affirming its possible existence is revelation, and God, the ground of whose possible existence is a rational argument. Since existence is one of the primary attributes of God, affirming His possible existence is tantamount to affirming His actual existence. In the particular case of God, then, the two senses of *thabata* are identical.

The term *wujūd* on the other hand, makes an existential statement about an object, namely that it exists at the present moment. In the *kalām* view, the existence of a created object in the world is the result of the action of agents having autonomous power, namely God (who is eternal and self-existent) and man. These agents can bring an object, which had until this moment been a possible existent, into existence at the present time. Thus God may bring an atom into existence, while a man may move himself or another object from one place to another thus bringing the accidents of motion and location into existence. In contrast, the logical act of affirming that an object is a possible being obviously says nothing about whether the object exists or not at the present time (see also Frank, *Beings*, 114 n. 14).

[32] According to Mānkadīm Shishdev (*Sharḥ uṣūl al-khamsa*, 88), the means, ways, or sources of knowledge are:

(1) perception, that is, our immediate knowledge of what we perceive by the five senses, namely vision, and the senses of taste, smell, touch, and hearing;
(2) consciousness of our own internal states, that is, our immediate knowledge of our internal states, for example of willing, loathing, knowing, etc.;
(3) our immediate knowledge of *a priori* truths, for example the principle of non-contradiction;
(4) argument, proof, or evidence (literally indication—*dalāla*) which arises as a result of reflection (*naẓar*) which may either depend on a rational argument (*ḥujjat al-'aql*), or the specifically religious proofs or evidences of revelation (*al-kitāb*), Prophetic tradition (*al-sunna*), or consensus (*al-ijmā'*).

by the same source, whether directly or mediately.[33] Therefore, since the atom is affirmed [to be a possible being] as a result of perception, it follows then that the attributes of the atom must also be affirmed by perception.

Of the attributes of the atom, perception acquires [knowledge of] the fact that it occupies space (*kawnuhu mutaḥayyizan*). But [this attribute] discloses (*yunbi'*) [the presence of] an essential attribute (*ṣifa dhātiyya*) which does not cease to be, regardless of whether the atom is non-existent (*'adam*) or existent (*wujūd*).[34]

[33] See also Ibn Mattawayh, *Tadhkira*, 56-57, 557; *Sharḥ al-tadhkira*, 6r. The assertion that the same source of knowledge leads both to knowledge of the possible existence of an object as well as of its attributes is also found in the discussion of the attributes of God—"The only source of knowledge for affirming [the possible existence] of God's Self (*dhāt*) is [His] activity. It follows therefore that [His] activity must [also] be the source of knowledge of His attributes, whether directly or mediately. Any attribute which is not indicated by [His] activity, whether directly or mediately, cannot be affirmed of Him. The reason for this is—the source of knowledge for affirming [the possible existence] of an object is also the source of knowledge for its attributes and any attribute which is not indicated by this source of knowledge cannot be affirmed to be true. Because, [if an attribute were affirmed of the object] it would have been affirmed without [there being] a source for [this] knowledge, and the affirmation of something for which there is no source of knowledge opens the door to ignorance. We therefore maintain that since perception is the source of knowledge for affirming [the possible existence] of the atom, it must also be the source for affirming its attributes, and [therefore] any attribute which is not indicated by perception cannot be affirmed of the atom. The same holds true in our case here" (Ismā'īl ibn Aḥmad al-Farzādī, *Ta'līq al-Farzādī 'alā uṣūl al-khamsa lil-Qāḍī 'Abd al-Jabbār*, MS Ṣan'ā' 'Ilm al-kalām 73, 30r, quoted in Abū Rīda's introduction to al-Nīsābūrī, *Ziyādāt al-sharḥ*, 60).

[34] The assertion that the non-existent is an atom (or an accident) is a particular form of the proposition 'the non-existent (*ma'dūm*) is an object (*shay'*)', that is, whether 'object' can be predicated of 'non-existent'. The Basrian Mu'tazilīs upheld this proposition, but it was vehemently rejected by their *kalām* opponents, most notably the Ash'arīs (for example al-Juwaynī, *Shāmil*, 124-139, 151-7). The Basrian Mu'tazilīs (except for Abū 'Abd Allāh al-Baṣrī (d. 367/977)), following the view of Abū Ya'qūb al-Shaḥḥām (his dates are unknown but he was a student of Abū al-Hudhayl and the teacher of Abū 'Alī al-Jubbā'ī and therefore was active in the later half of the third/ninth century), asserted that 'the non-existent is an atom' or 'the non-existent is an accident'. The Baghdadī Mu'tazilīs, on the other hand, denied this formulation, and insisted that 'non-existent' could not be said to be an 'atom' nor an 'accident', but only an 'object' (*shay'*) or an 'object of autonomous power' (*maqdūr*) or an 'object of knowledge' (*ma'lūm*) (al-Nīsābūrī, *Masā'il*, 37-38; Ibn Mattawayh, *Tadhkira*, 76; al-Mufīd, *Awā'il*, 79; Naṣīr al-dīn al-Ṭūsī, *Talkhīṣ al-muḥaṣṣal*, in Fakhr al-dīn al-Rāzī, *Muḥaṣṣal al-afkār al-mutaqaddimīn wa al-muta'akhkhirīn*, ed. A. Nūrānī, (Teheran: Institute of Islamic Studies, McGill University, Teheran Branch, 1980), 76; but al-Juwaynī, *Shāmil*, 125 considers the Baghdadī view to be similar to the Ash'arī view).

The Basrian Mu'tazilīs presented many arguments to support their view, but the one, which, in my view, clearly illustrates what they intend is: When God wishes to create the atom, He has the intention of bringing into existence (*ījād*) that object, which He knows has the attribute of occupying space when it exists. This entails that God must have knowledge of the object He wishes to create—namely the atom—knowledge, which must logically and temporally be prior to its coming-into-existence. This knowledge is knowledge of how this particular object, which He wishes to create, is differentiated from all the other objects He can choose to create. This knowledge of the object is only possible if the object is characterized by a distinct, differentiating attribute which distin-

guishes it from other objects which are known to Him. Therefore, this differentiating attribute belongs to the object regardless of whether the object itself exists or not, because it corresponds to our (and God's) conception of this object and not of any other (al-Nīsābūrī, *Masā'il*, 45, 46, 39; see also Abū 'Alī al-Jubbā'ī's view that God knows the atom or color before He creates it and the discussion of whether God's knowledge of bodies or things is eternal, i.e. it exists before their creation (al-Ash'arī, *Maqālāt*, 371, 158-163)). In contrast, the Shī'ī author Shaykh al-Mufīd, claims that Jahm ibn Ṣafwān and Hishām ibn 'Amr al-Fuwaṭī both held that knowledge of non-existent objects is impossible. Rather, they believed, only existent objects may be known. The context is too brief to enable us to determine whether 'non-existent' refers only to objects whose existence is impossible, for example unicorns, or also to objects whose existence is possible, even though they may not be in existence at present (al-Mufīd, *Awā'il*, 79). This would suggest that the problem of the status of non-existent objects has its roots in early discussions and that the Basrian *mutakallimūn* were trying to work out the problems raised by these early discussions.

In the later Basrian view, this differentiating attribute refers, for example, to our conception of the atom, and, as such, to how it is an object of knowledge which is distinct from all other objects of knowledge. Ibn Mattawayh therefore states, "It follows then ... that by [the term] 'non-existent' (*ma'dūm*) one refers to an object of knowledge (*ma'lūm*) which does not [at present] have the attribute of existence' (*Tadhkira*, 64; see also Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 175; al-Nīsābūrī, *Masā'il*, 44) and "... because the atom and all other objects (*dhawāt*) must be affirmed as being different from those objects from which they differ [even] when they are non-existent. This difference cannot be the result of the atom's being a thing-in-itself (*dhāt*), because being a thing-in-itself is common to all objects [i.e. things-in-themselves]. The difference must therefore lie in an attribute [of the object], and this attribute is the attribute which we term 'its being an atom' (*kawnuhu jawharan*). We affirm that non-existent objects differ [from each other] only insofar as they are objects of knowledge (*ma'lūmāt*). Either an object can substitute another object insofar as it is an object of knowledge, or it cannot substitute another object. In the former case, the identity of all non-existent objects is entailed, and if they are identical when non-existent, they must also be identical when they exist. But in the latter case, difference [between non-existent objects] is affirmed, and this can only be the result of an attribute" (*Tadhkira*, 71).

The Ḥanbalī jurist (*faqīh*) Abū Ya'lā ibn al-Farrā' (d. 458/1066) who was a contemporary of both Ibn Mattawayh and al-Nīsābūrī mentions five meanings of the term *ma'dūm* (in his *Mu'tamad fī uṣūl al-dīn*, ed. W.Z. Ḥaddād, (Beirut,1974), 34; see also al-Bāqillānī, *Tamhīd*, 15-6):

(1) the non-existent which can never exist, that is, the impossible, for example a body which is in two places at the same time;
(2) the non-existent which does not exist and can never exist, not because of any logical impediment, but because God has revealed it to be so, for example the return of the people of the hereafter to this earth, or the entry of unbelievers into paradise;
(3) the non-existent which will exist at a later time, for example the day of judgment;
(4) the non-existent which existed previously, for example our past actions;
(5) the non-existent which may or may not come into existence, for example the motion of a body presently at rest, or the coming to rest of a body presently in motion.

The Ash'arīs only acknowledge the first meaning of *ma'dūm*, namely the impossible, and therefore they reject the Basrian Mu'tazilī view of *ma'dūm* (al-Juwaynī, *Shāmil*, 124 who states "the non-existent is impossible in any manner whatsoever"; 'Aḍud al-dīn al-Ījī, *Mawāqif 'ilm al-kalām*, (Cairo,1907-1909), 3:63; Fakhr al-dīn al-Rāzī adds that the Mu'tazilīs Abū al-Hudhayl and Abū ['Abd Allāh] al-Ḥasan (sic) al-Baṣrī are among those who considered *ma'dūm* to mean the impossible (*Muḥaṣṣal*, 76)). The Basrians, on other hand, discuss the various meanings of *ma'dūm* in a manner similar to that of Abū Ya'lā in their works. Richard Frank has argued that, in the Basrian Mu'tazilī formulation, the term 'non-existent' (*ma'dūm*) in the proposition 'the non-existent is an object' denotes

> [Next], the atom's occupation of space depends on its existence (*mashrūṭun bil-wujūdi*). [The attribute of] existence must therefore also be affirmed of the atom.
>
> [Finally], the atom's occupation of space cannot become manifest except by its having a location in space (*illā bi-kawnihi kā'inan fī jihatin*). Thus it is one of the consequences of its occupation of space.[35] For this reason, when the atom exists and occupies space, it becomes possible for it to have a location. But if it does not exist and does not occupy space this is impossible. Therefore, it [i.e. the attribute of having a location] cannot be associated with anything else [besides the attribute of occupying space].
>
> It follows from this all that the attributes of the atom are four: its being an atom, its occupation of space, its existence, and its having a location.[36]

This example, despite its specific concern with the atom, clearly illustrates the two primary categories of *kalām* logical analysis, namely, objects or things (*dhāt/dhawāt* and *shay'/ashyā'*) and attributes or states (*ṣifa/ṣifāt* and *ḥāl/aḥwāl*).[37] The example also presents us with a list of the attributes of the atom.

Things or objects

Let us turn to the first category, namely that of *shay'* or *dhāt* ('thing' or 'object'). In the *Mughnī*, 'Abd al-Jabbār discusses how these terms are applied to God. He tells us, "Know that He, may He be glorified, is described as *shay'* ('thing') by virtue of the fact that it is possible that He be known and be the subject of predication (*min ḥaythu ṣaḥḥa an yu'lama wa yukhbara 'anhu*)"[38] and "God is described as *dhāt* ('object') because, in the convention of the *mutakallimūn*, the intent of [using] this [term] is that He is one of those [things] which can be characterized by attributes (*ṣifāt*) which differentiate Him from other [things]."[39]

It would seem then, that *shay'* is a general term, denoting any object of knowledge, while *dhāt* denotes a distinct entity having particular differentiating attributes. In many places, however, these two

the possible existent in the third, fourth, and fifth senses of Abū Ya'lā's usage and not the impossible as in the first and second senses ("Al-Ma'dūm wal-Mawjūd, the non-Existent, the Existent, and the Possible, in the teaching of Abū Hāshim and his followers," *Melanges de l'Institut Dominicain des Etudes Orientales*, 14(1980), 185-210; see also the discussion by Naṣīr al-dīn al-Ṭūsī, *Talkhīṣ al-muḥaṣṣal*, 76, 81-82; Bernard, *Problème*, 267-272).

[35] See below, Chapter Five, 146-148.

[36] Ibn Mattawayh, *Tadhkira*, 56.

[37] For the equivalence of attribute (*ṣifa*) and state (*ḥāl*) in Basrian Mu'tazilī texts, see the discussion of Richard Frank, "Ḥāl" in *The Encyclopaedia of Islam—Supplement*, new ed., 343-348.

[38] 'Abd al-Jabbār, *Mughnī*, V:249; Ibn Mattawayh, *Tadhkira*, 74; see also Frank, *Beings*, 23.

[39] 'Abd al-Jabbār, *Mughnī*, V:252-253.

terms are equivalent.[40] Thus al-Nīsābūrī states, "The intended [meaning] by our saying *dhāt* is that it is [something which] can be known and be the subject of predication."[41] This is identical to 'Abd al-Jabbār's formulation of the meaning of *shay'*. However, while *shay'* is, like its English equivalent—'thing', used in a general manner in a variety of contexts, for example for the object of perception, the use of *dhāt* is more precise. In the texts I have examined, it is mostly confined to the fundamental, irreducible entities of Mu'tazilī cosmology which, for the Basrian *mutakallimūn*, comprise God, atoms, and the twenty-two types of accidents.[42]

It is not clear why the use of *dhāt* is confined to these entities, and this raises several difficulties. One of these is, if *dhāt* denotes an object of knowledge, then how can objects of knowledge only comprise these twenty-four irreducible entities? Why is a common object like chair or man or horse not considered to be an object of knowledge and therefore a *dhāt*? In the present state of research, this question cannot be answered satisfactorily. There is textual support, however, for the position that, in the view of the Basrian *mutakallimūn*, these twenty-four entities encompass all the objects of knowledge. In his comments on the first chapter of the *Tadhkira*,[43] which, as we have seen at the beginning of this chapter, is a classification of all objects of knowledge, Ibn Mattawayh's commentator states,

> In this chapter, the intention of Ibn Mattawayh, may God have mercy upon him, was to encompass all the classes of the objects of knowledge (*qaṣada...ḥaṣra ajnāsi l-ma'lūmāti*) and to explain their [different] types. Qāḍī al-Quḍāt 'Imād al-dīn ['Abd al-Jabbār], may God be pleased with him, had previously delineated them in some places in a [summarized manner].[44] He said, they are God, atoms, and the accidents.[45]

As we shall see later, the Basrian *mutakallimūn* consider these irreducible objects to have distinct, differentiating, attributes. Consequently, the term *dhāt* can be applied to them, for it is in line with their definition that *dhāt* denotes something which can be characterized by attributes which differentiate it from other things. But why do these objects encompass *all* objects of knowledge?

[40] Fazlur Rahman notes that *dhāt* may have several meanings: (1) it can, as a general term, mean 'thing' like the term *shay'* and *ma'nā*; (2) it signifies the 'being', 'self' or 'ego'; (3) it can mean 'substance'; (4) or 'essence' (s.v. "Dhāt" in *Encylopaedia of Islam*, new ed., 2:220; see also "Dhāt" in al-Tahānawī, *Kashshāf iṣṭilāḥāt al-'ulūm*, (Beirut:n.d.), II:519). Even though he is discussing the usage of *dhāt* in *falsafa* texts, the first two senses which he lists are general and are also found in *kalām* texts.

[41] al-Nīsābūrī, *Masā'il*, 43; see also Ibn Mattawayh, *Tadhkira*, 73; *Sharḥ al-tadhkira*, 10v.

[42] This observation is also made by Frank, *Beings*, 43, 46.

[43] See above, 15-16.

[44] There is a illegible word in the manuscript here which, from the context, may mean 'summarized manner'.

[45] *Sharḥ al-tadhkira*, 2v.

Even the Ash'arī *mutakallimūn* regard that objects of knowledge comprise the irreducible, fundamental entities of the world. They hold that objects of knowledge consist only of existing objects (*mawjūd*), which they further enumerate as objects which are created and consist of atoms and accidents, and the object which is eternal, namely God.[46] Since the Ash'arīs consider non-existent objects (*ma'dūm*) to be impossible, they do not include them in their enumeration of the objects of knowledge. In contrast, the Basrian Mu'tazilīs maintain that non-existent objects are objects whose existence is possible even though they may not exist at the present time. As such, they are objects of knowledge.[47] It is clear then, that with the exception of their obvious disagreement about the status of non-existent objects, the views of the Ash'arī and the Mu'tazilī *mutakallimūn* regarding the enumeration of the objects of knowledge are in complete correspondence. This too seems to supports the thesis that strictly speaking, in *kalām*, objects of knowledge comprise the fundamental, irreducible entities of the world.

What then of compound objects? Doesn't a compound object like man also have distinct, differentiating, attributes? Isn't the term *dhāt* applicable to him? Clearly, every one of his constituent atoms and accidents is an irreducible object, having its own essential attributes, and to which the term *dhāt* is applicable. But what of him as a whole? We encounter the examples 'the self of Zayd' (*dhātu Zaydin*), or "... like death, since it makes it impossible for a thing (*dhāt*) to have the power of autonomous action (*qādir*) or to be knowing (*'ālim*)," or "the fact that a thing (*dhāt*) is alive" in the texts which illustrate the application of the term *dhāt* to man.[48] However, *kalām* texts are silent about the essential attributes of man. It is clear that being alive (*ḥayy*), having the power of autonomous action (*qādir*), knowing (*'ālim*), and being a willing agent (*murīd*) cannot be considered to be man's essential attributes for two reasons. The first is that these attributes do not belong to man because of the way he is in himself, but are, in the *kalām* view, the result of accidents inhering in him. The second reason, is that these are God's essential attributes, and whenever two entities share an essential attribute, they must be similar. Therefore, anthropomorphism

[46] al-Juwaynī, *Shāmil*, 139-142.

[47] al-Juwaynī, *Shāmil*, 124; see also note 34 above.

[48] These examples are found respectively in al-Nīsābūrī, *Masā'il*, 310; idem, *Ziyādāt al-sharḥ*, 13, 48.

(*tashbīh*) would result if God and man were to share one of these essential attributes.[49]

The root of the problem of the essential attributes of compound objects seems to lie in their quasi-unity. The unity of man is presented as follows:

> Some people consider the attribution of the term 'single unit' (*wāḥid*) to man to be a [metaphorical] extension (*tawassu'*), because in reality he is a composite whole (*jumla*) consisting of [many] parts (*ajzā'*). Man is said to be a single unit only in so far as he is a single composite whole (*jumla wāḥida*), just as 'ten' is said to be a single unit in so far as it is a single unit of ten.
>
> What our teacher Abū Hāshim had to say regarding this is: Their depiction of man that he is a single unit is real [and not metaphorical] because, in so far as he is a man, he must be indivisible. Don't you see that this term [i.e. 'man'] is not applied to a part of him, but rather is permissible [only] from the standpoint in which a substrate, which, in reality, is one and partless is man?[50]

The Basrians thus accept that man is, from a certain standpoint, a single unit. But what of his essential attributes? It seems that compound objects, and therefore man, do not have essential attributes in so far as they are compound objects.[51] Rather, a compound object has certain attributes which belong to it in so far as it is a compound object. Such attributes are the result of the inherence of certain accidents which entail properties belonging to the compound object as a whole, for example the accidents of the power of autonomous action, willing, knowledge, etc.. A rather scanty outline of such a view of compound objects can be discerned in al-Nīsābūrī's argument against those who hold that pockets of air may be compressed in such a manner that what were previously several objects now form a single object:

> Objects must, each one of them, have an essential attribute. When these objects become one object then one must either believe in the cessation of the [previous] multiplicity of essential attributes, and this is impossible as has been explained in books, or one must believe that a single object with multiple and similar essential attributes has been formed. This too is impossible. We have discussed this problem in further detail in the book *Refutation of the Natural Philosophers*.[52]

[49] "Similarity (*tashbīh*) between two things (*shay'ayn*) is entailed when one of their essential attributes (*ṣifātu l-nafs*) is shared" ('Abd al-Jabbār, *Mughnī*, V:205; see also XI:322-3; Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 99, 196).

[50] 'Abd al-Jabbār, *Mughnī*, V:244-245.

[51] "Essential attributes (*ṣifātu l-dhāt*) derive from component units (*āḥād*) not from composite wholes (*jumal*)" (al-Nīsābūrī, *Masā'il*, 238; see also 'Abd al-Jabbār, *Mughnī*, XI:340). Hence, 'Abd al-Jabbār tells us, "He who is essentially Alive," namely God, "cannot be a composite whole" (*Mughnī*, XI:367).

[52] al-Nīsābūrī, *Masā'il*, 47-48.

It seems then, that the Basrian *mutakallimūn* regard these fundamental, irreducible entities to, in the strict sense, be the true 'things' or 'objects' of our world and its ultimate principles, which have essential attributes and to which the term *dhāt* is applicable. In *falsafa* contexts, on the other hand, *dhāt* denotes 'substance' or 'essence'. In keeping with the essentialist metaphysics of Aristoteleanism, 'essences' comprise not only the irreducible material entities of the world, but also other objects of knowledge, for example, triangles which are purely mental objects, as well as compound objects like chairs, horses, and men. Moreover, 'essence' also denotes a universal quality, say triangularity, chairness, horseness, or humanity. By contrast, *dhāt*, in the *kalām* context denotes a concrete individual.[53] It is for this reason, as well as the fact that in many instances *dhāt* denotes one of the twenty-four irreducible entities of the world, that I consider the term 'object' to, in many instances, be an appropriate translation of *dhāt* as it is used in *kalām*. But the English term 'object' is not as extensive as the Arabic term *dhāt* and, at times, 'essence' or 'self' or 'thing-in-itself' are more appropriate renditions of *dhāt*, as in God's essence, or the essential attribute of the object.[54]

Attributes of things/objects

Turning to second category of *kalām* logical analysis, namely the attributes of these fundamental, irreducible objects, it would perhaps be helpful to begin with an overview. In the system of the Basrian *mutakallimūn*, attributes may be classified into those that arise as a result of the action of an agent (*bil-fā'il*), or those that are a consequence of an entitative accident (*li-ma'nā, ṣādira 'an ma'nā*), or those that derive from the object as it is in itself (*lil-dhāt*).[55] This last category,

[53] Marie Bernard translates *dhāt* as 'individu concret' or 'existence individuelle' (*Problème*, 366).

[54] See above, note 40. Richard Frank adopts 'essence' as a translation of *dhāt* (for example, *Beings*, 27, 53; and his translation 'attribute of the essence' for *al-ṣifatu l-dhāt*).

[55] 'Abd al-Jabbār, *al-Majmū'*, 1:100. Al-Nīsābūrī enumerates the different attributes as: (1) the attribute which is realized by an agent (*ṣifatun taḥṣilu bil-fā'ilī*); (2) the attribute which derives from an accident (*ṣifatun ṣādiratun 'an ma'nā*); (3) the attribute which is due neither to the object as it is in itself nor to an accident (*ṣifatun lā lil-dhāti wa lā li-ma'nā*); (4) the essential attribute of the object (*ṣifatun dhātiyyatun*); and (5) the attribute which is entailed by the essential attribute of the object (*ṣifatun muqtaḍātun 'an ṣifati l-dhāti*). In our example of the atom, the attribute realized by an agent is its existence, which in this case is realized by God; the attribute which arises from an accident is the spatial location of the atom which derives from its accident of location; its essential attribute, that is of being an atom, is due to itself (*dhāt*), that is, the class of object which it is; and the attribute which is entailed by this essential attribute is its occupation of space. An example of an attribute which is neither due to the nature of the object as it is in itself nor to an accident is the attribute of being created (*muḥdath*) (*Masā'il*, 31).

namely, attributes which depend on the object as it is in itself consist of the essential attribute of the object, which make this object what it is, and the attributes which are entailed by this essential attribute and are realized when the object exists. In the above example of the atom, four attributes are specified—its essential attribute which makes the atom an atom; the attribute which this distinctive attribute entails when the atom exists, which is its attribute of occupying space; its attribute of existence which is the result of the action of an agent who brings it into existence, namely God; and its attribute of being in some particular spatial location which is the result of an entitative accident of location. In contrast, the accident has three attributes—its essential attribute, for example of being the color red, the attribute this entails when the accident exists, that is its having the particular appearance of red, and its attribute of existence.[56]

Attributes of the fundamental, irreducible objects, then, consist of:

(1) The essential attribute of the object (*ṣifatu l-dhāt*). This is the attribute which differentiates one class of objects (*jins*) from all other classes of objects and is unique to the class.[57] This attribute is also, strictly speaking known as the class attribute (*ṣifatu l-jins*).[58] It is the attribute which makes an atom an atom, or black black, or God eternal, etc..[59] This attribute is therefore, in the case of the atom, denoted by the expression, 'its being an atom' (*kawnuhu jawharan*), which in general can be stated as "X's being X [and not not-X]." The

[56] *Sharḥ al-tadhkira*, 6r; al-Rāzī, *Muḥaṣṣal*, 83.

[57] This is also sometimes called *ṣifa dhātiyya* or *ṣifatun lil-dhāt* or *lil-nafs*, namely the attribute which is a result of the object as it is in itself, or *al-ṣifatu l-maqṣūratu 'alā al-dhāti*, namely the attribute which is restricted to the object itself, and *al-ṣifatu l-rāji'atu ilā al-dhāti*, namely the attribute which derives from the object itself (Frank, *Beings*, 55, note 1; and in general his chapter 3—"The Attribute of the Essence," 53-57).

The Basrian Mu'tazilīs unanimously agreed that all created objects have only one essential attribute (al-Nīsābūrī, *Ziyādāt al-sharḥ*, 459). In the case of God, however, Abū 'Alī had held that God has four essential attributes, namely, being Alive (*kawnuhu ḥayyan*), Knowing (*kawnuhu 'āliman*), having autonomous Power (*kawnuhu qādiran*), and Existing (*kawnuhu mawjūdan*). Abū Hāshim, on the other hand, held that God, like all other objects, has only one essential attribute, but that these four primary attributes are entailed by His essential attribute. In contrast, all other objects have only one attribute which is entailed by their essential attribute (*Sharḥ al-tadhkira*, 6r; Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 129, 182, 198-199; al-Nīsābūrī, *Ziyādāt al-sharḥ*, 246).

Man, like God, is also alive, knowing, having autonomous power, and existing. But unlike God, man has these attributes as a result of accidents which inhere either in all the atoms which constitute him, or inhere in the specific structure these atoms constitute as a whole. God, on the other hand, is Alive, Knowing, has autonomous Power, and Exists essentially because these are attributes which are entailed by His essence, namely, this is what God is in Himself.

[58] al-Nīsābūrī, *Masā'il*, 36; idem, *Ziyādāt al-sharḥ*, 174.

[59] This type of analysis undoubtedly arises from the problem of God's attributes, and their relationship to His Essence. Abū Hāshim holds that 'eternal' (*qadīm*) is God's essential attribute (Mānkadīm Shishdev, *Sharḥ*, 198).

essential attribute also denotes the object, as it is in itself, a monad undifferentiated by its other attributes. In the case of God, therefore, His essential attribute of being Eternal (*qadīm*) denotes the unity of God as He is in Himself undifferentiated by His other primary attributes of being Alive, Knowing, having autonomous Power, and Existing. The essential attribute of an object is not directly perceptible, even in the case of a perceptible object like color, for the essential attribute is affirmed of the object even in its state of not-existing (when it is imperceptible, but yet remains an object of knowledge).[60]

(2) However, when the object exists in the world, its essential attribute entails an attribute which, in the terminology of *kalām*, is expressed as 'the attribute entailed by the essential attribute of the object' (*al-ṣifatu l-muqtaḍātu 'an ṣifati l-dhāti*). This entailed attribute, we are told, is the property (*ḥukm*) by which the object is known, when it exists in the world.[61] Since all created objects have only one entailed attribute,[62] and the entailed attribute characterizes the object when it exists in the world, it follows that the entailed attribute must differentiate between different classes of existent objects. This guarantees the veracity of the perception for every class of perceptible object because the entailed attribute, which is the immediate object of perception, is

[60] al-Nīsābūrī, *Masā'il*, 302. Since the essential attribute of the object is what makes an object what it is, that is, it makes the atom an atom, the color black black, etc., the agent (*fā'il*), who brings the object into existence, cannot obviously make the object have another essential attribute and yet make it the kind of object it is (to do so entails that the object no longer belongs to its original class, but has been transformed to become a member of another class—this is termed *qalb al-ajnās* by the *mutakallimūn*). Namely, in the case of an atom, the agent cannot but make an atom an atom, nor can he make the atom that does not occupy space, for this would require that the atom would have a different essential attribute. It follows then that the essential attribute of an object which belongs to a particular class of objects is fixed regardless of whether this class presently exists or not (cf. Ibn Mattawayh, *Tadhkira*, 73; see also above, note 34).

Al-Nīsābūrī presents an extensive argument for the claim that the essential attribute of a perceptible object is imperceptible, but that its attribute entailed by this essential attribute is the true object of perception (*Masā'il*, 30-32).

[61] "An object (*dhāt*) must be qualified by an attribute which differentiates it from other objects. This attribute must have a property (*ḥukm*) by means of which the object becomes manifest (*taẓharu*) [in the world]. This property is, so to speak, the true nature of the object (*kal-ḥaqiqati lahā*), but [its manifestation] is dependent on the existence of the object" (al-Nīsābūrī, *Masā'il*, 317; see also Frank, *Beings*, 59 and in general his Chapter 4—"The Essential Attributes," 58-92).

[62] "The [attribute] entailed by the essential attribute cannot, for any object, be affirmed to be more than one attribute, except in the case of God" (*Sharḥ al-tadhkira*, 6r; see also Ibn Mattawayh, *Tadhkira*, 57 where the published text should be emended from *fa-kullu wāḥidin minhā lā yastaḥaqqu akthara min ṣifatin wāhidatin hiyā muqtaḍātun 'anhā* to *fa-kullu wāḥidin minhā lā yastaḥaqqu akthara min ṣifati l-dhāti wal-muqtadāti wal-wujūdi wa ṣarat hādhihi l-ḥawādithu ajma'a lā yastaḥaqqu azyada min ṣifatin wāhidatin hiya muqtaḍātun 'anhā*; and above, note 57).

unique for every class of possible objects.[63] In our example of the atom, this entailed attribute is its (supposedly) perceptible occupation of space, which is also said to be the 'true nature of the atom' (*ḥaqiqatu l-jawhar*), for this is the characteristic by which the atom is known when it exists.[64]

The followers of Abū Hāshim believe that God, unlike created objects, has four attributes which are entailed by His essential attribute, namely His attributes of being Alive, Knowing, having autonomous Power, and Existing.[65] These four attributes, along with His essential attribute of being 'Eternal' are His primary attributes.

The essential attribute of an object and the attribute(s) which it entails are sometimes considered to be the class attributes (*ṣifāt al-ajnās*) of the object, for both attributes differentiate the object from other classes of objects, even though, strictly speaking, the essential attribute is the only true class attribute (it differentiates objects even when they are non-existent while the entailed attribute can only differentiate objects which exist). However, both the essential attribute and the attribute it entails are the logical attributes of the object, which are unique for every one of the twenty-four irreducible classes of objects. They represent what it means to be this particular kind of object and cannot, as a result, be realized by the action of an agent.[66]

(3) Created objects, that is, atoms and accidents, have the additional attribute of existence, which is the condition (*sharṭ*) for the realization of the attribute entailed by the essential attribute of the object. Our knowledge of this attribute of existence is mediate, deriving from our

[63] "When we see atoms, we come to know the attribute which is entailed by their essential attribute, namely their occupation of space, just as when we see a color, we come to know its attribute which is entailed by its essential attribute, namely the [characteristic] appearance [of that color]" (*Sharḥ al-tadhkira*, 5v).

Al-Nīsābūrī states that "perception can only represent the object perceived by means of the attribute which is entailed by its essential attribute" (*Masā'il*, 29; and also *Ziyādāt al-sharḥ*, 39). The formulation of 'Abd al-Jabbār is less precise: "The perceiver ... perceives an object only by the most specific of its attributes" and "perception represents the object of perception by the most specific of its attributes" (*Mughnī*, XII:61, V:24). This means that the 'most specific attribute' must refer, in this case, to the attribute entailed by the essential attribute of the object (see also, al-Nīsābūrī, *Ziyādāt al-sharḥ*, 34-36).

[64] "The nature of the atom is that which, when it exists, occupies space" (Ibn Mattawayh, *Tadhkira*, 47). For the perception of the atom see below, Chapter Five, 141-145.

[65] See above, note 57.

[66] "It is impossible for any of the class attributes to be realized by an agent. This is a point of disagreement between us and our opponents" (Ibn Mattawayh, *Tadhkira*, 81).

"What produces similarity (*alladhī yu'aththiru fī l-tamāthuli*) is the essential attribute of the object and the attribute entailed by the essential attribute" (al-Nīsābūrī, *Masā'il*, 36).

"The class attributes (*ṣifāt al-ajnās*) become manifest only by means of the attributes which are entailed by them" (idem, *Ziyādāt al-sharḥ*, 192; see also 201).

knowledge of the attribute entailed by the essential attribute, which in the case of the atom is its occupation of space.

(4) Finally, atoms, unlike accidents, have the further attribute of possessing a spatial location which is a consequence of their entailed attribute of occupying space.[67]

To summarize, the Mu'tazilī *kalām* theory of attributes holds that all objects have one essential attribute which can be predicated of them regardless of whether they exist or not. When created objects exist, an additional attribute is realized, namely the attribute which is entailed by its essential attribute. This entailed attribute is the true object of perception in the case of perceptible objects. Created objects also have the third attribute of existence. Finally, atoms have a further fourth attribute of spatial location.

These attributes entail that the object has certain manifest properties (*aḥkām*), or to put it another way, these manifest properties are the means by which the attributes of the object are known.[68] For example, the atom has the manifest properties of: (1) being the substrate in which accidents inhere; (2) obstructing the presence of another atom in the location it is in; (3) the possibility of its perception by the senses of sight and touch.[69] These properties make the atom's attribute of occupying space (which is the attribute entailed by its essential attribute) known to us.

Besides their primary attributes, some objects, namely atoms, bodies, and certain composite structures like the human body, may have further attributes which are secondary and accidental, arising as a consequence of accidents which can inhere in these objects, for example

[67] This attribute is discussed in further detail below, Chapter Five, 146-148.

[68] "Every property is a consequence (*yatba'u*) of an attribute" (al-Nīsābūrī, *Masā'il*, 44; see also Frank, *Beings*, 83, n. 18).

The term *ḥukm* (with the plural *aḥkām*) in this context stands for a property of the atom or accident. This is clear from Ibn Mattawayh's introductory remarks on tastes, "Know that the discussion about the properties (*aḥkām*) of tastes closely follows what has previously [been mentioned] regarding colors, because: tastes are perceptible like colors; tastes consist of specific kinds (*ajnās makhṣūṣa*); it is possible for there to be more kinds [of tastes than these specific kinds]; each of the kinds of taste is homogeneous; between the one kind of taste and the other there is contrariety; taste requires a substrate in which to exist and it does not need anything else in addition to the substrate; it is possible for many accidents of taste to inhere in a single substrate; some substrates can certainly be without taste while we are unsure about whether they can be without color; only God has power of action over taste, He creates tastes directly; taste can continue to exist for more than a moment and can be brought back into existence (*yu'ādu*). The method of discourse concerning these properties (*aḥkām*) is the same with regard to taste as it is with color. There is therefore no need to discuss these separately [here]. We only need to discuss [here] what we have not stated previously there [in the discussion of color], that is, [properties] which are specific to taste" (*Tadhkira*, 294). What we have here is an enumeration of some of the properties of the accident of taste.

[69] al-Nīsābūrī, *Masā'il*, 68; idem, *Ziyādāt al-sharḥ*, 155.

the attribute of being a willing agent arises in man as a consequence of the act of willing something which derives from the inherence of the accident of willing in the composite as a whole.

It follows, then, that on the basis of the theory of knowledge and the theory of attributes presented above, the Mu'tazilī discussion of the constituents of the world, their attributes, and their properties must be based on our knowledge of the external world. Since, in the Mu'tazilī view, knowledge is of three types—namely, (a) immediate knowledge of the sensible objects of the world, which is acquired by perception; (b) acquired knowledge of the non-sensible objects of the world, the existence of which we infer on the basis of an argument which relies on proof or indication (*dalāla*) of some kind; and (c) acquired knowledge of entities which are non-existent—any discussion of the constituents of the world and their properties must ultimately depend on how these three types of knowledge affirm or deny the existence of a particular constituent or property. It is clear, then, that epistemology and cosmology are closely intertwined in the Mu'tazilī discussion of the constituents of the world and of their properties and it is therefore not surprising to find that their cosmological discussions, that is of atoms, accidents, and their properties, are carried out in a context where epistemological questions are always lurking in the background. For this reason we find a constant concern with the epistemological grounds for asserting that something or other is or is not an accident, or that it is or is not a property of an atom or of an accident in the Mu'tazilī texts.[70]

C. The Basrian Mu'tazilī Theory of Accidents and Their Properties

The remainder of this chapter, is devoted to a brief examination of one of the two primary constituents of the world, namely the accident. The following discussion of accidents, however, is from the particular perspective of how we acquire knowledge of the different species of accidents and of the features common to all or most accidents.

The definition of the accident

Let us begin with the definition of accident. What constitutes an accident is a question that dogged the early *mutakallimūn*. Al-Ash'arī reports their different positions regarding the question, "Why are the entities (*ma'ānī*) which subsist in bodies (*ajsām*) called accidents (*a'rāḍ*)?" as follows:

[1] Some persons said, "They are called this because they [are transient phenomena which] occur (*ya'tariḍu*) in bodies and subsist in them (*taqūmu bihā*)." They denied the existence of accidents which are not in any substrate (*lā fī makān*) and accidents which are not created in bodies. This is the doctrine of al-Naẓẓām and many of the Mu'tazila (*ahl al-naẓar*).

[2] Some said, "Accidents are not called accidents because they [are transient phenomena which] occur in bodies, for, it is possible for accidents which are not in bodies and for events (*ḥawādith*) which are not in any substrate to exist. For example, a moment of time (*waqt*), God's act of willing (*irāda*), [the accidents of] continuing to exist (*baqā'*), ceasing to exist (*fanā'*), and [the act of] creating (*khalq*) something, which [consists of the acts of] speech and willing by God." This is the doctrine of Abū al-Hudhayl.

[3] Some said, "Accidents are called accidents because they are transient (*lā labtha lahā*). This term was taken from the Qur'ānic verse [*lit.* God's saying]: "They say: This is a transient thing (*'āriḍ*, i.e. a cloud) which will give us rain" (42:24). They called it *'āriḍ* because it is transient. The Qur'ān also states: "You want the ephemeral [goods] (*'araḍ*) of the world" (8:67). The wealth (*māl*) [of the world] is thus called 'ephemeral' because it comes to an end and ceases to exist."

[4] Some said, "The accident is called an accident because it is not self-subsistent (*lā yaqūmu bi-nafsihi*) nor is it a kind of thing (*jins*) which is self-subsistent."

[5] Some said, "The entities which subsist in bodies are called accidents as a result of a convention adopted by the *mutakallimūn*. If someone were to deny the use of this term [for the accident], we could neither present an argument (*ḥujja*) to him on the basis of the Qur'ān, nor the Tradition of the Prophet, nor the consensus of the community, nor of the lexicographers." This is the doctrine of a group of the Mu'tazila (*ahl al-naẓar*), one of whom is Ja'far ibn Ḥarb.

[6] 'Abd Allāh ibn Kullāb called the entities which subsist in bodies accidents, he called them things (*ashyā'*), and he called them attributes (*ṣifāt*).[71]

This report shows that the meaning of the term 'accident' was already the subject of controversy in the early third/ninth century, for, four out of the six views that al-Ash'arī presents (i.e. [1], [2], [5], and [6]) are explicitly attributed to persons from this period. Al-Naẓẓām takes the position [1] that accidents must occur and subsist in bodies, and are therefore located in space. He is opposed by his teacher Abū al-Hudhayl, who believes [2] that some accidents, like time and God's acts of willing and creating, do not inhere in any particular substrate, and that therefore it is possible for accidents which are not located in space to

[70] For further details on Basrian *kalām* logic and ontology see Frank, *Beings and their Attributes*, and for epistemology see Bernard, *Le Problème*.

[71] al-Ash'arī, *Maqālāt*, 369-370.

exist. Statement [5] by Abū al-Hudhayl's other student, Ja'far ibn Ḥarb (d. 236/850) that the usage of the term *'araḍ* to mean accident was conventional and could not be justified on the basis of the Qur'ān, Prophetic Tradition, or consensus, shows that the usage of this term was already a point of controversy at this time, namely the first half of the third/ninth century. Finally, Ibn Kullāb (d. ca. 240/854) holds [6] that the terms 'accident', 'thing', and 'attribute' are equivalent.[72] In light of Ja'far ibn Ḥarb's view [5], we may suppose that position [3], which attempts to justify the usage of *'araḍ* to mean accident on the basis of the Qur'ānic verses 46:24 and 8:67 probably also belongs to this early period. This attempt is revealing because it fixes the meaning of 'accident' as something which has the characteristic of being fleeting, ephemeral, transitory, like the passing of a cloud. Therefore, in this context, the verbs *ya'tariḍu* and *ya'riḍu*, which we encounter in al-Ash'arī's report cannot have their usual dictionary meaning of 'to occur or to happen' but must further signify the sense of being transitory, fleeting, and ephemeral.

This interpretation of the term 'accident' is consistent with another position of al-Naẓẓām, namely, that there is only one kind of accident, that is, the accident of motion. Since motion can only be predicated of bodies which are in space, it follows that accidents must be located in space as is stated in this report. Furthermore, we, in our everyday experience, also observe the motion of bodies to be transitory and ephemeral.[73] His opponents' views also agree with this conception of accident as being transient and ephemeral, for, even though they hold that accidents comprise, not only motion, but also color, taste, etc. which inhere in bodies, their inclusion of the phenomenon of time, God's act of willing and of creation, and the accidents of continuing to exist and ceasing to exist demonstrates that they too regard accidents as transient and ephemeral phenomena. Therefore, in a cosmology whose only possible constituents, besides God, are atoms and accidents, phenomena which are less transitory than atoms or, better still, the bodies they compose, must be accidents.

[72] Ibid., 357.

[73] I do not wish to simplify al-Naẓẓām's position here, for he also holds that bodies are always in motion, and that rest is a kind of motion, namely 'the motion of *i'timād*' or a tendency or pressure or even force to move in a particular direction (al-Ash'arī, *Maqālāt*, 324-325). To muddy (or clarify?) the issue even further, some sources allege that he also believed in occasionalism, that at every moment God recreates every body and accident anew, thus making them both ephemeral and transitory (see below, 43). This may be the reason why the distinction between body and accident is not very crucial to his system, and later commentators like al-Juwaynī and al-Ījī mistake his rather clear position that all phenomena except for motions are corporeal, as being equivalent to that of al-Najjār that bodies are nothing but composites of accidents (al-Juwaynī, *al-Shāmil*, 148, 153-154; al-Ījī, *Mawāqif*, 7:2).

With this early third/ninth century *kalām* controversy over the meaning of 'accident' in the background, it is not surprising to find fourth/late ninth century and even later Basrian *mutakallimūn* divided over the definition of the accident. Abū 'Alī al-Jubbā'ī defines it as "that which occurs [as a transient phenomenon] in something else (*mā ya'riḍu fī ghayrihī*)."[74] His definition is based on the concept that the accident must inhere in some substrate which cannot itself be an accident. Abū 'Alī therefore seems to consider that ceasing to exist (*fanā'*), as well as God's acts of willing (*irāda*) and aversion (*karāha*), all of which were considered not to inhere in any substrate, were not accidents.[75] To overcome this difficulty, his son Abū Hāshim, defines the

[74] Ibn Mattawayh, *Tadhkira*, 218.

[75] The sources present conflicting evidence on this point. Al-Ash'arī states that Abū 'Alī affirmed the existence of ceasing to exist (*fanā'*) (*Maqālāt*, 368), while Ibn Mattawayh's commentator states, "Abū 'Alī justified his position by stating: The accident is that which occurs [as a transient phenomenon] in something else. This is not the case with regards to *fanā'*, since it is impossible for *fanā'* to inhere in a substrate (*maḥall*), and therefore this term cannot apply to it. For the same reason, we hold that it is impossible to apply this term to describe the act of willing or the act of aversion (*karāha*) which do not inhere in any place" (*Sharḥ al-tadhkira*, 37r). It is conceivable that by saying that Abū 'Alī affirmed the existence of *fanā'*, al-Ash'arī means no more than to say that this was an entity in Abū 'Alī's cosmology, and that he does not mean that he affirmed it to be an accident. Al-Nīsābūrī tells us of another difference regarding *fanā'* between Abū 'Alī's and Abū Hāshim's cosmologies, namely that the father did not, unlike his son and the later *mutakallimūn*, regard that the annihilation of one or some atoms entailed the annihilation of all them (*Masā'il*, 83).

The reason for holding that God's act of willing is not in any substrate while our act of willing inheres in a substrate, that is in our body, is that it depends on the mode of existence of the willing agent (*kayfiyyati l-wujūdi*). Since God is not in any substrate, His acts of creation, willing, etc., are not in any substrate, while our mode of existence is in a substrate and consequently our acts of willing are in a substrate (al-Nīsābūrī, *Ziyādāt al-sharḥ*, 170-171)

Abū al-Hudhayl was probably the first *mutakallim* to conceive of accidents which do not inhere in any substrate. Al-Ash'arī reports, "Abū al-Hudhayl held that continuing to exist for more than a moment (*baqā'*) and ceasing to exist (*fanā'*) are not located in a substrate (*makān*). Similarly, the act of creation (*khalq*) as well as time (*waqt*) [are not located in a substrate]. It is impossible [for these accidents] to exist for more than a moment" (*Maqālāt*, 367). Abū al-Hudhayl therefore applies the concept of accidents which are not in any substrate to the phenomena of time, the accidents of continuing to exist and ceasing to exist, and God's act of creation which he considered to be God's act of will (*irāda*) and His command (*qawl*): Be! (*Maqālāt*, 363-364; on the basis of the Qur'ānic verses, "And when He decrees a thing, He but says to it, Be! and it is" (2:117); "When We will a thing, We but say to it, Be! and it is" (16:40); "When He wills a thing, His command is to say to it, Be! and it is" (36:82); "When He decrees a thing, He but says to it, Be! and it is" (40:68); see also Ibn Mattawayh, *Tadhkira*, 154).

The inclusion of time in this list is intriguing, for it may originate in a post-Aristotelian Peripatetic view that time is an accident of motion (for example, Proclus' statement, "The Peripatetics call time an accident of motion" *On Plato's Timaeus* 271D, in Long & Sedley, *The Hellenistic Philosophers*, text 51F, 305). Elsewhere, al-Ash'arī relates, "Time is the

accident as "that which comes into existence [as a transient phenomenon] but which may not last as long as atoms do (*mā ya'ridu fī l-wujūdi wa lā yujabu lahu labthu l-jawāhirī*)."[76] The later Mu'tazilī *mutakallimūn* seem to have adopted Abū Hāshim's view, and find partial justification for it in the lexicographers who defined the accident as "that which comes into existence [as a transient phenomenon] but whose abiding is contingent (*lā yujabu labthuhu abadan*)."[77] This definition is very similar to [3] in al-Ash'arī's report, which, even though it is unattributed, probably originates from the lexicographers because of the derivation of the term *'arāḍ* on the basis of Qur'ānic texts.

Ibn Mattawayh and his commentator also tell us that the definition of the lexicographers, that is, that the accident is "that which comes into existence [as a transient phenomenon] but whose abiding is contingent," entails that the lexicographers do not distinguish between the application of the term *'arāḍ* to bodies and its application to accidents. The lexicographical definition, they inform us, is based upon the usage of *'arāḍ* in the phrases, 'Fever is a transient phenomenon' and 'the cloud is a transient phenomenon', as well as the Qur'ānic verse "This is a transient thing which will give us rain" (42:24), and the idiom, "The world is a transient presence; both the pious and the impious eat thereof."[78] Then, these sources tell us, *'araḍ* became a technical term of the *mutakallimūn* and was confined, in their usage, to those transient phenomena which do not abide as long as the atom. It is interesting to note that Ja'far ibn Ḥarb's view as reported by al-Ash'arī [5] also regards the *mutakallimūn*'s appropriation of the term *'arāḍ* for 'accident' as conventional. This has a ring of truth to it, although Ja'far's denial of the influence of Qur'ānic texts and the lexicographers seems somewhat stretched in light of the accounts of al-Ash'arī, Ibn Mattawayh, and of his commentator.

difference [that transpires] between actions. It is the duration (*madā*) which transpires between one action and another action. An action is produced at every moment in time. This is the doctrine of Abū al-Hudhayl" (*Maqālāt*, 443).

[76] Ibn Mattawayh, *Tadhkira*, 218. Al-Nīsābūrī defines the accident as "that which comes into existence [as a transient phenomenon] but which may not last as long as other things, namely atoms and God" (*Ziyādāt al-sharḥ*, 233; see also Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 230-231).

Ibn Mattawayh's commentator reflects the position of Abū Hāshim: "Accidents can be also divided into those which may exist without inhering in a substrate and those for which this is impossible. The former consist of [the accidents of] willing, aversion, and ceasing to exist, but in addition, [the accident of] ceasing to exist can never exist in a substrate. The remaining accidents must inhere in a substrate" (*Sharḥ al-tadhkira*, 3r).

[77] Ibid., 36.

[78] Ibn Mattawayh, *Tadhkira*, 219; *Sharḥ al-tadhkira*, 37r. For the idiom 'the world is a transient presence; both the pious and impious eat thereof' see E.W. Lane, *An Arabic-English Lexicon*, (London: Williams and Norgate, 1863-93; repr., Cambridge: Islamic Texts Society, 1984), 5:2008. For an Ash'arī view, see al-Juwaynī, *Shāmil*, 166-168.

The temporal duration of accidents

The temporal aspect of accidents was also, like the spatial aspect that we have been discussing, a question which deeply divided the early *mutakallimūn* and their successors. Obviously, they were in agreement that accidents were transient phenomena. But the problem of the actual duration of their transiency had two major opposing solutions. On the one extreme, there was the absolute occasionalist solution attributed to al-Naẓẓām. As we have noted above, the only accidents in his system are motions. The later *mutakallimūn* alleged that in al-Naẓẓām's view, these motions in addition to the bodies in which they inhere last for only one moment, and are created anew by God at every moment in time.[79]

A modified version of occasionalism held that accidents cannot continue to exist for more than one moment while the atoms and the

[79] The ascription of occasionalism to al-Naẓẓām was challenged by Naṣīr al-dīn al-Ṭūsī (in his comment on al-Rāzī's discussion of al-Naẓẓām's occasionalism, he states, "the ascription of this doctrine to al-Naẓẓām is without foundation" (*Talkhīs al-muḥaṣṣal*, 211)) and more recently by Josef van Ess (on the grounds of its inconsistency with al-Naẓẓām's theory of change and its lack of mention in the early sources ("Abū Esḥāq al-Naẓẓām" in *Encyclopaedia Iranica*, I:275-280)). Even though the ascription is historically suspect, al-Naẓẓām is said to have held this view in many *kalām* works of the sixth/eleventh and later centuries (for example, 'Abd al-Jabbār, *Mughnī*, IV:248; Ibn Mattawayh, *Tadhkira*, 148; al-Mufīd, *Awā'il*, 75-76; al-Juwaynī, *Shāmil*, 160; al-Rāzī, *Muḥaṣṣal*, 40; al-Ījī, *Mawāqif*, 7:231-232). Ibn Mattawayh's commentator describes it as, "... the annihilation of the atom is due to the fact that God, at every moment, creates it anew (*yatajaddadu 'alayhi l-wujūda ḥālan ba'da ḥālin*), and therefore when He does not create it anew, it is annihilated. This is the doctrine of al-Naẓẓām" (*Sharḥ al-tadhkira*, 36r).

Al-Ash'arī preserves an earlier report on al-Naẓẓām's view on the duration of motion: "Some persons hold that there are no accidents except for motions, and that it is impossible for them to continue to exist for an extended duration. Al-Naẓẓām holds this view" (*Maqālāt*, 358). If this was indeed al-Naẓẓām's view, then it is not difficult to see why he was later thought to uphold absolute occasionalism because he believed (a) motions are the only accidents; (b) rest is a kind of motion; (c) bodies are always in motion; (d) motions do not last for more than a moment. The conclusion that bodies cannot therefore, like the motions that inhere in them, last for more than a moment, while logically false (because there is no reason for the substrate not to continue to exist, even though the motions in it are recreated at every moment) is formally similar to the conclusion that bodies must be created in time because bodies are never free of accidents, and accidents are created in time (This argument is discussed in detail in H. Wolfson, *The Philosophy of the Kalam*, 392-409).

'Abd al-Qāhir al-Baghdadī (d. 429/1037), unlike his contemporaries, does not attribute occasionalism to al-Naẓẓām, but states, "Al-Naẓẓām held that there are no accidents except for motion, and that the existence of motion for an extended duration is impossible. As for colors, tastes, odors, sounds and thoughts (*khawāṭir*), they are bodies whose existence for an extended duration is possible" (*Uṣūl al-dīn*, (Instanbul,1928), 50).

bodies in which they inhere may last for an extended duration because God can create the accident of 'continuing to exist' (*baqā'*) in them. This is the view of the Ash'arīs and the Baghdadī Mu'tazilīs.[80]

The other position on the temporality of created objects, which was advanced by Abū al-Hudhayl, holds that atoms, the bodies they compose, and some accidents may continue to exist for an extended duration. Al-Ash'arī reports this position, with particular regard to accidents, as follows:

> Abū al-Hudhayl held that accidents comprise those that can exist for an extended duration, and those that cannot continue to exist for more than a moment. Motions cannot exist for more than a moment, while [some accidents of] rest may continue to exist for an extended duration.
>
> He claimed that the rest of the inhabitants of paradise is a rest that continues to exist [indefinitely]. Similarly their accidents of location (*akwān*) and their motions are interrupted and determinate, reaching an end.
>
> He claimed that colors continue to exist for an extended duration, as do tastes, odors and [the accident of] life. The autonomous power of action [also] continues to exist without being in a substrate (*lā fī l-makān*).
>
> He claimed that the accident of continuing to exist (*baqā'*) is God's command to the thing: Continue to exist! (*ibqa*). The same applies to the continuation of the existence of the body and the continuation of the existence of all of the accidents which can continue to exist for an extended duration.[81]

It is clear from this report that, in Abū al-Hudhayl's view bodies and, as a result, the atoms out of which they are composed, as well as some accidents can continue to exist for an extended duration. His view is therefore opposed to both the absolute and modified occasionalism of

[80] Al-Ash'arī's own position is stated by Ibn Fūrak: "He believed that none of the accidents can continue to exist for an extended duration, while atoms and bodies may continue to exist for an extended duration.... He believed that 'continuing to exist' (*baqā'*) is an accident which cannot [itself] continue to exist for an extended duration. A body continues to exist for an extended duration by the recreation of its accident of continuing to exist at every moment" (*Mujarrad al-maqālāt*, 237). The Ash'arī view is also found in al-Ījī, *Mawāqif*, VII:4.

For the Baghdadī Mu'tazilī view, see al-Ash'arī, *Maqālāt*, 358; al-Mufīd, *Awā'il*, 75-76, 78; al-Nīsābūrī, *Masā'il*, 74, 122; Ibn Mattawayh, *Tadhkira*, 156. Al-Ash'arī's report states that Aḥmad ibn 'Alī al-Shaṭawī (his dates are not known, but he is mentioned in the biographical dictionaries of Abū al-Qāsim al-Balkhī (*Maqālāt*, 74 in *Faḍl al-'itizāl*) and 'Abd al-Jabbār (*Faḍl al-i'tizāl*, 300) who make him a contemporary of Abū al-Qāsim, that is, in the early fourth/tenth century) was the author of this doctrine, and that he was followed in this by Abū al-Qāsim al-Balkhī and the Shī'ī *mutakallim* Muḥammad ibn 'Abd Allāh ibn Mumallak (?) al-Iṣbahānī (he is mentioned in the *Fihrist*, I:442 as a contemporary of Abū 'Alī al-Jubbā'ī).

[81] al-Ash'arī, *Maqālāt*, 358-359; see also below, note 82.
Abū al-Hudhayl is notorious for his position that the enjoyment of the inhabitants of Paradise (as well as the punishment of those in Hell) will come to an end (Abū al-Ḥusayn al-Khayyāt, *Kitāb al-intiṣār*, 56-57).

his contemporaries, for he accepts the continued existence of some accidents while they deny the continued existence of all accidents. However, his view is in agreement with modified occasionalism insofar as it accepts the possibility of the continued existence of bodies. It is interesting to note, however, that Abū al-Hudhayl, agrees with the occasionalists, who, like al-Naẓẓām, believed that accidents of motion cannot continue to exist and last for only one moment.[82] Abū al-Hudhayl's need to explain the reason why some accidents, atoms, and bodies can continue to exist for an extended duration—namely because God commands them "Continue to exist!"—suggests that the burden of explanation for the continued existence of these objects fell upon those who believed in their continued existence and not upon those who denied their continued existence claiming that they were recreated at every moment. Al-Ash'arī's report does not clearly state whether or not, in Abū al-Hudhayl's view, God needs to issue this command at every moment in time for the object's continued existence at the next moment. It seems rather unlikely that he would hold that the command needs to be issued at every moment, for this would entail that Abū al-Hudhayl's position is not unlike that of the Baghdadī Mu'tazilīs, who get a separate mention by al-Ash'arī. That is to say, just as the Baghdadī Mu'tazilīs consider it necessary for God to reconfer the continuation of the existence of bodies or atoms by creating the accident of continuing to exist in them at every moment, Abū al-Hudhayl would deem it necessary for God to command "Continue to exist!" at every moment in time to objects (including accidents) which are to continue to exist. This interpretation of Abū al-Hudhayl's doctrine is not consistent with his view on the annihilation of atoms, for, as Ibn Mattawayh's commentator, in his enumeration of the theories of the annihilation of atoms, tells us, "...Or, the annihilation of the atom is the result of a command of God. This is the doctrine of Abū al-Hudhayl."[83] Hence, if God needs to specifically annihilate anything

[82] Abū 'Alī al-Jubbā'ī, following Abū al-Hudhayl, also held that motion cannot exist more than a moment while rest may exist for an extended duration (Ibn Mattawayh, *Tadhkira*, 459, 467). He further maintained there are two kinds of rest, the rest of animate beings which cannot last for more than a moment, and the rest of inanimate objects which can last for an extended duration (al-Ash'arī, *Maqālāt*, 359). Moreover, rest, in his view is a member of the class of accidents of location, while motion forms a class by itself. Abū al-Hudhayl, in contrast, held that neither rest nor motion are members of the class of accidents of location (*Ziyādāt al-sharḥ*, 131-132).

[83] *Sharḥ al-tadhkira*, 36r, 28r. Al-Ash'arī reports, "Abū al-Hudhayl held that the creation of an object (*khalqu l-shay'*) is not identical with the object, nor is [the accident of] continuing to exist (*baqā'*) the same as the object which continues to exist (*bāqī*), nor is the [the accident of] ceasing to exist (*fanā'*) the same as the object which ceases to exist (*fānī*). [The accident of] continuing to exist is God's command to the thing, 'Continue to exist!' while [the accident of] ceasing to exist is His command, 'Cease to exist!'"

which can continues to exist for an extended duration, its annihilation cannot be the result of God's withholding the command "Continue to exist!" at this moment in time. These commands, namely, "Be!" for creation, "Continue to exist!" and "Cease to exist!" are, like time, accidents in Abū al-Hudhayl's system, because they are transient phenomena. However, as we have seen above, they do not, unlike the rest of the accidents, inhere in any substrate.

The later Basrian Mu'tazilī *mutakallimūn* follow Abū al-Hudhayl's view in part, for, they agree that some accidents may continue to exist for an extended duration. However, they differ with his view that the reason for the continued existence of an accident or atom is God's command: "Continue to exist!" or, in the case of its annihilation: "Cease to exist!" Ibn Mattawayh's commentator states:

> The eighth view, which is that the annihilation of atoms can only be linked with a command which God brings into existence by His saying "Cease to exist!" (*ifna*) and "Be annihilated!" (*i'dam*), is false. [God's command] "Be!" cannot be .. [illegible word in the manuscript probably meaning 'offered as a defense of'] its falsification. This is because if a command were efficacious (*lahu ta'thirun*) in annihilating atoms, then atoms would be annihilated whenever we [human beings] utter the same command, for something which is efficacious does not change [in being efficacious] because its agent has changed as is the case with motion. But we know that atoms are not annihilated even though we may utter these commands.[84]

The Basrian Mu'tazilīs, therefore, reject the view that atoms or bodies continue to exist because of God's command to them, "Continue to exist!" because when human beings utter the same command it does not produce this effect. In their view, the reason for the continued existence of atoms and some classes of accidents for an extended duration is entirely different, namely, their continued existence is a consequence of the kind of objects they are. The Basrian Mu'tazilīs have no need, in the case of atoms, for an inhering accident of "continuing to exist" as the Baghdadī Mu'tazilīs hold, nor do they require God's command "Continue to exist!" whether at every moment or just at the moment of creation, as Abū al-Hudhayl holds for the

(*Maqālāt*, 366). Therefore, as al-Ash'arī reports elsewhere (Ibid., 376), Abū al-Hudhayl had no need for the accident of annihilation (*fanā'*) which, in the view of the later Basrian Mu'tazilīs is the contrary of bodies, for, unlike them, he considers annihilation of bodies to be the result of God's command and not the result of the coming into existence of the accident of annihilation.

[84] Ibid., 36v-37r (the corresponding passage in the *Tadhkira*, (217-218) is very terse). That the continued existence of accidents for an extended duration is a property of the class of accidents they belong to is clear from the statement, "The continued existence of an object for an extended duration derives from its class (*jinsihi*)" (al-Nīsābūrī, *Ziyādāt al-sharḥ*, 41).

continued existence of both atoms and some accidents. Rather, atoms and the bodies they constitute, in addition to the accidents of color, taste, odor, heat and cold, humidity and dryness, life, the autonomous power of action, location, and adhesion can continue to exist for an extended duration because this is a property of the kinds of objects they are.[85]

The theory of change

The annihilation of atoms and accidents by their contrary is the principle on which the Basrian Mu'tazilī theory of change is based. They do not believe that God annihilates atoms or bodies by commanding them, "Cease to exist!" They hold, instead, that He annihilates them by creating their contrary (*ḍidd*), namely the accident of ceasing to exist (*fanā'*), as a result of which they are annihilated. Needless to say, this accident of ceasing to exist can last only for a moment, nor does it inhere in any substrate.[86] As we shall see later, the followers of Abū Hāshim also believe that when the atom is created, it must, by the very nature of its occupation of space, have a location, which in their view is an accident. The atom need not have any other accident inhere in it at this moment of its creation.[87] Subsequently, other accidents may come to inhere in the atom for a variety of reasons. For example, man can create the accidents of location (which includes motion), force, adhesion, pain, sound, externally, that is in other bodies, as well as the accidents of reason, willing, aversion, conviction, and opinion in himself, either directly or mediately.[88] The accidents of color, taste, odor,

[85] The accident of force (*i'timād*) is a special case, for it comprises intrinsic or necessary force (*i'timād lāzim*), namely the downward force of heavy objects, for example water, stones, etc., or the upward force of fire, and, in addition, the force which is exerted by other agents on bodies, that is, extrinsic or acquired force (*i'timād mujtalab*). Intrinsic force can continue to exist for an extended duration, while extrinsic force, regardless of whether it is exerted by us, or by God, cannot (Ibn Mattawayh, *Tadhkira*, 551-553).

[86] Ibid., 204, 224; al-Nīsābūrī, *Masā'il*, 83, 87.

[87] al-Nīsābūrī, *Masā'il*, 62; idem, *Ziyādāt al-sharḥ*, 131. In contrast, Abū 'Alī and Abū al-Qāsim al-Balkhī hold that the accidents of color, taste, odor, hot and cold, humidity and dryness, always inhere in the atom (Ibn Mattawayh, *Tadhkira*, 124).

[88] 'Abd al-Jabbār, *Mughnī*, IX:13, where this is attributed to Abū 'Alī and Abū Hāshim. The accidents of willing and aversion are directly created by man, and never require a mediate cause (*lā sababa lahu*). Other accidents may be created directly (*mubāsharan*) or mediately (*mutawalladan*), for example the accidents of location and force. Finally, some accidents can only be created mediately, for example the accidents of sound, pain, and adhesion (see also VIII:43 and Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 90).

The topic of which accidents are within the ability of man to produce has it roots, like the other questions that are discussed here, in the early *kalām* discussions of the late third to early fourth/late eighth to early ninth centuries which have been reported by al-Ash'arī (*Maqālāt*, 377-378). The similarity between the views of Abū 'Alī and Abū Hāshim to that of Abū al-Hudhayl is once again striking. Abū al-Hudhayl is reported to

heat and cold, humidity and dryness, life, the autonomous power of action, instinctual desire and loathing, and annihilation are, on the other hand, directly created by God.[89] God can also create the accidents which are within the ability of man, directly or mediately. The subsequent temporal duration of the inherence of these accidents in a substrate is clearly governed by whether the accident in question can continue to exist for an extended duration or not.

When an accident which does not last for more than a moment, for example sound, comes to inhere in the atom for whatever reason, it must disappear at the next moment, and is, as such, annihilated. Therefore, even when such accidents have contraries, they do not play any role in change.[90] In contrast, the accidents of color, taste, odor, heat and cold, humidity and dryness, and location, which can continue to exist for an extended duration have contraries, while the accidents of life, the power of autonomous action, adhesion, and intrinsic force do not have contraries.[91] For the former class of accidents, namely those which have a contrary, change is effected by the appearance (*ṭurū'*) of the contrary accident, because once one of these accidents comes to exist in the atom, it or its contrary must always be present in the atom.[92] Thus, the color white which is inherent in some substrate is annihilated and replaced when its contrary, namely the color black, or red, or green, or yellow appears in this substrate. The accident which is replaced cannot move to another substrate but must be annihilated by this process, for, motion is only possible for atoms and the bodies they constitute.[93] Moreover, if accidents were capable of motion, this would entail the inherence of an accident in an accident, which, needless to say, is impossible.[94] In our example, the annihilating contrary when white is replaced by black belongs to the same class of

have held that man has the ability to create the accidents of motion, rest, sound, pain, as well as all accidents whose method of production (*kayfiyya*) is known to him, while colors, tastes, odors, life and death, and inability and the power of autonomous action are created by God alone.

[89] Ibn Mattawayh, *Tadhkira*, 284, 294, 300; MS Ambrosiana C104, 130v; al-Nīsābūrī, *Masā'il*, 128; Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 90.

[90] 'Abd al-Jabbār, *Mughnī*, XI:434.

[91] Ibid., 434, 441; Ibn Mattawayh, *Tadhkira*, 41, 288-293, 294, 301, 467-470, 515, 551-556; MS Ambrosiana C104, 131r-131v; al-Nīsābūrī, *Masā'il*, 122-126, 177-180, 237-238, 258-266.

[92] Ibn Mattawayh, *Tadhkira*, 124.

[93] Ibn Mattawayh, *Tadhkira*, 272-3. If it were possible for accidents to move to other substrates, several absurd consequences would follow. One of us could perhaps be responsible for joining two mountains, because the accident of bringing together would, by chance, move from him into them. Or it would be impossible to bring two feathers or two mustard seeds together because, by chance, it would be impossible to move them (al-Nīsābūrī, *Ziyādāt al-sharḥ*, 186-187).

[94] Ibn Mattawayh, *Tadhkira*, 274-275.

accident, namely color. Consequently, once one of these accidents which continues to exist for an extended duration and possesses contraries comes to inhere in an atom, it can never completely disappear from this atom but can only be replaced by its contrary which must belong to the same class as it does.[95]

Accidents which continue to exist for an extended duration and which do not have contraries are annihilated by "something which functions as if it were a contrary" (*ma'nā yajrī majrā al-ḍidd*) as expressed by Mānkadīm Shishdev or "by the cessation (*buṭlān*) of what it requires for its existence or the continuation of its existence" as stated by his teacher 'Abd al-Jabbār.[96] The accidents in these category are dependent on certain conditions and when these conditions no longer exist, their disappearance plays the role of the contrary. For example, "being alive depends on atoms, accidents of humidity and dryness, accidents of adhesion, and accidents of life. The separation of some of these constituents from the others is impossible because the constituted whole, insofar as it is alive, is in need of them all."[97] Therefore, when one of these constituents is separated, it is as if a contrary had come upon the accident of life. Similarly, the power of autonomous action depends on the presence of the accident of life, adhesion depends on the contiguity of two atoms and perhaps the accident of humidity in one and dryness in the other, while the intrinsic upwards or downward force (*i'timād*) of a body depends on the presence of the accidents of dryness or humidity.[98]

The explanation of another kind of change, namely the burning of wood or the sparks which are generated as a result of the striking of two stones is radically different. These phenomenon, we are told, are nothing but the manifestation of fire atoms in the wood, or the stones, which had previously been hidden from view (*kāmina*).[99]

It is clear that this aspect of the Basrian Mu'tazilī theory of change has its origins in earlier *kalām* discussions. On the one hand, it utilizes

[95] "When color comes to exist in an atom, it is impossible afterwards for the atom to be without color or its contrary. This is because its contrary can, like the original color, continue to exist for an extended duration and neither one of them requires anything more than the substrate in order to exist" (al-Nīsābūrī, *Masā'il*, 62 and 122). Shaykh al-Mufīd tells us that the Baghdadī Mu'tazilīs and Abū Alī held that any class of accident which may inhere in an atom must always be present in the atom (*Awā'il*, 74-75).

[96] Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 108-109; 'Abd al-Jabbār, *Mughnī*, XI:441; see also al-Nīsābūrī, *Masā'il*, 238 which deals solely with the accident of life.

[97] al-Nīsābūrī, *Ziyādāt al-sharḥ*, 107. The contrary of the accident of life is not the accident of death (*mawt*) in the view of the Basrian *mutakallimūn*—"We do not accept that the contrary of the accident of life is death, nor do we accept that death is an accident" (Ibid., 124).

[98] Ibid., 238, 257; Ibn Mattawayh, *Tadhkira*, 519

[99] al-Nīsābūrī, *Masā'il*, 56-7; Ibn Mattawayh, *Tadhkira*, 146; *Sharḥ al-tadhkira*, 26v.

the theory of latency and appearance (*kumūn/ẓuhūr*) which was championed by anti-atomists, in particular al-Naẓẓām, who denied the existence of all accidents with the exception of motion. They believed that the appearance of fire was a result of the manifestation of what had, until this moment, been latent fire-bodies.[100] The Basrian Mu'tazilīs restrict the application of this theory of latency and appearance to phenomena which are exhibited by atoms, as in the above example of the burning of wood or the generation of sparks by the striking of stones. On the other hand, the Basrian Mu'tazilī theory of change relies, for the most part, on the theory of their fourth/ninth century atomist predecessors who had upheld the existence of numerous accidents, and had believed that change was either the result of the replacement of a currently inherent accident by another, or the inherence of a new accident in the substrate.

How we acquire knowledge of accidents

With these and other features of accidents in mind, we find that the *mutakallimūn* who follow Abū Hāshim classified accidents in various ways.[101] However, from the viewpoint of how we acquire knowledge of them, they divided these accidents into four categories:

(1) The first category comprises perceptible accidents, which are therefore known immediately. This category includes the classes of color, taste, odor, and sound, which require a specialized sense organ (*ḥassa*) for their perception, as well as the accidents of hot, cold, and pain, which are perceived by any part of the composite whole which forms the living being (*jumla*), and do not, in the *kalām* view, require a specialized sense organ in order to be perceived.[102]

Even though these accidents are directly perceptible, their perception may sometimes be in some doubt (*ishtibāh*). In this case, perception leads to knowledge of their existence in a general and undifferentiated manner (*'alā sabīli l-jumlatī*). For example, because both the atom and color are visually perceptible, the question may arise as to whether they are distinct ontological objects. There is therefore a need to distinguish between them and show that they are separate objects, even though they are both perceptible in the same manner. This is always possible for it seeks to isolate the attribute by which this object is

[100] The theory of *kumūn* is discussed by Josef van Ess in "Kumūn" in *Encylopaedia of Islam*, new ed., 5:384-385.

[101] See for example Ibn Mattawayh's chapter on the classifications of accidents (*Tadhkira*, 35-46; *Sharḥ al-tadhkira*, 3v-4v).

[102] Ibn Mattawayh, *Tadhkira*, 35; *Sharḥ al-tadhkira*, 2v; Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 96.

differentiated from all other objects.[103] The Mu'tazilī argument to establish the separate identity of these accidents is—since bodies are similar to each other, any perceptible differences between them, for example between a black body and a white body, must be the result of inherent accidents, otherwise there could not be any perceptible difference between these two bodies. But since there is a perceptible difference between them, it follows that these inherent accidents are not identical with their substrates.[104]

(2) The second category comprises accidents which are imperceptible, but are, nevertheless, known immediately. It consists of the class of the accidents of location (*akwān*). As we shall see in the next chapter, the *mutakallimūn* believed that space, like matter, is discrete and consists of cells of the same size as atoms. The location of an atom in a particular cell, must, in their view, be the result of an accident which determines the atom's location in this and not any other spatial location (*jiha, muḥādhāh*). As such, the accidents of location are of a single kind (*naw'*) of accident only, but they are known by several names, namely, motion (when the atom is in a spatial location at the next moment other than the one it is in at present), rest (when the atom remains in the same spatial location for more than one moment), contiguity (*mujāwara, ijtimā'*—when the atom is in a spatial location which is contiguous with a spatial location which is occupied by another atom), and separation (*mubā'ada, muftariqa, iftirāq, mubāyana*—when there is an empty distance, that is, there are empty spatial locations, between two atoms).[105]

The thesis that these accidents of location are imperceptible, but are yet known immediately, which was originated by Abū Hāshim al-Jubbā'ī, raised several difficulties for the Basrian Mu'tazilīs. To begin

[103] "It must be possible to arrive at knowledge of every object in particular. This would be impossible were it not for the attribute by which it is differentiated from other objects and which is affirmed of it in both the state of non-existence and existence" (al-Nīsābūrī, *Ziyādāt al-sharḥ*, 191-192).

[104] Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 92. Ibn Mattawayh discusses why color cannot be identical with the atom or body (*Tadhkira*, 53-55, 250-252) and why sound is not a body (Ibid., 331-333; see also 'Abd al-Jabbār, *Mughni*, V:24; al-Nīsābūrī, *Ziyādāt al-sharḥ*, 40-44).

[105] Ibn Mattawayh, *Tadhkira*, 45-46, 63, 432, 471-502; *Sharḥ al-tadhkira*, 4v, 70v; Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 96. Al-Nīsābūrī reports Abū Hāshim's definitions of these *akwān* as, "The accident of location, if it lasts for two moments, is know as rest (*sukūn*), but if a contrary (*ḍidd*) befalls it as a result of which the atom moves to a second spatial location (*jiha*), it is motion (*ḥaraka*) ... If another atom attaches itself to this atom, then the accident of location between them is contiguity (*mujāwara*), because contiguity is the term which is used when the [other] atom is close. But if the other atom is farther, then their accident of location is called separation (*mubā'ada, iftirāq*), because separation is the term which is used when the [other] atom is at a distance" (*Ziyādāt al-sharḥ*, 76).

with, both his father Abū 'Alī and the Baghdadī Mu'tazilī Abū al-Qāsim al-Balkhī denied that the accidents of location are imperceptible. They believed that these accidents are perceptible by sight and by the sense of touch. Thus Abu 'Alī argued that since we are able to distinguish between the moving body and the body at rest, the accidents of motion and rest must be perceptible. The proponents of the thesis that these accidents are imperceptible devised several arguments to support their position, but their main argument relies on the fact that a passenger on a ship is not always aware whether the ship is in motion or at rest in the same manner as he is aware that the interior of the ship is black or white. This, in their view, entails that the passenger's knowledge of the motion of the ship or its rest is not a result of direct perception of motion or rest.[106]

The second problem is, if it is granted that these accidents are imperceptible as the followers of Abū Hāshim believed, then how do we acquire knowledge of them? In the view of the proponents of this thesis, accidents of location may be divided into those which are known immediately and those that are known as a result of a proof. Accidents of location which we know immediately are known in a general and undifferentiated manner (*na'lamu hādhā l-ma'nā ḍaruratan 'alā al-jumlati*). They comprise of accidents of location which are a result of our movement, for example of sitting, or standing which we know necessarily.[107] Since our immediate knowledge of these accidents of location is general and undifferentiated, and moreover is confined only to those bodies which fall under our domain of action, we need to turn to a proof in order to obtain specific knowledge of these accidents and their properties which is true for all bodies, regardless of whether they fall under our domain of action or not.

The proof which affirms the existence of these accidents in general relies on exclusion. It is based on the premise that there must be a cause upon which the distinction between a moving body and a stationary body is based. After showing that this distinction cannot be due to the body as it is in itself (*dhāt*), nor the attribute entailed by its essential attribute, nor the existence of the body, nor its coming-into-being, nor some aspect of its coming-into-being, nor its non-existence, nor the absence of an accident, nor the agent who brings it into existence, the conclusion is reached that this distinction must be based on

[106] Ibn Mattawayh, *Tadhkira*, 471-476; *Sharḥ al-tadhkira*, 79r-80r; al-Nīsābūrī, *Masā'il*, 212-218; idem, *Ziyādāt al-sharḥ*, 133, 139-141.

[107] Ibn Mattawayh, *Tadhkira*, 432, which is very terse and therefore muddled, but is clearer in the *Sharḥ al-tadhkira*, 70v.

the only remaining possibility, namely, that it is the result of an accident.[108]

(3) The third category of accidents are also imperceptible, but are known as a result of proof (*dalāla*). They consist on the one hand of the classes of life, the power of autonomous action, as well as the psychological accidents of conviction (which includes knowledge (*'ilm*)), instinctual desire and loathing, willing and aversion, opinion and reason, which all require the presence of life, as well as the classes of force, adhesion, humidity and dryness on the other.[109] In general, the argument which is used to establish the existence of the psychological accidents relies on the distinction we observe between our state of, for example, willing and not willing. This difference, it is argued cannot be the result of anything else but an inherent accident.[110]

The argument for proving the existence of the accident of adhesion is based on the observation that we find it difficult to break some bodies into their constituent atoms while other bodies can broken without much effort. After arguing that the obstacle to the dissolution of a body is neither the result of its attributes, nor of the agent who brings it into existence, nor of the accident of contiguity, the conclusion that it must be another accident, which is the accident of adhesion, is reached.[111]

The argument for proving the existence of force (*i'timād*) is similar. The basis for the argument is the observation that we feel a pressure when we are next to a body which is pushing against us, but we do not feel a pressure when the body is not pushing against us. We also observe that this pressure is found concomitant with the accidents of motion or rest, adhesion, or humidity, but this pressure is not identical to these accidents, but is a result of the accident of *i'timād*.[112]

(4) The fourth category consists only of the accident of annihilation (*fanā'*) which is known only as a result of revelation. However, strictly speaking, revelation only informs us of the future annihilation of atoms. On the basis of this information, we, on rational grounds, postulate the existence of the accident of annihilation.[113]

In this discussion of the common properties of accidents and the epistemological grounds on which the accidents which are affirmed by the Basrian Mu'tazilīs are shown to exist, we have encountered some

[108] This argument is developed most fully in al-Farzādī, *Ta'līq*, MS Ṣan'ā' 'ilm al-kalām 73, 18r, (quoted in the Introduction to al-Nīsābūrī, *Ziyādāt al-sharḥ*, 48).

[109] Ibn Mattawayh, *Tadhkira*, 45-46, 503, 530, 532-534, 608-610; *Sharḥ al-tadhkira*, 2v, 4v.

[110] Mānkadīm Shishdev, *Sharḥ uṣūl al-khamsa*, 93.

[111] Ibn Mattawayh, *Tadhkira*, 503.

[112] Ibid., 532-534.

[113] 'Abd al-Jabbār, *Mughnī*, XI:436-441; Ibn Mattawayh, *Tadhkira*, 43, 209-210; *Sharḥ al-tadhkira*, 35v-36r.

of the problems which the Basrian Mu'tazilī *mutakallimūn* inherited from their predecessors and incorporated into their research program. These problems, as we have seen, include epistemological questions, questions of definition, as well as questions of the features of accidents. Similar kinds of questions, which also have their roots in the early *kalām* discussion of the late third and early fourth/late eight and early ninth centuries, were also asked about atoms and the bodies they constitute. It is to these questions that we now turn as we examine the Basrian Mu'tazilī theory of the atom, its attributes, and its properties in the subsequent chapters.

CHAPTER THREE

ATOMS, SPACE, AND VOID

In the technical lexicon of the *mutakallimūn*, the atom is almost always denoted by the term *jawhar*. For the *falāsifa*, however, the same term denotes the Peripatetic concept of substance. The *mutakallimūn* of the third/ninth century were aware of these different usages of *jawhar* and attempted to explain and contrast their own specific usage. In the fourth/tenth century, the *kalām* atomists explicitly defined the atom as 'that which occupies space' (*mutaḥayyiz*). This definition underlined the interdependence between the *kalām* theory of matter and its theory of space, for, in the view of these *mutakallimūn*, it is impossible to conceive the atom without at the same time conceive it as space-occupying. The question of the existence of void spaces is a related problem, for in the view of the *mutakallimūn* it is posed by the question of whether the intervening space between two atoms can be empty or not, or in more familiar terms, whether the universe is a plenum or not. These three concepts of atom, space, and void, then, are fundamental to the physical theory of *kalām*.

A. THE ATOM AND ITS OCCUPATION OF SPACE

The equivalence of jawhar (substance) and juz' (atom)

Ibn Mattawayh's classification of what is known has been discussed at the beginning of the previous chapter. In this discussion, the term *jawhar*, which in this passage is described as 'that which occupies space', was, without further comment, understood to denote the atom.[1] This usage, however, merits further analysis.

Jawhar is the Arabization of the Persian term *gawhar* (Pahlavi *gōr*) where it signifies 'substance'. Indeed, in the *falsafa* tradition, *jawhar* primarily signifies substance, while the atom is signified by expressions like 'the particle which is indivisible' (*al-juz' alladhī lā yatajazza'*) etc..[2] On the other hand, in the *kalām* tradition, *jawhar* almost always signi-

[1] See above, Chapter Two, 16.

[2] S. van den Burgh, "Djawhar" in *Encylopaedia of Islam*, new ed., II:493-494; L. Gardet, "Djuz'" in *Encylopaedia of Islam*, new ed., II:607-608.

fies the atom.[3] The *mutakallimūn*, were aware of their specialized and distinctive use of *jawhar*. This is evident in the following report by al-Ash'arī on the various uses of *jawhar*:

> People were divided regarding *jawhar* and its meaning into four schools of thought:
> [1] The Christians believed that *jawhar* is the self-subsistent (*al-qā'imu bi-dhātihi*). Everything which is self-subsistent is therefore a *jawhar*, and every *jawhar* is self-subsistent.
> [2] Some philosophers (*mutafalsafa*) believed that *jawhar* is that which is self-subsistent, the receptacle (*qābil*) of contraries (*mutaḍāddāt*).
> [3] Some believed that *jawhar*, when it exists, is a carrier (*ḥāmil*) of accidents. The author of this doctrine has claimed that *jawāhir*[4] are *jawāhir* in themselves (*bi-anfusihā*). He has claimed that *jawāhir* may be known before they come into existence.[5] The holder of this doctrine is [Abū 'Alī] al-Jubbā'ī.
> [4] Al-Ṣāliḥī believed that *jawhar* is that which contains (*iḥtamala*) accidents. In his view, *jawhar* may exist even though God may not have created an accident in it. It is not a substrate (*maḥall*) of accidents but it is a container (*muḥtamil*) for them.[6]

This report clearly shows that the *mutakallimūn* were conscious of the fact that *jawhar* was an equivocal term. What al-Ash'arī has preserved for us here, then, is an enumeration of the different ways in which this term had been used during the third/ninth century. The first use of *jawhar*, which is ascribed to the Christians, signifies the self-subsistent. This formulation allows the Christians to use *jawhar* to denote God, that is to say, the three hypostases which form the Christian Trinity.[7]

[3] The *kalām* and *falsafa* uses of *jawhar* are contrasted by al-Ījī in his *Mawāqif*, VI:275-277.

[4] Viz. the plural of *jawhar*.

[5] This is a reference to the Basrian Mu'tazilī doctrine that objects whose existence is possible can be objects of knowledge before they are existent objects (see above, Chapter Two, note 34).

[6] al-Ash'arī, *Maqālāt*, 306-307.

[7] In his refutation of the doctrines of the Christians, 'Abd al-Jabbār states, "We shall relate of their doctrines what needs to be mentioned [for our purposes]. The three groups [namely the Jacobites, the Nestorians, and the Melkites] agreed that the Creator God is a single *jawhar* [and] three hypostases (*aqānim*). The first of these hypostases is a Father, the second a Son, and the third the Holy Spirit. The Son is the Word, the Spirit is Life, while the Father is the Eternal, the Living, the Articulate. These three hypostases are identical with regards to the *jawhar*, but differ with regards to their hypostases" (*Mughnī*, V:81). It is clear that in this context *jawhar* signifies 'substance'. In Wolfson's view, Origen (in Greek) and Tertullian (in Latin) had experimented with various terms in their search of a philosophical nomenclature which could be used to designate the distinctness of each member of the Trinity as well as a designation for their underlying unity, for which they adopted the Greek term *ousia* which in Arabic is rendered by *jawhar* (H. Wolfson, "Greek Philosophy in Philo and the Church Fathers" in *Studies in the History of Philosophy and Religion*, eds. Isadore Twersky and George Williams, (Cambridge: Harvard University Press, 1973), 86-88).

The three other uses of *jawhar* reported by al-Ash'arī explicate it by its relationship with accidents, that is, whether it acts as their receptacle, carrier, or container. The differences between these three kinds of relationships need not concern us at present. What is clear from al-Ash'arī's report is that *jawhar*, in all of the four doctrines which are mentioned, denotes 'substance' in one of its many senses. The Christians regarded substance to be the self-subsistent, some philosophers regarded it to be the self-subsistent as well as the receptacle of contraries, Abū 'Alī al-Jubbā'ī regarded it to be the carrier of accidents, and Abū al-Ḥusayn al-Ṣāliḥī regarded it to be the container for accidents.

Now the two *mutakallims*, Abū 'Alī al-Jubbā'ī and al-Ṣāliḥī, to whom al-Ash'arī attributes the third and fourth doctrines of his report, were both atomists. With respect to al-Ṣāliḥī, al-Ash'arī tells us elsewhere that he claimed that "the indivisible particle (*al-juz' alladhī lā yatajazza'*) is a body (*jism*) which contains (*yaḥtamilu*) accidents. Similarly the meaning of *jawhar* is that it contains accidents."[8] Therefore, the indivisible particle is, for al-Ṣāliḥī at the very least, identical to *jawhar* in so far as both are containers for accidents. *Jawhar*, then, denotes the atom, in the sense that it is a container for accidents. The further identification of the body with the atom which is reported by al-Ash'arī is a doctrine peculiar to al-Ṣāliḥī, for he, unlike other *mutakallimūn*, held that a body may be constituted out of a single atom.[9]

Al-Ṣāliḥī was not the only *mutakallim* to identify *jawhar* with the atom. The other *mutakallim* who is the subject of al-Ash'arī's report, namely, Abū 'Alī al-Jubbā'ī followed in the footsteps of some of the *mutakallimūn* of the early third/ninth century who had also made the same identification. This is made clear by al-Ash'arī in another report:

> Every *jawhar* is not a body. It is impossible for a single *jawhar* which is indivisible (*al-jawharu l-wāḥidu alladhī lā yanqasimu*) to be a body because the body is that which is long, broad, and deep. The single atom is not like this. This is the doctrine of Abū al-Hudhayl and Mu'ammar. [Abū 'Alī] al-Jubbā'ī followed this doctrine.[10]

[8] al-Ash'arī, *Maqālāt*, 301.

[9] "There is no atom (*jawhar*) save that it is a body" (Ibid., 307). The various *kalām* doctrines on the least number of atoms which constitute a body are discussed below in Chapter Four.

[10] Ibid. Al-Ash'arī mentions that there were three doctrines regarding whether all *jawāhir* (atoms or substances) were bodies or whether it was possible for *jawāhir* which were not bodies to exist. The first and second doctrines are attributed to specific *mutakallimūn* where the term *jawhar* denotes the atom. Thus the first doctrine, which is attributed to Abu al-Hudhayl and Mu'ammar, and was the doctrine adopted by Abū 'Alī al-Jubbā'ī, maintains that atoms (*jawāhir*) are not all bodies. The second doctrine is attributed to al-Ṣāliḥī and maintains that all atoms (*jawāhir*) are bodies. The third doctrine

The use of the phrase 'the single *jawhar* which is indivisible' here makes it clear that *jawhar* signifies the atom.

Further evidence for the identification of *jawhar* with the atom is provided by Abū 'Abd Allāh Muḥammad al-Khawārizmī (fl. ca. 366-367/976-977), who, in his *Mafātīḥ al-'ulūm* (a handbook of technical terms used in various disciplines) states: "According to the Mu'tazilī *mutakallimūn*, bodies are constituted out of indivisible parts (*ajzā' lā yatajazza'*), and these, in their view are *jawāhir*."[11] We may note that this statement also applies to the use of *jawhar* by the Ash'arī *mutakallimūn* of this period.[12]

The use of 'substance' (*jawhar*) to denote the atom is not peculiar to the *kalām* atomists but can already be found in Greek Atomism or, to be more precise, in Aristotle's analysis of Greek Atomism. Thus Aristotle states that Democritus "identifies his atoms (*atoma*) with substances (*ousias*)."[13] He makes this observation in a rather rambling discussion of substance in Books Z and H of the *Metaphysics*. In his analysis of this discussion, G.E.R Lloyd notes that according to Aristotle the term 'substance' can be applied to "(1) the essence or 'the what it is to be a thing'; (2) the universal; (3) the genus, and (4) the substratum and he distinguishes between three different aspects of the substratum, (i) matter, (ii) form, and (iii) the combination of the two (the concrete individual)."[14] Aristotle points out that the marks of substance are that it

is not attributed to any specific person or group, but it must be the doctrine of the *falāsifa*, for it maintains that there are two kinds of substances (*jawāhir*), compound and simple, and that simple substances are not bodies, while compound substances are.

[11] Abū 'Abd Allāh Muḥammad al-Khawārizmī, *Mafātīḥ al-'ulūm*, ed. G. van Vloten, (Leiden: Brill, 1895), 23.

[12] "Some of the leading authorities held that *jawhar* is every atom (*juz'*). This is best definition [of *jawhar*]" (al-Juwaynī, *Shāmil*, 142).

[13] *Metaphysics*, 1039a10-11. Whether or not Democritus himself used 'substance' to denote the atom is irrelevant here. It is clear that Aristotle considers atom and substance to be identical in the Democritean context.

[14] G.E.R. Lloyd, *Aristotle: The Growth & Structure of his Thought*, (Cambridge: Cambridge University Press, 1968), 129.

Ibn Sīnā presents the following *falsafa* perspective of the different meanings of *jawhar*: "*Jawhar* is an equivocal term:

[1]-*Jawhar* is said of the essence (*dhāt*) of anything whatsoever, for example [of] man or white.

[2]-*Jawhar* is also said of any essentially existing thing which does not, with regards to its existence, depend on another entity (*dhāt*) with which it is associated. Hence it subsists actually. This is the meaning of their statement, '*Jawhar* is the self-subsistent' (*qā'imun bi-dhātihi*).

[3]-*Jawhar* is also said of something which has this attribute [that is of being self-subsistent] as well as having the property that it receives contraries which one after the other come upon it.

[4]-*Jawhar* is also said of every entity (*dhāt*) whose existence is not in a substrate (*maḥall*).

is the first in definition and the first in order of knowledge. He rejects the claims of the universal and genus to substance and considers that essence and form have special claim to substance. He wavers regarding the claims of matter, stating in one place that it is impossible for matter to be substance (1029a26f.), but in another that "clearly matter also is substance" (1042a32) because matter is the underlying substrate in which change occurs.[15] It would seem, then, that when Aristotle makes Democritus' atoms to be substances he has the notion of substance as matter in mind, that is substance as the underlying substrate for change, which, for the Atomists is the individual atom.

In my view, it is this concept of the atom as the material substrate of change, which underlies the *kalām* use of *jawhar* to denote the atom. The differing views of *jawhar* which are reported by al-Ash'arī reflect this, for, apart from the Christian view of substance, the three other views which he reports attempt to define *jawhar* as the substrate in which accidents, whose role it is to explicate change, inhere. Indeed, the differences between these three views concerns the nature of this inherence, namely, whether the underlying substrate is the receptacle, carrier, or container for the accidents which inhere in it. This concern betrays the primacy of the role of *jawhar* as the substrate in which change occurs. The *kalām* use of the term *jawhar*, then, denotes the atom insofar as the atom is the material substrate for inherent accidents which are responsible for change. More succinctly, *jawhar* represents the smallest unit of matter, so long as by matter we mean the substrate in which accidents inhere.[16]

[5]-*Jawhar* is also said of every entity whose existence is not in a subject (*mawḍū'*). The ancient philosophers (*al-falāsifa al-qudamā'*) have, since the time of Aristotle, adopted this [meaning] in their use of the term *jawhar*.

We have already drawn the distinction between subject (*mawḍū'*) and substrate (*maḥall*). Thus by their statement "The existent (*mawjūd*) which is not in a subject" they mean the existent which differs from [an existent] whose existence is associated with an actually self-subsistent substrate which provides its basis (*muqawwam*). It does not matter that the existent is in a substrate which cannot actually subsist without the existent, for, if it is in a substrate it cannot be in a subject.

Every existent, insofar as it is like white, or hot, or motion, is a *jawhar* in the first sense. The First Principle (*al-mabda' al-awwal*) is a *jawhar* in the second, fourth, and fifth senses and not in the third sense. Prime Matter (*hayūlā*) is a *jawhar* in the fourth and fifth senses, and not in the second and third senses. Form is a *jawhar* in the fifth sense and not in the second, third, and fourth senses" (*Kitāb al-ḥuddūd*, ed. A.M. Goichon, (Cairo,1963), 23-24). We may note here that Ibn Sīnā's usages [2] and [3] correspond to al-Ash'arī's first two usages, that is of the Christians and the philosophers (see above, 56).

Al-Fārābī also discusses the various senses of *jawhar* in his *Kitāb al-ḥurūf*, ed. M. Mahdi, (Beirut,1973), 97-105.

[15] Lloyd, *Aristotle*, 129-132.

[16] I agree with Richard Frank's remark that the use of *jawhar* in *kalām* means atom and that the translation 'substance' which has been employed by some scholars is inap-

Ibn Mattawayh, it seems, also recognized the need for explicating the use of *jawhar* to denote the atom. He based his explanation on the lexical meaning of *jawhar* as 'constituent':

> ... in the view of the lexicographers, *jawhar* means constituent (*aṣl*). They say, "the *jawhar* of this cloth is excellent or inferior," that is its constituent [material]. Therefore, atoms (*jawāhir*) are the constituents of bodies.[17]

Such a definition of *jawhar* as constituent is also found in standard lexicographical works. For example, Lisān al-Dīn Ibn al-Khaṭīb (d. 776/1375) states in his *Mufradāt*, "The *jawhar* of something is its constituent. It is used generally for the true nature (*ḥaqīqa*) of a thing which is a composite of matter (*mādda*) and form (*ṣura*)."[18] This author's endorsement of the Peripatetic doctrine that substance is a composite of matter and form does not detract from the fact that he considers *jawhar* to mean constituent. Another example may be found in the classical dictionary *Tāj al-'arūs* of al-Zabīdī. In this work, both uses of *jawhar* which are relevant for our discussion are mentioned, namely, that the *jawhar* of some things is that from which its nature is established, or for other things, the constituents out of which its nature is created.[19]

Ibn Mattawayh's view is that the *kalām* use of *jawhar* to denote the atom derives from the lexical meaning of *jawhar* as constituent, for atoms are the constituents out of which bodies are formed, or to put it another way, they are the smallest units of matter. This explication is probably incorrect from the historical point of view. We have seen above that the concept of substance as matter has its roots in Antiquity and that the further step of identifying *jawhar*, in its meaning as substance, with the atom is already found in Aristotle. On the other hand, it is clear that the meaning of *jawhar* as a fundamental constituent, and therefore the atom, is very closely related to the concept of *jawhar* as matter.

propriate in the *kalām* context (Richard Frank, "Bodies and Atoms: The Ash'arite Analysis" in *Islamic Theology and Philosophy: Studies in Honor of George F. Hourani*, ed. Michael E. Marmura, (Albany: State University of New York Press, 1984), 290-291, note 19). What I have tried to show here is that there is one property of substance, in so far as it denotes matter, namely the property of being the receptacle of accidents, which is applicable to the atom, and that this may be the reason for the *kalām* appropriation of the term *jawhar* to denote the atom (see also al-Juwaynī's discussion of the definition of *jawhar* in *Shāmil*, 142).

[17] Ibn Mattawayh, *Tadhkira*, 74.

[18] Lisān al-Din Ibn al-Khāṭib, *Mufradāt*, ed. 'A. al-Wadghīrī, (Morocco,1988), 49.

[19] Muḥammad Murtaḍā al-Zabīdī, *Tāj al-'arūs*, ed. Ibrāhīm al-Tarzī, (Kuwait,1972), X:494-495.

The Basrian Mu'tazili definition of the atom

After these preliminary remarks about the use of *jawhar* to denote the atom, we can now turn to Ibn Mattawayh's definition of the atom:

> The true nature (*ḥaqīqa*) of the atom (*jawhar*) is that it is that which, when it exists, occupies space (*mā lahu ḥayyizun*). The object which occupies space (*mutaḥayyiz*) is characterized by an attribute (*ḥāl*), by virtue of which,
> [1] it forms a larger unit (*yata'āẓamu*) by the addition of another [atom] to itself; or,
> [2] it fills (*yashgalu*) a portion (*qadr*) of space (*makān*); or,
> [3] it is that which measures space (*mā yuqaddiru taqdīra l-makāni*)[20] having occupied (*ḥāza*) this space; or,
> [4] it prevents another atom from being [in the space] where it is.
> These, and others similar to them, are the properties (*aḥkām*) of that which occupies space.
> Single units which have this attribute are called atoms (*jawhar*). The composition of bodies is out of these entities (*a'yān*) and for this reason, atoms are considered to be the constituents (*uṣūl*) of bodies.[21]

It is rather surprising to find that Ibn Mattawayh does not define the atom as the smallest material particle, nor as the indivisible particle. Rather, this definition lays emphasis on the space-occupying characteristic of the atom, which is here considered to be 'the true nature' of the atom. To elucidate this space-occupying characteristic further, Ibn Mattawayh then presents us with a list of the properties of space-occupying objects. As we shall see, these properties entail that atoms must be spatially extended objects. The fact that the single units of spatially extended objects are atoms is only mentioned towards the end of the passage. The starting point, then, for this definition of the atom is our everyday experience of the properties of spatially extended objects, namely bodies.[22]

[20] For the expression *mā yuqaddiru taqdīra l-makāni*, see below, 65-66.

[21] Ibn Mattawayh, *Tadhkira*, 47. Al-Juwaynī also mentions the same definition: "If someone asks what is the true nature of the atom? We say: The explications of the *uṣūliyyūn* [i.e. the *mutakallimūn*] regarding this differ ... Some of the leading authorities said 'the atom (*jawhar*) is that which fills space (*mā yashgalu l-ḥayyiza*) or the object which occupies space (*mutaḥayyiz*)'. It is nonsensical to say that spatial occupation (*taḥayyuz*) is an unknown concept (*majhūl*) [i.e. not defined in the context of this definition] for the aim of the definition (*ḥadd*) is clarification, and spatial occupation is a well-known concept (*ma'qūl*). The same is true for the filling of space for space is designated by boundaries and location (*jiha*) so that the space of the object which occupies space is characterized by the location of the object. This is clear to anyone who reflects upon this. There is no room for any confusion" (*Shāmil*, 142).

[22] One can note a slight resemblance here with Epicurus' *Letter to Herodotus*, in which Epicurus' argument for the existence of theoretical indivisibles or minimal parts moves from the division of sensible bodies into physical indivisibles or atoms which are insensible and then to the division of atoms into theoretical indivisibles or minimal parts

At this point, it may be appropriate to analyze the term *mutaḥayyiz*, namely, 'the object which occupies space' further. As we shall see, this term entails that such a space-occupying object must be spatially extended. This term does not seem to have been used to describe atoms or bodies by the *mutakallimūn* of the third/ninth century for it is not found in fragments attributed to them. The term, it seems, originated with Abū Hāshim al-Jubbā'ī, who, as we shall later, represents a departure from the atomism of his predecessors for he maintained that the atom has size. *Mutaḥayyiz* does not seem to have been used by his father Abū 'Alī al-Jubbā'ī, nor his contemporary and rival al-Ash'arī. Nevertheless, the conceptual clarity which resulted from Abū Hāshim's use of this term to denote the atom soon led to its adoption not only by his followers but also by the Ash'arīs and Baghdadī Mu'tazilīs. The importance of this term is therefore obvious. Clearly, the analysis of its meaning is not just a philological exercise, for, whether or not atoms are extended, and if they are extended then how can they be indivisible, were points of controversy between the atomist *mutakallimūn* and their anti-atomist opponents. Moreover, the constitution of bodies, which, in the view of these *mutakallimūn* have length, breadth, and depth, out of atoms which do not in their view have length, breadth, and depth but yet occupy space in some manner raises the difficulty of the manner in which the atom is extended. We shall examine this latter question of the constitution of bodies out of such atoms in further detail in the next chapter. For now, let us turn to the *kalām* theory of space, in particular, the examination of the meaning of the term *mutaḥayyiz*, as well as the related terms *ḥayyiz* and *makān*, all of which are mentioned by Ibn Mattawayh in his definition of the atom.

B. THE THEORY OF SPACE

Spatial occupation and the properties of the atom

We have seen that Ibn Mattawayh defines the atom as *mutaḥayyiz*, namely the space-occupying object, and then lists the following properties of such a space-occupying atom:

[M1] it forms a larger unit by the addition of another atom to itself;
[M2] it fills a portion of space (*makān*);
[M3] it is that which measures space (*mā yuqaddiru taqdīra l-makāni*) having occupied this space;
[M4] it prevents another atom from existing where it is.

(David Furley, *Two Studies in the Greek Atomist*, (Princeton: Princeton University Press, 1967), 7-27).

Ibn Mattawayh's commentator adds two further properties to this list:[23]

[C5] it makes the inherence of accidents in the atom possible;
[C6] it is perceptible by the senses of sight and touch.

In a discussion which is more informative than that of Ibn Mattawayh or his commentator, the fifth/eleventh century Ash'arī *mutakallim* al-Juwaynī notes that the *mutakallimūn* held different views regarding the meaning of the term *mutaḥayyiz*. Even though he only presents the views of al-Bāqillānī and 'the leading authorities' of *kalām*, al-Juwaynī's mention of the existence of these different views suggests the existence of a controversy in the fourth and fifth/tenth and eleventh centuries over the meaning of this term and it illustrates the central importance of this term for *kalām* atomism of this period. He states:

> We have already stated that the atom (*jawhar*) is a space-occupying object (*mutaḥayyiz*). Now we will explain spatial occupation (*taḥayyuz*) and what it means for it is one of those subjects over which the definitions (*'ibārāt*) of the *mutakallimūn* have differed.
>
> [A1] Some of them said: "The space-occupying object (*mutaḥayyiz*): it is that existent which cannot exist in the place where another thing, similar to it, exists."
>
> This definition is invalid even although many of the leading authorities [of *kalām*] (*a'imma*) have adopted it. [The reason for this is that] when an accident subsists in its substrate, another similar accident cannot exist where it exists because two similar accidents are contraries. However, even though this is the case, the accident is not a space-occupying object[24] Thus [this] definition of *mutaḥayyiz* is falsified by the above objection.
>
> The most correct of these definitions are the ones with which al-Qāḍī [al-Bāqillānī], may God be pleased with him, was satisfied:
>
> [B1] He said, "The space-occupying object is a corporeal object (*jirm*). It does not have any other meaning."
>
> [B2] He said, "It is that which has magnitude (*lahu ḥaẓẓun min al-misāḥati*)."
>
> [B3] He also said, "It is that which cannot exist in the place where an atom exists." By stating the definition in this manner he avoided the counter-example of the accident.
>
> [B4] He also said, "It is that existing thing which cannot exist in the place where a similar thing exists even though there is no contrariety [between them]."

[23] *Sharḥ al-tadhkira*, 4v.

[24] The point here is that the reason two like accidents cannot be in the same substrate is that they are contraries and not because they may occupy space. The whole question of whether accidents were space-occupying objects was also discussed by the *mutakallimūn*. See below, Chapter Four, 90-95.

> Even though these definitions are different they have the same meaning.[25]

Al-Juwaynī's preference for al-Bāqillānī's definitions of *mutaḥayyiz* is not without merit, for not only are al-Bāqillānī's definitions consistent with all of the properties that Ibn Mattawayh and his commentator ascribe to it, but his statement [B1] that *mutaḥayyiz* means *jirm*, namely a corporeal object having bulk or volume, is one of the clearest statements from this period that *mutaḥayyiz* denotes a spatially extended object.[26] Another Ash'arī *mutakallim*, Abū Bakr al-Fūrakī (d. 478/1085) confirms this in his unambiguous and explicit statement that the atom is "the smallest of what is small in respect to volume (*ḥajm*)" and that "this is the most exact expression for the meaning of the atom."[27] Therefore, the occupation of space by an atom, which is denoted by the term *mutaḥayyiz*, must be identical with the occupation of space by sensible bodies. That the spatial occupation of such sensible bodies entails that they have volume or bulk is clear to us in our everyday experience. *Mutaḥayyiz* cannot have a different meaning in the context of atoms, namely, it cannot represent a different kind of occupation of space. Specifically, *mutaḥayyiz* cannot mean being located in space but yet not occupying space in the manner of a mathematical point. Rather, in order for it to have the same meaning as *jirm*, *mutaḥayyiz* must denote an object which is spatially extended and occupies space like a bulky object which has volume, namely a body.

This view of *mutaḥayyiz* as denoting an extended object is in line with the properties which are listed by Ibn Mattawayh and his commentator as well as the other properties that al-Bāqillānī had mentioned and which are listed by al-Juwaynī. Thus, it is clear that an extended object increases in magnitude when it is appended to another extended object [M1]; the extended object must, by definition, occupy some portion of space [M2] and have magnitude [B2]; and by the addition of the further premise upheld by the atomist *mutakallimūn* that

[25] al-Juwaynī, *Shāmil*, 156.

[26] See also al-Juwaynī, *Shāmil*, 157. Yet al-Juwaynī states that the atom has neither side (*ṭarf*) nor extremity (*ḥadd*) nor part (*juz'*) (*Shāmil*, 143). It must then be possible for the atom to have volume but yet not have sides. This puzzle, as we shall see in the next chapter, is resolved when the atom is understood within the perspective of a discrete geometry.

[27] Abū Bakr al-Fūrakī, *Al-Niẓāmī fī uṣūl al-dīn*, MS Ayasofya no 2378, 18r, quoted in Frank, "Bodies and Atoms," 43, 289, note 13. Al-Juwaynī (*Shāmil*, 157) states that the spatial occupation (*taḥayyuz*) of the atom can be explained by the fact that the atom has bulk or volume (*ḥajm*).

extended objects are impenetrable,[28] it follows that an extended object will prevent another extended object from simultaneously occupying the location it is in [M4, A1, B3 and B4]; and the extended object must also be perceptible, at least when it has a certain magnitude, by the sense of touch and sight [C5].[29] On the other hand, the property of making the inherence of accidents possible listed by Ibn Mattawayh's commentator [C6] does not require that the substrate be an extended object because the inherence of an accident in a non-extended object, for example in another accident, or in a non-extended substance like a Neoplatonic intellect, is conceivable (although this was denied by the *mutakallimūn*).

One of the properties of the extended object which is listed by Ibn Mattawayh, namely, that it is "that which measures (or apportions) space" (*mā yuqaddiru taqdīra l-makānī*) [M3] probably derives from Epicurus' view that conceptual indivisibles or minimal parts are *units of measure* (this view is also expressed in the pseudo-Aristotelean treatise *On Indivisible Lines*).[30] Ibn Mattawayh explains the phrase "that which measures space" further by adding the remark "having occupied this space," while his commentator adds, "in the manner of being contiguous with [empty] space" (*'alā sabīli l-mujāwarati lil-jihati wal-muḥādhāti*).[31] The phrase also occurs, albeit in a slightly different form, in al-Juwaynī's *Shāmil* when he turns to discuss the meaning of *ḥayyiz*, or occupied space. He states:

> If someone asks: What, then, is *ḥayyiz*?
>
> Some of the leading authorities [of *kalām*] have said: It is the apportioning of space (*taqdīr al-makān*). They do not, by this, mean that when God creates a single atom, its *ḥayyiz* is the apportioning of the space which belongs to it, for this [entails that *ḥayyiz*] awaits [the appearance of] an existent. But *ḥayyiz* is a real thing (*thābit*) and not something which is anticipated. Its meaning, rather, is that it is a space (*makān*) that belongs to an atom which has apportioned [this space] (*li-jawharin muqaddirin*).
>
> The clearest statement that can be made regarding *ḥayyiz* is that it is, in itself, space-occupying (*innahu mutaḥayyizun bi-nafsihi*) and the meaning of an object which occupies space has been presented above. Moreover, the relationship of the atom to *ḥayyiz* is not difficult to conceive just as the relationship of existence to the atom is not difficult to conceive.[32]

[28] For the Mu'tazilīs, see the discussion by Ibn Mattawayh on why two atoms cannot occupy the same location (*Tadhkira*, 113-115); for the Ash'arīs, see the discussion by al-Juwaynī (*Shāmil*, 160-162).

[29] For the visual perception of the atom, see below Chapter Five, 141-145.

[30] Furley, *Two Studies*, 115-116; pseudo-Aristotle, *On Indivisible Lines*, 986b4ff..

[31] *Jiha* and *muḥādhāh*, like *makān*, denote empty space. See below, 69-70.

[32] al-Juwaynī, *Shāmil*, 156.

The expression "that which apportions space" also occurs in al-Bāqillānī's *Inṣāf*:

> *Jawhar* is that thing which occupies a portion of space (*mā lahu ḥayyizun*) while *ḥayyiz* is the space (*makān*) [which is occupied], or, it is that which apportions space (*mā yuqaddiru taqdīra l-makānī*) preventing another object from appearing in it.[33]

Occupied spaces and empty spaces

These remarks by al-Bāqillānī and al-Juwaynī clearly show that two kinds of space are distinguished by the use of the terms *makān* (also denoted by *jiha* and *muḥādhāh*) and *ḥayyiz*. *Makān* denotes empty space, while *ḥayyiz* denotes a particular portion of previously empty space which is now occupied by an extended object and which is thus apportioned or measured off from empty space. In the strict sense, therefore, *ḥayyiz* denotes space which is occupied by an extended object, *makān* denotes empty unoccupied space, while *mutaḥayyiz* denotes the extended object which is now occupying space.[34] Al-Juwaynī mentions the question of whether *ḥayyiz* is created at the same time as when the atom which occupies it is created. This shows that *ḥayyiz* cannot signify empty space. Such an interpretation of *ḥayyiz* as occupied space is consistent with Ibn Mattawayh's remark [M3] that an extended object apportions space by having occupied a particular portion of space. Ibn Mattawayh's anonymous commentator further adds: "The atom is that which apportions space in such a manner that it is contiguous with empty space" (*'alā sabīli l-mujāwarati lil-jihati wal-muḥādhāti*).[35] It follows then that occupied space is not inherent in empty space, or in other words, occupied space does not interpenetrate empty space. Rather, these two kinds of space are contiguous regions of space such that occupied spaces are embedded in, and surrounded by empty space.

The view, then, that *makān* denotes empty space unoccupied by any object entails the further belief in the existence of the void, a doctrine which was held by both the Basrian Mu'tazilī as well as the Ash'arī *mutakallimūn* of the fourth and fifth/tenth and eleventh and later centuries.[36] The theory of the void will be examined in further detail in the next section of this chapter. For now, it is sufficient to note that the theory of space which has been reconstructed above is implicit in most of the *kalām* texts of this period and does not constitute a subject worthy of discussion in its own right.[37] Shaykh al-Mufīd who usually inclines towards the views of the Baghdadī Mu'tazilīs,[38] draws the implication that the doctrine of empty space entails belief in the existence of the void. He states in his *Awā'il al-Maqālāt*:

> I believe that the universe (*'ālam*) is [completely] filled with atoms, and that there is no void (*khalā'*) within it. If there were a void within it, then it would be impossible for atoms and bodies which are combined together (*mujtama'*) to differ from those which are separate (*mutafarraq*). This is the doctrine of Abū al-Qāsim of the Baghdadī [Mu'tazilīs] in particular, as well as the doctrine of most of the early *mutakallimūn*. It is opposed by [Abū 'Alī] al-Jubbā'ī and his son as well as a group of the *mutakallimūn* of the Materialists (*hashwiyya*), the Determinists, and the Anthropomorphists (*ahl al-jabar wa l-tashbīh*).
>
> I believe that space (*makān*) is that which completely envelopes a thing from all sides. The motion of atoms is impossible except in spaces (*amakīn*). This is the doctrine of Abū al-Qāsim and other Baghdadī [Mu'tazilīs] and some of the early *mutakallimūn*. It is opposed by al-Jubbā'ī and his son, the Bānū Nawbakht, and those who tend towards the doctrine of the Determinists and the Anthropomorphists.[39]

Al-Mufīd's account specifies two of the elements of the *kalām* theory of space, namely the existence or the non-existence of the void and the nature of space (*makān*), that is, whether it is a two-dimensional surface which completely envelopes a body or whether it is a three-dimensional expanse. On the positive side, al-Mufīd's account tells us that the Baghdadī Mu'tazilīs denied the existence of the void and considered the universe to be a plenum filled with atoms. Moreover, they believed that space was the two-dimensional container which completely envelopes a body. Since, in their view, the universe is completely filled, they could not uphold the doctrine of a body embedded

[33] al-Bāqillānī, *Insāf*, ed. 'Izzat al-Aṭṭār al-Ḥusaynī, (Cairo,1950), 15.

[34] Hence Shaykh al-Mufīd states, "What is the definition of *mutaḥayyiz*? It is the occupier of space (*makān*), such that it can be pointed to by a sensible gesture (*ishāra ḥissiyya*) that it is here or that is there" (*al-Jawāhir al-I'tiqād*, (Najaf,1374 A.H.), 75). Ibn Sīnā's use of *ḥayyiz* for the natural place of an object also conveys the sense of a part of space which has been apportioned. However, for Ibn Sīnā the world is a plenum and therefore does not contan any empty spaces.

The dictionary meanings of *ḥayyiz* include "the imaginary portion of space occupied by a thing having extent, as a body or by a thing not having extent as an indivisible atom" (Lane, *Lexicon*, I:668, which derives from al-Muṭarrizī's (d. 610/1213) *Mughrib*).

[35] *Sharḥ al-tadhkira*, 4v. For the use of *jiha* and *muḥādhāh* to denote space, see below 69-70.

[36] Ibn Mattawayh, *Tadhkira*, 116-124; al-Nīsābūrī, *Masā'il*, 47-55; al-Juwaynī, *Shāmil*, 508-509. Ibn Fūrak reports that al-Ash'arī affirmed the existence of the vacuum (*Mujarrad*, 206, 272).

[37] This stands in contrast with later *kalām* works in which the theory of space is discussed separately and much more elaborately, for example in Fakhr al-dīn al-Rāzī's *al-Maṭālib al-'āliyya*, ed. A. Ḥ. al-Safā, (Beirut,1987), V:109-155.

[38] W. Madelung, "Imamism and Mu'tazilite Theology" in *Le Shī'isme Imāmite: Colloque de Strasbourg (6-9 mai 1968)*, (Paris: Presses Universitaires de France, 1970), 24; M. McDermott, *The Theology of al-Shaikh al-Mufīd*, (Beirut,1978), 395-396.

[39] Shaykh al-Mufīd, *Awā'il*, 81-82. For the Bānū Nawbakht, see Madelung, "Imamism," 15-17.

in empty space. Their view on the nature of space was thus akin to the Peripatetic and Neoplatonic view, that is, that space is the two-dimensional container which envelopes the body.

On the other hand, their opponents, including the Basrian Mu'tazilīs, not only upheld the existence of void spaces within the universe but they also denied the doctrine that space was the two-dimensional surface which envelopes the body.[40] Al-Mufīd's report does not provide a positive account of the Basrian Mu'tazilī theory of space. But their conception of *makān* as empty space within which parts of space are apportioned by the extended bodies which reside therein—a conception which we have encountered above—seems to suggest belief in the idea of absolute space, or an empty three-dimensional expanse in which spatially extended bodies are embedded. However, this belief is not clearly stated and was probably vaguely conceived, as we shall see in the Basrian Mu'tazilī criticism of the arguments against the void. Other contemporary non-*kalām* accounts also mention such a conception of space without identifying its proponents. The scientist Ibn al-Haytham (d. 432/1040), for one, in his treatise on space (*Risāla fī al-makān*) tells us that scholars had two different conceptions of the nature of space:

> [1] One group believed that the space of a body is the surface which envelopes the body.
> [2] Another group believed that the space of a body is the imaginary empty space (or void *khalā'*) which the body has occupied.
> ...
> Empty space is nothing but [a region having] dimensions (*ab'ād*) which is devoid of matter (*mawādd*). Therefore, the imaginary empty space which a body occupies is an imaginary [region whose] dimensions are equal in magnitude to the dimensions of the body when it is imagined to be devoid of matter. The imaginary empty space, then, which the body occupies is the imaginary [region whose] dimensions have the same magnitude as the dimensions of the body.[41]

[40] Ibn Mattawayh states, "Abū al-Qāsim [al-Balkhī] held that space is the container which envelopes the heavy body on all its sides. This is an erroneous use of language [reading *al-lugha* for *al-'ibāra* as in MS Ambrosiana C104, 91r] because the lexicographers (*ahl al-lugha*) do not refer to a shirt as the place of someone, even though it envelopes him on all his sides [reading *min jamī'i jawānibihi* for *min jawānibihi* as in MS Ambrosiana C104, 91r]" (*Tadhkira*, 484).

[41] Ibn al-Haytham, *Risāla fī al-makān*, in *Majmū' al-rasā'il*, (Hyderabad,1357 A.H.), 2, 6. Ibn al-Haytham also states, "I have been unable to find a thorough examination by any earlier writers on the nature (*māhiyya*) of space, nor [have I found] a clear exposition (*dalīl*) which has a coherent presentation of the nature of space. This being the case, I thought that I should investigate the nature of space thoroughly so that it is apparent and manifest and by which disagreement will be resolved and confusion come to an end."

Even though Ibn al-Haytham, in conformity with his Peripatetic leanings, denied the existence of real empty or void spaces, he could imagine the body as occupying a portion of empty space equal in magnitude to the dimensions of the body. In the end he endorsed this view of space (which derives ultimately from John Philoponus) as the less problematic one.[42] The Basrian *mutakallimūn*, on the other hand, had no problems with the existence of void spaces and considered bodies and atoms to be embedded within real empty space, or, to be separated by real void spaces.

Two further points need to be made regarding the atomist *mutakallimūn*'s theory of space. The first is that the Basrian *mutakallimūn*, in particular, also use the terms *jiha* and *muḥādhāh* as synonyms of *makān*, that is empty space. This is clear from the context in which in these terms occur in their texts.[43] It is also made explicit in a remarkable treatise by Ibn Sīnā which begins by an unidentified person requesting Ibn Sīnā to present his view on a contemporary controversy over the nature of space.[44] The request, and the ensuing response by Ibn Sīnā are remarkable for they reveal the contact and dialogue between the *falāsifa* and the *mutakallimūn* over cosmological questions. In the particular case of Ibn Sīnā, his response to this request shows that he was acquainted with the views of the *mutakallimūn* of his day as well as with some of their writings. The request begins:

Ibn Sīnā also discusses the various conceptions of space in his *al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, ed. S. Zā'id, (Cairo,1983), 114-116.

[42] Ibn al-Haytham, *Risāla fī al-makān*, 10; John Philoponus, "Corollary on Place," tr. David Furley in *Place, Void, and Eternity*, (Ithaca: Cornell University Press, 1991), 28-30.

[43] "The atom exists in space (*fī makānin aw muḥādhātin*)" (Ibn Mattawayh, *Tadhkira*, 62); "The object which occupies space (*mutaḥayyiz*) must be in space (*fī jihatin*)" (Ibid., 88); "Just as it is impossible for the atom to occupy two places (*makānayn*) at the same time, it is also impossible for two atoms to occupy a single space (*fī jihatin wāḥidatin*)" (Ibid., 113-114); "The cause (*'illa*) which prevents two atoms from occupying a single space (*fī muḥādhātin wāḥidatin*)..." (Ibid., 115).

[44] The request and Ibn Sīnā's response are published in *Ibn Sina Risāleri*, ed. Hilma Ziya Ülken, vol. 2, *Les Opuscules D'Ibn Sina et Le Livre de la Différence entre L'Espirit et L'Ame par Qusta b. Luqa*, (Istanbul,1953), 155-159 with the title, "Risāla li-ba'ḍ al-mutakallimīn ilā al-shaykh fa-'ajābahum." It is also published with a Persian translation in Āyatullāh Muḥammad Ṣaliḥ Ḥā'irī's *Ḥikmat-e Bū 'Alī Sīnā*, ed. Ḥasan Faḍā'ilī, (Teheran,1957), I:37-44) Ḥā'irī, without citing any evidence, claims that the request was made by Ibn Sīnā's student Abū 'Abd Allāh Ma'ṣūmī. The request and the reply are listed under item 67 by G. Anawati in his *Essai de Bibliographie Avicenniene*, (Cairo,1950), 135-136 and under item 129 by Y. Mahdavi in his *Fihrist-e muṣannafāt-e Ibn-e Sīnā*, (Teheran,1954). The incipit and excipit that are listed by Anawati and Mahdavi show that both printed texts are riddled with errors.

> What is this expanse (*wus'a*) which contains[45] all things which some of the Ancients have called a god and worship it,[46] some have called *faḍā'*, others have called *makān* and *markaz*, while the *mutakallimūn* have called it *jiha* and *ḥayyiz* and the Mu'tazila have called it *muḥādhāh*, all of them signifying it by [the spatial terms] 'the place in which' (*ḥaythu*) and 'where?' (*'ayna*).
>
> 'Abd al-Jabbār, in his commentary on the *Maqālāt* of al-Balkhī, mentions that "Those who call it *faḍā'*, signify by *faḍā'* the same thing which we signify by *muḥādhāh*. Since they do not affirm it to be a body (*jism*), for a body is [that which] moves in space (*dhāhibu l-jihāti*),[47] nor do they describe it as contiguous (*mujāwara*) nor inhering (*ḥulūl*), the difference between us [and them] regards the term (*lafẓ*) [used] and not its meaning."
>
> ...
>
> I ask the Shaykh, may God lengthen his life, that he explain to me his view regarding this ...[48]

This request to Ibn Sīnā reveals that the *mutakallimūn* used the terms *jiha* and *ḥayyiz*, while the Mu'tazilīs also used *muḥādhāh* for the space in which material objects are imbedded, or in other words, these terms were synonymous with *makān*. The fragment quoted from 'Abd al-Jabbār's commentary on al-Balkhī's *Maqālāt*, which is no longer available to us, further shows that in the view of the Basrian *mutakallimūn* empty space is neither body, for a body is capable of motion and can also, like the atom, be predicated as 'contiguous', nor is it an accident, for accidents are predicated as 'inhering' in a substrate.

The inclusion of *ḥayyiz* in Ibn Sīnā's questioner's list of the terms used to signify space shows that there is some latitude in the meaning of the terms which are used to denote space. Thus *ḥayyiz*, which, as the above analysis of Basrian Mu'tazilī usage of this term has shown, denotes the space occupied by an object, may, in some contexts refer to empty space, namely *makān*. *Makān*, in turn, is also equivocal and sometimes denotes place, and, particularly in Peripatetic texts, the natural place of a body.[49] The atomist *mutakallimūn* were opposed to this Peripatetic doctrine of natural place and in its stead had their own theory of place. Ibn Mattawayh states:

> A body has no need of place (*makān*) save in two situations:

[45] Reading *tasa'u* as in the incipit in Anawati, *Essai*, 135 for *yasa'u*.

[46] Reading *allatī samāhā ba'ḍu l-awā'ili ilāhan wa 'abadūhu* as in incipit in Anawati, *Essai*, 135 and in Ḥā'irī, *Ḥikmat*, I:37 for *allatī samāhā al-awā'ilu ilayhā wa 'addūhu*.

[47] As al-Juwaynī explains, this expression means that the body traverses the directions of breadth, length, and depth (*Shāmil*, 401).

[48] "Risāla li-ba'ḍ al-mutakallimīn ilā al-shaykh fa-'ajābahum" in *Ibn Sina Risāleri*, 156.

[49] "Every body occupies a portion of space (*ḥayyiz*) and has a natural place (*makān ṭabī'ī*)" (Ibn Sīnā, *al-Najāh*, (Beirut,1985), 171).

> [1] The first is when the body is a living being [which is capable of] independent movement. It must, then, have a place which constrains it and upon which it rests.
>
> [2] The second is when a body is characterized by heaviness (*thiql*). It must then require something which prevents its weight from causing its descent.[50]

The function of place thus is to restrain a body in a particular spatial location.[51] This theory of place is clearly opposed to the Peripatetic theory of distinct regions of space which are reserved for particular types of bodies and the resulting hierarchical cosmos of ether, fire, air, water, and earth. Rather, it maintains that place only makes sense in two situations: the first is the place that an animate being occupies, a place which changes as the being moves from one place to the other; and the second is the place in which a heavy body is constrained, that is to say, the heavy body is held in place because it is constrained in its downward descent by the presence of the body which is beneath it.[52]

C. THE EXISTENCE OF VOID SPACE

Two kinds of void or vacuum were distinguished in ancient and medieval philosophy. The first are the intercosmic void spaces between the particles which constitute the cosmos and the second is the extracosmic void beyond the bounds of the finite universe. For the Greek Atomists, the question of extracosmic void did not arise for their universe was infinite containing infinite cosmoi. Rather, they were proponents of intercosmic or interstitial voids between the atoms of the cosmos. The Stoics, on the other hand, were proponents of an extracosmic void beyond a unique cosmos but they denied intercosmic void spaces. Finally, Aristotle, and the Peripatetics who followed him, rejected the void altogether.[53]

[50] Ibn Mattawayh, *Tadhkira*, 52 and also *Sharḥ al-Tadhkira*, 5r-5v; see also the extended discussion about the meaning of *makān* in *Tadhkira*, 484-494; Cf. al-Juwaynī, *Shāmil*, 159 for the Ash'arī view of space.

[51] Ibn Mattawayh reports a controversy over whether the restraining body must be larger than the body which is being restrained (*Tadhkira*, 180-181).

[52] "Know that *makān*, in the view of those who believe in atoms, is not the same as *ḥayyiz*. This is because [the meaning of] *makān*, in their view, is close to the lexical understanding of this term. That is to say *makān*, is that upon which an object rests, for example the earth for a bed ... *Ḥayyiz*, in their view is the imaginary space which is occupied by that which occupies space, that is to say, the space which, if it were not occupied would be empty, for example, by the entry of water into a vase" (Nāṣir al-Dīn al-Ṭūsī, *Sharḥ al-Ishārāt*, ed. S. Dunyā, (Cairo,1957-1960), II:132).

[53] Richard Sorabji, *Matter, Space, & Motion: Theories in Antiquity and their Sequel*, (Ithaca: Cornell University Press, 1988), 125-141; Edward Grant, *Much Ado about*

In the Islamic milieu, the question of the existence of the void was addressed by both the *mutakallimūn* and the *falāsifa*. The earliest surviving discussion is the very brief definition of the void by the *faylasūf* Ya'qūb ibn Isḥāq al-Kindī (d. 256/870) as "a place without any spatial object in it."[54] This view of void was attacked by the physician Muḥammad ibn Zakarīyā al-Rāzī (d. 313/925) who held the radical conception of absolute space or void in which material spatial objects are embedded. In his metaphysics, this absolute space or void was one of five eternals, the others being God, Soul, matter, and absolute time.[55] Furthermore, the translations of Peripatetic Hellenistic commentators like Simplicius and Philoponus contained extensive discussions and arguments affirming or denying the existence of the void.

There is no evidence that the void was discussed by the earlier *mutakallimūn* of the third/ninth century. It seems that Shaykh al-Mufīd's statement that these *mutakallimūn* denied the existence of void spaces is based on the lack of such a discussion and not because they formulated arguments against the void.[56] The endorsement of the void by al-Rāzī and the arguments for and against void in the Peripatetic commentaries form the background then to the discussion of void by both the *falāsifa* and the *mutakallimūn* of the fourth/tenth and later centuries.[57] Unlike the *falāsifa*, the *mutakallimūn* do not explicitly formulate a definition of the void.[58] Rather, they either affirm the void or deny it by a series of arguments in which the definition of void is implicit.

Nothing: Theories of space and vacuum from the Middle Ages to the Scientific Revolution, (Cambridge: Cambridge University Press, 1981), 3, 105-108.

[54] al-Kindī, "Fī al-falsafa al-ūlā." in *Rasā'il al-Kindī al-falsafīya*, ed. Abū Rīda, (Cairo,1950-53), 1:109. This work has been translated with a commentary by Alfred Ivry in his *al-Kindi's Metaphysics: A Translation of Ya'qūb ibn Isḥāq al-Kindī's Treatise "On First Philosophy"*, (Albany: State University of New York Press, 1974).

[55] Al-Rāzī had discussed these views in his now lost *Metaphysics* (*Kitāb al-'ilm al-ilāhī*) fragments of which survive in later hostile sources. These have been collected in *Rasā'il falsafīyya*, ed. P. Kraus, (Beirut,1979). The criticism of al-Kindī's definition of void and al-Rāzī's doctrine of the five eternals is found on pages 170-171. Al-Rāzī's doctrine of space is discussed by Shlomo Pines in his *Beiträge zur islamischen Atomenlehre*, 45-49. His doctrine of the five eternals is discussed by Pines in this work (pages 60-78) and more briefly in his contribution on "Philosophy" in *The Cambridge History of Islam*, eds. P.M. Holt, A.K.S. Lambton and B. Lewis, (Cambridge: Cambridge University Press), 801-803.

[56] See above, 66.

[57] Al-Kindī and al-Rāzī, together with contemporary *kalām* discussion form the background to al-Fārābī's monograph on the void (Aydin Sayili, "Al-Fārābī's article on Vacuum," *Turk Tarih Kurumu Belletin*, 15(1951), 151-174; Hans Daiber, "Fārābīs Abhandlung über das Vakuum: Quellen und Stellung in der islamischen Wissenschaftsgeschichte," *Der Islam*, 60(1983), 37-47).

[58] Ibn Sīnā defines the void as an extension, empty of matter, in which the three dimensions are present ("Risāla fī al-ḥuddūd," 33).

As we have seen above, Abū al-Qāsim al-Balkhī of the Baghdadī Mu'tazilīs denied intercosmic void spaces.[59] He also denied extracosmic void as is reported by Shaykh al-Mufīd:

> I believe that it is impossible to extend a hand or anything else beyond the universe since extending cannot occur save by motion and the object in motion cannot move except in space. But there is no existing thing beyond the universe so that it can be a space or not a space ... This is the doctrine of Abū al-Qāsim al-Balkhī and the rest of the rationalists (*ahl al-naẓar*).[60]

The existence of intercosmic void spaces was, on the other hand, upheld by Basrian Mu'tazilīs beginning with Abū 'Alī al-Jubbā'ī. Regarding the extracosmic void, there is no direct evidence of a Basrian Mu'tazilī position. It is possible that Shaykh al-Mufīd may be correct when he, in the above report, suggests that they held the same view as their Baghdadī rivals. However, in his *Maqālāt*, al-Ash'arī reports two views on the question of what would happen if someone were to extend their hand beyond the boundary of the universe. The first states that the universe would then extend with the hand, and that this extension would then be the place for the hand for the motion of the hand must be in some medium. The second view holds that the extended hand would extend beyond the universe and would move into void space.[61] The first view is to some extent similar to, although clearly not identical with, the Baghdadī Mu'tazilī position reported by Shaykh al-Mufīd. Is the second view reported by al-Ash'arī the position which was adopted by the Basrian Mu'tazilīs? Conclusive evidence to answer this question is lacking. In any case, even if the Basrian Mu'tazilīs did in fact believe in the existence of extracosmic void it seems clear that they did not further, like the Greek Atomists, believe in the existence of more than one cosmos.

The question of intercosmic void was vigorously debated by the *mutakallimūn* for, as our sources show, its proponents and opponents formulated arguments in support of their positions which were in turn met by objections, refutations, and counter-examples by their opponents, which elicited further replies and counter-challenges. The question of the existence of intercosmic void spaces itself was posed rather simply: Is it possible or not for two atoms to be separated without a third atom between them?[62]

[59] See above, 67.

[60] Shaykh al-Mufīd, *Awā'il*, 110.

[61] al-Ash'arī, *Maqālāt*, 433.

[62] Ibn Mattawayh, *Tadhkira*, 116-124; al-Nīsābūrī, *Masā'il*, 47-55. See also al-Nīsābūrī, *Ziyādāt al-sharḥ*, 416-427 where the question of the existence of void is discussed in the context of the possibility of the atoms of a body being separated.

Baghdadī Mu'tazilī arguments against intercosmic void spaces

Seven Baghdadī Mu'tazilī arguments against the existence of intercosmic void spaces are preserved by Ibn Mattawayh and al-Nīsābūrī. These can be categorized into the arguments based on the non-being of the void (arguments one and two below) and arguments based on the principle of nature's abhorrence of void. The two arguments based on the non-being of the void derive ultimately from Aristotle's remark in the *Physics* that "there is no extension, whether separable or in actual operation distinct from bodies" in the course of his discussion of what people mean by 'void'.[63] The arguments based on the principle of nature's abhorrence of void derive, on the other hand, from Aristotle's Hellenistic commentators, to wit, the cupping glass argument (argument three) is made by Simplicius in his *De Caelo* commentary;[64] the argument of the rise of water in an evacuated flask immersed in water (argument five) resembles Ibn Rushd's account of an argument by Themistius;[65] the clepsydra argument (argument six) is mentioned by Philoponus;[66] and since the argument of the breaking of the jar in which water has frozen solid (argument seven) is discussed in commentaries on Aristotle's *Physics* in the Latin Middle Ages, it is very likely that it too is derived from one of Aristotle's Hellenistic commentators.[67] It is clear, then, that all but one of Abū al-Qāsim al-Balkhī's arguments (namely the fourth argument) against the impossibility of intercosmic void spaces derive from the Peripatetic tradition.

First Argument

If it were possible for two atoms to be separated so that there was no third atom between them, then the distance between these two separated atoms must be less than, greater than, or the same as the distance between another pair of separated atoms. But less than, greater than, or the same as, can only be said of a real existent (*shay' thābit*). Whatever can be measured, then, must be a real existent body or atom. It cannot be a void or empty space for this is not a real thing.[68]

The Basrian Mu'tazilīs answer this argument by asserting that measurement is determination. That is to say, if some determinate number of atoms were between these two separated atoms, these interposed

[63] Aristotle, *Physics*, IV:213a32.
[64] Grant, *Much Ado about Nothing*, 80.
[65] Ibid., 78.
[66] Philoponus, "Corollary on Place," 30-33; see also Grant, *Much Ado about Nothing*, 83-86.
[67] Grant, *Much Ado about Nothing*, 81.
[68] al-Nīsābūrī, *Masā'il*, 51 (where read *thābitan/thābitatan* for *thāniyan/thāniyatan*); idem., *Ziyādāt al-sharḥ*, 480; Ibn Mattawayh, *Tadhkira*, 119; *Sharḥ al-tadhkira*, 20v.

atoms would surely constitute a measurable length, for they would be greater than, less than, or equal to the number of atoms interposed between another pair of separated atoms. This situation is, the Basrian Mu'tazilīs argue, analogous to the following: if God were to create a body and then immediately create another body and then later create a third body, surely the delay between the creation of the first and second bodies is less than the delay between the creation of the first and third bodies. Hence, time has, in some sense, been measured here so that one may say that the time interval between the first and second creations is less than the time interval between the first and third creations, even though the exact interval of time between the second and the third creations remains undetermined.[69] Similarly, we can state that the distance between two separate atoms is greater than, less than, or equal to the distance between two other separated atoms even though the actual distances are not known.

The Basrian Mu'tazilī reply to the Baghdadī argument thus completely ignores the central problem of the non-being of the void and the resulting question of how it is capable of measurement or more broadly, dimension. From their response, it seems that while the Basrian Mu'tazilīs had a concept of empty space, it was not, strictly speaking, the same as the concept of absolute three-dimensional space.

Second Argument

When we visually perceive two separated atoms we perceive the two atoms as well as the intervening space between them. Since nonexistent things cannot be perceived, the space between the atoms cannot be empty but must be filled. Therefore the existence of void or empty space is impossible.[70]

The Basrian Mu'tazilīs object to the premise of this argument that perception of the distance between the two separated atoms entails that something perceptible must be between them. They hold instead that it is possible to visually perceive two separated atoms without, at the same time, perceiving what lies between them. No impediment, they argue, prevents us from perceiving that one of the atoms is in one location (*jiha*) and the other is at a different location which is at some distance, even though we do not perceive anything else.[71]

[69] al-Nīsābūrī, *Masā'il*, 51-52 (where for *al-tarākhī bayna l-awwali wa th-thalāthi aqallu mimā yakūnu bayna l-awwali wa th-thānī* read *al-tarākhī bayna l-awwali wa th-thānī aqallu mimā yakūnu bayna l-awwali wa th-thalāthi*); idem., *Ziyādāt al-sharḥ*, 424; Ibn Mattawayh, *Tadhkira*, 119-120; *Sharḥ al-tadhkira*, 20v-21r.
[70] al-Nīsābūrī, *Masā'il*, 52; Ibn Mattawayh, *Tadhkira*, 120; *Sharḥ al-tadhkira*, 21r.
[71] al-Nīsābūrī, *Masā'il*, 52; Ibn Mattawayh, *Tadhkira*, 120; *Sharḥ al-tadhkira*, 21r.

Once again, it is clear that the Basrian Mu'tazilī response does not directly address the problem of the non-being of space and its resulting imperceptibility which is the central point of the Baghdadī argument. Moreover, it is not clear how in the Basrian Mu'tazilī view, after perceiving the two atoms separately, one arrives at the judgment that the one is at some distance from the other if this judgment is not a result of the visual perception of the intervening space.

Third Argument

A cupper places a cupping glass (*miḥjama*) over a vein and sucks the air out of the cupping glass. As a result, flesh is drawn into the cupping glass to replace the air which has been sucked out, the cause for this being the impossibility of void in the cosmos.[72]

This argument is found in Simplicius' commentary on Aristotle's *De Caelo* and is one of several arguments made by the opponents of void which are based on the principle of nature's abhorrence of void.[73] The Basrian Mu'tazilīs reject the Baghdadī analysis that this phenomenon is due to nature's abhorrence of void. In their view the phenomenon has nothing to do with void. Rather, they propose that the reason why flesh is drawn into a cupping glass is the fact that the air in the cupping glass has mixed (*mukhtalaṭ*) with the flesh which is under the cupping glass. Hence, when air is sucked out of the cupping glass, flesh is also drawn along with it because of its tenacious attachment to the air. The Basrian Mu'tazilīs maintain that a similar explanation also applies to a pipette (*anbūba*) partially immersed in water into which water is drawn when the air in the pipette is sucked out.[74] Such an explanation of the drawing of water into a pipette had already been made by Philo of Byzantium (fl. ca. 250 B.C.) in his *Book on Pneumatic Devices* probably on the basis of Aristotle's comment at *De Caelo* 312b4-12 that, "air will not move upwards into the place of fire, if the fire is removed, except by force in the same way as when water is drawn up when its surface is amalgamated with air and upward suction acts more swiftly than its downward tendency." The power of air to draw water in this manner is also emphasized by Simplicius in his comment on this *De Caelo* passage.[75]

The Basrian Mu'tazilīs present a counter-example in order to support their alternative explanation of the cupping glass phenomenon. Here, the cupping glass is placed instead on a smooth stone. It is clear

[72] al-Nīsābūrī, *Masā'il*, 53; Ibn Mattawayh, *Tadhkira*, 121; *Sharḥ al-tadhkira*, 21r.

[73] For the formulation of this principle see Grant, *Much Ado about Nothing*, 67-69. See also Philoponus, "Corollary on Place," 30-33.

[74] al-Nīsābūrī, *Masā'il*, 52; Ibn Mattawayh, *Tadhkira*, 121; *Sharḥ al-tadhkira*, 21r.

[75] Grant, *Much Ado about Nothing*, 67-68, 80.

that even when air is sucked out of the cupping glass, the stone is not drawn into the cupping glass despite the fact that nothing has replaced the air which has been sucked out. The reason why the stone is not drawn into the cupping glass is, in the Basrian Mu'tazilī view, that particles of stone unlike particles of flesh do not mix with air. Since the situations of the stone and flesh under a cupping glass are otherwise identical, the fact that the stone is not drawn into the cupping glass shows that the alleged reason of the impossibility of void to explain why flesh is drawn into the cupping glass cannot be correct.

Another counter-example which the Basrian Mu'tazilīs present in defense of their position is a thought experiment in which two cupping glasses are placed on either side of a sheet (*ṣafīḥa*) of atoms. Then the air in both cupping glasses is sucked out. The sheet of atoms must, as a result, either remain in its original position or be pulled to one or the other direction. Regardless of whether it remains in its original position or is pulled to one or the other direction a void will have been created. It follows then that in the case of flesh being drawn into the cupping glass, the reason cannot be the impossibility of void any more than it can be attraction of the flesh by the particles of glass![76]

Fourth Argument

When a bone-setter wants to set a broken bone, he places an electuary (*'ajīn*) at the site of the fracture, then puts a hot coal on it and covers them with a bowl. The air under the bowl is heated by the coal and thus evacuates the bowl through its pores. As a result, the fire of the coal is drawn upwards to take the place of the departing air, and in turn the electuary is lifted to take the place of the fire. In its turn, the fractured bone underneath is lifted to take the place of the electuary thus returning to its place and being set. All of this occurs because of the impossibility of void.[77]

This argument is not found in the Peripatetic tradition but probably derives from the Hellenistic medical tradition. The Basrian Mu'tazilīs challenge the claim that abhorrence of void is the reason why the broken bone is set into its place. They offer an alternative explanation which is based on their theory of impetus or force (*i'timād*). They maintain that since, in this situation, fire is constrained from its customary upward motion, it is forced to move downwards and in this process penetrates the pores of the electuary and underlying flesh. When this downward force is exhausted, the intrinsic upward force of fire as-

[76] al-Nīsābūrī, *Masā'il*, 52-53; Ibn Mattawayh, *Tadhkira*, 121; *Sharḥ al-tadhkira*, 21r.

[77] al-Nīsābūrī, *Masā'il*, 53; idem., *Ziyādāt al-sharḥ*, 480; Ibn Mattawayh, *Tadhkira*, 121-122; *Sharḥ al-tadhkira*, 21r.

serts itself and as a result the fire pulls up the flesh and bone which are tenaciously bound with it as it ascends. This explanation, the Basrian Mu'tazilīs argue, is more likely than the alleged impossibility of void, for, if the electuary were placed on a stone and the hot coal and bowl were placed on it in the same manner as in the case of the broken bone, the stone would not be forced upward. Hence, their opponents would have to assert that in such a situation a void has actually been created!

The Basrian Mu'tazilīs consider this situation to be analogous to when damp earth is heated by the sun and vapors arise from it. In their view, this phenomenon occurs because when the downward force imposed on the sunlight penetrating the earth is exhausted, its intrinsic upward force reasserts itself and draws along the particles of water with which it has been mixed. Thus the rising vapors.[78]

Fifth Argument

Air is sucked out of a narrow necked flask which is then turned over and partially submerged in water. Water is observed to rise into the flask contrary to its property of descent. The reason for the rise of the water into the flask is the impossibility of void in the cosmos for, as a result of the sucking, hot air from our breath enters the flask. When the flask is then submerged in the water, the hot air rapidly leaves and therefore water is forced into it to replace the departing air.[79]

The Basrian Mu'tazilīs object that hot air from breath cannot enter into the vase when air is being sucked out of the vase. Air can only enter the vase when it is blown into the vase, not when it is being sucked out. Rather, they offer the alternative explanation that the rise of water is a result of the fact that when the air is sucked out of the vase, the particles of fire which were in the vase are now more evident. These particles have great force so that when the vase is turned over and immersed in water, the force of these particles is directed downwards and they enter into the water. Then, when this downward force is exhausted and the intrinsic upward force of these particles of fire reasserts itself, they pull along the particles of water in their ascent upwards.[80]

[78] al-Nīsābūrī, *Masā'il*, 53; idem., *Ziyādāt al-sharḥ*, 423; Ibn Mattawayh, *Tadhkira*, 122; *Sharḥ al-tadhkira*, 21r-21v.

[79] al-Nīsābūrī, *Masā'il*, 54; idem., *Ziyādāt al-sharḥ*, 421; Ibn Mattawayh, *Tadhkira*, 120-121; *Sharḥ al-tadhkira*, 21r. This argument is similar to one made by Themistius (Grant, *Much Ado about Nothing*, 78).

[80] al-Nīsābūrī, *Masā'il*, 54; idem., *Ziyādāt al-sharḥ*, 426; Ibn Mattawayh, *Tadhkira*, 121; *Sharḥ al-tadhkira*, 21r. Cf. the fifth Basrian Mu'tazilī argument for the existence of void, below, 85-86.

Sixth Argument

When a clepsydra (*sarrāqatu l-mā'*)[81] is filled with water and its mouth is stopped by the thumb, water does not flow out through the perforations of the clepsydra even though water has the property of descending and flowing downward. This is the case only because if the water were to flow out a void would be created. Since no other body can replace the water, it remains in the clepsydra and does not flow out for the void is impossible.[82]

The Basrian Mu'tazilīs reject this explanation and maintain instead that the water does not flow out because of the scarcity of air in the filled clepsydra. Thus when the thumb is removed from its mouth, air enters into the clepsydra and water can now flow out. This shows, they hold, that the quantity of air in the clepsydra does not have sufficient strength to overcome the obstacle which prevents the water from flowing out. Hence, when the perforations are enlarged, water does not remain in the clepsydra for air can now enter in through the larger perforations. The Basrian Mu'tazilīs support their rejection of the Baghdadī explanation of the clepsydra by a counter-example in which the clepsydra is filled with mercury. The mercury, they claim, will flow out, even though, like in the case of water, no body replaces it. In fact in the case of mercury, the Basrian Mu'tazilīs argue, an actual void must be formed in the clepsydra.[83]

In the view of the Basrian Mu'tazilīs, the explanation of the clepsydra is that the force (*i'timād*) exerted by the outside air at the perforations is greater the force exerted by the water which is trying to flow out. As a result, the water is prevented from flowing out. When the force of the water is equal to the force of the air, the water trickles out. However, when the mouth of the clepsydra is unplugged more air enters into the clepsydra and aids the descent of the water. Similarly, when the perforations of the clepsydra are enlarged, water flows out because the force of the water is now greater than the force of the air.[84] We can detect here that the Basrian Mu'tazilīs were struggling with the

[81] The Arabic term *sarrāqatu l-mā'* meaning 'stealer of water' is an almost literal translation of the Greek *klepsudra* which literally means 'stealer of liquid'. This device was used to transport liquids. It had a wide body with perforations at the bottom and a narrow neck with an opening which could be plugged by the thumb. The clepsydra would be immersed in the liquid to be transported and then the opening at the top would be plugged. The liquid in the clepsydra could now be transported and upon unplugging the opening, would flow out (see Grant, *Much Ado about Nothing*, 83; Philoponus, "Corollary on Place," 30-33).

[82] al-Nīsābūrī, *Masā'il*, 54; Ibn Mattawayh, *Tadhkira*, 122; *Sharḥ al-tadhkira*, 21v.

[83] al-Nīsābūrī, *Masā'il*, 54; Ibn Mattawayh, *Tadhkira*, 122-123; *Sharḥ al-tadhkira*, 21v.

[84] *Sharḥ al-tadhkira*, 21v.

phenomenon of air pressure within the context of their theory of *i'timād*.

Seventh Argument

When water in a jar completely freezes, the jar breaks. The reason for this is that the particles of water contract as they freeze. Since there cannot be empty or void spaces between the walls of the jar and the frozen water the jar must break.[85]

The Basrian Mu'tazilīs reject this explanation and even challenge the possibility of the contraction of water in the plenum world of their opponents, for the water does not, in such a world, contain internal void or empty spaces which are filled up as it contracts.[86] Moreover, they argue, if the reason for the breakage of the jar is the impossibility of the creation of void spaces, then it should not matter whether the jar is made out of iron or glass. But we know that vessels (*āniya*) which are hard and dense, for example of iron, do not break when the water in them freezes. Hence, the impossibility of void is not the correct explanation for this phenomenon.

For the Basrian Mu'tazilīs, the explanation for the breakage of the jar is that, as a result of the cooling, increased pressure or force (*i'timād*) is exerted by the water on the sides of the jar and hence the jar breaks. This increase in pressure, they believe, arises because the water particles, which are now combined as a result of being frozen into a solid mass, exert a larger force on the sides of the jar than when they were uncombined and in the liquid state.[87]

We can see that the Basrian Mu'tazilī response to the above Baghdadī arguments based on the principle of the abhorrence of the void was varied. While they did not challenge the existence of the phenomena which the Baghdadīs presented as evidence for nature's abhorrence of void, they objected to their opponents' explanation of these phenomena on the basis of this principle. Whatever the merits of the challenges they raised to oppose the Baghdadī arguments against intercosmic void, there can be little doubt about their original use of their theory of *i'timād* (force, pressure, or impetus). While this *kalām*

[85] al-Nīsābūrī, *Masā'il*, 55; idem., *Ziyādāt al-sharḥ*, 420 (reading *jarra* for *jazza*); Ibn Mattawayh, *Tadhkira*, 123; *Sharḥ al-tadhkira*, 21v. For the medieval Latin use of this argument see Grant, *Much Ado about Nothing*, 81, 311 note 85.

[86] The doctrine that expansion and contraction of matter is due to the presence of internal voids, which was held by the Greek Atomists, was already known to Aristotle. He states that those who believe in the void consider that "from the rare and dense it is manifest there is a void" and that by the rare they mean "that which has many separate voids" (Aristotle, *Physics*, IV:9, 216b22; see also IV:6, 213b15-18).

[87] al-Nīsābūrī, *Masā'il*, 55; idem., *Ziyādāt al-sharḥ*, 424 (reading *jarra* for *jazza*); Ibn Mattawayh, *Tadhkira*, 123; *Sharḥ al-tadhkira*, 21v.

theory is, no doubt, derived from Philoponus' concept of impetus. Philoponus did not believe the actual existence of void spaces, despite his objections to Aristotelean arguments against void.[88] Hence the Basrian Mu'tazilī explanation in terms of their theory of *i'timād* of the phenomena which their opponents attributed to the principle of nature's abhorrence of void was innovative and probably formulated in the fourth/tenth century.

Basrian Mu'tazilī arguments for intercosmic void spaces

Eight Basrian Mu'tazilī positive arguments for the existence of void spaces are mentioned in our sources. The first three of these derive from the Greek Atomist tradition, two are adaptations of arguments against the void made by the Baghdadī Mu'tazilīs but originally formulated by Aristotle's Hellenistic commentators, while the remaining three arguments are, it seems, formulations by the Basrian *mutakallimūn*.

First Argument

If there were no empty spaces in the universe which were devoid of atoms and bodies, it would be impossible for us to move about. Since this is not the case, empty void spaces must exist in the universe.[89]

This argument is first mentioned by Aristotle who tells us that "they," that is, the proponents of the void, "say first that there would be no change in respect of place if there were no void."[90] While Aristotle does not actually name these proponents, he probably has the Greek Atomists Leucippus or Democritus in mind. Epicurus also has a version of this argument. He states, "... and if place, which we call 'void', 'room', and 'intangible substance' did not exist, bodies would not have anywhere to be or to move through in the way they are observed to move."[91] The argument is also repeated in a somewhat more detailed fashion as one of five arguments for the existence of void by Lucretius.

[88] Fritz Zimmerman, "Philoponus' Impetus Theory in the Arabic Tradition," in *Philoponus and the Rejection of Aristotelean Science*, ed. Richard Sorabji, (London: Duckworth, 1987), 121- 129; Philoponus, "Corollary on Void," tr. David Furley in *Place, Void, and Eternity*, (Ithaca: Cornell University Press, 1991), 49.

[89] al-Nīsābūrī, *Masā'il*, 47; idem., *Ziyādāt al-sharḥ*, 416; Ibn Mattawayh, *Tadhkira*, 117; *Sharḥ al-tadhkira*, 20r.

[90] Aristotle, *Physics*, IV:6, 213b4-15.

[91] Epicurus, *Letter to Herodotus*, 39-40 quoted in A.A. Long & D.N. Sedley, *The Hellenistic Philosophers, Volume 1: Translations and Commentary*, (Cambridge: Cambridge University Press, 1987), 27, text 5A. Lucretius' version of this argument is: "So there exists intangible space, void, and emptiness. Otherwise there would be no way in which things could move. For that which is the function of body, to hinder and block, would be there at all times; so that nothing would be able to move forward, since nothing would start the process of giving way. But as it is, we see before our eyes, many things moving in many different ways, through seas, lands and the lofty skies. If void did not exist, these things would not just be deprived of their restless motion: they would

Aristotle's answer to this argument appeals to his well-known doctrine of 'mutual replacement' (*antiperistatis* or *antimetastasis*), namely, "it is possible for things to simultaneously make way for each other."[92] Lucretius hints at this Aristotelean doctrine when he states that some people consider motion in a plenum to be like the motion of fish through water. However, such a view, he argues, is false for a fish can only move forward when the water it is moving into retreats and this is not possible in a plenum for the water will have no place to which it can retreat.[93] Ibn Mattawayh's formulation of this first argument for the existence of void is rather similar to Lucretius':

> We believe that there must be void spaces (*mawāḍi' khālīya*) in the world else it would be impossible for us to move about. For there would then be air instead which would prevent us from being located in the place it occupies. We would be unable to move until this body [namely, the air] had moved from its place to another place. An infinite regress would then ensue [for whatever was in the place it was moving into would first have to move to another place and so on]. This leads to the impossibility we have mentioned.[94]

A series of objections to this argument are mentioned by the Basrian *mutakallimūn*, some of which derive from Aristotle but may have actually been raised in their discussion with their Baghdadī Mu'tazilī opponents of void. The first of these objections counters that motion in a plenum is possible because air is elastic. Hence, when we move, the air in the place to which we are moving is compressed while air expands into the place we are vacating. But this objection is easily dismissed by the Basrian Mu'tazilīs who, like their Greek Atomist predecessors, regard the phenomenon of contraction and expansion to actually be a proof of the existence of empty spaces.[95] In their view, objects have interspersed empty spaces or voids which are filled up when these objects contract or are compressed. When objects expand, internal void spaces are either formed or enlarged. Hence, the Basrian Mu'tazilīs ask, if there were no empty spaces in the cosmos how could the claimed expansion and contraction of air then occur?[96]

everywhere be jammed solid and at rest" (*De Rerum Natura*, 1.334-390 quoted in Long and Sedley, *The Hellenistic Philosophers*, 31, text 6A).

[92] Aristotle, *Physics*, IV:7, 214a26-32.

[93] See note 91 above. This view is also mentioned by the Brethren of Purity, who were inclined to the views of the *falāsifa*. They believe that the problem which the proponents of void raise would only arise if motion was through a solid medium like that of stone or iron (Ikhwān al-Ṣafā', *Rasā'il*, (Beirut:1957), 2:28).

[94] Ibn Mattawayh, *Tadhkira*, 117; al-Nīsābūrī, *Ziyādāt al-sharḥ*, 418-419.

[95] See above, note 86.

[96] al-Nīsābūrī, *Masā'il*, 47; Ibn Mattawayh, *Tadhkira*, 117; *Sharḥ al-tadhkira*, 20r.

The second objection to this argument for the existence of void is the Aristotelean doctrine of mutual replacement, namely, that we can move about in a plenum because our movement into a place occupied by air is simultaneous with the movement of air into the place we are vacating. The Basrian Mu'tazilīs raised several challenges to this Peripatetic doctrine. One of them denied the possibility of simultaneous replacement by means of two counter-examples: (1) it would then be possible for the water in two filled flasks to simultaneously flow out from the one into the other; (2) in a narrow alley in which only one person may pass at a time it would be possible for two persons to pass each other by the simultaneous exchange of their places.[97] Another challenge exploited a weakness in the mutual replacement doctrine. It is clear that when we move forward, we also push forward the air which is in the path of our motion. How then can the air in the place we are moving into move in the direction opposite to our motion so that it will fill the place which we are vacating?[98] Yet another challenge to the Aristotelean doctrine relied on an analysis of the supposed mutual replacement on the basis of the *kalām* doctrine of impetus or force (*i'timād*). That is to say, when the air which is in the place to which we are moving moves to fill the place we are vacating, its movement must be the result of impetus we have imparted to it as a result of our motion forward. But impetus can only generate motion in time. That is to say, at the instant in which we move away from the place we are occupying air cannot occupy it and thus this place must remain empty. Otherwise, in order for the motion of the air into the place we are vacating and our motion into its place to be simultaneous, we would need to have imparted impetus to the air which is to fill the place we are vacating before we move into the place it occupies. However, when an obstacle, which in this case is our body, prevents the impetus from generating motion in the air in a particular direction, namely towards the place we are vacating, the motion is generated in some other direction and, as a result, mutual replacement cannot take occur. It follows then that either an empty space must momentarily exist and the replacement is not simultaneous or the motion of the air is in a direction other than the one required for mutual replacement and therefore the empty space must also exist.[99]

[97] al-Nīsābūrī, *Masā'il*, 48; idem. *Ziyādāt al-sharḥ*, 417 (where the examples are slightly different); Ibn Mattawayh, *Tadhkira*, 117; *Sharḥ al-tadhkira*, 20r.

[98] al-Nīsābūrī, *Masā'il*, 48.

[99] Ibid.

Second Argument

In a plenum, it would be impossible to prick an inflated bladder with a pin for the pin and the air in the bladder at the site of the penetration of the pin would occupy the same space at same time. Since this is possible, there must be void empty spaces in the bladder.[100]

This argument, even though it does not mention motion, is similar to the first argument for it too is based on the unstated premise of the impossibility of the interpenetration of bodies. This second argument bears a slight resemblance to the growth argument for the existence of the void which is mentioned by Aristotle (and by Lucretius), namely, that growth of living beings is possible because of the existence of void spaces in their bodies through which nutrition can travel, for in a plenum, such travel and therefore growth would be impossible.[101]

Third Argument

We take an inflated bladder and forcibly deflate it by squeezing the air out of it so that its sides stick together. Then we tightly stop its mouth so that air cannot reenter into it. When we then forcibly pull the sides apart, a void space is formed in the bladder.[102]

This argument, like the previous two, seems to also derive from Greek Atomism for it is an adaptation of Lucretius' fifth argument for the existence of void. He states:

> If two broad bodies, which have come together, quickly spring apart, it is of course necessary that air come to occupy all the void created between them. Now however fast the currents with which the air converges from all sides, it will still be impossible for the entire space to be filled at one and the same time. For it must occupy each successive place before the whole space is occupied.[103]

That the *kalām* argument is an adaptation of this Lucretian argument is clear from Ibn Mattawayh's mention that the example of the deflated

[100] al-Nīsābūrī, *Masā'il*, 49 (where read *illā an yakūna hunāka khilālun* for *illā an yakūna hunāka khalā'un*); idem. *Ziyādāt al-sharḥ*, 418-419; Ibn Mattawayh, *Tadhkira*, 117 (where read *ziqq* for *riqq*); *Sharḥ al-tadhkira*, 20r.

[101] Aristotle, *Physics*, IV:6, 214b18-20; Lucretius, *De Rerum Natura*, 1.334-90 quoted in Long and Sedley, *The Hellenistic Philosophers*, 32, text 6A.

[102] al-Nīsābūrī, *Masā'il*, 48; idem. *Ziyādāt al-sharḥ*, 418; Ibn Mattawayh, *Tadhkira*, 118 (where read *ziqq* for *riqq*); *Sharḥ al-tadhkira*, 20v.

It is interesting to note that a similar setup was used to prove the opposite point, namely, the impossibility of void, in the Latin Middle Ages by the Parisians John of Jandun (ca. 1275-1328) and John Buridan (d. ca. 1358). They argued that the sides of a bellows, in which air had been expelled and whose openings had been stopped, stick together and can never be separated unless a third body intervened between them (Grant, *Much Ado about Nothing*, 82-83).

[103] Lucretius, *De Rerum Natura*, 1.334-90 quoted in Long and Sedley, *The Hellenistic Philosophers*, 32, text 6A. This argument was widely discussed in the Latin Middle Ages (Edward Grant, *Much Ado about Nothing*, 86-95).

bladder is similar to when we place our palms together and squeeze out the air between them. Then we separate the palms in the middle keeping the sides together. Since contact at their sides prevents air from reentering into the clenched palms, the middle remains empty of air and therefore is a void space.[104]

One objection to the deflated bladder argument, namely, that air enters into the bladder through its pores when we separate its sides and therefore a vacuum is not created, is mentioned by the Basrian Mu'tazilīs. They counter that if air were to enter the bladder through its pores a deflated bladder would, after some time, become inflated but this is not observed. Moreover, if it were true that air could enter in this manner into a deflated bladder, then it would also follow that air could not remain in a bladder we were trying to inflate for it would escape through the same pores. Therefore, when the openings of the bladder are stopped, air cannot enter into it and this objection is invalid.[105]

Fourth Argument

We suck the air out of a narrow necked flask. Then, stopping its mouth with our thumb, we immerse it in water. Water enters the flask but we do not hear the usual bubbling sound. If air were still in the flask, we would have heard this sound which is made when we do not suck the air out of the flask. We therefore know that the air in the flask was evacuated as a result of the sucking and was not replaced by something else and thus a void space has been formed in the flask.[106]

This argument is, in al-Nīsābūrī's view, the strongest argument for the existence of void spaces. He attributes it to Abū Isḥāq ibn al-'Ayyāsh (fl. ca. 360/970). This, as well as the next argument are clearly adaptations of the fifth Baghdadī Mu'tazilī argument against the void in which the phenomenon of the rise of water in an immersed flask whose air has been sucked out is attributed to nature's abhorrence of void.

Fifth Argument

We suck the air out of a narrow necked flask. Then, stopping its mouth with our thumb, we invert it and immerse it in water. Water enters into the flask. If we had not sucked the air out, water would not have entered into the flask. Therefore, it is possible for us to evacuate

[104] Ibn Mattawayh, *Tadhkira*, 118; *Sharḥ al-tadhkira*, 20v.

[105] al-Nīsābūrī, *Masā'il*, 48-49 (where on page 49 read *wa kāna yajibu idhā nafakhnā fihi an lā yabqā al-hawā'u fihi bi-an yakhruja min dhālika l-khilāli* for *wa kāna yajibu idhā nafakhnā fihi an lā yabqā al-hawā'u fihi bi-an yakhruja min dhālika l-khalā'i*); idem. *Ziyādāt al-sharḥ*, 418; Ibn Mattawayh, *Tadhkira*, 118; *Sharḥ al-tadhkira*, 20v.

[106] al-Nīsābūrī, *Masā'il*, 49; idem. *Ziyādāt al-sharḥ*, 419; Ibn Mattawayh, *Tadhkira*, 118; *Sharḥ al-tadhkira*, 20v.

the air in the flask without something else replacing it and form a void space therein.[107]

It is evident that this argument, like the previous argument, inverts a similar the Baghdadī Mu'tazilī argument against the void in which nature's abhorrence of void is said to be the reason for the rise of water into the flask. Not surprisingly then, the objections and challenges raised there are applicable to this argument. Hence, in the view of the Baghdadī Mu'tazilī Abū al-Qāsim al-Balkhī, when we suck air out of the flask we do not form a void space. Rather, we introduce hot air into the flask which replaces the evacuating cold air. Now hot air has the property of fast motion while cold air moves slowly. As a result, when the flask is immersed in water, the hot air escapes and water must take its place for the existence of void space is impossible.[108]

This objection, which applies also to the previous argument, was replied by Abū Hāshim al-Jubbā'ī. He countered that Abū al-Qāsim's objection here contradicts his own cupping glass argument against the void,[109] for in that argument, he had held that flesh is pulled into the cupping glass to replace the air which is being extracted. Abū al-Qāsim cannot therefore claim that in the case of the cupping glass sucking removes air but that in the case of the flask sucking introduces hot air. Moreover, Abū Hāshim retorts, air can only be introduced by blowing into the flask not by sucking air out of it. Finally he states, when we heat the flask so that the air in it is hot and we then immerse it into water, water does not enter into the flask. This, Abū Hāshim claims, shows that the reason for the entry of water into the flask cannot be the presence of particles of hot air, as maintained by Abū al-Qāsim.[110] While Abū Hāshim's denial of the presence of particles of hot air in the flask is valid, his claim that water does not rise in a flask which had been heated before it was immersed in water is clearly erroneous and reveals that this, as well other Basrian Mu'tazilī arguments and objections, were not actually based on experiment.

Sixth Argument

We take a line consisting of six atoms ABCDEF and then simultaneously remove the four middle atoms BCDE. The terminal atoms A and F either immediately rush towards each other to fill up the resulting gap and come into contact in the places which were originally occupied by the atoms C and D or they remain in place. If they rush to immediately fill the gap, they must leap over the intervening spaces occupied by the atoms B and E and this is impossible.[111] Therefore they must remain separate and in place without any intervening atoms between them—this is all that is meant by void space.[112]

This thought-experiment is ingenious for the opponents of void are left only with the objection that the simultaneous removal of the four atoms is impossible. In their plenum world, these four atoms must be replaced by something else for the two end atoms are insufficient to fill the vacated space. The Basrian Mu'tazilī answer the objection of the impossibility of the simultaneous removal of these atoms simply. They ask, what can prevent the simultaneous removal of the atoms? Would they not move simultaneously had they not been attached to the end atoms A and F? Why, then, is it impossible for them to move simultaneously when they are attached to these atoms? In the Basrian Mu'tazilī view, the only possible obstacle to the movement of these atoms is their heaviness. However, since heaviness is not relevant to the argument, they need not be heavy and can therefore be moved. But even if they were heavy, God surely has the power to move them. There is therefore no conceivable obstacle which prevents their simultaneous motion save that it falsifies the doctrine of the impossibility of void spaces![113]

Seventh Argument

Air does not reach the bottom of deep wells for animals cannot live there, and candlelight and sunlight cannot reach its bottom and illuminate it but are extinguished. There must therefore be void spaces there.

This argument is attributed to Abū Hāshim. However, his Basrian Mu'tazilī followers considered it to be fallacious. In their view, the reason why animals cannot live at the bottom of deep wells is the lack of fine or subtle (*raqīq/laṭīf*) air which is necessary for the sustenance of life. Instead, gross or dense (*kathīf*) air is found at the bottom of such wells and it cannot sustain life. Moreover, the force (*i'timād*) of sunlight and candlelight is too weak to penetrate this dense air and hence they do not reach the bottoms of these wells and illuminate them.[114]

[107] al-Nīsābūrī, *Masā'il*, 49; idem. *Ziyādāt al-sharḥ*, 419.

[108] al-Nīsābūrī, *Masā'il*, 49; Ibn Mattawayh, *Tadhkira*, 120-121; *Sharḥ al-tadhkira*, 21r. See also above, 78.

[109] See above, 76-77.

[110] al-Nīsābūrī, *Masā'il*, 50; Ibn Mattawayh, *Tadhkira*, 121 (where read *nata'a* for *nabā*); *Sharḥ al-tadhkira*, 21r.

[111] This is al-Naẓẓām's notorious doctrine of the leap (*ṭafra*), which is discussed in further detail below, Chapter Five, 176-181.

[112] al-Nīsābūrī, *Masā'il*, 50 (where the editor's emendation of the number of atoms to four because of a note in the margin should be disregarded); Ibn Mattawayh, *Tadhkira*, 118-119; *Sharḥ al-tadhkira*, 20v.

[113] al-Nīsābūrī, *Masā'il*, 50.

[114] al-Nīsābūrī, *Masā'il*, 50-51; Ibn Mattawayh, *Tadhkira*, 119; *Sharḥ al-tadhkira*, 20v.

Eighth Argument

This argument is directed specifically against the Baghdadī Mu'tazilīs for it is based on their doctrine that objects endure as a result of God's creation of the accident of continuing to exist (*baqā'*) in them, and that consequently, the continued existence of one object is independent of the continued existence of another.[115] Thus, the Basrian Mu'tazilīs contend, the Baghdadī doctrine entails that God has the power to annihilate the bodies which are between the sky and the earth (namely air, clouds, etc.) by withholding their accidents of continuing to exist. Would the sky and the earth then remain separate or would they rush towards each other to fill up the resulting gap? In the former case, the existence of void space has been affirmed, while the latter entails acceptance of the absurd doctrine of motions by leaps![116] It is clear that this argument is an adaptation of the sixth argument for the existence of void space.

These eight Basrian Mu'tazilī arguments for the existence of void spaces, like their objections against the arguments of their Baghdadī opponents of void spaces, clearly show that the Basrian Mu'tazilīs were well acquainted with the pre-Islamic Hellenistic views, doctrines and arguments regarding the void. Moreover, they show that the Basrian Mu'tazilīs proposed original arguments and objections to the debate on void. Yet it is also clear that the target of their debate on this question were not the *falāsifa*, but rather their rivals, the Baghdadī Mu'tazilīs.

* * *

We can now list the three main points which summarize this discussion of atoms, space, and void. The first is that the atomist *mutakallimūn*, like their Greek Atomist counterparts, believed that extension is a fundamental property of matter, and therefore atoms and bodies are extended. This tenet contrasts with the doctrine of the *falāsifa* who, like their Peripatetic predecessors, believed in an unextended prime matter, and held that extension was the result of the combination of this prime matter with substantial forms.[117] This identity of matter and extension, even though it is not stated explicitly in these terms, is fundamental to the cosmology of the atomist *mutakallimūn*. Such a concept of extension as the primary property of matter is

[115] See above, Chapter Two, 43-44.

[116] al-Nīsābūrī, *Masā'il*, 51 (where read *baqā'* for *balā*); Ibn Mattawayh, *Tadhkira*, 119; *Sharḥ al-tadhkira*, 20v.

[117] "We do not consider it possible that the atom [initially] exists without occupying space and it then occupies space, as is the view of those who believe in Prime Matter (*aṣḥāb al-hayūlā*)" (Ibn Mattawayh, *Tadhkira*, 77). Here, 'atom' (*jawhar*) clearly has the meaning of 'matter'.

reminiscent of the more familiar seventeenth century view of Descartes: "Nor should they find it strange if I conceive of its [i.e. matter's] extension, or the property it has of occupying space, not as an accident, but as its true form and essence."[118] However, Descartes, unlike the *mutakallimūn*, who are the subject of this study, was not an atomist but considered bodies to be indefinitely divisible. Nevertheless, his definition of matter is in complete accord with that of the *mutakallimūn*. On the one hand, both the *mutakallimūn* and their *falāsifa* opponents accepted the extension of bodies without controversy. This view was of course also widely held by the Greeks of Classical and Late Antiquity. The extension of atoms on the other hand, was much more controversial. The controversy over the extension of atom is the subject of the next chapter which treats the *kalām* theory of the composition of bodies out of atoms.

The second point is that some of the atomist *mutakallimūn*, namely the Basrian Mu'tazilīs and their Ash'arī counterparts, held that this extended matter is imbedded in space which is not a plenum. Rather, bodies and atoms are separated by empty or void spaces. This doctrine was also held by the Greek Atomists, including Epicurus.[119]

Finally, the atomist *mutakallimūn*, like their Greek Atomist predecessors, denied the doctrine of natural place which was advocated by the Peripatetics, namely, that space is hierarchical and consists of regions, each of which is particular to one of the five Aristotelean elements.

[118] René Descartes, *Le Monde, ou Traité de la lumierè*, tr. Michael Mahoney, (New York: Abaris, 1979), 51.

[119] Long & Sedley, *The Hellenistic Philosophers*, I:27-32.

CHAPTER FOUR

ATOMS AS MINIMAL PARTS AND THE COMPOSITION OF BODIES

We have seen in the previous chapter that the *mutakallimūn* primarily conceive the atom as the smallest object which occupies space, and hence the smallest material object. The properties of the atom which they list in its definition are properties which arise from its attribute of occupying space (*taḥayyuz*). Two questions may be raised at this point. The first is: What is the need for a separate and distinct category of object which is the extended material substrate? Why not hold that a combination of accidents gives rise to such an extended material substrate? This position turns the Stoic doctrine of the materiality of accidents on its head, and proposes instead that matter itself, or more strictly the material body, is constituted by the combination of accidents and that, as a consequence, accidents are the sole entities in the world. In the texts of the *mutakallimūn*, this position is presented and refuted in the discussion of—"Why the combination of accidents does not constitute an atom"—which is found in both Mu'tazilī and Ash'arī texts.[1]

The second question is, if the material body is indeed a distinct entity not constituted out of a combination of accidents, then what is the manner of its composition out of atoms? This question seeks, on one level, to know how atoms combine to constitute a body, but on a more fundamental level it is a question about the nature of the atom itself. As I will attempt to show here, the answer to this question reveals that the *kalām* atom is akin to the Epicurean minimal part.

A. SPATIAL EXTENSION DOES NOT DERIVE FROM THE COMBINATION OF ACCIDENTS

Richard Sorabji has shown that the doctrine that accidents are the sole constituents of the world and therefore that bodies are bundles of accidents has its origins in Greek Antiquity.[2] In the late second and early

[1] Ibn Mattawayh, *Tadhkira*, 49-51; *Sharḥ al-tadhkira*, 5r; al-Juwaynī, *Shāmil*, 147-153; al-Ījī, *Mawāqif*, VII:2-5.

[2] R. Sorabji, "Chapter Four: Bodies as bundles of properties," in *Matter, Space and Motion*, 44-59. Al-Juwaynī also reports that some of the *falāsifa* inclined to this view but he does not mention any names. It is unclear whether he is referring to pre-Islamic figures of Greek and Late Antiquity or whether he has some contemporaries or near contemporaries in mind (*Shāmil*, 148).

third/late eighth and early ninth century, the *mutakallimūn* Ḍirār ibn 'Amr, Ḥafṣ al-Fard, and Ḥusayn al-Najjār were its *kalām* exponents and were consequently known as the *aṣḥāb al-a'rāḍ* (the partisans [of the theory] of accidents). Al-Ash'arī reports,

> Ḍirār, Ḥafṣ al-Fard, and al-Ḥusayn al-Najjār claimed that the parts [of the body—*ajzā'*] are [the accidents of] color, taste, hot and cold, rough and smooth. These combined things are the body. Parts have no meaning other than these things. The smallest number of parts is ten, and this [forms] the smallest body. These parts are contiguous (*mutajāwara*), in very close proximity. They denied that [these parts] interpenetrate (*mudākhala*).[3]

For these partisans of the theory of accidents, the parts which constitute the body are neither atoms nor another kind of a material substance, but rather are the accidents which are listed in this report. As a result, they do not use the term *juz'/ajzā'* to signify the atom/atoms as is the case for most of the other *mutakallimūn*. Rather they use this term to signify its lexical meaning of part/parts, which, in the context of their theory, are accidents. Therefore, their emphatic denial, which al-Ash'arī preserves in his report, that the parts of a body may have any meaning save for these accidents.

This theory of the body as a bundle of accidents was attacked by contemporary *mutakallimūn*, in particular al-Naẓẓām who denied the existence of all accidents save motion and who, instead of accidents, advocated his theory of latency and appearance to account for change. Al-Naẓẓām's criticism of these *aṣḥāb al-a'rāḍ* is preserved in the *Kitāb al-Ḥayāwān* of his student al-Jāḥiẓ. On the basis of this account, as well as other sources, Josef van Ess has attempted to reconstruct the views of Ḍirār ibn 'Amr.[4] The bundle theory does not seem to have had followers among later *mutakallimūn* and came under the attack of both Ash'aris and Mu'tazilīs. Since my goal here is to reconstruct the theory of the atom of the Basrian Mu'tazilīs, the understanding of the views of these *aṣḥāb al-a'rāḍ* by their later fifth/eleventh century critics is sufficient and there is no need to reconstruct the actual views of the *aṣḥāb al-a'rāḍ* nor the criticism of their contemporary opponents.

Ibn Mattawayh tells us that Ḍirār, Ḥafṣ, al-Najjār, and others whom he does not name, believed that the body is a bundle of certain acci-

[3] al-Ash'arī, *Maqālāt*, 317-318.

[4] J. van Ess, "Ḍirār ibn 'Amr und die 'Cahmīya'. Biographie einer vergessen Schule," *Der Islam*, 43(1967):241-279, 44(1968):1-70, 318-320.

dents.[5] These are the accidents of color, taste, hot and cold, and other such accidents, namely, those accidents, which, in the view of these *aṣḥāb al-a'rāḍ*, continue to exist for an extended duration. The accidents of location constitute the sole exception, for, even though they may exist for an extended duration, they are not part of the bundle of accidents which constitute a body. Ibn Mattawayh then draws the conclusion that on the basis of this theory, the extension of the body which is formed either derives from the pre-existing extension of one or all of these accidents; or, its extension results from the combination of accidents which are not themselves extended.[6]

Ibn Mattawayh attributes the first possibility, namely, that the extension of the resulting body derives from the pre-existing extension of one or more of its constituent accidents to al-Najjār. In his *first argument* against the bundle theory, Ibn Mattawayh refutes al-Najjār's position on logical grounds. That is to say, in the logical system of the Basrian Mu'tazilī *mutakallimūn*, extension or the occupation of space (*taḥayyuz*) is the class attribute (*ṣifatu l-jins*) of the atom.[7] Now, as we have seen, the Basrian Mu'tazilīs maintain that objects which share a class attribute must belong to the same class and therefore be similar, because in order for objects to differ they must have different class attributes. Moreover, accidents not only differ from bodies, but they also differ, the one from the other. It follows then, that if the premise that accidents are extended is granted, then accidents must all be similar, because they would share the same class attribute of occupying space.

As it stands, this is a weak argument. The premise that extension must, in this case, be the class attribute of all accidents need not be granted. Rather, only one type of accident, say color, which we usually associate with the extended body, need be extended. This restricts extension to the accident of color alone and therefore the question of the similarity of all accidents does not arise. In addition, there is no reason for extension to be the class attribute of an accident, say of color. Extension could conceivably be a property of the class attribute of color. Ibn Mattawayh (as well as his commentator) acknowledges this as a possible counter-argument but defers its discussion to the section on the properties of color. There, and in the section on the properties of sound, we find arguments against anti-atomists like al-Naẓẓām on why the accidents of color or sound cannot be bodies, and therefore cannot be extended.[8] The question of the possible extension of color is

[5] al-Juwaynī (*Shāmil*, 148) and al-Ījī (*Mawāqif*, VII:2) also include al-Naẓẓām in this list. But as I have shown above (Chapter Two, note 73) this attribution is incorrect.

[6] Ibn Mattawayh, *Tadhkira*, 49; see also al-Juwaynī, *Shāmil*, 149-150.

[7] See above, Chapter Two, 35-36.

[8] See above, Chapter Two, 40 and note 79.

also encountered in another context, namely in the discussion of the perception of the atom. Here, the doubt of whether the proper object of visual perception is the spatial occupation of the atom, as held by the Basrian *mutakallimūn*, or its color, and therefore whether the one is independent of the other is raised. I, too, will defer the discussion of this counter-argument to the discussion of the perception of the atom in the next chapter.[9]

The second possibility listed by Ibn Mattawayh is that accidents are in themselves unextended but when they combine they form an extended body. This position, Ibn Mattawayh tells us, was upheld by Ḥafs al-Fard and Ḍirār ibn 'Amr. The main argument by the Basrian Mu'tazilīs against this position is based on the premise that this would entail the transformation of one class of object into another class of object. That is to say, accidents, which are objects which do not occupy space, must, when so combined, be transformed into objects which have the class attribute of occupying space. Such a transformation of class is impossible in the system of the *mutakallimūn*.[10] If such a transformation of class were possible, then what could prevent the further combination of these extended bodies, which are formed by the combination of non-extended accidents, to then form a non-extended combination of bodies? This is possible, if we allow the transformation of the attributes of class, because the class attribute of the body, namely extension, may again be transformed by the combination of extended bodies into the class attribute of non-extension![11]

The *second argument* against the doctrine that an extended body is formed by the combination of certain non-extended accidents also relies on logical considerations. Since, in the logical system of the Basrian Mu'tazilī *mutakallimūn*, the object which occupies space occupies space because of its intrinsic nature, this property of occupying space must belong to every one of its parts. Therefore an essential attribute, like spatial occupation, cannot be the attribute of the body as a whole, but must be present in every one of its constituent parts.[12] Each of its parts must then occupy space, and this contradicts the original premise that the accidents which form the bundle are in themselves unextended.[13]

[9] See below, Chapter Five, 141-145.

[10] See above, Chapter Two, note 60.

[11] Ibn Mattawayh, *Tadhkira*, 50.

[12] A similar consideration dictates that the accident of life inheres in every component atom of the specific structure that forms the living whole and is not solely a property of the structure as a whole.

[13] Ibn Mattawayh, *Tadhkira*, 50.

The *third argument* against the view that the body is formed as a result of the combination of accidents which are in themselves unextended relies on the nature of combination of these accidents. That is, the accidents which combine together are either contiguous in the body which they form or are inherent in it. But contiguity presupposes spatial occupation and therefore contiguity and spatial occupation are mutually dependent on each other. Neither can then be prior to the other and as a result neither contiguity nor spatial occupation can be realized. If, on the other hand, the accidents are inherent in the body which they form, then they must either all inhere in some substrate which then acquires extension as a consequence of their inherence in it, or some of the accidents must inhere in other accidents. In the former case of inhering in some substrate, it is impossible for the inherence of these accidents to be the cause of the substrate's subsequent extension. If, on the other hand, some accidents inhere in other accidents, then some of them must act as a substrate to the others. But inherence in a substrate must require that substrate be extended or we end up with the difficulty of how the unextended accident which serves as a substrate subsequently becomes an extended accident. Therefore, the only remaining possibility is for some or one of the accidents to already be extended and to serve as a substrate in which the other accidents inhere and this position has already been refuted.[14]

The *fourth argument* against the bundle theory relies on causation. The combination of accidents which results in the formation of the extended body must either be necessary or contingent. If the combination of these accidents is necessary, then it must either be the result of the intrinsic nature of these accidents (*li-dhawātihā*) or be entailed by their intrinsic nature. Now if the combination is a result of the intrinsic nature of these accidents, then the accidents which form the body must always remain combined. It follows, then, that the body which they form cannot change. For example, the color of the body, which is one of its constitutive accidents, would then be forever fixed once these accidents have combined to constitute the body. This conclusion also holds in the case when the combination is entailed by the intrinsic nature of accidents. But such a conclusion is contrary to our experience of bodies, for we see them combine and separate, change their color, etc.. It follows then that their combination cannot be necessary.

On the other hand, if their combination is contingent, then it must be the result of an entitative accident (*ma'nā*). But this accident must inhere in some substrate, and it can only inhere in the substrate after it

[14] Ibid.

is extended. Therefore, it is impossible for the combination to be contingent either.[15]

As a result of these four arguments, it follows that the body cannot be constituted by the combination of accidents but must be composed from entities which are in themselves extended and which are substrates for the accidents which belong to them.

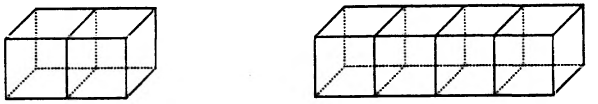
B. THE ATOM AS A MINIMAL PART

The composition of lines, surfaces, and bodies out of atoms

After presenting his definition of the atom as "that which, when it exists, occupies space" and a list of its properties insofar as it occupies space, Ibn Mattawayh turns to the composition of lines, surfaces and bodies out of these atoms.[16] He states:

> The manner in which composition (*tarkīb*) occurs in these atoms is:
> [1] The presence of two atoms and their composition lengthwise is called a line (*khaṭṭ*). So this [kind of] composition is a line. If the number of its atoms are increased then, provided that they are in the same direction (*samt*), the line is long.
> [2] Next, when two other atoms are placed along these two atoms in the direction of breadth, then length and breadth are realized in these four [atoms]. The composition is then a surface (*saṭḥ*), plane (*ṣafḥa*), etc..
> [3] If four atoms are placed above these four atoms, then depth is realized in addition to the length and breadth. The composition is then a body.[17] For this reason, depth is the presence of one atom on top of another atom while length and breadth are found underneath. It follows then that the least [number of atoms] out of which a body can be constituted is eight atoms.[18]

As we shall see below, the atom, in the view of the Basrian Mu'tazilīs has the shape of a cube with dimensions of one minimal unit. The least line which, according to Ibn Mattawayh's above remarks, is constituted out of two such atoms as well as a longer line constituted out of four atoms may be depicted as follows:



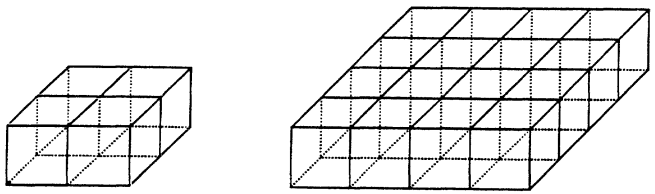
[15] Ibid., 50-51.

[16] For Ibn Mattawayh's definition of the atom and list of its properties, see above Chapter Three, 61.

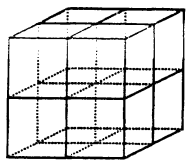
[17] Reading *fa-huwa jismun* instead of *fa-huwa* ا ∨ *jismun* which is a typographical error.

[18] Ibn Mattawayh, *Tadhkira*, 47-48, also *Sharḥ al-tadhkira*, 4v.

The least plane which is constituted out of four atoms, two forming its length and two its breadth, and a larger plane bounded by lines four atoms in length may be depicted as follows:



Finally, the least body which is constituted out of eight atoms consisting of two smallest possible planes, one on top of the other, and thus having length, breadth, and depth may be depicted as follows:



The formation of lines, surfaces, and bodies out of a minimum of two, four, and eight atoms respectively was upheld by the *mutakallimūn* of the fourth and fifth/tenth and eleventh centuries. Ibn Mattawayh's above account of the constitution of lines, surfaces, and bodies out of atoms is also found, albeit in an abbreviated version, in Shaykh al-Mufīd.[19] But this rare example of unanimity between the rival Baghdadī and Basrian branches of the Mu'tazila cannot obscure the fact this doctrine of the formation of lines, surfaces, and bodies out of atoms raises a serious difficulty. If the atom is indeed extended, as it seems clear from the analysis of its meaning as a space-occupying object (*mutaḥayyiz*), then should it not itself have length, breadth, and depth by virtue of this extension? What, then is the meaning of the doctrine that the linear dimensions of lines, surfaces, and bodies are constituted out of some specific minimum number of atoms? Does this doctrine derive, as some have argued, from the notion that lines are constituted out of points, surfaces are constituted out of lines, and bodies are constituted out of surfaces, so that the atom is equated to a

[19] "I believe that bodies are atoms composed to form length, breadth, and depth. The smallest [number of atoms] out of which a body may be composed is eight atoms. Two of these, one above the other, form length; two of them lying on the side of these two, to the left or to the right, form breadth; and four abutting these four, so that depth is realized" (Shaykh al-Mufīd, *Awā'il*, 77). The Ash'arīs, on the other hand, define the body as the composite (*mu'allaf*) and therefore hold that minimum of two atoms may constitute a body (al-Juwaynī, *Shāmil*, 401; Frank, "Bodies and Atoms," 45-48; see also below, 136).

point and, as such, its spatial occupation must be like that of a point? But, as we have seen in the previous chapter, the premise that the spatial occupation of the atom is like that of the point is not supported by the texts, but is, as we shall see below, opposed by them. How then can the atom be said to constitute length when it is joined to another atom and yet be extended by the very fact of its occupation of space? In my view, the answer, to these problems lies in the definition of the concepts of 'extension', 'length', 'breadth', and 'depth'.

Shlomo Pines' analysis of kalām atomism

We will return to examine the definitions of these concepts of linear dimension by the *mutakallimūn* of the fourth and fifth/tenth and eleventh centuries later. For now, let us digress and consider the pioneering work of Shlomo Pines on *kalām* atomism in which he examined the views of the early *mutakallimūn* of the third/ninth century on the nature of the atom. When he wrote his *Beiträge zur islamischen Atomenlehre* in 1936, Pines only had the works of the *kalām* heresiographers as well as al-Khayyāṭ's *Kitāb al-Intiṣār*, al-Nīsābūrī's *Masā'il*, and al-Ash'arī's *Maqālāt* available to him as his primary *kalām* texts.[20] The works of Ibn Mattawayh, al-Juwaynī, 'Abd al-Jabbār etc., which are the major sources for this study of *kalām* atomism in the fourth and fifth/tenth and eleventh centuries, were, as yet, unavailable. On the basis of the texts at his disposal, as well as earlier studies on this subject, Pines reached the conclusion that the atoms of the early *mutakallimūn* were non-extended.

Pines began his argument for the non-extendedness of the atom in *kalām* by listing the following three views of the constitution of the body out of atoms which are found in al-Ash'arī's *Maqālāt*:

> [1] Abū al-Hudhayl held that the body is that which has a right and a left [side], a front and a back, and a top and a bottom. The smallest that a body can be is six atoms, the first of a pair is the right and the other the left [side]; the first of [the next] pair the front and the other the back; and the first of [the third] pair the top and the other the bottom.
> [2] Mu'ammar held that the body is the long, the broad, and the deep. The smallest body consists of eight atoms ... He claimed that when an atom is joined to an atom length is formed; breadth is the joining of two atoms to these two; and depth is formed when four atoms are placed on top of four atoms. Therefore eight atoms are a body which is long, broad, and deep.
> [3] Hishām al-Fuwaṭī held that the [smallest] body consists of thirty six atoms. That is, he held that there were six building blocks (*arkān*) and he held that each building block consisted of six atoms.

[20] Pines, *Beiträge zur islamischen Atomenlehre*, 2-3.

> Therefore, that which Abū al-Hudhayl said was an atom, Hishām held to be a building block.[21]

According to Pines, these three views identify the atom as a constituent of the body and hold different positions on the minimum number of atoms which form a body. The report also makes it clear that the linear dimensions of length, breadth, and depth, or more strictly extension, are a characteristic of bodies and not of individual atoms. However, Pines noted that, in his *Masā'il*, the fifth/eleventh century Basrian Mu'tazilī author al-Nīsābūrī mentions a controversy over whether the atom has magnitude (*qiṣṭun min al-misāḥati*).[22] He informs us that Abū Hāshim al-Jubbā'ī held that atoms have magnitude while his father Abū 'Alī and the leader of the Baghdadī Mu'tazilīs, Abū al-Qāsim al-Balkhī, both denied this and maintained instead that atoms do not have magnitude. In addition, he reports that Abū al-Qāsim al-Balkhī further believed that the magnitude of the atom does not derive from its intrinsic nature, but rather is the result of the accident of adhesion. That is to say, atoms in themselves do not have a magnitude, but when they combine, which means that the accident of adhesion (*ta'līf*) inheres in them, they then have the magnitude which belongs to the extended unit of which they are now a constituent. Pines also made the crucial observation that al-Nīsābūrī does not, in his text, mention the number of atoms which constitute the smallest body. Pines thereby concluded that since al-Nīsābūrī and the later Basrian Mu'tazilīs follow Abū Hāshim's teaching that the atom has magnitude, the question of the number of atoms which constitute the smallest body has no relevance for them, because the atom, in their view, has magnitude and must, as such, be extended having length, breadth, and depth.[23] In contrast, Pines claimed that the atom of the earlier *mutakallimūn* must have been unextended for, as al-Ash'arī's report shows, it is explicitly said to have neither length, nor breadth, nor depth when it is not combined with other atoms. On the basis of this analysis, Pines argued that the earlier *mutakallimūn* were in agreement over the non-extended, point-like, quality of the atom, and that their disagreement was over the number of such non-extended atoms which constitute the smallest extended body. Pines also adduced other evidence, in particular fragments from al-Naẓẓām's lost book *On the Atom* as well as al-Naẓẓām's criticism of atomism to support his thesis of the non-extended atom of the *mutakallimūn* of the third/ninth century.[24]

[21] Ibid., 4-5 quoting al-Ash'arī, *Maqālāt*, 302-304.

[22] Strictly speaking, this expression denotes 'a portion of surface area'. However, this is one instance of the use of two-dimensional terminology for a three-dimensional object. The other instance of such a use of two-dimensional terminology, as I show below, regards the shape of the atom which is said to be a square when a cube is the more correct designation. The intent here, however, is clear, that is, that the atom has magnitude and is not unextended. The premise that an atom has magnitude is discussed in further detail below, 106-113.

[23] Ibid., 6-7 quoting al-Nīsābūrī, *Masā'il*, 58.

[24] Ibid., 10-11. Al-Ash'arī preserves five fragments from this work in the following report (*Maqālāt*, 316-317):

"In his book *On The Atom*, al-Naẓẓām related that :

[1] Some people claimed that the atom (*al-juz' alladhī lā yatajazza'*) is an object which has neither length, nor breadth, nor depth. It has neither sides (*jihāt*); nor is it an object which occupies spaces (*amākin*); nor an object which may be at rest, nor an object which may be in motion. It is impossible for it to be isolated (from other atoms). This doctrine is held by 'Abbād ibn Sulaymān. He believes that motion, rest, spatial accident (*kawn*), or occupation of spaces (*al-ishgāl al-amākin*) are not possible for the atom. It neither has sides, nor can it be isolated. He [also] believes that the meaning of the part (*juz'*) is that it has a half, and that the half has a half.

[2] Al-Naẓẓām related that some people believed that the atom has one side (*jiha wāḥida*), like the side of objects which is in view, that is, its surface which is in front of you.

[3] Al-Naẓẓām also related that some people believed that the atom has six sides which are accidents in it and different from the atom. The atom is indivisible but its accidents are different from it. Number applies to the atom. It cannot be separated from its sides — top, bottom, right, left, front and back.

[4] He related that others believed that the atom exists (*qā'im*) but is not self-subsistent (*lā yaqūmu bi-nafsihi*), and cannot subsist in any object which is smaller than eight atoms. Anyone who inquires about one of the atoms of the object is inquiring about its component units, even though they cannot [actually] be isolated. However it can be known [i.e. the object of knowledge]. Regarding the doctrine of the eight, it is that the [object consisting of] eight [atoms] has length, breadth, and depth, for length is two atoms; length to length is a surface having length and breadth; and surface to surface is a body [reading *juththa* for *jiha*] having length, breadth, and depth.

[5] He related that others believed that the parts [of a body] may be divided until two parts remain. If you try to cut them, the cutting annihilates them both. If you try to imagine one of the two atoms [without the other], you will not find it in your imagination. When you try to distinguish between them by the imagination or other means, you will not but find the annihilation of both.

This is the last of the reports by al-Naẓẓām."

The first view which is attributed to 'Abbād ibn Sulaymān holds that the atom has neither length, nor breadth, nor depth and that the atom neither moves, rests, nor occupies space. However, the report also suggests that 'Abbād was not an atomist for he believed that a part or atom may have a half, and this half has a half, that is to say that it is infinitely divisible. These two positions are clearly at odds. Since Ibn al-Nadīm (*Fihrist*, 215) attributes a work titled *On the Affirmation of the Existence of Indivisible Atoms* to 'Abbād this would indicate that he was an atomist. However this still leaves the question of how to reconcile the two positions in al-Ash'arī's report. The second and third views hold that the atom has one or six sides (held by Abū al-Hudhayl?) respectively, and this means that it must have magnitude. The fourth position is, in some of its aspects, similar to the position of Mu'ammar and the Mu'tazilīs of the fourth and fifth/tenth and eleventh centuries for it holds that two atoms form length and eight form the smallest body. Could the atom then be a minimal part here? The evidence is insufficient but the belief that the atom is not self-subsistent and that only the body is self-subsistent implies that eight such minimal parts form the smallest self-subsisting body.

The lack of attribution of all but the first view is intriguing. Could al-Naẓẓām's lack of attribution be due to the fact that these are the views of non-Muslim predecessors who were unknown to him? If so, then the differences between the *mutakallimūn* on the

The obvious question which was raised by Pines' thesis of the unextended atoms of *kalām* was, what was origin of this kind of atomism? Pines, for the first time, presented a detailed examination of the possibilities, namely Greek atomism or Indian atomism.[25] He noted that since *kalām* atoms were unextended and do not, as a result, have size or shape, they were unlike the atoms of Greek atomism. However, Pines acknowledged a resemblance between the minimal parts of Epicurus and *kalām* atoms:

> The minimal parts of Epicurus (not atoms) certainly bear some similarity to the atoms of the *mutakallimūn*, particularly when compared with bodies, for [Epicurean] atoms are to be counted as bodies. Moreover, one can identify similarities between both [Epicurean and *kalām*] theories of space and time. Yet our lack of knowledge and uncertainty over this aspect of Epicurus' teaching prevents us from examining these similarities further and reaching somewhat firm conclusions.[26]

In the end Pines thought that the differences between Greek atomism and *kalām* atomism were too great and therefore believed that the search for a Greek source for *kalām* atomism was inconclusive.[27] Likewise Pines established some congruities between the doctrines of Indian atomism and *kalām* atomism but failed to find possible routes of transmission from the former to the latter.[28]

However, as we have seen above, Ibn Mattawayh's discussion of the constitution of lines, surfaces, and bodies out of atoms, renders untenable one of the premises of Pines' argument to show that the atom of the early *mutakallimūn* was non-extended. To wit, Ibn Mattawayh, like his Basrian Mu'tazilī colleagues follows Abū Hāshim al-Jubbā'ī's view that atoms have magnitude, but yet goes on further to claim that a minimum of two atoms constitute a line, four atoms constitute a surface, and eight atoms constitute a body, and that therefore the isolated atom has neither length, nor breadth, nor depth. This is remarkably similar to the position which al-Ash'arī attributes to the third/ninth century *mutakallim* Mu'ammar, albeit without an explicit avowal (or disavowal) that Mu'ammar believed that atoms have some magnitude.[29] Therefore, we are faced with two problems. The first is: How can the Basrian Mu'tazilīs maintain that the atom has magnitude and yet hold

question of the nature of the atom may possibly be reflections of the disagreements of their predecessors and that therefore the confusion over the doctrine of minimal parts belongs to Late Antiquity.

[25] Pines, *Beiträge*, 94-133.

[26] Ibid., 98.

[27] Ibid., 102.

[28] Ibid., 118.

[29] According to Hans Daiber, Mu'ammar's atoms have 'eidetical' magnitude (*Mu'ammar*, 326-328).

that it has neither length, nor breadth, nor depth? The second problem is: How then are we to understand the views of the earlier *mutakallimūn* of the third/ninth century who also, like the followers of Abū Hāshim believed that the atom has neither length, nor breadth, nor depth but yet, it seems, denied that the atom has magnitude?

Epicurean minimal parts and discrete geometry

I would like to propose that the answer to the first question of how the atom can be said to have magnitude and yet not have length, nor breadth, nor depth in itself, is to be found in the Epicurean doctrine of the atom which is constituted out of physical and conceptual *minimal parts*. As we have seen above, Pines had noted that Epicurean minimal parts were similar to *kalām* atoms, but had refrained from pursuing this line of investigation because of "our lack of knowledge and uncertainty" regarding Epicurus' doctrine of minimal parts. However, in the decades since Pines' study, much work has been done on Epicurean atomism and has resulted in a better understanding of his theory of minimal parts. This, in addition to the discovery of previously unavailable *kalām* texts allows us now to reconsider the relationship between Epicurean minimal parts and *kalām* atoms.

Scholars of Epicurean atomism have concluded that Epicurus believed that sensible bodies were composed of insensible and physically indivisible parts or atoms which in turn consisted of *conceptually indivisible minimal parts* (and therefore mathematically indivisible parts). This view of Epicurean atomism has gained considerable following in the past three decades.[30] There is general agreement that Epicurus formulated his doctrine of minimal parts in response to Aristotle's devastating critique of Democritean atomism in Book Z of the *Physics*.[31] In

[30] Initially propounded in S. Luria, "Die Infinitesimaltheorie der antiken Atomisten," *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, B 2(1932-1933), 106-185; and then Jürgen Mau, *Zum Problem des Infinitesimalen bei den antiken Atomisten*, (Berlin: Akademie-Verlag, 1954), this theory has been adopted by more recent Epicurean scholarship. Relevant studies include David Furley, "Study I: Indivisible Magnitudes" in *Two Studies in the Greek Atomists*, (Princeton: Princeton University Press, 1967), 3-158; David Konstan, "Problems in Epicurean Physics," *Isis*, 70(1979), 394-418; Ibid., "Ancient Atomism and Its Heritage: Minimal Parts," *Ancient Philosophy*, 2(1982), 60-75; David Sedley, "Epicurus and the Mathematicians of Cyzius," *Cronache Ercolanesi*, 6(1976), 23-54; Richard Sorabji, "Part V: Atoms, Time-Atoms and the Continuum" in *Time, Creation, and the Continuum: Theories in Antiquity and the Early Middle Ages*, (Ithaca: Cornell University Press, 1983), 321-421. The primary text adduced to support the doctrine of minimal parts is Epicurus' *Letter to Herodotus* which is translated in Long and Sedley, *The Hellenistic Philosophers*, 39-44 and analyzed in many of the above-mentioned studies.

[31] These arguments are discussed in Furley, *Two Studies*, 111-130. I follow Furley's analysis of the Aristotelian arguments and Epicurus' response to them here.

the first of three arguments against atomism, Aristotle analyzed continuous magnitudes. He argued that it is impossible for any continuous magnitude to consist of indivisibles, for example, for a line to consist of points. The reason for this, Aristotle maintained, is that continuity requires that two things become one. This entails that the two parts of a line must, where they meet, merge so that the formerly two extremities become one and, as a result, the line is continuous. But points being indivisibles cannot have extremities for it is impossible to distinguish extremities or any other part of indivisibles. Nor can we say that a continuous line consist of points in contact with each other, for, points, having no parts, can only be in contact whole to whole. But the whole to whole contact of points cannot form a continuous line.[32]

Aristotle thus showed that it is impossible for continuous magnitudes to be constituted out of indivisibles which have no size but he did not show, as Furley argues, that indivisibles must have no size. Epicurus' response to this argument, then, was to insist that the extremity of any magnitude *must have dimension*. He therefore countered Aristotle's argument that the line cannot be composed of indivisible, sizeless, units, namely points, by holding that indivisible units must have some magnitude as well as dimension without at the same time having parts. While agreeing with Aristotle that the line cannot be constituted out of sizeless indivisibles, Epicurus held that the extremity of a line is not a sizeless point. Rather, the extremity must have the same dimensions as the line itself. Likewise, Epicurus' minimal parts which constitute atoms, have extremities which have the same dimensions as the atom itself. These indivisible minimal parts were, for Epicurus, units of measure, or the smallest possible extended magnitudes.[33] Atoms, then, consist of an integral number of such minimal parts which are in contact in the same manner in which bodies can be in contact, the one with the other, namely by their sides or edges.[34]

Aristotle's two other arguments against atomism were based on motion and concluded that if matter was constituted out of discrete parts or atoms, then so were space, time, and motion.[35] Epicurus was forced to accept this conclusion and in his doctrine, space, time, and motion consist of minimal parts which are proper to them. His acceptance of this conclusion, however, has implications beyond physical theory. It is evident from Aristotle's first argument against atomism (that it is impossible for a geometrical magnitude, namely a line, to be composed of indivisibles, namely points) that no distinction was drawn between geometrical and physical magnitudes and therefore geometrical and physical space in Antiquity. It follows that those who held that physical space was continuous also held that geometrical space was continuous while those who held that physical space was discrete had to hold that geometrical space too was discrete. As a result, the Epicureans were forced to reject Euclidean geometry for they could not uphold its hypotheses of infinite divisibility and continuous magnitude.[36]

[32] Ibid., 114.
[33] Ibid., 115-116.
[34] Furley, *Two Studies*, 128.
[35] Ibid., 121. See also below, 123-133.

There is some evidence to suggest that Epicurus' followers not only rejected Euclidean geometry on these grounds but that they may have speculated about replacing it with a discrete geometry.[37] Such a claim is found in Proclus' commentary to Euclid's *Elements*. In this work, Proclus divides those who oppose Euclidean geometry into two groups. The first of these consists of those Epicureans and Pyrrhonists who doubt its principles, while the second consists of the Epicurean Zeno of Sidon who accepts its principles but denies its consequences unless something further is conceded.[38] Proclus does not furnish further information about which of the principles of geometry were denied by the first group of Epicureans and their grounds of rejecting these principle. But he has preserved Zeno of Sidon's position on what needs to be further conceded in order for Euclidean geometry to be valid, which may, to some degree, indicate the Epicurean perspective on geometry and geometrical objects.

[36] The fragmentary evidence of the reason for the Epicurean rejection of Euclidean geometry concerns the *elachiston* or minimal part (Sedley, "Epicurus and the Mathematicians of Cyzius," 24-26).

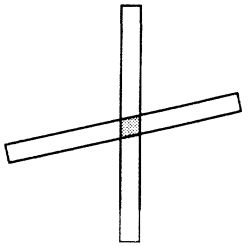
[37] This thesis is strongly restated in Sedley, "Epicurus and the Mathematicians of Cyzius." Gregory Vlastos has rejected that Epicurus was a mathematical atomist or that his followers proposed a discrete geometry to replace Euclidean geometry in his "Minimal Parts in Epicurean Atomism," *Isis*, 52(1966), 121-147.

Despite the fragmentary historical evidence, Michael J. White has attempted to conceptually work out Epicurean physical theory in his *The Continuous and the Discrete: Ancient Physical Theories from a Contemporary Perspective*, (Oxford: Oxford University Press, 1992), esp. Chapter Five, "The Quantum Model: Spatial Magnitude," 193-251 and Chapter Six, "The Quantum Model: Time and Locomotion," 252-283. White also discusses whether there may have been an Epicurean geometry and Vlastos' rejection of this (Ibid., 239-244).

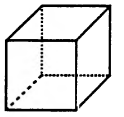
[38] G. Vlastos, "Zeno of Sidon as a Critic of Euclid," in *The Classical Tradition: Literary and Historical Studies in Honor of Harry Caplan*, ed. Luitpold Wallach, (Ithaca: Cornell University Press, 1966), 148-159.

Aristotle had already pointed out that "a view which asserts atomic bodies must needs come into conflict with the mathematical sciences in addition to invalidating many reputable opinions and phenomena of sense-perception" (*De Caelo*, 303a20-24) and also "Admit, for instance, the existence of a minimum magnitude, and you will find that the minimum which you have introduced causes the greatest truths of mathematics to totter" (Ibid., 271b9-11).

Thus, in his discussion of Euclid's First Proposition—On a given line to construct an equilateral triangle—Proclus states that Zeno had held that this consequence could not be established unless one were to further concede that two intersecting lines cannot have a common segment. While the interpretation of this statement is controversial, scholars who ascribe mathematical atomism to Epicurus and his followers consider it to mean that this consequence is only valid if the lines that are constructed do not have a thickness, for in the Epicurean scheme, lines must have a thickness of one minimal part, and therefore two intersecting lines must have a common segment as we can see in the diagram.[39] Here the common segment of the two intersecting lines has been shaded.[40]



Hence, in accordance with such a view of a line in two-dimensional space, points in three-dimensional space must also have minimal length, depth, and breadth and resembles the cubes of Euclidean geometry as can be seen here in the accompanying figure.



This concept can be extended to other geometrical magnitudes, namely surfaces which have length and breadth but minimal depth, and bodies which have length, breadth, and depth. Moreover, it is clear that in two-dimensional space, the requirement of minimal depth is no longer relevant. Since these geometrical objects are usually depicted on a two-dimensional surface, terms that denote two-dimensional concepts, for example surface area, are sometimes confused for their three-dimensional counterparts, which in our example is volume. Such a tendency to use two-dimensional terms is also encountered among the *mutakallimūn* for

[39] Sedley, "Epicurus and the Mathematicians," 24. Vlastos, on the other hand, regards Zeno to be a friendly critic whose aim was to fill the logical gaps of Euclid's argument ("Zeno of Sidon," 154; cf. Jürgen Mau, "Was there a Special Epicurean Mathematics?" in *Exegesis and Argument: Studies presented to G. Vlastos, Phronesis*, Suppl. 1(1973), 421–430).

[40] Scholars are divided over whether the Epicurean minimal part has shape, since Epicurus does not address this question. On the grounds that the minimal part must be three-dimensional, Vlastos has postulated that it must be a cube with the dimensions of one minimal part, while Furley allows any shape that can interlock without leaving interstitial spaces (Furley, *Two Studies*, 116-117; Vlastos, "Minimal Parts," 128). On the other hand, Konstan, Sorabji, and Sedley have denied that it has shape, although it is difficult to see how it can have magnitude but no shape (Konstan, "Problems," 405; Sedley, "Epicurus," 23; Sorabji, *Time, Creation, and the Continuum*, 372). See also White, *The Continuous and the Discrete*, 233-234.

they state that the atom has surface area and that it has the shape of a square instead of their three-dimensional counterparts, namely that the atom has magnitude or volume and the shape of a cube, which would have been more accurate.

What would be the definition of a line in such a discrete geometry? Can one two-dimensional minimal part form a line? This does not appear to be the case because a line in discrete geometry must, like its Euclidean counterpart, have two extremities, and consequently must consist of at least two minimal parts, one at each extremity. Therefore, the concept of length, in such a discrete geometry, requires at least two minimal parts. Such a concept of length is clearly foreign to a geometry of continuous magnitudes, for in the latter system, any part having magnitude must possess length, breadth, and depth, and as such, be a body, no matter how small. Consequently, the minimal part or point of discrete geometry must, from the perspective of a geometry of continuous magnitude, have length, breadth, and depth. This statement, however, is false in discrete geometry where the dimension of length is formed only when at least two minimal parts are contiguous because a line must have two extremities. It follows that statements which are true in the geometry of continuous magnitudes may be false in a discrete geometry and vice versa.

In Epicurean atomism, then, the evidence is suggestive of the stronger version of discrete physical theory, namely, that not only matter, but also space, time, and motion, are also constituted out of indivisible minimal parts. Therefore its accompanying geometry must also be a discrete geometry with appropriate definitions of geometrical objects, magnitude, and linear dimension. Moreover, the analysis of physical phenomena must be a discrete analysis. On the other hand, in the weaker version of discrete physical theory, matter only is discrete while space, time, and motion are continuous. This would then allow for a continuous geometry and continuous analysis of physical phenomena. Aristotle's arguments against atomism, however, did not leave much room for the adoption of the weaker version of discrete physical theory.[41]

Minimal parts and kalām atomism

Let us now, after this long digression, return to the atomism of the Basrian Mu'tazilīs. Are there sufficient grounds for the hypothesis that *kalām* atoms are akin to Epicurean minimal parts and that *kalām* atomism is to be regarded from the perspective of a discrete geometry

[41] See also White, *The Continuous and the Discrete*, 194-258.

of the kind that has been sketched above? We do not, as is the case for Epicurus, have an explicit statement by the *mutakallimūn* which affirms their belief in minimals parts which are analogous to Epicurean minimal parts. In my view, however, there is sufficient evidence on which one can argue that such minimal parts were upheld by many of the *mutakallimūn*. The Epicurean premise of minimal parts can be stated as:

[1] *The Atom consists of minimal parts*

This premise can, in the Basrian Mu'tazilī case, be replaced by the alternative premise that the atom itself is the minimal part and hence that the atom consists of a single minimal part.

[1'] *The Atom consists of a single minimal part*

This alternate premise, which I propose was held by the *mutakallimūn* of the fourth and fifth/tenth and eleventh centuries, can be established on the basis of the following sub-premises:

[A] The Atom has magnitude, that is, it is extended.

[B] The Atom is cubical in shape having dimensions of one minimal part.

[C] Atoms are homogeneous, therefore all atoms have the same shape and magnitude.

[D] The Atom is physically and conceptually indivisible, and is therefore a minimal part.

In the following sections, I hope to establish that these sub-premises were held by the Basrian Mu'tazilīs of the fourth and fifth/tenth and eleventh centuries. We will also see, in somewhat lesser detail, that these sub-premises were likewise held by their contemporaries among the Baghdadī Mu'tazilīs and the Ash'arīs.

Premise [A]:The atom has magnitude

We have, in the previous chapter, already seen that the term *mutaḥayyiz* means 'the space-occupying object' and that such an object occupies space in a manner similar to the occupation of space by a body, that is to say, *mutaḥayyiz* signifies a spatially extended object. The use of the term *mutaḥayyiz* to denote the atom seems to have been originated by Abū Hāshim al-Jubbā'ī and was subsequently used by the Basrian Mu'tazilīs, the Baghdadī Mu'tazilīs, as well as the Ash'arīs. Moreover, both Mu'tazilī and Ash'arī *mutakallimūn* of the fifth/eleventh century (and perhaps even earlier) also agreed that atoms have magnitude. Shaykh al-Mufīd reports:

> I believe that the atom has intrinsic magnitude (*lahu qadrun fī nafsihī*) as well as volume (*ḥajm*) by virtue of which it occupies space (*lahu ḥayyizun*) when it exists. This [is the property] by which an object which is other than the atom is differentiated. Most of the Mu'tazila (*ahl al-tawḥīd*) uphold this view.[42]

The Ash'arī position on the magnitude of the atom is also stated clearly by al-Bāqillānī: "The atom is that which has magnitude" (*mā lahu ḥaẓẓun min al-misāḥatī*).[43] These two reports make it clear that magnitude was considered to be an intrinsic property of the atom and further that the atom must, as a result, have volume. However, the *mutakallimūn* of the third/ninth century did not, it would seem, conceive the atom in this manner. While we have, in the previous chapter, considered the space-occupying property of the atom from the perspective of the meaning of *mutaḥayyiz*, we will here examine another aspect, namely, what do the *mutakallimūn* mean when they say that the atom occupies space? We will thus examine the arguments which the *mutakallimūn* formulated to support the proposition that the atom has intrinsic magnitude.

Shaykh al-Mufīd, as we have seen, usually inclines to the Baghdadī Mu'tazilī viewpoint.[44] It would seem from his statement regarding the intrinsic magnitude of the atom that both the Basrian as well as Baghdadī Mu'tazilīs were in agreement over the premise that atoms have magnitude. However the texts of the Basrian Mu'tazilīs, namely of al-Nīsābūrī, Ibn Mattawayh, and his commentator, are at odds with al-Mufīd's account. They depict instead a sharp disagreement between the Basrian and Baghdadī Mu'tazilīs over this premise. Al-Nīsābūrī, for one, states, "Abū Hāshim [al-Jubbā'ī] inclined to the view that every atom has magnitude (*anna li-kulli juz'in qiṣṭan min al-misāḥatī*), but Abū al-Qāsim [al-Balkhī] believed that the atom cannot be said to have magnitude."[45] Ibn Mattawayh further adds that "Abū 'Alī [al-Jubbā'ī] had denied this and had held that the magnitude of the atom is due to something else (*bi-ghayrihī*), just as its length is due to something else. This is also the view of Abū al-Qāsim."[46] It is extremely unlikely, if the accounts of Ibn Mattawayh and al-Nīsābūrī are correct, and we have

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[42] Shaykh al-Mufīd, *Awā'il*, 74.

[43] al-Juwaynī, *Shāmil*, 142.

[44] See above, Chapter Three, note 38.

[45] al-Nīsābūrī, *Masā'il*, 58. As I have mentioned in note 22 above that the expression *qiṣṭun min al-misāḥati* literally means 'a portion of surface area' since *misāḥa* is the term for 'surface area'. But it is clear from (1) Shaykh al-Mufīd's account that the atom intrinsically has a volume (*ḥajm*); (2) al-Bāqillānī's interpretation that *mutaḥayyiz* stands for an extended object having bulk or volume (*jirm*); and (3) Abū Bakr al-Fūrakī's statement that the atom is the smallest of what is small with respect to volume; that the atom must have volume (see above, Chapter Three, 64). *Misāḥa* must therefore signify size, magnitude, or extent here and the expression *qiṣṭun min al-misāḥati* must signify a portion of magnitude.

[46] Ibn Mattawayh, *Tadhkira*, 181.

no reason to doubt their accounts, that Shaykh al-Mufīd was unaware of Abū al-Qāsim al-Balkhī's denial of magnitude to the atom.

The discrepancy between al-Mufīd's report and those of al-Nīsābūrī and Ibn Mattawayh cannot be the result of an oversight on the part of al-Mufīd, but rather is indicative of the *mutakallimūn*'s lack of agreement over the precise meaning of atom's occupation of space (*taḥayyuz*) and indeed the very nature of the atom. As has been noted, al-Juwaynī tells us that the *mutakallimūn* had different definitions about the meaning of *mutaḥayyiz*.[47] He must, when making this statement, have had the dispute which is reflected by the positions of Abū 'Alī al-Jubbā'ī with his son Abū Hāshim over whether the atom has magnitude in mind for the definitions which he lists are not that different. But Ibn Mattawayh recognizes that the crux of the dispute between these two leading Basrian Mu'tazilīs is over what it means for the atom to occupy space, for he states:

> The controversy over this [that the atom has magnitude] is on the one hand conceptual (*min jihati l-ma'nā*) and on the other hand a matter of the manner of expression (*min jihati l-'ibārati*). When we say that the atom has magnitude (*lahu misāḥati*) we mean that it is a space-occupying object (*mutaḥayyiz*) and that, because of this attribute, a larger unit is formed when another atom is appended to it. Abū 'Alī does not deny this.[48]

Al-Nīsābūrī concurs with this position:

> By our statement that the atom has magnitude we mean the attribute which is unique to it, which is the attribute as a result of which atoms form larger units by the appending of some atoms to others.[49]

It is clear, then, that the concept of spatial occupation which is denoted by the terms *taḥayyuz* and *mutaḥayyiz* lies at heart of the disagreement between Abū Hāshim al-Jubbā'ī and his followers, that is to say the *kalām* theory of the atom in the fourth and fifth/tenth and eleventh centuries, and Abū 'Alī al-Jubbā'ī and Abū al-Qāsim al-Balkhī who represent the older theory of the third/ninth century.

For Abū Hāshim al-Jubbā'ī and his followers, the premise that the atom must have magnitude is based on their view of how the extended body is formed by the combinations of atoms. The magnitude of such a body must, they believe:

[a] Either derive from the fact that the atoms which constitute it intrinsically have magnitude and therefore their aggregated magnitude is reflected in the magnitude of the body which they constitute;

[b] Or, the magnitude derives from the composition of atoms which do not in themselves have magnitude. In other words, the magnitude of the body derives from the accidents of adhesion (*ta'līf*) which must be present in these atoms when they have combined and formed the body.

[47] See above, Chapter Three, 63.
[48] Ibn Mattawayh, *Tadhkira*, 181.
[49] al-Nīsābūrī, *Masā'il*, 58.

The first alternative [a] was upheld by those who believed that the atom has magnitude, that is the followers of Abū Hāshim al-Jubbā'ī while the second alternative [b] was preferred by those who denied that the atom has a magnitude, namely al-Balkhī and Abū 'Alī al-Jubbā'ī.

The following arguments are listed in our sources in support of the premise that the atom has magnitude:

First Argument

If the magnitude of a body derives from the adhesion of unextended atoms, then, when a body which is twenty units long is cut lengthwise into twenty parts, no length will remain because the accidents of adhesion between the twenty parts have been removed. However, experience clearly shows us that this is absurd. It follows then that the magnitude of a body cannot derive from the accidents of adhesion which inhere in its constituent atoms.

This argument, al-Nīsābūrī tells us, is the standard argument for the magnitude of the atom in *kalām* works. However, as he recognizes, it is open to the following objection: Since the length of the body does not vanish when it is cut, one may reach the conclusion that its length is not a result of adhesion. It would follow then that adhesion has no effect on the length of a body. But this patently false, for, when a part adheres to a body, the body becomes longer. Therefore adhesion must have some effect on the length of the body.[50]

Second Argument

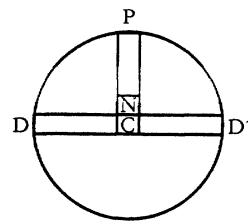
If the magnitude of a body is derived from the accidents of adhesion which inhere in it, then it is possible to conceive that an accident of adhesion in two atoms which combine will be equivalent in its effect to the effect which is the result of all the accidents of adhesions in the world, so that the length which results from the combination of these two atoms would be the length of the entire universe! This is absurd. Therefore the magnitude of a body cannot derive from the accidents of adhesion which inhere in it.[51]

[50] al-Nīsābūrī, *Masā'il*, 58; Ibn Mattawayh, *Tadhkira*, 183.
[51] al-Nīsābūrī, *Masā'il*, 59 (reading *al-'ālam* for *al-'ilm*); Ibn Mattawayh, *Tadhkira*, 182.

This argument also shows that in order to account for a consistent increase in magnitude when atoms are appended to each other, that atoms themselves must intrinsically have a magnitude. Moreover, as we shall soon see, the *mutakallimūn* believed that atoms are homogeneous. It follows then they must have the same magnitude. Therefore the combination of any two atoms will always form a unit which has the same length as the combination of any other two atoms. If length were derived from the accident of adhesion, we would need to argue that this accident can only have a single value, and that its effect cannot be intensified by the inherence of multiple accidents of adhesion in two atoms.

Third Argument

In a circle with atom C at its center and atom N next to atom C, the length PC, where P is the intersection formed by the extension of line NC to the circumference of the circle, must be greater than the length PN. This is true only because atoms intrinsically have magnitude.[52]



Fourth Argument

It must be possible to distinguish between the existence of an object and its non-existence. If it were possible for the atom to exist without at the same time being a space-occupying object then it could not be affirmed to be the object by which spatial occupation occurs.[53]

It follows then, that the magnitude of the atom is, in the Basrian Mu'tazilī view, an intrinsic property of the atom, and is identical with its attribute of occupying space. Every atom must have magnitude even before it is appended to another atom. As a result, when the atom is appended to a body, the body becomes larger. While one cannot say that the accident of adhesion has no effect on the magnitude of the body, the increase in the magnitude of a body (or a surface or a line) derives from the intrinsic nature of the atom and is not produced by the accident of adhesion *per se.*

The above arguments were formulated by the followers of Abū Hāshim al-Jubbā'ī in support of the premise that the atom has intrinsic magnitude, which is the amount of space it occupies when it exists. Similar arguments may have been made by the other *mutakallimūn* of the late fourth and fifth/late tenth and eleventh centuries, for, as we have seen, the followers of Abū Hāshim were not alone in upholding

[52] al-Nīsābūrī, *Masā'il*, 59; Ibn Mattawayh, *Tadhkira*, 182.
[53] Ibn Mattawayh, *Tadhkira*, 182.

the premise that the atom has magnitude. This premise was also upheld by Shaykh al-Mufīd and perhaps his contemporaries from the Baghdadī Mu'tazilīs and by the Ash'arīs of this period, as is evident in the remarks of al-Bāqillānī, al-Juwaynī, and Abū Bakr al-Fūrakī that the atom has magnitude and is the smallest possible volume. There seems, then, to have been a consensus among the *mutakallimūn* of the fourth and fifth/tenth and eleventh centuries regarding the magnitude of the atom. But at the turn of the third/ninth century both Abū 'Alī al-Jubbā'ī and Abū al-Qāsim al-Balkhī upheld that the atom is in space, and yet they denied that the atom has magnitude. What was its manner of spatial occupation? Was it similar to the occupation of space by a mathematical point? The answer to this question, in my view, is paradoxically both yes and no.

The controversy over the question of the magnitude of the atom between the *mutakallimūn* was, as Ibn Mattawayh tells us, in part conceptual and in part a matter of the manner of expression. If the atom is a minimal part, it cannot in the discrete geometry which is associated with the minimal parts doctrine, be said to have length, breadth, or depth. How then can it be said to have magnitude? Undoubtedly, the disagreement between those *mutakallimūn* who hold that atoms have magnitude and those who deny that they have magnitude revolves around the meaning of 'magnitude'. Thus Ibn Mattawayh reports, "Abū 'Alī believes that magnitude (*misāḥa*) is knowledge of length, breadth, and depth."[54] On the other hand, he reports the view of the followers of Abū Hāshim on the meaning of 'magnitude' as:

> Even though the atom has magnitude (*misāḥa*) it does not have length and breadth ... This is because length is a specific kind of combination (*ta'līf makhṣūṣ*). For this reason one says that an iron bar is lengthened when specific kinds of combination are carried out on it. But when we say regarding two objects that one is longer than the other, this does not derive from an increase in the [number of] combinations without at the same time an increase in the [number of] atoms. This being the case, and since the existence of the accident of combination in separate isolated atoms is impossible, the atom cannot have length nor breadth.[55]

It is clear that both sides agree that the atom itself has neither length, nor breadth, nor depth. These dimensions, in their view, require a combination of at least two atoms in a particular direction which, within in a discrete geometry, constitutes the dimension of length for the resulting unit now has at least two extremities in this dimension. But even though the atom is a minimal part and as such the smallest

[54] Ibid.
[55] Ibid., 183.

extended object, in a discrete geometry this extension is insufficient to constitute length, breadth, or depth. Now those who admit that atoms have magnitude believe that the smallest extended object has magnitude, even though they consider this magnitude to be insufficient to constitute the dimensions of length, breadth, and depth. They hold that the atom occupies space in the same manner as a body occupies space, yet they believe that the atom cannot, within the discrete geometry which they implicitly hold, be said to have length, breadth, or depth. Thus their use of 'magnitude' or 'size' differs from their use of 'length', 'breadth', 'depth', and 'dimension'.

On the other hand, those who deny magnitude to the atom are perhaps more consistent. They hold that since the single atom has neither length, nor breadth, nor depth, then it cannot also have magnitude. This is true regardless of whether or not they accept the premise that the atom is a minimal part, for just as they accept the definition of 'length' to be a combination of at least two atoms in a specific manner they can also adopt the convention that magnitude also requires multiple minimal parts. Hence, in their view, adhesion or combination is the cause of the magnitude which is formed by the aggregation of two or more unextended atoms, because, adhesion combines isolated unextended atoms to form units which, since they now have two extremities, four bounding lines, or six bounding surfaces can be said to be lines, surfaces, or bodies, respectively, in the framework of a minimal parts discrete geometry. Such a perspective, I believe, explains Ibn Mattawayh's remark that the disagreement between those who maintain that the atom has magnitude and those who deny this is in part a matter of the manner of expression, that is, a question of the definition of 'magnitude'. It follows then, that those who deny magnitude to the atom need not accept the definition of the atom as 'the space-occupying object', and they do not therefore use the term *mutaḥayyiz* to denote the atom. Moreover they consider adhesion to be the cause of the extended magnitude which is formed when unextended atoms aggregate to form larger units.

Clearly, statements by post-fifth/eleventh century opponents of *kalām*, for example the *faylasūf* Maimonides that the atoms of the *mutakallimūn* "do not have any magnitude (*kam*),"[56] or the anti-atomist heresiographer Ibn Ḥazm that atomists "claim that bodies are divisible into parts which have neither breadth, nor length, nor depth, nor

[56] Mūsā ibn Maymūn al-Qurṭubī al-Andalusī, *Dalālāt al-ḥā'irīn*, ed. Hüseyin Atay, (Ankara,1974), 200; *Guide to the Perplexed*, tr. S. Pines, (Chicago and London: University of Chicago Press, 1963), I:195.

magnitude, nor are they divisible, nor are they bodies"[57] need to be considered within the context which has been suggested above. That is, while these statements repeat what some *mutakallimūn* had stated, they do not further specify that such statements were made within the framework of a discrete geometry. The conclusion which is then reached on the basis of such statements that *kalām* atoms are unextended within a continuous geometry is therefore invalid. The dispute of the atomist *mutakallimūn* with their anti-atomist opponents, whether they be the *falāsifa* or other *mutakallimūn*, is, in this fundamental sense, over the geometrical concepts of magnitude and dimension. Their adherence to different geometries makes their understanding of these fundamental concepts incommensurable. Indeed, the difficulties which the anti-atomists raised to refute atomism regarded, as we shall see later, geometrical objects for the most part. Two examples of these are that a circle cannot be smooth but must be serrated and that the Pythagorean theorem cannot hold for any right triangles.[58]

The premise that the atom is extended is of course shared with Greek Atomism. However, the extended atoms of both Democritus and Epicurus came in various shapes and magnitudes,[59] but this, as we shall soon see, is not true for *kalām* atomism.

Premise [B]: Atoms are cubical in shape

The shape or figure (*shakl*) of atoms is discussed by Ibn Mattawayh in a chapter on why an atom can only be in contact with a maximum of six other atoms. He states:

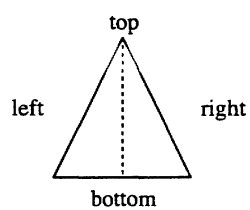
[57] Ibn Ḥazm, *al-Fiṣal fī al-milal wa al-ahwā' wa al-niḥal*, eds. M. Naṣr and 'A. 'Umayra, (Jedda:1982), V:224. Even though Ibn Ḥazm attributes the statement, "They believed that a body (*jirm*) is adjacent to a part of [another] body which can be severed from this second body. They believe that this is a confirmation of the [existence of the] atom." This is a clear statement that the atom must have magnitude, albeit, within their discrete geometry they may not represent it as such. Ibn Ḥazm recognizes this claim of magnitude for the atom, for he goes on to state, "But this is a perverse misrepresentation, because, we do not deny that there is a limit (*nihāya*) with regards to magnitude, but what we believe is that every body has a limit and a surface by which its extension may be severed, and that which is severed from it is a body and hence a part which is finite, but it too is capable of division" (Ibid.). The central issue rather, is whether the atomic magnitude can be divided further. The atomists consider this to be impossible. Ibn Ḥazm thus clearly misses the point that the two views of divisibility are incommensurable because they subscribe to different geometrical frameworks.

[58] It is easy to see why. In a right triangle with sides of 3 units and 4 units, the hypotenuse is 5 units ($\sqrt{3^2+4^2}$). But in a triangle with sides of 2 units and 2 units, the hypotenuse, which is $\sqrt{8}$ is incommensurable and cannot be made up of integral units. See below, Chapter Five, 173-174.

[59] W. K. C. Guthrie, *A History of Greek Philosophy*, vol. 2, *The Presocratic Tradition from Parmenides to Democritus* (Cambridge: Cambridge University Press, 1965), 392-396; Long & Sedley, *The Hellenistic Philosophers*, I:52-53.

> The proposition that the atom may be in contact with six other atoms is based upon [the premise] that if the atom resembles (*shabbaha*) any one of the geometrical figure (*ashkāl*), then it most resembles the square (*murabba'*). We mean by this that this figure is, out of all geometrical figures, characterized [by the property] that its sides (*jawānib*) and its extremities (*aṭrāf*) are equal so that they do not differ. Similarly, the atom must be identical from whatsoever direction it is viewed by an observer. The reason for this is the fact that it is a single entity (*kawnuhu shay'an wāḥidan*), as has been previously verified. Therefore, its being identical in the situation which we have mentioned is necessary. This can be explained as follows:
>
> [1] Were the atom to resemble a triangle, then it would seem bigger from one of its sides than from another, for this is a property of the triangle. Moreover, bodies could not be composed save with serrated edges and not with straight edges.
>
> [2] Were the atom to resemble a circle, then it would not be possible for atoms to adhere in a compact manner, so that there would be no gaps between them. For, when a circle is adjoined to another a fissure is formed between them. This entails that there is something smaller in magnitude than the atom.
>
> Thus when it has been verified that its resemblance is with a square, there can be no difficulty regarding the possibility of its contact with six atoms. This is a property of the square, namely, that it can be in contact with six others like it, along the established directions (*al-jihāt al-ma'lūma*).[60]

The argument here is clear. The atom, because it is a minimal part, must be equal on all of its sides and extremities, and it must be seen as such from all directions, which, as the commentary points out are the six directions of top, bottom, right, left, front, and back.[61] I do not believe that this implies that the atom can be literally seen, but it is to be seen in the mind's eye.



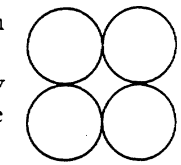
Now if the atom were to resemble a triangle, then because it must consist of minimal units, we have only to consider the situation of the equilateral triangle. Leaving aside the three-dimensional analog, it is clear from the diagram that different views result when an observer looks at the equilateral triangle from the top, the bottom, the left, and the right sides. Clearly, the view of the atom from the bottom and the top presents a larger sized object, which is equal to the one unit of the bottom side, while the view from the left or right sides would present a smaller size equal $\sqrt{0.75}$ units. Moreover, bodies

[60] Ibn Mattawayh, *Tadhkira*, 173. See also, 519.
[61] *Sharḥ al-tadhkira*, 31v.

formed out of such triangular atoms would serrated instead of having straight edges. Even a straight line consisting of five atoms would be serrated (as in (a) below).

(a) (b)

However, as Ibn Mattawayh's commentator notes, this is an invalid argument, for it is possible to pack such atoms to produce straight edges (as in (b) above).



In the case of the atom resembling a circle, we may consider the accompanying figure which illustrates the composition of a surface from four circles.

The circle meets the condition that the atom must have the same magnitude regardless of the direction from which it is viewed. But the space between the four circles is smaller than the circles themselves. This is impossible for the atom must constitute the smallest magnitude. Furthermore, the objection of the lack of a straight edge in a body constituted out of circular atoms, which was raised in the case of the triangle also applies here.

The square, on the other hand, meets the above objections, for it has the same size when it is viewed from the top, bottom, left, or right; when it is combined with other squares, there are neither fissures, nor gaps; and a body composed out of such atoms has straight edges.

Two further points can be made about Ibn Mattawayh's argument. The first is his use of 'square' for an object which clearly has six sides (for six atoms to be in contact with it!), namely a cube. There can be no doubt that he means a cube here for he mentions 'sides' and 'extremities' and these can only be said of a cube and not a square. His use of 'square', then, reflects the use of a two-dimensional term for a three-dimensional entity just as the term 'surface area' (*misāḥa*) is used for volume in the discussion of the magnitude of the atom. The second point regards Ibn Mattawayh's reluctance to state that the atom *is* a square, or for that matter *is* a triangle or circle. He prefers, rather, to use the expression 'the atom *resembles* a square' or a triangle or circle. At first glance, this may seem like an attempt to distinguish between mathematical and physical objects, namely, that the physical atom, being physical, can only resemble a mathematical object. This explanation, however, fails because the *mutakallimūn* have no difficulty stating that two atoms compose a line, four atoms compose a surface, and eight atoms compose a body. The reason behind the use of such an expression lies in the discrete geometrical analysis of this situation. In

discrete geometry, the square is a surface, and hence must consist of at least two minimal parts on each side which constitute its length and breadth. Therefore, strictly speaking, the atom cannot be a square or cube, but can only be said to resemble a square or cube. We find the same expression in al-Nīsābūrī, "there can be no doubt that the shape (*hay'a*) of the atom most resembles (*ashbahu*) the square."[62]

The question of the shape of the atom is also discussed by the Ash'arī *mutakallim* al-Juwaynī, who states:

> The separate isolated atom (*al-jawhar al-fard*) does not have a shape, but the *uṣūliyyūn*[63] held different opinions regarding its approximate resemblance (*fī tashbīhihi bi-ba'ḍi l-ashkāli taqrīban*) with one of the [geometrical] figures. Some of them believed that it resembles the circle. Others believed that it resembles the square. Still others believed that it resembles a triangle. In some of his books, the Qāḍī [al-Bāqillānī] inclined towards the view of its resemblance with the square because a long line may be arranged out of [such] isolated atoms while this cannot be achieved with the circle without gaps and fissures.
>
> However, in his *Naqḍ al-Naqḍ*[64] he chose to reject all of these doctrines. For after he had established that the atom has no shape, there was no sense to [the discussion about] its resemblance with anything which has a shape, for only a shape can resemble a shape ... Thus denying that the atom has shape while at the same time holding that it resembles a [geometrical] figure is invalid. Rather, he said, "The atom does not have a shape, nor does it resemble a figure. It is, instead, a part of a figure (*juz'un min shaklin*) [which is formed] when another atom is joined to it. Therefore figures formed by the combination of the atoms are, depending on the extent [of their combination], all valid."
>
> If someone objects: If we can affirm that the atom has magnitude to the extent of its joining together with other atoms and that it has no magnitude in isolation then it may be possible for a similar doctrine to be applicable for the shape of the atom.
>
> We reply: The atom in isolation has a fixed magnitude which is independent of its joining with other atoms. It has a measure (*qadr*), even though its measure has no parts, for an atom is measured by an atom.[65]

On the face of it, this report suggests that, the Ash'arīs, as represented here by al-Juwaynī and al-Bāqillānī, disagreed with the Basrian Mu'tazilī view on the shape of the atom. But al-Bāqillānī's previous position that the atom resembles a square entails his former adherence

[62] al-Nīsābūrī, *Masā'il*, 98.

[63] This term refers to those engaged in the discipline of *uṣūl al-dīn*, or the principles of faith, which is synonymous with *kalām* (see G. Makdisi, "Ash'arī and the Ash'arites in Islamic Religious Thinking," *Studia Islamica*, 16(1962), 37-80; 17(1963), 19-40).

[64] 'Abd al-Jabbār had written a refutation of the *Kitāb al-Luma'* of al-Ash'arī entitled *Naqḍ al-Luma'* (The Refutation of the *Luma'*). This was answered by his Ash'arī contemporary al-Bāqillānī in his *Naqḍ al-Naqḍ* (The Refutation of the Refutation) (D. Gimaret, *La doctrine d'al-Ash'arī*, (Paris: CERF, 1990), 9).

[65] al-Juwayni, *Shāmil*, 158-159. See also al-Ījī, *Mawāqif*, VI:280.

to a minimal parts discrete geometry which was also espoused by the Basrian Mu'tazilīs. Is his later disavowal, namely, that the atom has no shape, also a disavowal of this discrete geometry? The evidence, as I read it, would suggest not. For he still affirms that the atom has an intrinsic size regardless of its participation in a larger composite unit. His difficulty lies with the use of the term 'resemble', for how can something which does not, in this discrete geometrical system, constitute a surface or a solid, be said to resemble a figure? This is only possible when the minimal parts discrete geometry is conflated with the continuist Euclidean geometry, so that when one says that the atom resembles a square, one has the square of Euclidean geometry in mind, and not the square of the minimal parts discrete geometry! If one were to adhere strictly and consistently to the discrete geometry, one would have to affirm that since the atom has the size of one minimal unit it cannot have shape, because shape may only be predicated of composite units which contain more than one atom. It seems likely that while al-Bāqillānī and al-Juwaynī disagree with the Basrian Mu'tazilī view that the atom resembles a square, their disagreement is over the manner of expression and is not substantive, that is to say, it does not constitute a rejection of the minimal parts discrete geometry.

I have not been able to find any discussion on the fourth and fifth/late tenth and eleventh century Baghdadī Mu'tazilī position on the shape of the atom. However, we may suppose that their earlier position, during the late third and early fourth/late ninth and early tenth centuries, would have been to deny that the atom has shape. The reason for this, as we have seen above, is that al-Balkhī denies that the atom has magnitude, and he cannot then maintain that it has shape. This may also have been the position of the third/ninth century Basrian Mu'tazilīs as represented by Abū 'Alī al-Jubbā'ī.

Premise [C]: Atoms are homogeneous

The premise that atoms are homogeneous (*mutamāthila*, *mutajānisa*) was accepted by both the Basrian and Baghdadī Mu'tazilī, as well as the Ash'arī *mutakallimūn* of the fourth and fifth/tenth and eleventh centuries. Shaykh al-Mufīd states:

> I believe that all atoms are homogeneous. They differ only by the different accidents which inhere in them. Most of the Monotheists (*muwaḥḥidīn*) are agreed on this.[66]

Al-Juwaynī, too, tells us that the belief in the homogeneity of atoms was universally accepted in his time. The only exception to this view

[66] Shaykh al-Mufīd, *Awā'il*, 73.

that he lists belongs to the early third/ninth century, that is al-Naẓẓām.[67] Since al-Juwaynī considers the grounds for al-Naẓẓām's denial of the homogeneity of the material substrate to be the latter's alleged belief that accidents constitute bodies, it would follow then that the real proponents of the doctrine that accidents constitute bodies, namely, Ḍirār ibn 'Amr, Ḥusayn al-Najjār, and Ḥafs al-Fard also denied the homogeneity of the material substrate. Moreover, despite al-Juwaynī's false attribution to al-Naẓẓām of the doctrine that the body is constituted out of accidents, he is correct in regarding al-Naẓẓām as a proponent of the heterogeneity of material substrates.[68] Al-Naẓẓām, as we have seen above, believed that all entities, save for motions are bodies and it follows therefore that his material substrates are heterogeneous.[69] It is clear then, that the opponents of the doctrine of the homogeneity of atoms are all anti-atomists.

The homogeneity of atoms, in the Basrian Mu'tazilī system, rests upon their all having the same essential attribute (*ṣifatu l-dhāt*), for, similarity and difference between entities is the result of the similarity or difference of their class attributes.[70] This explains why the Basrians feel compelled to attack the Baghdadī position of Abū al-Qāsim al-Balkhī that atoms may be similar or different depending on the similarity or difference of the accidents which inhere in them.[71] The Basrians deny that similarity or difference of entities may derive from attributes which are realized by an agent (*al-ṣifatu yata'allaqu bil-fā'ilī*), namely the attribute of existence, or by causes (*al-ṣifatu yata'allaqu bil-'ilalī*), namely entitative accidents like color, etc., which was the position of al-Balkhī. It follows then, that asserting that atoms are homogeneous is, for the Basrian Mu'tazilīs, the same as asserting that they all share the same class attributes, namely the essential attribute of being an atom, and the attribute entailed by the essential attribute, which is their occupation of space. The accident of color, on the other hand, is a genus which consists of the five primary colors of black, white, red, green, and yellow. The genus of color is therefore heterogeneous, for, each of the primary colors has its own essential attribute and entailed attribute, for example, the essential attribute of being black, and the entailed attribute of having the particular visual appearance of black. Moreover, each of the primary colors is homogeneous within itself, that is to say, this instance of the color black is similar to any other instance of the color black.[72]

The Basrian Mu'tazilī argument for the homogeneity of atoms is made on epistemological grounds. If we assert that atoms are heterogeneous, our claim must rest on some epistemological foundation, that is to say, we must have direct or indirect knowledge of their heterogeneity. If we assert that our claim is made on the basis of direct knowledge, such knowledge must derive either from perception or immediate *a priori* knowledge. On the other hand, indirect knowledge of heterogeneity must derive from our knowledge of differences in the intrinsic properties (*aḥkām*) of atoms.[73]

The argument that perception does not support the heterogeneity of atoms is developed extensively by al-Nīsābūrī.[74] He states that since perception represents its objects by the attribute entailed by their essential attribute, similarity in representation (*ishtirāk*) must entail the homogeneity of perceived objects. The veracity of their perception, depends, of course, on the requirement that there are no obstacles which would impede perception. Now perception does not support the claim that atoms are heterogeneous, for, all atoms are alike with respect to perception. This in turn reveals that they share the same entailed attribute of occupying space, and that they therefore have the same class attributes and must be homogeneous. The objection that perception shows that a white atom differs from a black atom, and that therefore two white atoms or two black atoms may be similar, but that atoms as whole differ and are heterogeneous is answered on the grounds that (1) this is a result of the white atom and the black atom having different inherent accidents, and that heterogeneity of atoms cannot be the result of attributes which are the result of entitative accidents. Rather, heterogeneity requires differences between the essential

[67] "Atoms/substances (*jawāhir*), in the view of the true believers [i.e. the Ash'arīs] (*ahl al-ḥaqq*) are homogeneous. All the Mu'tazilīs held this position. Al-Naẓẓām disagreed with it for he does not consider substances (*jawāhir*) to be similar unless their accidents are similar. He based his doctrine on what we have mentioned previously about him where he said, 'Substances are combinations of accidents'. Therefore since some accidents are different, and substances are accidents, then it is impossible to categorically assert that substances are [all] similar." (al-Juwaynī, *Shāmil*, 153-154).

[68] I have discussed the false attribution of this doctrine to al-Naẓẓām above (Chapter Two, note 73).

[69] See above, Chapter Two, note 79.

[70] See above, Chapter Two, 34-36. The Ash'arī view is similar although they use the term *ṣifatu l-nafs* for the essential attribute (al-Juwaynī, *Shāmil*, 154).

[71] Ibn Mattawayh, *Tadhkira*, 137; *Sharḥ al-tadhkira*, 24v; al-Nīsābūrī, *Masā'il*, 29. According to al-Nīsābūrī, al-Balkhī believed that homogenous objects must have identical attributes, except for their temporal and spatial attributes. Thus the color black which exists now is the same as the color black which exists at another time or two accidents of the color black are the same even though they are in different locations (*Masā'il*, 36).

Since Shaykh al-Mufīd's assertion of the homogeneity of atoms also states that differences between atoms are the result of the inherence of different accidents in them, it follows that the criticism of Ibn Mattawayh and al-Nīsābūrī is also applicable to him.

[72] Ibn Mattawayh, *Tadhkira*, 253-258.

[73] Ibn Mattawayh, *Tadhkira*, 139; *Sharḥ al-tadhkira*, 25r.

[74] al-Nīsābūrī, *Masā'il*, 29-33; see also Ibn Mattawayh, *Tadhkira*, 143-145.

attributes of the white and black atoms or differences between the attributes entailed by their essential attributes and this is certainly not the case; (2) when the white atom and the black atom are perceived by the sense of touch and not visually, they are perceived to be similar, because their attributes of spatial occupation are similar; (3) differences between entitative accidents do not entail the heterogeneity of atoms because the atom which we now perceive to be white may previously have been black. In other words color is not the essential attribute of the atom, nor an attribute entailed by its essential attribute.

With regards to immediate *a priori* knowledge of the heterogeneity of the atom, Ibn Mattawayh considers it to be far-fetched and inconceivable, for, immediate *a priori* knowledge is of our own internal states and of logical principles like the principle of self-contradiction. It is difficult to see how we could have immediate *a priori* knowledge of the heterogeneity, or indeed the homogeneity, of atoms.[75]

Turning to indirect knowledge of the heterogeneity of atoms, such indirect knowledge must be based on differences of their intrinsic properties. But an examination of such properties does not support this, for, atoms share their essential attribute of being atoms, they share the attribute of occupying space when they exist which is the attribute entailed by their essential attribute, and they share the property that when they exist, each atom may be substrate for the same accidents as any other atom. In other words, since the properties of atoms derive from their attributes, and since atoms share their attributes of being atoms, of occupying space, of existing, and of being located in the spaces in which they are, they must share the properties which result from these attributes. Therefore, it follows, that atoms have similar intrinsic attributes and properties, and cannot be heterogeneous on these grounds.[76]

The above epistemological argument for the homogeneity of atoms is open to the following objection: Granted that atoms share the same essential attribute of being atoms and the same entailed attribute of occupying space, then what is there to prevent us from holding that atoms have different sizes? In other words, atoms can have these attributes and yet differ in size because the entailed attribute of occupying space may have multiple values, and as a result *kalām* atoms, like the atoms of Greek atomism, can have many different sizes. Since the argument I am making here is to show that *kalām* atoms are minimal parts within a discrete geometry analogous to Epicurean minimal parts,

[75] Ibn Mattawayh, *Tadhkira*, 140.

[76] al-Nīsābūrī, *Masā'il*, 33-34; Ibn Mattawayh, *Tadhkira*, 140-141.

it is crucial to show that by the premise that atoms are homogeneous, we mean that they have the same size. That is to say, the attribute of the occupation of space can only have a single value. Ibn Mattawayh argues against the possibility of the attribute of atom's occupation of space having multiple values:

> If it were possible for the [attribute of the] atom's occupation of space to increase in size [lit. to become larger and larger (*yatazāyada taḥayyuzuhu*)] then it would be possible for a single atom to have the appearance of a large mountain as a result of the increase realized in the attribute which is necessary for increase and augmentation in size.[77]

This argument is based on physical considerations. While it does not directly meet the objection of the possibility of that atom having multiple sizes, its formulation betrays the minimal parts discrete geometry, because Ibn Mattawayh's denial of the increase in the attribute of the occupation of space is made on the grounds that an increase in this attribute will lead to the atom being very large. He denies that such an increase is possible at all. Is it not then possible that atoms, though not large enough to be perceptible, yet have different sizes which cannot then increase further? I do not think so, for this would mean that the attribute of spatial occupation is not uniform, but has different values, being larger in some, and smaller in others.[78]

Premise [D]: Atoms are physically and conceptually indivisible

The premise that atoms are physically indivisible lies at the heart of atomism. The further premise of the conceptual indivisibility of minimal parts is found in the Epicurean atomism where the atoms consist of an integral number of such minimal parts.

The Basrian Mu'tazilī arguments for the indivisibility of atoms will be discussed in the next chapter. Here, my goal is more modest, namely to establish that the Basrian Mu'tazilīs held the premise that atoms are conceptually indivisible. Ibn Mattawayh states, "In our view, the division of a body reaches a limit beyond which further division is impossible. This [limit] is the smallest of quantities (*aṣghar al-maqādir*)."[79] The opponents of atomism, on the other hand, either hold that the atom is divisible, in the sense that an agent who has the

[77] Ibn Mattawayh, *Tadhkira*, 68; *Sharḥ al-tadhkira*, 9v. The attribute of spatial occupation necessitates augmentation or increase in size because, when two atoms combine, the intrinsic sizes of the two atoms which derive from their spatial occupation are appended and form a combined unit whose size is the sum of the sizes of the two atoms.

[78] Al-Juwaynī states, "If our opponent is ignorant and claims that the [atom's] occupation of space can increase in size, this is false for the single atom occupies one part [of space] (*juz' wāḥid*)" (*Shāmil*, 152).

[79] Ibn Mattawayh, *Tadhkira*, 162.

ability to do so can divide it further, or that its further division is conceivable even if it is impossible to carry out in practice. But Ibn Mattawayh counters this by arguing that anything whose existence is impossible cannot be conceptualized, for if this were true, then the combination of two opposites, which is impossible, could also be conceptualized. It follows then that the distinction between physical and conceptual divisibility has no place in Basrian Mu'tazilī atomism. Therefore, if atoms are physically indivisible, they must also be conceptually indivisible.

The Basrian Mu'tazilī position rests on their doctrine of the formation of bodies. Bodies are composite units, whose components are held together by accidents of adhesion (*ta'līf*). The division of bodies is possible only because of the presence of these accidents of adhesion. When the body has been divided through and through, no accidents of adhesion are left in it. The parts or atoms which are thereby formed cannot be divided further, whether physically or conceptually, because no more accidents of adhesion remain.[80]

With regards to the Baghdadī Mu'tazilī view, while Shaykh al-Mufīd does not explicitly state that atoms are conceptually indivisible, his discussion of the formation of bodies out of atoms also relies on accidents of adhesion as the glue which binds atoms together. This entails belief in the conceptual indivisibility of the atom, for since accidents of adhesion do not inhere in the single atom, it is indivisible. Since al-Balkhī also accepted the accident of adhesion, he too may have held the belief in the conceptual indivisibility of the atom.[81]

In the Ash'arī view, the body is defined as that which is composite (*mu'allaf*) and it therefore consists of a minimum of two atoms. It follows, then, that the Ash'arīs also accept the conceptual indivisibility of the atom which, in their view, is not composite.

We have seen above that the four premises: [A] The atom has magnitude; [B] The atom is cubical in shape; [C] Atoms are homogeneous; and [D] The atom is physically and conceptually indivisible; were held by all the *mutakallimūn* of the fourth and fifth/tenth and eleventh centuries, regardless of whether they were Basrian or

[80] I discuss this argument for the indivisibility of the atom in further detail below in Chapter Five, 152-159.

[81] Al-Balkhī's view that *ta'līf* is nothing but the contiguity of two atoms (al-Nīsābūrī, *Masā'il*, 219) does not, I think, imply that the atom is conceptually divisible in his system, for even with this minimal view of adhesion, the fact that contiguity is predicated of atoms, and not of parts within the atom, implies that they are conceptually indivisible. On the other hand, *ta'līf*, in the Basrian Mu'tazilī view, is an accident which inheres in both of the substrates which it binds together. Therefore, *ta'līf* explains why it is more difficult or easier to cut or separate some bodies rather than others.

Baghdadī Mu'tazilīs or Ash'arīs.[82] It follows then that they all accept the proposition that the atom consists of a single minimal part. Their atomism, then, is a minimal parts atomism, formulated within a minimal parts discrete geometry.

C: MINIMAL PARTS OF SPACE, TIME, AND MOTION

Belief in the minimal material particle, or the atom, is only one feature of Epicurean doctrine of minimal parts. Epicurus, as Furley has shown, formulated his doctrine of minimal parts as a direct response to Aristotle's argument against atomism in the *Physics*.[83] Furley states:

> The case which Epicurus had to answer can now be seen as a whole. Aristotle produced an argument to show that every magnitude must be divisible, based on the premise that no indivisible can be in contact with another; we have already seen Epicurus' answer to that. Aristotle had a second argument for the divisibility of magnitude, based on a study of motion; if there is an indivisible magnitude, then there must be an indivisible motion; and this is very difficult. There is then a third argument which employs the concept of faster and slower motion, and shows that time and distance must be divisible along with motion.
>
> Epicurus' solution of these difficulties can be briefly summed up. He accepted Aristotle's conclusion that there must be indivisible units of time, distance, and motion if there are indivisible units of any of these three. He asserted that there *are* indivisible units of motion and indivisible units of time, such that one unit of motion involves traversing one unit of space in one unit of time; and in this case (he agreed with Aristotle) it is *never* true to say "it is moving" but only "it has moved." And he accepted Aristotle's contention that faster and slower motion entails the divisibility of time and distance; he developed the theory that there are no *real* differences in speed, and he undertook to explain away the apparent differences in the speeds of visible moving bodies.[84]

We have already discussed Epicurus' doctrine of the minimal part of the atom and how, in fourth and fifth/tenth and eleventh century *kalām* atomism, this minimal part was equated with the atom itself. What, then of the minimal units of space, time, and motion and the differences in speed which Epicurus had to answer in his response to Aristotle's second and third arguments?

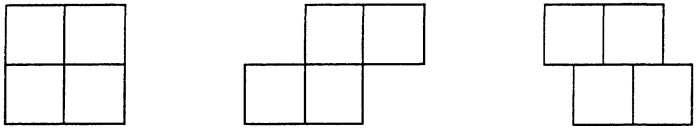
In showing that atoms may only exist in a finite number of shapes, Lucretius, uses the theory of minimal parts in the following manner. He considers three possibilities for the arrangement of two atoms above

[82] Although we have no information about the Baghdadī Mu'tazilī view of the shape of the atom, it is quite likely that they too must have held that it resembles a cube.

[83] Furley, *Two Studies*, 111-130.

[84] Furley, *Two Studies*, 121. Italics for emphasis are in the original text.

two other atoms, which are depicted below. He permits (a) and (b) as valid arrangements, but denies (c) on the grounds that (c) involves the concept of *half* a minimum.[85]



(a) (b) (c)

This may be visualized in another manner, namely, by considering space to have a discrete structure like that of a three-dimensional grid with cubical cells having dimensions of one minimum unit. Atoms, which have the same magnitude as these cells, may only occupy the spatial cells within their boundaries. That is to say, they cannot occupy a spatial cell partially. Clearly possibility (c) does not fit this discrete conception of space.

The same problem of the permissible arrangements of atoms is also discussed by the *mutakallimūn* in response to a counter-argument al-Naẓẓām had raised against the atomists. Al-Naẓẓām had asked them: Is it possible to place an atom on the boundary between two atoms? If this is possible, he argued, then the atom has been conceptually divided into one part which is above the first atom, and another part over the second atom (as depicted in (c) above).[86] Al-Juwaynī, al-Nīsābūrī, and Ibn Mattawayh discuss the atomist response to this argument.[87] These discussions allow us to ascertain whether the *mutakallimūn* also upheld a discrete cellular conception of space.

Ibn Mattawayh tells us that Abū Hāshim al-Jubbā'ī had argued that it was possible for an atom to be placed on the boundary between two atoms. He was followed, in this, by Abū Aḥmad ibn Abī 'Allān (d. 409/1019)[88] as well as al-Nīsābūrī. On the other hand, Abū 'Alī al-Jubbā'ī, Abū al-Qāsim al-Balkhī, Abū Isḥāq ibn al-'Ayyāsh, 'Abd al-Jabbār, as well as Ibn Mattawayh denied this.[89] It is rather interesting to note how the lines of disagreement fall on this question. They are not, as in the questions we have discussed so far, divided along the Baghdadī versus Basrian Mu'tazilī line, nor along the earlier

[85] Ibid., 43.

[86] al-Juwaynī, *Shāmil*, 438.

[87] al-Juwaynī, *Shāmil*, 438-439; al-Nīsābūrī, *Masā'il*, 96-100; Ibn Mattawayh, *Tadhkira*, 175-178; *Sharḥ al-tadhkira*, 31v-32r.

[88] Reading 'Allān with Ms. Ambrosiana 33r for Gullāb in *Tadhkira*, 175. Al-Jushamī mentions that Abū Aḥmad ibn [Abī] 'Allān was a student of Abū 'Abd Allāh al-Baṣrī (*Sharḥ al-uyūn*, in *Faḍl al-i'tizāl*, ed. F. Sayyid, 378).

[89] Ibn Mattawayh, *Tadhkira*, 175.

mutakallimūn as represented by Abū 'Alī al-Jubbā'ī and Abū al-Qāsim al-Balkhī versus the latter as represented by Abū Hāshim al-Jubbā'ī and his successors. Rather, this disagreement persisted well into the fifth/eleventh century with one of our sources, that is al-Nīsābūrī taking one side while Ibn Mattawayh takes the other, reflecting, I believe, the attempts to overcome the difficulties which arose as a result of the strict and consistent adherence to the minimal parts doctrines of matter, space, time, and motion. The same difficulties also divided the Ash'arī *mutakallimūn*, for al-Juwaynī tells us the leading figures of this school wavered over whether or not it is possible to place an atom on the boundary between two atoms.[90]

Ibn Mattawayh presents two positive arguments in support of the view that it is impossible for an atom to be placed on the boundary between two atoms because this entails the existence of a part smaller then the minimal part, or, in the words of al-Nīsābūrī "the division of the atom."[91]

The *first argument* in support of the doctrine of discrete cellular space begins with a line consisting of four atoms as in (a) below:

(a) (b)

If it were possible for an atom to be placed on the boundary between two atoms, we could place two atoms as depicted in (b) above.

This would leave a gap between the two atoms at the top which is smaller than the minimal part or atom. But, in the words of Ibn Mattawayh, the minimal part or the atom "is the smallest of magnitudes" (*aṣgharu l-maqādir*) or in the words of al-Nīsābūrī, "this entails the possibility that there is something smaller than the atom as well as the possibility that there is a space (*jiha*) smaller than the space of an atom (*aqallu min muḥādhāti juz'in*)." Therefore, he concludes, it is impossible to place an atom at the boundary between two atoms.[92] This argument is analogous to Lucretius' argument that such an arrangement entails the concept of a magnitude smaller than the minimal part.

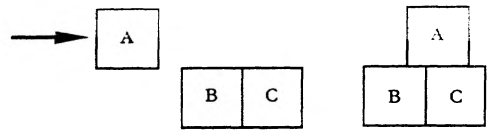
[90] al-Juwaynī, *Shāmil*, 438.

[91] al-Nīsābūrī, *Masā'il*, 98.

[92] Ibn Mattawayh, *Tadhkira*, 175-176; *Sharḥ al-tadhkira*, 31v; al-Nīsābūrī, *Masā'il*, 100 which is slight variant on this argument.

The opponents of the doctrine of discrete space object to this argument on the grounds that it relies on the contested premise that an empty space smaller than the minimal dimensions is impossible, and that since they do not accept this premise they need not accept its consequence.[93]

The *second argument* of those who believe in the doctrine of discrete space relies on the *kalām* doctrine of *i'timād*, that is, impetus or force. If the atom could be placed at the boundary between two atoms, then if we were to generate impetus in atom A (see diagram below) causing it to move, then what would determine its final position relative to the two atoms B and C which are beneath the path of motion? That is to say, what would be the reason for it to be contiguous to, for example, 60% of atom C and 40% of atom B?



Another absurd consequence of this argument, from the point of view of someone who upholds the discrete conception of space, is that an atom would have more than one accident of location (*kawn*), because it would occupy parts of two cells in space. "The accident of location," as Ibn Mattawayh tells us, "is what entails the fact that the atom is located in a space (*jiha*)."[94] That is to say, in terms of the theory of discrete space, the accident of location entails the location of the atom in this particular cell of space, rather than another. Now accidents of location are contraries, namely, it is impossible for two accidents of location to inhere in the same atom which would be the case if an atom could be placed on the boundary between two atoms. Therefore it is impossible for an atom to be placed on the boundary between two atoms.[95]

Al-Nīsābūrī, who denies that space is discrete, raises the objection that an atom may be created in, or occupy any available empty space, as long as it is large enough to fit the atom. If two atoms were created above this atom, then this atom could be on the boundary between the two other atoms. Therefore, *i'timād* plays no role in the location of the atom here.[96]

[93] al-Nīsābūrī, *Masā'il*, 100.

[94] Ibn Mattawayh, *Tadhkira*, 432. The terms *jiha*, *makān*, and *muḥādhāh* which denote space can also stand for discrete spatial cells, for these cells are the spaces which are occupied by atoms.

[95] Ibn Mattawayh, *Tadhkira*, 176; *Sharḥ al-tadhkira*, 31v; al-Nīsābūrī, *Masā'il*, 99.

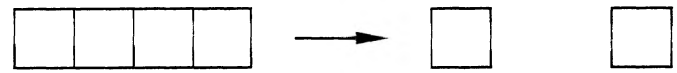
[96] al-Nīsābūrī, *Masā'il*, 99.

Abū Hāshim and his partisans considered it possible for an atom to be located on the boundary between two atoms. Therefore, they denied the discrete cellular composition of space. Many arguments in support of such a non-discrete continuous view of space are reported by al-Nīsābūrī.

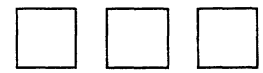
The *first argument* is as follows: Suppose that the two atoms, on whose boundary we want to place an atom did not exist. Surely we must then be able to place the atom in the location (*muḥādhāh*) which would have been the location of the boundary between the two atoms if they did in fact existent. The reason for this is that it must be possible for an atom to apportion or to measure any vacant space (*jiha fārigha*). If an atom cannot exist in such a location and apportion it, then it cannot apportion or exist in any location whatsoever. Therefore, if an atom may exist in this location when the two atoms beneath it are absent, then it must be able to exist here even when the two atoms are present because the vacancy of the location, as well as the possibility of an atom occupying it, is independent of the absence or presence of the two lower atoms.

This argument clearly rejects the discrete cellular theory of space and favors a non-discrete continuous doctrine of space. The occupancy of space by an atom therefore depends only on the vacancy of this space and its being of sufficient size so as to accommodate the atom. This principle underlies the rest of the arguments which are offered by those who reject the cellular view of space.[97]

In the *second argument*, we suppose a line which consists of four atoms. We then remove the two middle atoms so that we are left with the two end atoms.



It must then be possible to place an atom in the vacant space which lies between these two end atoms in such a manner that it does not touch any one of them as depicted below.



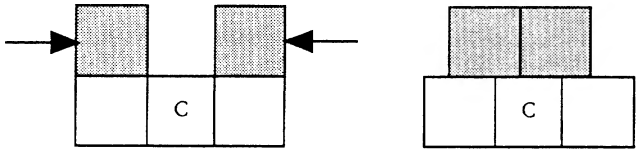
Therefore, the atom in the middle now occupies part of the space which was previously occupied by the two atoms which were removed.[98]

[97] al-Nīsābūrī, *Masā'il*, 96; Ibn Mattawayh, *Tadhkira*, 177; *Sharḥ al-tadhkira*, 31v. Ibn Mattawayh considers this to be the most convincing of the arguments (*ashaff*) of those who were opposed to discrete space.

[98] Ibid.

Ibn Mattawayh raises the objection that these two arguments entail the existence of a spatial gap which is smaller in magnitude than the atom. But, since the atom is the smallest of magnitudes, the placement of an atom as described above is impossible.[99]

The *third argument* supposes a line consisting of three atoms. Two atoms are placed on top of the terminal atoms of the line as depicted in (a) below.



(a) (b)

Now if two agents of equal strength were to push each of the atoms at the top towards the center, then each atom would move the same distance towards the center, and therefore the two atoms at the top would be located at the boundary between the two sets of two atoms at the bottom as in (b). The objection by someone who upholds the discrete theory of space, namely, that this impossible and that both atoms must remain in their initial positions is invalid. The reason for this is that the impetus to move (*i'timād*) in each of the atoms is not hindered by an obstacle which would prevent the motion of the two atoms. The opponents cannot defend their position by claiming that it is the opposing atom which poses an obstacle to the realization of motion as a result of this impetus in its counterpart because, in order for the opposing atom to be an obstacle to the motion of the other atom, there must be contact between the two atoms, and this is absent in our case.[100] However, this argument only works in a continuous space, for in a discrete space, motion itself is discrete, and the possibility of moving towards the center does not arise. Rather, the motion of the atom is a jerky motion whereby it is in one discrete location at one moment and in a contiguous discrete location at the next moment. But how can someone who hold the theory of discrete space then explain what happens when two atoms jerk towards the same discrete location? This poses a serious challenge to the concept of discrete space.

The *fourth argument* considers a square. Here, a diagonal (*quṭr*), which in the view of the *mutakallimūn* consist of the same number of atoms as the sides, seems larger than a side (*ḍil'*). For example, in a

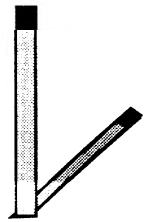
[99] Ibn Mattawayh, *Tadhkira*, 177-178.

[100] al-Nīsābūrī, *Masā'il*, 97. The anti-atomists used this argument to show that a magnitude smaller than the atom does exist (see below, Chapter Five, 171-172).

square whose sides consist of four atoms, the diagonals also consist of four atoms, namely AFKP and DGJM.

A	B	C	D
E	F	G	H
I	J	K	L
M	N	O	P

Even though the diagonals and the sides have the same number of atoms, the diagonal seems larger because the contact of the atoms that constitute the diagonal is corner to corner (*bi-arkānihā*) rather than side to side in the above two-dimensional depiction. One can, in this case, see that it is possible for an atom to be placed at the boundary between two atoms, for example, the atoms I and N are at the boundary between the atoms J and M.[101] But this, as Ibn Mattawayh objects, is a weak argument which hinges on the meaning of 'the boundary between two atoms'. Those who deny the possibility of an atom being placed at the boundary between two atoms do not mean the placing of a corner of an atom at the boundary formed by the juncture of the corners of two other atoms, but rather they mean placing the sides of an atom at the boundary formed by the sides of two other atoms. Moreover, as Ibn Mattawayh tells us, the diagonal is not a straight line but is a serrated line which has gaps in it. If it were a straight line which consisted of the same number of atoms as in the sides, then it would appear to have the same length as the sides.[102]



The *fifth argument* considers an atom placed atop a stick which is inserted into the ground. The shadow formed by the stick and the shadow formed by the atom at its top must have corresponding ratios. That is to say, when the shadow of the stick is half the size of the stick, then the shadow of the atom must be half the size of the atom. This is impossible unless the atoms in the shadow can be placed at the boundary between two atoms, for only then can the length of the shadow change in a continuous manner rather than by discrete increments of one atomic length.[103]

Ibn Mattawayh dismisses this argument as 'weak' and states that a shadow can only be produced by a dense body (*kathīf*), and this is not true of a single atom, nor sometimes of a multitude of atoms, for ex-

[101] al-Nīsābūrī, *Masā'il*, 97-98; Ibn Mattawayh, *Tadhkira*, 176; *Sharḥ al-tadhkira*, 31v.

[102] Ibn Mattawayh, *Tadhkira*, 193.

[103] Ibn Mattawayh, *Tadhkira*, 176-177; *Sharḥ al-tadhkira*, 31v. See also al-Ījī, *Mawāqif*, VII:27.

ample the atoms of air. Therefore, he claims, the single atom on the top of the stick cannot produce a shadow.

It is clear that Ibn Mattawayh's objection is not convincing and fails to address the argument which was formulated by the proponents of discrete space. His position is indicative of the predicament faced by those who believed in the doctrine of discrete space. That is to say, Abū Hāshim and those who followed his opinion in permitting the placement of an atom at the boundary of two other atoms, conceded that space itself was not discrete in response to the difficulties which arose as a result of the adoption of the discrete minimal part geometry by their predecessors. Both his father Abū 'Alī and the Baghdadī Mu'tazilī Abū al-Qāsim al-Balkhī held the minimal parts doctrines of matter and space, which was also, as we shall see, held by their predecessors among the early *mutakallimūn* of the third/ninth century. As a consequence of their strict application of the framework of a minimal parts discrete geometry, these *mutakallimūn* denied that the atom has size, or shape. They can therefore be counted among those who held the stronger version of discrete physical theory. Abū Hāshim, on the other hand, continued to adhere to the minimal parts doctrine of matter, but abandoned the minimal parts doctrine of space, and also the minimal parts doctrines of motion and time. He thus adopted the position that while space is continuous, matter is discrete. Abū Hāshim therefore is to be counted among those who held the weaker version of discrete physical theory. He could therefore, without being inconsistent, state that the atom has size, or shape. But since most of the *mutakallimūn* who came after him did not accept continuous space but instead continued to hold that space was discrete and therefore the stronger version of discrete physical theory, their adoption of Abū Hāshim's conclusion that the atom therefore has size or shape was inconsistent. Ironically, this inconsistency in holding the minimal parts doctrines of matter and space thereby claiming that the atom has no length, breadth, or depth on the one hand, but yet maintaining that the atom has size and shape on the other hand, provides us with the key to unravel the puzzle of *kalām* atomism. This inconsistency can only be understood within the context of the stronger version of discrete physical theory, namely, the minimal parts doctrines of space, matter, time, and motion. Having established that these *mutakallimūn* upheld the minimal parts doctrines of space, matter, time, and motion, we may then turn to their predecessors and determine whether they too subscribed to the doctrines of the minimal parts of matter, space, time, and motion.

Turning to question of time, there is no direct evidence to support or deny the claim that the *mutakallimūn* believed in discrete time. However a late hostile source, namely the sixth/twelvth century *faylasūf* Maimonides, attributes the doctrine of discrete time to them in his list of the premises of the *mutakallimūn*. The third of these premises concerns discrete time:

> This is their statement that time consists of moments (*ānāt*). They mean that there are many units of time which are indivisible because of the shortness of their duration (*mudda*). This premise is also necessary for them because of the first premise.[104] That is to say, they must have seen Aristotle's demonstrations in which he had demonstrated that distance, time, and motion are all three of them equivalent with respect to existence. I mean that the relationship of each of them to the other is the same and that when one is divided so is the other in the same proportion. Hence, they knew necessarily that if time were continuous and capable of infinite division, then it follows that the part which they considered indivisible must likewise be capable of infinite division. Similarly, if distance were presumed to be continuous, then the division of moments of time, which they had presumed to be indivisible, also follows, as Aristotle had explained in his *Physics*. For this reason they presumed that distances were not continuous but were composed out of parts which had reached the utmost limit of division. Likewise, time reaches a limit, namely the moments, beyond which further division is impossible. An example of this is that one hour consists of sixty minutes, and the minute consists of sixty seconds, and the second consists of sixty thirds. This, in their view, reaches a limit of parts which are either tenths for instance, or even smaller than them, which are in no sense divisible, and which do not, like distance, admit of further division.[105]

Maimonides does not have direct evidence for discrete time in *kalām*, but he insists on the basis of Aristotle's analysis that such a doctrine must, of necessity, be held by any kind of atomism. The situation here is analogous with that of Epicurus. The surviving fragments of Epicurus do not offer direct evidence of discrete time in Epicurus, but such a doctrine is attributed to him by Sextus and Simplicius.[106]

The doctrine of discrete time, if it is held implicitly, is almost impossible to discern. By their very nature discrete units of time are indivisible. One may not point to the beginning of a duration of a unit of time, nor to its end. However, in the analysis of motion, an atom can in one unit of time only move into the next spatial location. But if time were not discrete, then one could say that an atom traverses the distance of one minimal unit of space in some duration of time, say one moment.

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[104] Namely, the premise that atoms are the smallest constituents of matter.

[105] Mūsā ibn Maymūn, *Dalālāt al-ḥā'irīn*, 201-202; *Guide to the Perplexed*, tr. S. Pines, I:196.

[106] Sorabji, *Time, Creation, and the Continuum*, 375.

However, since time would be infinitely divisible, it would be incorrect to say that this motion takes place in one indivisible moment. Rather, there would be an infinite number of instants between the beginning of the motion and its end and therefore the motion would be continuous and not discrete. The analysis of motion, then, provides the clearest evidence of the doctrine of discrete or atomic time. Indeed, such an analysis of the Epicurean doctrine of motion is the strongest evidence for Epicurus' adherence to the doctrine of discrete time.

If time consists of indivisible units of time, then the only kind of motion possible is the jerky movement by an atom of a minimal unit of space in a minimal unit of time.[107] It would follow then, that strictly speaking, atoms could only move with the same speed. The observed slowness and fastness of bodies must then be explained away in some fashion. Epicurus, for one, believes that only compounds, that is bodies, and not atoms exhibit differences in speed. This, he believes, is because in the short run, that is in a short duration consisting of a few units of time, the component atoms of a body are not moving in the same direction, but jostling and colliding with each other. Only over an extended period of time is their tendency to move in some particular direction manifested. The degree of the interference which is caused by this jostling and colliding determines the speed of the body.[108]

The problem of the speed of bodies is also raised by Ibn Mattawayh. He states:

> Abū Hāshim, may God have mercy upon him, had stated in his *Naqd al-Abwāb* that the cause of the fastness of the motion of one of two bodies and the slowness of the other is that one of the two bodies is larger than the other, and therefore the motion which arises as a result of its weight is more [than the motion of the other body]. This is not correct on the basis of what we have verified, namely that increase in motion, like decrease in motion lies in the fact that only one spatial location (*makān wāḥid*) can be traversed as a result of the motion in one moment of time (*wa l-waqta wāḥidun*).[109]

Ibn Mattawayh thus attests to doctrine of maximum speed based on the premise that an atom may travel one minimal unit of space in one indivisible moment of time. As we have seen above, Ibn Mattawayh belongs to the group of the *mutakallimūn* who hold that space is discrete. His further adherence to the doctrines of discrete motion, and discrete time is consistent with this conception of space.

[107] Obviously the movement is jerky only from the point of view of a non-atomistic, continuous doctrine of time and space.

[108] Furley, *Two Studies*, 121-124.

[109] Ibn Mattawayh, *Tadhkira*, 466-467; also *Sharḥ al-tadhkira*, 79r.

Abū Hāshim and a few other *mutakallimūn*, on the other hand, hold the weaker version of discrete physical theory, that is to say, a continuous conception of space. And, consistent with this, they deny the doctrine of maximum speed, and therefore, they also deny the doctrines of discrete motion and of discrete time.

D. MINIMAL PARTS AND DISCRETE GEOMETRY IN THE THIRD/NINTH CENTURY

In the previous sections, the evidence which supports the thesis that the doctrines of the minimal parts of matter, space, and time are found among the *mutakallimūn* of the fourth and fifth/tenth and eleventh centuries has been presented and analyzed. We have seen that the *mutakallimūn* of this period held the doctrines that the atom has size, shape, and is conceptually indivisible, and the doctrine that atoms are homogeneous—doctrines which entail that their adherance to the doctrine that the atom is a minimal part of matter akin to the minimal part of Epicurean atomism. Within the course of the discussion, the argument was made that the holding of the doctrines that the atom has neither size nor shape by Abū 'Alī al-Jubbā'ī and Abū al-Qāsim al-Balkhī was consistent with their strict interpretation of the minimal parts doctrine of matter within the context of its underlying discrete geometry. Moreover, we have also seen the interconnection between the minimal parts doctrines of motion, space, and time and also that propositions like the maximum speed of the atom, etc., indicate adherence to these doctrines. In this section, a preliminary survey of the evidence of these doctrines among the *mutakallimūn* of earlier periods, namely, from the third/ninth centuries will be presented.

The fragmentary state of our knowledge of *kalām* doctrines of this period, does not provide us with as many details about these doctrines nor, more importantly, the arguments which were formulated in support them as we find in the fourth and fifth/tenth and eleventh centuries. However, we find traces of the doctrine of the constitution of bodies out of atoms which do not have the dimensions of length, breadth and depth, and the premises of the atom having size, shape, and being conceptually indivisible as well as the premises that atoms are homogeneous. Moreover, we also find traces of the minimal parts doctrines of space and motion. These traces, not all of which can always be found for any one *mutakallim*, allow us to tentatively conclude that the stronger version of discrete physical theory was also held during this earlier period.

Let us begin with three transitional figures who span the third and early fourth/ninth and early tenth centuries who were considered to be the leading figures of the *kalām* schools of the fourth/tenth and later centuries. These are Abū 'Alī al-Jubbā'ī, Abū al-Qāsim al-Balkhī, and Abū al-Ḥasan al-Ash'arī who were the leaders of the Basrian Mu'tazilīs and the Baghdadī Mu'tazilīs of this period, and the founder of Ash'arī school of *kalām* respectively.

Al-Ash'arī tells us that Abū 'Alī al-Jubbā'ī held that the atom is not a body because the body has length, breadth, and depth, while the isolated atom does not have these dimensions.[110] This is consistent with the belief that the atom is a minimal part and therefore cannot, strictly speaking, be said to have dimension. We have already encountered the testimony of Ibn Mattawayh that Abū 'Alī denied that the atom has magnitude.[111] Moreover, Abū 'Alī also believed that an atom may be in contact with six other atoms which suggests that he conceived the atom as a cube, although, we may presume that because he denied magnitude to the atom, he must also have denied shape to the atom, for the minimal part cannot, strictly speaking be said to have shape as magnitude or shape are properties which only have meaning for compound aggregates of atoms.[112] Furthermore, he believed that eight atoms form the smallest body.[113] He must have also accepted the premise that atoms are homogeneous, for, as we have seen above, only the anti-atomists were opposed to this premise. We also have the explicit testimony of al-Ash'arī that Abū 'Alī denied that 'a single motion' is divisible, that is to say, he upheld the minimal part doctrine of motion.[114] Finally, as we have seen above, he denied that an atom can be placed on the boundary of two other atoms. He must therefore have subscribed to the minimal parts doctrine of space. On the basis of this evidence, we may conclude that Abū 'Alī al-Jubbā'ī upheld the discrete minimal parts doctrines of matter, space, motion, and time in their entirety.

110 "Every atom (*jawhar*) is not a body. It is impossible for a single indivisible atom (*al-jawharu l-wāḥidu alladhī lā yanqasimu*) to be a body because the body is that which is long, broad, and deep. The single atom is not like this. This is the doctrine of Abū al-Hudhayl and Mu'ammar. [Abū 'Alī] al-Jubbā'ī followed this doctrine" (al-Ash'arī, *Maqālāt*, 307).

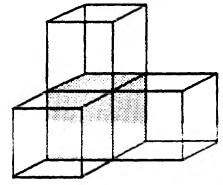
111 See above, 107.

112 "Al-Jubbā'ī affirmed the existence of the atom. He said that it may, by itself, be in contact with six others like it" (al-Ash'arī, *Maqālāt*, 315).

113 al-Juwaynī, *Shāmil*, 407.

114 "Al-Jubbā'ī and other rationalists (*ahl al-naẓar*) denied that a motion could be divided or partitioned" (al-Ash'arī, *Maqālāt*, 319). In another report, al-Ash'arī attributes to him the doctrine that a descending stone has hidden pauses which explain why a heavier stone descends faster than a lighter one. This too is consistent with a minimal parts doctrine of motion (Ibid., 322).

Similarly, with regards to Abū al-Qāsim al-Balkhī, Ibn Mattawayh informs us that he considered four atoms to form the smallest body.[115] In fact the four atom configuration is the minimal configuration for the formation of a body which has length, breadth, and depth as they are defined in the minimal parts discrete geometry. Hence the late Ash'arī *mutakallim* al-Ījī (d. 756/1355) states that according to the Mu'tazilīs four atoms are required to form a body.[116] Four atoms may be arranged in the minimal part discrete geometry so that two atoms form the dimension of length, two form the dimension of breadth, and two form the dimension of depth and therefore the four atoms constitute a minimal body as follows:[117]



Like his Basrian rival, Abū al-Qāsim denies that the atom has magnitude or shape.[118] Moreover, Abū al-Qāsim upholds the homogeneity of atoms and in all likelihood its conceptual indivisibility.[119] Finally, as Ibn Mattawayh tells us, he denied that an atom can be placed on the boundary of two other atoms. It would therefore seem that Abū al-Qāsim, like Abū 'Alī al-Jubbā'ī, subscribed to the doctrine of discrete space. But as we have seen in the previous chapter, he also believed that space is the two-dimensional container enveloping a body, which is a Peripatetic doctrine. This is only one of the many traces of Peripatetic influence on his cosmology.[120] As a result, we cannot on the basis of the few fragments of his doctrines confidently assert that Abū

115 Ibn Mattawayh, *Tadhkira*, 48; *Sharḥ al-tadhkira*, 4v.

116 al-Ījī, *Mawāqif*, VI:294.

117 Pines states that Shams al-dīn Muḥammad ibn Ashraf al-Ḥusaynī al-Samarqandī, in his *Kitāb al-ṣaḥā'if fī al-kalām*, had reported that, "Ka'bī [namely, Abū al-Qāsim al-Balkhī] believed that four atoms (this, for him is the minimal number) can constitute a body in the following manner: three atoms can make a triangle. Now when the fourth atom is places above them, a pyramid is formed" (*Beiträge*, 6). Pines remarks that the term in the text is 'cone' (*makhrūṭ*) but that 'pyramid' is better. But neither 'cone' nor Pines' emendation to 'pyramid' conform with this minimal body when it is seen from the perspective of the minimal parts discrete geometry.

118 See above, 107.

119 See above, 117-123.

120 Abū al-Qāsim also believed that bodies have 'natures' (*ṭibā'*) which are the proximate cause of their actions. This was criticized by the Basrian Mu'tazilī *mutakallimūn* (Shaykh al-Mufīd, *Awā'il*, 82-83; Ibn Mattawayh, *Tadhkira*, 145-148; al-Nīsābūrī, *Masā'il*, 133-150).

al-Qāsim held the discrete minimal parts doctrines of space, time, and motion.

At first sight, it seems that Abū 'Alī al-Jubbā'ī's student, Abū al-Ḥasan al-Ash'arī's atomism does not confirm with the discrete minimal parts atomism of his contemporaries. The reason for this was his rejection of his teacher's definition of body, namely, that it is the long, broad, and deep.[121] In contrast, al-Ash'arī defined the body as the composite (*mu'allaf*), and, as a result, he held that the smallest body may be constituted out of two atoms.[122] Al-Ash'arī admitted that these two atoms constitute a single dimension only, namely length, and that the least body therefore only has this dimension in his system, but this poses no problems because it is consistent with his definition of body.[123] Consequently, al-Ash'arī, like his teacher Abū 'Alī al-Jubbā'ī, accepted the premise that two contiguous atoms constitute one of the linear dimensions. This premise, as we have seen, is a fundamental axiom in the minimal parts discrete geometry, for two atoms are the minimum which can form the two extremities of a line and hence of a linear dimension. There is no information about al-Ash'arī's view on the size of the atom. It seems likely that he adopted the view of Abū 'Alī al-Jubbā'ī and did not regard it to have size, and, as a result, shape. However, we know that he held that an atom may, at the most, be in contact with six other atoms.[124] He must then, like his teacher, have conceived of the atom as a cube. It follows that his assumed denial of size and shape are consistent with strict adherence to the minimal parts discrete geometry which we also find with Abū 'Alī al-Jubbā'ī and Abū al-Qāsim al-Balkhī. We have evidence of al-Ash'arī's acceptance of the premises of the homogeneity of atoms[125] and the conceptual indivisibility of the atom.[126] We may therefore count al-Ash'arī among the holders of the minimal parts doctrine of matter but we do

[121] "Similarly, he denied the doctrine held by some of the Mu'tazila that the meaning of 'body' is that it is long, broad, and deep" (Ibn Fūrak, *Mujarrad*, 210).

[122] al-Ījī, *Mawāqif*, VI:277; Ibn Mattawayh, *Tadhkira*, 48; Frank, "Bodies and Atoms," 45-51; Gimaret, *La Doctrine*, 68.

[123] "He believed that when an atom is joined with another atom, then both of the atoms have a length, which is a joining, or a touching, or a combining" (Ibn Fūrak, *Mujarrad*, 203).

[124] "He believed that it is possible for one atom to be in contact with six atoms. Therefore, the atom has six sides (*jihāt*). He denied that the atom could be in contact with a greater number of atoms than this" (Ibid., 204).

[125] "Differences are a result of the accidents of a body. As for the atoms of a body, they are homogeneous; there is no difference between them" (Ibid., 208).

[126] "He held that the bodies of the world are composed out of indivisible parts, in the sense that each of these parts does not have a half, nor a third, nor a fourth, nor is it possible to imagine their division nor partition so that it forms divisions or parts" (Ibid., 202; see also 203-204).

not have sufficient evidence to determine his adherence to the discrete minimal parts doctrines of space, time, and motion.

Turning to the earlier period of the first half of the third/ninth century let us consider the views of the alleged founder of the Basrian Mu'tazilī school, namely, Abū al-Hudhayl al-'Allāf, and Mu'ammar ibn 'Abbād al-Sulamī, both of whom have been cited by Pines as proponents of the doctrine of non-extended atoms.[127]

Even though there are a wealth of fragments regarding the cosmological views of Abū al-Hudhayl, they do not present his views regarding the size or shape of the atom. These views, may however, be inferred from these fragments. We know that he held that the atom does not have the dimensions of length, breadth, and depth and that the combination of two atoms produces the dimension of length. Moreover, he held that the atom can be in contact with a maximum of six other atoms which is consistent with the concept of the atom as a cube.[128] He seems to have held that the body, in contrast, has length, breadth, and depth, but he defined the body as that which has a right, a left, a front, a back, a top, and a bottom and consists of at least six atoms.[129] From these fragments, one may infer that Abū al-Hudhayl would have, like Abū Alī al-Jubbā'ī and Abū al-Qāsim al-Balkhī, denied that the atom has size and shape because of his strict adherence to the framework of a minimal parts discrete geometry. While his belief in the

[127] See above, 97-98. Information regarding the views of the third proponent cited by Pines, namely, Hishām al-Fuwaṭī, is very scanty and difficult to interpret. I have therefore omitted the discussion of his adherence or lack of thereof to the minimal parts doctrines of matter, space, time, and motion.

[128] "Abū al-Hudhayl believed that God can remove and annihilate the [accidents of] combination (*ijtimā'*) which inhere in a body so that it [is broken down into] the atoms [which constituted it]. The atom has neither length, nor breadth, nor depth. Neither [the accident of] combination nor [the accident of] separation (*iftirāq*) inhere in it" (al-Ash'arī, *Maqālāt*, 314).

"Abū al-Hudhayl denied that the atom [reading *al-juz'* for *al-jism*] is composite, long, broad, and deep. He held that two things, neither of which has length, combine to become a single thing which has length" (al-Ash'arī, *Maqālāt*, 315).

"Abū al-Hudhayl held that the body is that which has a right and a left [side], a front and a back, and a top and a bottom. The smallest that a body can be is six atoms, the first of a pair is the right and the other the left [side]; the first of [the next] pair is the front and the other the back; and the first of [the third] pair is the top and the other the bottom. The atom may be in contact with six other [atoms] like itself" (al-Ash'arī, *Maqālāt*, 303).

[129] "Some people believed that every atom (*jawhar*) is not a body. It is impossible for a single indivisible atom (*al-jawharu l-wāḥidu alladhī lā yanqasimu*) to be a body because the body is that which is long, broad, and deep. The single atom is not like this. This is the doctrine of Abū al-Hudhayl and Mu'ammar. [Abū 'Alī] al-Jubbā'ī followed this doctrine" (al-Ash'arī, *Maqālāt*, 307).

"Abū al-Hudhayl held that the least body is constituted out of six atoms, He placed three atoms on top of three atoms" (al-Juwaynī, *Shāmil*, 407). See also Ibn Mattawayh, *Tadhkira*, 48; al-Ījī, *Mawāqif*, VI:294 and note 128 above.

homogeneity of atoms is not directly attested, we have noted that only the anti-atomists were against this doctrine. We may therefore, with confidence, assume that he considered atoms to be homogeneous. Finally, since Abū al-Hudhayl held that the accidents of combination and separation do not inhere in the atom,[130] it follows that he must have considered atoms to be conceptually indivisible. We may, on the basis of his adherence to these premises, presume that he subscribed to the minimal parts doctrine of matter.[131]

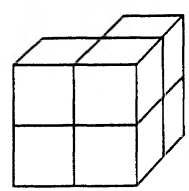
Evidence for Abū al-Hudhayl's adherence to the doctrine of the discrete theories of space, time, and motion is found in the following report by al-Ash'arī regarding those who rejected the doctrine of the leap (*ṭafra*) of the anti-atomist *mutakallim* al-Naẓẓām:

> Many of the people of *kalām* rejected his doctrine, among them Abū al-Hudhayl and others. They denied that a body can move to a place without passing through the place before it. They said, "This is absurd. It is impossible." They held that some parts of a body may be at rest, while many of its parts are in motion. [They held] that a horse in motion has hidden pauses (*waqfāt*) even in the heat of a race when placing its feet on the ground and raising them. For this reason, one of two horses is slower than its companion. Similarly, a descending stone has hidden pauses, as a result of which, it is slower than a heavier stone which is released simultaneously with it.[132]

The view that some parts of a body may be at rest while many others are in motion is evidence of the attempt to explain variations in the speeds of bodies. This is a variation of Epicurus' doctrine that the speed of a body is determined by degree of jostling and collision of its component atoms. Another explanation for variation in speed is the

[130] This is the basis for his argument for the conceptual indivisibility of the atom. See below, Chapter Five, 152-159.

[131] However, his view that the smallest body consists of six atoms poses a problem. Al-Ash'arī claims that Abū al-Hudhayl regarded the body to be the long, broad, and the deep and that he believed that these dimensions are constituted out of a combination of two atoms. But it is difficult to conceive how these atoms are arranged together. The most likely arrangement is depicted below.



This arrangement is in accord with al-Juwaynī's report that Abū al-Hudhayl placed three atoms on top of three atoms and the requirement that the body have length, breadth, and depth within the context of a discrete geometry. However, it is not consistent with al-Ash'arī's report that the body has right, left, front, back, top, and bottom sides each of which are formed from the combination of two atoms for, in this arrangement, the right and front sides consist of four atoms; the top and bottom sides consist of three atoms, and only the left and back sides consist of two atoms. The same problem is faced even when the arrangement is considered within a continuous geometry.

[132] al-Ash'arī, *Maqālāt*, 321-322.

theory of hidden pauses, or discrete temporal units when motion does not occur. This too fits well within the context of the minimal parts doctrines of motion and time. We may therefore infer that Abū al-Hudhayl held the stronger version of discrete physical theory.

Mu'ammar, like Abū al-Hudhayl, also holds that the atom is not a body and that the body is the long, the broad, and the deep. In his view, the smallest body consists of eight atoms. Length is formed when an atom joins with another atom; breadth is formed when two atoms are joined to these two; and depth is formed when four atoms are placed over these four atoms.[133] This doctrine of the constitution of the body is similar to the doctrine we find later in the fourth and fifth/tenth and eleventh centuries. It suggests that Mu'ammar conceived of atoms as cubes. It is quite likely that he, like Abū al-Hudhayl, denied that atoms have shape or size. There is no further information on his atomism, but the above views are consistent with a minimal parts doctrine of matter. His rather unusual doctrine that bodies are actually at rest and only metaphorically in motion is also consistent with the Epicurean doctrine that one cannot state that a body is in motion, but rather that it has moved.[134] This suggests an adherence to the minimal parts doctrines of motion and time and consequently the minimal parts doctrine of space and hence the stronger version of discrete physical theory.[135]

Even though the doctrines of only some of the early *mutakallimūn* and whether they are consistent with the stronger version of discrete physical theory, namely, the minimal parts doctrines of matter, space, time, and motion have been discussed here, it is clear that these doctrines had some proponents during the formative period in the development of *kalām* cosmology. More research into the details of these doctrines, as well as the nature of its appropriation by the *mutakallimūn*, and also the survival and possible transformation of Epicurean atomism in Late Antiquity needs to be conducted. I hope, however, that the analysis which has been presented above has shown that the minimal parts doctrines of matter, space, time, and motion and

[133] "Mu'ammar held that the body is the long, the broad, and the deep. The smallest body consists of eight atoms. Accidents are entailed when atoms combine. These are created by natural necessity (*bi-ijābi l-ṭab'i*) and each atom creates in itself the accidents which inhere in it. He claimed that when an atom is joined to another, length is produced; and that breadth is the joining of two atoms to these two; and that depth is produced when four atoms are placed over these four. Therefore, eight atoms form a body having length, breadth, and depth" (Ibid., 302). See also note 129 above.

[134] "Mu'ammar believed that every body is actually at rest and [only] metaphorically in motion" (Ibid., 325). See also above, 132 for Epicurus' view of motion.

[135] Hans Daiber presents a different view of Mu'ammar's physical theory in his *Mu'ammar*, 322-337.

the discrete geometry which is associated with them, help explain the puzzles which have been associated with *kalām* atomism and further that this perspective provides new avenues for research into the physical and cosmological theories of *kalām*.

CHAPTER FIVE

THE EPISTEMOLOGICAL BASIS OF BASRIAN MU'TAZILĪ ATOMISM

In the discussion of Basrian Mu'tazilī epistemology in the second chapter, we have seen that the *mutakallimūn* held that our knowledge is either immediate or acquired. Immediate knowledge consists either of *a priori* knowledge of logical principles, for example our knowledge of the principle of non-contradiction, or it is perceptive knowledge, or it is existential knowledge of our own internal states. Acquired knowledge, on the other hand, is mediate and arises as a result of reflection. It can derive from rational argument, or the religious sources of revelation, Prophetic tradition, or communal consensus.[1] We have also seen how the *mutakallimūn* applied this epistemological classification in their analysis of our knowledge of accidents.[2] The same questions may be asked about atoms, that is, how do we know of their existence? and, what are their attributes?

A. PERCEPTION AND THE ATOM

Ibn Mattawayh asserts that atoms are perceptible by the senses of vision and touch. Hence, he maintains, our knowledge of the existence of atoms and their attributes is immediate deriving from sense perception. It is therefore impossible for us to deny their existence.[3] This is an extraordinary claim for it is obvious that we do not, in our everyday experience, have sensible knowledge of individual atoms, whether by sight or by touch. Rather, our immediate sensible knowledge is of the spatial extension of bodies.

As it turns out, Ibn Mattawayh is aware of this problem for, a little later into his work, he discusses the Basrian Mu'tazilī dispute over just this point, namely the possibility of perceiving individual atoms. His predecessors had all agreed, he tells us, that God can perceive individual atoms and that we perceive the larger units which they form when

[1] See above, Chapter Two, 22-23 and note 32.
[2] See above, Chapter Two, 50-53.
[3] "Know that atoms are perceptible by the senses of sight and touch" (Ibn Mattawayh, *Tadhkira*, 53). "We know the atom immediately as a result of perception so that to deny knowledge of it in ourselves is impossible" (Ibid, 54).

they combine together but that we do not perceive individual atoms. They however disagreed on the reason for our inability to perceive individual atoms. Ibn Mattawayh concurs with the view of Abū 'Alī al-Jubbā'ī and his son Abū Hāshim that our failure to perceive them is not due to the intrinsic nature of the atom itself. Rather, our inability to see atoms may be due either to the weakness of the visual ray (*shu'ā'*), as Abū 'Alī had argued, and therefore, were God to intensify the ray we would be able to see them;[4] or our inability may be due, as his son Abū Hāshim had argued, to the fact that the combination of atoms is a condition for their visual perception, just as the removal of obstacles which prevent vision is a condition for visual perception. This is because the visible object must be opaque or dense (*kathāfa*) in order to be visually perceptible and opacity or denseness is not a property of individual, isolated atoms but only of clusters of atoms.[5] Since the individual atom is not opaque, we cannot perceive it visually.[6] On the other hand, Abū 'Abd Allāh al-Baṣrī (367/977) had argued that the individual atom is imperceptible because it cannot be sensibly differentiated from the visual ray by means of which it is seen.[7]

Our inability to perceive individual atoms and therefore have immediate perceptive knowledge of their existence raises two problems. The first is a problem of interpretation. If, as is clearly the case, Ibn Mattawayh and the Basrian Mu'tazilīs are aware that individual atoms cannot be sensibly perceived, then why do they claim that the atom is

[4] There is no adequate study of *kalām* theories of vision. According to A.I. Sabra, the Mu'tazilī discussion of illusions found in 'Abd al-Jabbār's *Mughnī*, IV:70-79 "presupposes a version of the visual-ray theory which can be described as 'Platonic'" (*The Optics of Ibn al-Haytham*, II:107).

A very terse but summarized view of the *kalām* theory of sense perception in general, and vision in particular, is found in the *Awā'il al-maqālāt* of Shaykh al-Mufīd. He states, "I believe that all sense perception (*ḥiss*) is: [i] the result of contact (*mumāssa*) of the sense organ [with the sense object] and its coalescence (*ittiṣāl*) with the sense object; or [ii] contact of the sense organ with that which coalesces with the sense object; or [iii] contact of the sense organ with that which emanates (*yanfaṣalu*) from the sense object; or [iv] contact of the sense organ with that which coalesces with that which emanates from the sense object. For example, vision, for its ray (*shu'ā'*) must either coalesce with the visual object, or coalesce with that which emanates from the visual object, or it must coalesce with that which coalesces with that which emanates from the visual object" (*Awā'il*, 114). A more detailed discussion of the *kalām* visual ray theory is found in 'Abd al-Jabbār, *Mughnī*, IV:59-79.

[5] Al-Juwaynī informs that Abū al-Hudhayl considered the smallest dense body (*al-jism al-kathīf*) to be constituted out of thirty-six atoms (*Shāmil*, 407).

[6] Ibn al-Haytham also regards opacity to be a condition of vision (*wa ayḍan fa-innā nujidu l-baṣara laysa yudriku shay'an min al-mubṣarāti illā idhā kāna kathīfan aw kāna fihi ba'ḍu l-kathāfati*) (*Kitāb al-manāẓir*, ed. A. I. Sabra, (Kuwait: The National Council for Culture, Arts, and Letters, 1983), I:67; English translation in *The Optics of Ibn al-Haytham*, I:9).

[7] Ibn Mattawayh, *Tadhkira*, 184-186; *Sharḥ al-tadhkira*, 34r.

known immediately as a result of visual or tactile perception? What can they possibly mean by this statement? The second problem is a logical consequence of the imperceptibility of individual atoms. That is, if we do not have direct perceptive knowledge of individual atoms, then our knowledge must, as is in Greek atomism, be indirect and based on rational arguments which attempt to prove that the continual division of matter is impossible and that matter must ultimately consist of indivisible atoms. What, then, were the arguments presented by these later *mutakallimūn* in support of their atomistic theory of matter? The first of these questions is the focus of this section while the second question will be discussed in a subsequent section of this chapter.

The *mutakallimūn* maintain that perception of the atom results in our knowing the most characteristic attribute of the atom, which is the attribute entailed by its essential attribute, namely its attribute of occupying space (*taḥayyuz*). In other words, the true object of perception in the case of the atom is its extension or occupation of space. It follows then that when the *mutakallimūn* claim that the atom is perceptible, what they mean is that its occupation of space is perceptible. In the case of a body, it is clear that we may visually or by the sense of touch, perceive that it occupies space. Now, since the atom is a component of such a perceptible body and is, like the body, extended and space-occupying, it too must be perceptible.[8] It seems clear then that when the *mutakallimūn* claim that the atom is perceptible they do not mean that it is perceptible as an individual isolated unit. Rather, they must mean that the larger conglomerated unit it constitutes, namely the body, is perceptible. The discussion then turns to the reason for the imperceptibility of the individual atom and consequently the conditions necessary for its perception, namely, its participation in a body which is dense or opaque. Perception, then, provides direct knowledge of extension, which is a property of bodies as well as atoms. Strictly speaking, since our knowledge of extension is knowledge of the extension of bodies, we need to furnish additional arguments that these bodies are in turn constituted of extended atoms.

With this in mind, we can turn our attention to the claim that when we visually perceive atoms, or strictly speaking, the bodies which they constitute, we perceive their extension or 'occupation of space'. This claim was rejected by the *mutakallim* Abū al-Ḥusayn al-Ṣāliḥī (fl. last quarter of third/ninth and first quarter of fourth/tenth century) who

[8] In his commentary on Ibn Mattawayh's chapter on the perception of the atom, Ibn Mattawayh's anonymous commentator states, "Another argument that shows that bodies are known necessarily is ..." (*Sharḥ al-tadhkira*, 5v). This is not a slip of pen, but rather an acknowledgement that the the argument for the perception of atoms is primarily an argument for the perception of bodies.

maintained that color, and not extension, was the proper object of visual perception.[9] Al-Ṣāliḥī's view was a consequence of his belief that a body may be constituted out of a single atom.[10] Therefore, he needed to explain why the atom being a body is imperceptible. His doctrine was considered to be a serious challenge to the Basrian Mu'tazilī position that bodies, and the atoms which constitute them, as well as perceptible accidents, are known necessarily by our perception of unique qualities (or accidents). Indeed, for the Basrian Mu'tazilīs, the possibility of their perception is the strongest evidence we have for their existence in the world. If we deny the perception of extension we must also deny the existence of bodies. In the view of the later *mutakallimūn*, such an absurd claim opens the door to ignorance of the existence of a class of objects in the world, either because they are imperceptible, or because their existence cannot be inferred on the basis of argument. The Basrian Mu'tazilīs were therefore obliged to argue against al-Ṣāliḥī and show that both extension and color are visually perceptible.

Ibn Mattawayh argues against al-Ṣāliḥī's view that the proper object of visual perception is color by asserting that we cannot deny that we visually perceive something. The question is, is the proper object of visual perception a color or the atom itself, or are they both proper objects of perception? Ibn Mattawayh answers that both color and the atom are the proper objects of visual perception, and that neither one has more of a claim to be its proper object. For, according to Basrian Mu'tazilī epistemology, perception is the means to knowledge of the most characteristic attribute of a perceptible object, namely the attribute entailed by its essential attribute. This, in the case of the atom, is its spatial occupation or extension while in the case of color it is the particular visual appearance which is characteristic of some specific color. Vision, then, is the means to knowledge of the atom's spatial occupation just as it is the means to knowledge of the particular visual appearance (*hay'a*) of a specific color, for example, black.[11] That color and extension both are distinct objects of perception is clear from our ability to visually distinguish between bodies of different colors and between the longest or shortest of a number of bodies. Our ability to distinguish between bodies of different sizes is independent of our perception of color, for, if it were dependant on the perception of color then we would be unable to make such a distinction in the case

[9] Ibn Mattawayh, *Tadhkira*, 53 and also, "Bodies are not visible. Only colors are visible and they are accidents" (al-Ash'arī, *Maqālāt*, 363).

[10] See above, Chapter Three, 57.

[11] See above, Chapter Two, note 24 for the use of *hay'a* as 'visual appearance'.

of dusty or obscure bodies (*aghbār*), since we can perceive their dimensions without perceiving their color.[12] Moreover, our knowledge of spatial extension would not then be as precise and clear as that of color for it would be derivative.[13]

The *mutakallimūn* also state a theological argument for the visual perception of extension. This argument states that since it is possible for atoms to not have color, then it is within God's power to create bodies devoid of color. Now if we were unable to perceive atoms by their attribute of extension, then we would have no access to knowledge of these bodies whatsoever. This would lead to ignorance of their existence and this is impossible. Therefore we must be able to perceive extension, that is to say, our knowledge of bodies which derives from perception of extension is guaranteed by God.[14]

On the other hand, the difficulties which are encountered regarding the visual perception of atoms, namely that color and not extension may be the true object of visual perception, have no place in perception by the sense of touch. We directly perceive extension when we grasp a body in our hand, and since the body is constituted out of atoms, it follows that we directly perceive the extension of its atoms.

B. THE PRIMARY ATTRIBUTES OF THE ATOM

After arguing for the perception of the atom, the Basrian Mu'tazilī *mutakallimūn* turn to consider the primary attributes of the atom which are known as a result of this perception.[15] These are the attributes which must be predicated of the atom. The attribute of spatial occupation or extension (*taḥayyuz*) is the direct object of perception. As we have seen above, the attribute which is the direct object of perception is the attribute entailed by the essential attribute of an object.[16] This attribute then reveals the presence of the essential attribute of the atom, namely the attribute of being an atom (*kawnuhu jawharan*). Moreover, perception of the extension of the atom depends on the ex-

[12] Ibn Mattawayh, *Tadhkira*, 54; but much clearer in *Sharḥ al-tadhkira*, 5v. An example is our perception of distant objects. We can distinguish between their sizes even though our perception of their colors is imperfect (*muntaqiṣ*) (Ibn Mattawayh, *Tadhkira*, 239; *Sharḥ al-tadhkira*, 41r; see also 'Abd al-Jabbār, *Mughnī*, IV:83ff.). The question of whether it is possible for bodies to be without color is discussed by Ibn Mattawayh (*Tadhkira*, 136-137). Ibn al-Haytham, on the other hand, lists twenty-two individual visible properties including light, color, distance, position, solidity, shape, etc. (*Kitāb al-manāẓir*, I:230; English translation in *The Optics of Ibn al-Haytham*, I:138).

[13] Ibn Mattawayh, *Tadhkira*, 54-55.

[14] Ibn Mattawayh, *Tadhkira*, 55; *Sharḥ al-tadhkira*, 6r.

[15] I have discussed Ibn Mattawayh's analysis of this above, Chapter Two, 26-29.

[16] See above, Chapter Two, 22-25, 35-36.

istence of the atom, and therefore, existence (*wujūd*) is also a primary attribute of the atom. Finally, extension cannot occur without the atom having a location in space, therefore being in some location in space (*kawnuhu kā'inan fī jihatin*) is also a primary attribute of the atom.[17] Therefore, the atom has four primary attributes: its essential attribute of being an atom, its extension which is the attribute entailed by its essential attribute, its existence, and its being located in space.

The grounds for these four primary attributes are as follows: Its essential attribute, namely being an atom, derives from its essence (*li-dhātihi*), that is to say the kind of object it is; its extension is entailed by its essential attribute (*muqtaḍā 'an ṣifati dhātihi*); its existence is the result of creation (*bil-ḥudūthi*) by the agent whose power of autonomous action is intrinsic (*min jihati l-fā'ili l-qādiri li-nafsihi*), namely God[18]; and its being located in space is the result of an entitative accident (*li-ma'nā*), namely the accident of location (*kawn*).

Each of these four primary attributes gives rise to the characteristic properties (*aḥkām*) of the atom. The essential attribute gives rise to the property of being an atom, and the attribute of existence gives rise to the property of being an existing object. The attribute of spatial occupation or extension gives rise to a number of properties, for example, the property that an aggregation of atoms forms larger units, the property of the occupation of space, the property of measuring or apportioning space, the property of preventing another atom from occupying the place it has occupied, the property of being perceptible by the senses of vision and touch, and the property of being a substrate for accidents.[19]

The property which derives from the atom's attribute of being located in space is the impossibility of its being in two places at the same time.[20] In order to understand how this attribute gives rise to this property it is useful to consider the accident of location which is the ground for this attribute. Ibn Mattawayh states:

> The accident of location (*kawn*) is what necessitates the fact that the atom is situated in a location in space (*yujibu kawna l-jawhari kā'inan fī jihatin*). The terms which are used for it vary, even though all of them denote this category [of accident]. Hence, when the subsequent [accident of location] is the contrary (*ḍidd*) of the [previous] accident of location, the accident of location is called motion (*ḥaraka*); but when the atom, by means of the accident of location, remains situated in a location in space for more than one moment, or the subsequent [accident of location] is the same as (*mithl*) the [previous] accident of location, the accident of location is called rest (*sukūn*); and when it is an initial [accident of location] which has not been preceded by another accident of location, it is simply called an accident of location (*kawn*), for it is present in the atom at the moment of its creation. If another atom is next to this atom then the accident of location between them is called contiguity (*mujāwara*); but when it is at a distance from the other atom then the accident of location between them is called separation (*mufāraqa*) or distance (*mubā'da*).[21]

The accident of location thus encompasses the phenomena of motion and rest, and contiguity and separation.[22] It would seem then that it is a relational accident having temporal and spatial aspects. But this is denied by Ibn Mattawayh, who insists that the accident of location is an entitative accident by means of which the substrate in which it inheres has a particular attribute, namely, the attribute of being in this location and not another. The specificity of spatial location cannot be the result of the extension of the atom, but must derive from its accident of location.[23] Since the atom must have a spatial location, an accident of location must always inhere in the atom, and therefore having a spatial location is a primary attribute of the atom.

Now if an atom were to be in two places at the same time, it would have two accidents of location, one for each of these two places.[24] But accidents of location are contraries, and therefore only one accident of location may inhere in an atom at a time. Therefore the property that the atom cannot be in two places at the same time is a result of the

[17] Ibn Mattawayh, *Tadhkira*, 56. Also, "An atom must, when it comes into existence, be located in space. The meaning of this is that it comes into existence in such a manner that if another atom was present, it would either be close to it or far away from it. It would be to the left of it or the right of it or in [any] one of the six directions. But it would not be in the same place as the other atom" (Ibid., 62).

[18] Ibn Mattawayh, *Tadhkira*, 109-110. In contrast, man's ability to act is the result of an accident caused in him by God. Therefore man is called *al-qādir li-ma'nā*, namely, the agent whose power of autonomous action derives from the entitative accident of *qudra*.

[19] See above, Chapter Three, 63.

[20] Ibn Mattawayh, *Tadhkira*, 113, 62. Both *makān* and *jiha* are used for place here.

[21] Ibn Mattawayh, *Tadhkira*, 432; *Sharh al-tadhkira*, 71r.

[22] This is the view of the followers of Abū Hāshim. Abū 'Alī, Abū al-Qāsim al-Balkhī, and Abū al-Hudhayl maintained that motion and rest were not accidents of location but were a separate category of accidents (Ibn Mattawayh, *Tadhkira*, 448; *Sharḥ al-tadhkira*, 76v).

[23] Ibn Mattawayh, *Tadhkira*, 433.

[24] Ibn Mattawayh states that Abū Ya'qūb al-Bustānī (who was a contemporary of 'Abd al-Jabbār (al-Jushāmī, *Sharḥ al-'uyūn*, 378)) considered the atom's attribute of spatial occupation and not its attribute of location in space to be the cause of this property. Ibn Mattawayh denies this but considers that the atom's occupation of space and its location in space may both be the causes of this property—"It is possible that this property (*ḥukm*) is caused by the fact that if the atom were in two places (*jihatayn*), then it would occupy space which is larger than its size (*qadrihī*). But since it is characterized by a particular size (*ikhtaṣṣa bi-qadrin*) it is impossible for it to occupy two such spaces because this negates the fact [that it is characterized by a particular size]. It is possible that both causes act together, because each one of them has an effect on this property" (*Tadhkira*, 113).

attribute of spatial location which in turn is grounded in the presence of the accident of location.

C. ARGUMENTS FOR THE EXISTENCE OF ATOMS

We have seen above that perception cannot, strictly speaking, be the ground for knowledge of the existence of atoms for perception only leads to knowledge of the extension of bodies. The Basrian Mu'tazilīs, as indeed all the atomist *mutakallimūn*, therefore needed rational arguments to support their atomism. In his chapter—"On Establishing the Existence of the Atom"—Ibn Mattawayh presents the arguments of the *mutakallimūn*, as well as the objections raised by their anti-atomist opponents and the *mutakallimūn*'s subsequent replies.

Ibn Mattawayh begins by stating the atomist premise, namely, that indivisible atoms are the product of the through and through division of a body:

> In our opinion the division of a body reaches an utmost limit (*ḥadd*) beyond which its further partition and division is impossible. This is the smallest of magnitudes (*aṣgharu l-maqādir*).
>
> Al-Naẓẓām and those who followed him, held that the division does not reach an utmost limit and that [further] division is always possible.[25]

Although the anti-atomist opponents are here indentified as al-Naẓẓām and his followers, there can be no doubt that we must also number the *falāsifa* among them.

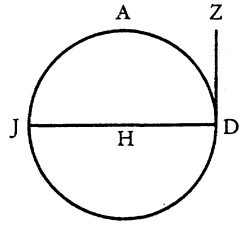
In order to support this atomist premise of the existence of indivisible magnitudes, Ibn Mattawayh turns first to statements by earlier authorities, namely, the Ancient Greeks, which allegedly refer to the existence of indivisible magnitudes:

> The ancients (*awā'il*) have different opinions. Some of them incline to our doctrine in this matter, while others are opposed to it. Abū al-Qāsim [al-Balkhī] has related that they said:
>
> [1] There exists an angle (*zāwiya*) such that nothing [i.e. no angle] is narrower than it. It is impossible for lines to emerge from this angle (*la yaṣiḥḥu ikhrāju l-khuṭūṭi 'anhā*). This shows their affirmation of the existence of the atom, otherwise all angles would have to be equivalent with respect to the emergence of lines from them.
>
> [2] In his book, Euclid mentions that a point has no parts, and that the distance (*bu'd*) from the center of a circle to its circumference is the same in all directions. But if the atom were divisible, then there would surely be infinite distances (*ab'ādun ghayra mutanāhiyatin*).
>
> [3] In the *De Caelo*, Aristotle mentions that a line may be divided lengthwise but not breadthwise, that a surface is divisible in two directions (*jihatayn*), and a body is divisible in three directions. It has also been related that he, and others, held that the line has a single dimension (*bu'd*), the surface has two dimensions, and the body has three dimensions.
>
> Abū Hāshim therefore said: This agrees with what we believe regarding the atom, otherwise, if [the division of a body] were not to reach a limit, then lines and surfaces would be similar to bodies in so far as they[26] would have infinite distances (or dimensions *ab'ād*), and therefore there would be no distinction between them.[27]

[25] Ibn Mattawayh, *Tadhkira*, 162; *Sharḥ al-tadhkira*, 29v.

The claim that evidence for the existence of indivisible magnitudes can even be found in the works of Aristotle and Euclid who are the foremost adherents of continuous geometry is quite fantastic. It can only be understood in the context within which the atomist *mutakallimūn* read the geometrical statements of their continuist opponents, namely, within their own framework of a discrete geometry.

The first report [1] derives from Euclid's *Elements* Book Three Proposition Sixteen (in the Arabic Euclid, this was Proposition Fifteen). In this proposition, the horn angle, which is the angle formed between the arc of a circle and a tangent to the circle, is shown to be smaller than all rectilinear angles. This can be seen in the accompanying figure in which the horn angles ADZ is smaller than any rectilinear angle so that no line from the point of contact D which would intersect with AZ but not also intersect with the circle can be constructed.



Al-Nayrīzī (d. ca. 310/922) who was the author of a commentary on the *Elements*, notes that, "Euclid intended that the angle which is enclosed by the arc JAD and the tangent DZ is smaller than any acute angle because it is indivisible (*li-annahā ghayru munqasimatin*)."[28] There can be no doubt that the *mutakallimūn* seized al-Nayrīzī's statement of the indivisibility of the horn angle without considering how the horn angle could actually be an atom. What was important for them was the acknowledgement of the existence of indivisible magnitudes in geometry.

Ibn Sīnā mentions this argument as one of the proofs (*barāhīn*) cited by the atomists but he recognizes al-Nayrīzī's error and asserts that the horn angle is not indivisible and that what Euclid demonstrates in this Proposition is that no rectilinear angle can be produced from a

[26] Reading *lahā* for *lahum* with MS. Ambrosiana C104, 30r.

[27] Ibn Mattawayh, *Tadhkira*, 162-163; *Sharḥ al-tadhkira*, 29v.

[28] *Codex Leidensis 399,1: Euclidies Elementa ex interpretatione al-Hadschdschadschii cum commentariis al-Nairizii*, eds. P.O. Besthorn and J.L. Heiberg, (Copenhagen,1893-1932), II:70.

horn angle. However, this does not preclude the infinite division of the horn angle by an infinite number of arcs which lie between the arc AD and the tangent ZD and to which ZD is also a tangent.[29] Hence the claim that this proposition of Euclid admits the existence of indivisible magnitudes is without foundation.

The next two citations [2] and [3] which Abū al-Qāsim alleges as evidence for the existence of indivisible magnitudes make sense only when they are considered within the framework of a minimal parts discrete geometry. This is not surprising for how can we expect the atomist *mutakallimūn* who upheld a minimal parts discrete geometry to read these citations from the point of view of a, to them, incommensurable continuist geometry? That is to say, Euclid's definition of the point as that which has no parts, when seen from the perspective of a discrete geometry, refers to a minimal part or atom which is also partless. Indeed, al-Juwaynī's assertion that those who were deeply versed in geometry (*al-muta'ammiqūn fī l-handasa*) were atomists because they defined the atom by the point can only be understood in this light.[30] Similarly, the proposition that the radii of a circle are equal in length when seen within the perspective of a discrete geometry means that these radii must consist of equal numbers of such minimal parts. We may measure the length of these radii by traversing them mentally from the center to the circumference and counting the number of minimal parts traversed. But if these minimal parts were not indivisible but could be further divided, then these radii would consist of an infinite number of these parts and we would be unable to traverse them mentally and count them and therefore measure them. In order then, for the distance to be measurable and therefore consist of a finite number of parts, indivisible parts must exist. This argument is a modification of Epicurus' argument for the existence of minimal parts, namely that we must reject infinite divisibility because we would be unable to traverse the infinite parts of any interval, from one extreme to the other.[31]

The citation of Aristotle's discussion of the line, the surface, and the body [3] which is used to support the existence of indivisible magnitudes must also be taken within the framework of a discrete geometry. For, in a discrete geometry, a line can only be divided lengthwise, a surface can be divide lengthwise and breadthwise, and a body can be divided lengthwise, breadthwise and depthwise. Moreover, in a discrete geometry, a line only has the dimension of length, a surface has the dimensions of length and breadth, and a body has the dimensions of length, breadth, and depth. Abū Hāshim's comment that if a body were continuously divisible then there would be no distinction between lines, surfaces, and bodies reveals that he is reading Aristotle from the perspective of discrete geometry. That is, a line in discrete geometry is a parallelopipe having the dimensions of one minimal unit of breadth and depth and at least two units of length, while a surface is solid having the dimension of a minimal unit of depth but at least two units of length and depth, and a body has at least two units of length, breadth and depth.[32] If such lines, surfaces, and bodies are then considered within the framework of a continuist geometry where they are infinitely divisible, then there can be no distinction between them, for they are all three-dimensional geometrical magnitudes. Moreover, in the context of a discrete geometry, length, or 'distance' is measured by the number of minimal units which comprise it. But in a continuous geometry, the minimal unit of discrete geometry is infinitely divisible, and therefore the lengths or 'distances' of the lines, surfaces, and bodies of discrete geometry are infinite.

Ibn Mattawayh then classifies those who deny the indivisibility of the atom into three groups:

> Those who claimed that the atom is divisible had different opinions:
> [1] Some of them said: The atom is <actually divisible (*bil-fi'li*), meaning that it intrinsically consists of an infinite number [of parts].
> [2] Others said:>[33] It is potentially divisible (*bil-quwwati*), meaning that even though it is a single entity, it is possible for an agent to make many entities out of it.
>
> It is farfetched to conclude that someone who upholds this second doctrine does not believe that the parts of the atom are infinite. Therefore this doctrine, and the previous doctrine are similar. This may be explained by the fact that such a person must believe that the actual performance of the division is possible in order that one may say, "An agent has the power to perform it."
> [3] The same holds if they believe that the division may be imagined. For, if its existence is impossible, then it is impossible to imagine it. Otherwise, if it were possible to imagine something whose existence is impossible, then it should be possible to imagine the combination of two contraries (*ḍiddayn*) [in the same substrate].

[29] Ibn Sīnā, *Mubāḥathāt*, in *Arisṭū 'ind al-'arab*, ed. 'A. Badawī, (Cairo: Maktaba al-Nahḍa al-Miṣriyya, 1947), 171; idem, *al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 186, 201.

[30] al-Juwaynī, *Shāmil*, 143.

[31] Furley, *Two Studies*, 12-14.

[32] I have depicted these diagrammatically in the discussion of the constitution of bodies above, Chapter Four, 95-96.

[33] The text within the square brackets (<...>) has been omitted in the published text but is found in MS Ambrosiana C104, 30r. Therefore the printed text *faflhim man qāla innahu yanqasimu bil-quwwati* should be amended to *faflhim man qāla innahu yanqasimu bil-fi'li bi-ma'nā annahu fī nafsihi ghayru mutanāhin wa minhum man qāla innahu yanqasimu bil-quwwati.*

> When we have shown that the division reaches a limit beyond which it cannot be divided, the doctrines of all those who disagree [with us] will be refuted.[34]

These three groups then consist of those who consider that the atom is actually divisible into an infinite number of parts; those who consider that the atom to be potentially divisible;[35] and those who consider its division to be conceptually but not actually possible. Despite these differences, Ibn Mattawayh shows that these views are equivalent from the perspective of the atomist. Hence, when the atomist has shown that the division of a body reaches an actual limit, then all of these three views will have been refuted.

The first argument for the indivisibility of the atom

Ibn Mattawayh then moves to the first of five arguments formulated by the *mutakallimūn* to establish the indivisibility of the atom. This argument is based on the *mutakallimūn*'s theory of the composition of bodies by means of the accident of adherence:

> The principle (*aṣl*) here is that these bodies are composite (*mu'allafa*) as a result of adhesion (*ta'līf*) regardless of whether the adhesion is due to an entitative accident (*ma'nā*) which is found in two substrates or is a result of [their] contiguity (*mujāwara*). The division of these bodies is possible only because of the presence of adhesion in them. When the adhesion in them is exhausted as a result of separation (*tafrīq*) (which has the property of being the contrary of adhesion), then there remain entities (*a'yān*) which cannot possibly be divided [any further] because they lack adhesion. It does not matter whether the adhesion in them is finite or infinite. The argument (*kalām*) [would still] stand and is not hindered by what we have described [above], because if it were possible for adhesion to be infinite, it would follow that he, who has the ability to accomplish this, would [also] have the ability to accomplish its contrary to the same degree, and therefore bring about the end [of its adhesion] and

[34] Ibn Mattawayh, *Tadhkira*, 163. This may be compared with Fakhr al-dīn al-Rāzī's four-part division of the theories of the composition of bodies:
[a] bodies are composed of a finite number of indivisible parts, as held by most *mutakallimūn*;
[b] bodies are composed of an actually infinite number of parts, as held by al-Naẓẓām;
[c] bodies are not composite, but they are infinitely divisible;
[d] bodies are composite, but their division never reaches an utmost limit beyond which no further division is possible.
Naṣīr al-dīn al-Ṭusī states that al-Rāzī elsewhere attributes the third theory to al-Shahrastānī (d. 548/1153) (*Talkhīs al-muḥaṣṣal*, 183).

[35] Ibn Mattawayh's commentator states that al-Naẓẓām held the view that the atom is potentially divisible (*Sharḥ al-tadhkira*, 29v). This is either an error on his part, or a scribal error in which the second doctrine, rather than the first has been attributed to al-Naẓẓām. Al-Naẓẓām's view, as many others, including Fakhr al-dīn al-Rāzī have noted (see previous note) is that the body consists of actually infinite parts, and this is what compelled him to formulate his theory of the leap (see below, 176-181).

> its exhaustion. If a single atom were to come upon a substrate which contained an infinite number of its contraries [i.e. separations which are contraries of adhesion], it would still remain whole.[36]

This argument, which is also mentioned by Ibn Sīnā, reveals that, in the view of the atomists, it is solely the presence of adhesion which allows for the division of bodies into their parts.[37] Division, then, is

[36] Ibn Mattawayh, *Tadhkira*, 163-164. See also al-Juwaynī, *Shāmil*, 147-148.
An interesting variant of this argument is mentioned by Ibn Ḥazm: "The atomists asked, 'Did anyone else, besides God, compose a body out of its parts?' There is no recourse but to answer yes [only God composed the body out of its parts]. They then asked, 'Does God have the power to divide its parts so that no adhesion is left in it and these parts are incapable of further division or is God incapable of performing this?' They then said, 'If you reply that He is unable, then you make your Lord powerless, but if you reply that He is able, then this is your confirmation of the existence of the atom'" (*al-Fiṣal*, V.225).

[37] Ibn Sīnā states (*al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 184-185):
"Those who believed that bodies [when divided through and through] result in indivisible parts consist of:
[a] Those who take these parts to be bodies themselves;
[b1] Those who take them to be indivisible lines;
[b2] Those who take them to be neither bodies nor lines, nor things which intrinsically have regions (*aqṭār*) or dimensions (*ab'ād*).
The first [a] of these two groups—they are the followers of Democritus, Proclus (*Abrūqilūs*, perhaps *Lūqibūs* for Leucippus, or *A<m>badūqilūs* for Empedocles?), and Epicurus—differ from the correct doctrine because (reading *li-anna* for *anna*) they believe that composition (*tarkīb*) out of these bodies is by contiguity (*tamāss*) alone. [They also believe] that a continuous body never arises out of them, and that sensible bodies are not actually continuous. These primary bodies are actually present in sensible bodies, each one of them distinct from the others. They do not admit physical division, but rather conceptual division. In addition, some of them are smaller and others are larger. The followers of the true doctrine accept that there may be a large sensible body which may not actually have any parts and that there may be parts, which, when, actually formed, may be divisible again. Thus a single thing results from the parts and the specificity of each of the parts is destroyed. Therefore each part does not exist separately.
Let us return to where we were. We say: The followers of Democritus differ from the other atomists because these other atomists do not consider their atoms to be bodies. Each group has its specific arguments (*ḥujaj*). Those who believe in the indivisible part, and that it is not a body, have, as one of their arguments that every body is capable of division. If it is divided then its parts admit of adhesion (*ta'līf*) [again] in the manner in which they had been previously. Since this is the case, then every body must, before division, have adhesion in it. If there were no adhesion in it, then there would be no differences between bodies with regards to the difficulty or ease of splitting (*tafkīk*) them.
They said that this is not because they are of different kinds (*jinsuhā mukhālifun*), where by kind (*jins*) they mean their individual characteristics (*al-tabī'a al-naw'iyya*). They said that the difference [of the difficulty or ease of splitting them] can be attributed neither to differences of agents [who perform the splitting], nor to the absence of something, nor to the [other] possibilities which they mention. Therefore [the differences] must be attributed to adhesion. Thus when adhesion is present in the body, they conceive that its ceasing to exist is not impossible. When adhesion completely ceases to exist then what remains has no adhesion in it, and what has no adhesion in it is not a body because every body is capable of division, and that which has no adhesion in it is indivisible. The principle of this argument derives from Democritus, except that he deviated slightly from it, as will become evident when we turn to his argument."

nothing but the removal of adhesion between the parts which compose a body. When the composition of a body is seen in this way, then its constitution out of indivisible parts follows logically. The conclusion follows, that since the indivisible part does not have any adhesion in it it cannot be divided any further. The indivisibility of the atom is therefore due to the utter solidity or partlessness of the atom which cannot, in any way, be overcome. This argument for indivisibility, then, relies on the role of the accident of adhesion in the formation of bodies. According to Ibn Sīnā, this argument is a modification of an argument by Democritus that the through and through division of a body is possible because parts, which are indivisible by their very nature are produced by the division, and that these parts must be extended in order for the bodies which they form to be extended.[38] The reason for their indivisibility is logical, namely, complete divisibility entails the breakdown of the body into nothing. Simplicius, on the other hand, attributes the indivisibility of the atom to the lack of a void in his account that Democritus, Leucippus, and Epicurus "thought that [the principles] are atomic and indivisible and impassive because of their being massy and having no share of the void; for they said that division comes about by virtue of the void in bodies."[39] It follows then that even though the absence of adhesion does not play a role in the Greek Atomist arguments for the indivisibility of the atom, the place of adhesion is taken by the void. It is conceivable that the modification from

[38] "Those who consider that these finite parts [which result from the through and through division of bodies] are [themselves] bodies are the followers of Democritus. They said: A body is either completely divisible so that no part of it is indivisible or it is not completely divisible. If its nature is such that it is divisible then its division is possible. The existence of such a body need not entail a logical contradiction (*muḥāl*). Rather, its existence may entail an untrue statement (*khidb*) but it need not entail a logical contradiction. Furthermore, an untrue statement which is not a logical contradiction does not entail a logical contradiction. So let us assume that every possible division in the body is actually carried out. Then, the division must either produce nothing, or produce points, or produce indivisible bodies. However it is impossible for the division to terminate into nothing or into points because if the body breaks down into nothing, then the body must have been composed out of nothing, and this is absurd. If the body breaks down into points then the body must have been composed out of points and this too is absurd. Scholars have agreed that no matter how many points are combined together, their size cannot exceed the size of one point, because their contact is whole to whole in such a manner that one point does not cover another by the contact, nor does [the contact of] the points move forward to lead to a composite so that the points occupy space. A continuous [body] cannot therefore arise from them. It follows then that [only the possibility of] the body's breaking down into bodies whose nature is such that they are indivisible except in the imagination or conceptually, remains" (Ibn Sīnā, *al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 186-187). Ibn Sīnā is referring to Aristotle's account of Democritus' argument (*On Generation and Corruption*, I.2, 316a10-317a12).

[39] Simplicius, *De Caelo*, 242, 18 quoted in Barnes, *The Presocratic Philosophers*, 347. See also Lucretius 1.503-98 quoted as text 8B in Long & Sedley, *The Hellenistic Philosophers*, 38.

the argument which Simplicius attributes to the Greek atomists to the *kalām* argument in which the indivisibility of the atom is attributed to the absence of adhesion arises from a change in the conception of the atom. That is to say, for Democritus, atoms had a variety of shapes and sizes and were linked together by mechanical means, by the presence of hooks, convexities, hollow spaces, etc..[40] Is this also Epicurus' view? This is possible, for since Epicurean atoms consist of minimal parts, we may conceive of the atoms of a body to be shaped in such a manner as to fit together like pieces of a jigsaw puzzles, albeit the pieces can only be composed out of minimal parts. But since, in the Epicurean situation, the atoms, being composed of minimal parts, may interlock so as not to leave any space between the atoms, it follows that the body which they form will not have any voids in it, and therefore be indivisible. Such a problem is even more evident in the *kalām* situation where atoms are minimal parts, and the bodies which they form may not have any internal voids. Therefore, by attributing the indivisibility of the atom to the absence of adhesion, the *mutakallimūn* were able to overcome this difficulty.

Ibn Mattawayh tries next to convince us that the composition of a body must be the result of the accident of adhesion which binds its parts together and conversely that its divisibility must be the result of the removal of this adhesion:

> What is required at this juncture is to explain the doctrine regarding adhesion. That is, that divisibility can only be linked (*muta'allaq*) with adhesion. You may, in order to explain this, say: Since it is impossible for divisibility to derive from the atom's being an object (*kawnuhu dhātan*), or the attributes which characterize it (*ma yakhtaṣṣu bihi min al-ṣifati*), or its existence (*wujūd*), or its non-existence (*'adam*), or the agent (*fā'il*) [who creates it], divisibility must derive from the presence of an entitative accident (*ma'nā*) which is [the accident of] separation (*iftirāq*) and the absence (*'adam*) of an accident which is [the accident of] adhesion (*ta'līf*). The reason for this is that anything else besides these [accidents] cannot have any effect on this property [of divisibility]. This shows that when adhesion is absent, then [the body] must already have been divided and rendered into [its] parts.[41] Even if every accident is affirmed to exist and if all these accidents save separation were to inhere in [the atom], it could not be partitioned or divided further. It follows that divisibility and partitioning derive from adhesion and its absence [alone]. [Therefore,] since

[40] Simplicius, *De Caelo*, 295, 1 quoted in Barnes, *The Presocratic Philosophers*, 343. Simplicius' account comes from Aristotle's lost monograph, *On Democritus*.

[41] Ibn Mattawayh's commentator states, "Therefore none of the possibilities remain save that divisibility is due only to the inherence of [the accident of] adhesion in it. Since this has been established, then when adhesion ceases to exist in it, it follows that its further division is impossible and [only] indivisible entities remain" (*Sharḥ al-tadhkira*, 30r).

divisibility depends on the removal of adhesion, the doctrine of he who believes that the atom is potentially and not actually divisible is refuted.

Moreover, since it has been established that it is impossible to divide accidents, non-existent [or possible][42] objects, and God, and the possibility of the division of bodies has been affirmed, such a possibility cannot be attributed to anything other the inherence of adhesion in bodies and the impossibility of its inherence in [these] other objects.[43]

Here, Ibn Mattawayh subjects the phenomenon of divisibility to the categories of *kalām* analysis and reaches the conclusion that it must derive from the presence of the accident of adhesion. Therefore, the claim that bodies are potentially infinitely divisible makes no sense. For, either adhesion is completely removed and indivisible parts, whether finite or infinite are the result, or adhesion has not been completely removed from the body. The claim of the continuist who seeks to defend his position by asserting that there are an infinite number of accidents of adhesion in a body is countered by the response that if God could have put together these infinite parts by means of an infinite number of accidents of adhesion then He can surely remove the infinite accidents of adhesion so that the infinite constituent parts remain.[44] This entire argument is made within the framework of a discrete minimal parts theory. That is to say, indivisible minimal parts of matter, which have spatial extension, combine by virtue of the accident of adhesion with other indivisible minimal parts to form larger units. Once one accepts this framework, it is very hard to argue for a continuist theory of matter.

The anti-atomist may yet object that divisibility derives from extension or does not depend at all on the accident of adhesion. This objection is met as follows:

> If someone raises the objection that the possibility of the division of a body is due to its spatial occupation (*taḥayyuz*), and that spatial occupation is absent in [these] other objects [namely accidents, possible objects, and God, and that this is the reason for their indivisibility] we say to him: We have already affirmed [that the atom] occupies space but [that its] division and partition are impossible. If we were to join six bodies to a body on all its sides and then separate it from them by moving the body to a different place, the extension of the body would still remain despite the impossibility now of separating it from the other bodies. The cause for this is none other than the absence of adhesion at the present time and therefore division and separation are no [longer] possible. In the former situation however, separation was possible because of the presence of adhesion. But spatial occupation is present in both cases. It follows then that the cause [for divisibility] is something other than what they claim.[45]

This argument further illustrates the *mutakallimūn*'s commitment to a framework of discrete parts. The choice of the example of a body which can be separated from the bodies which are joined to it and yet remained extended in both situations reveals the underlying conceptual structure of extended discrete minimal parts. The *mutakallimūn* cannot but conceive bodies as composites of such discrete parts held together by accidents of adhesion. Within this scheme, it is impossible to conceive of further division. This scheme and the anti-atomist continuous scheme are incommensurable ways of looking at the phenomenon of the composition and decomposition of bodies.

The anti-atomist al-Naẓẓām raised a clever objection to this argument, namely, that since the atom can never exist without an inherent accident of location (*kawn*), then why not the same with regards to the accident of adhesion? This objection tries to present the anti-atomist argument in another way, namely, that since the accident of location is always present in matter by virtue of its extension then so must the adhesion be always present in matter, no matter how small the part of matter.

> If someone raises the objection: You have based your doctrine on the possibility that God may remove adhesion from bodies, but we do not assent to this. Rather, we deny that He has power over this, because the atom's embrace of adhesion is like its embrace of the accident of location, or anything else with respect to the dependancy between two entities. Since it is impossible for the accident of location be removed from the atom, then the same is true regarding adhesion. Therefore the premise upon which you base your doctrine is refuted.[46]

[42] *Ma'dūm*, in the view of the Basrian Mu'tazilī *mutakallimūn* stands for possible objects; see above, Chapter Two, note 34.

[43] Ibn Mattawayh, *Tadhkira*, 164-165.

[44] Al-Ash'arī reports that al-Naẓẓām and other anti-atomists denied that God had the power to remove all the adhesion in bodies so that they were separated into their constituent atoms (*Maqālāt*, 567).

[45] Ibn Mattawayh, *Tadhkira*, 165.

[46] Ibid. In Ibn Ḥazm's report of a variant of this argument, the possibility of God having the power to remove all the adhesion in a body is mentioned (see above, note 36). But Ibn Ḥazm has a forceful counter-argument, "This is the strongest of their specious arguments, by means of which they stir up trouble. But it is an argument in favor of us and against them. The answer is, that we say them, 'Your question [about whether God can divide the parts of a body so that no adhesion is left in them] is an empty question (*su'āl fāsid*) and an empty argument. The parts of the world were never separated, and then combined by God, nor were they combined together, and then God separated them. Rather God created the world with everything which is in it by saying to it: Be! and it was, or by saying to every one of its bodies when He wanted to created it: Be! and this body then was. Then God created the combining together of those bodies which He had created separately and which He wanted to combine, so He combined them, and He created the separating of those bodies which He had combined together and wanted to separate, so He separated them. This is the truth, not the empty question by which you summarize and by means of which you instill the delusion into ignorant

This objection is another way of stating that the very fact of extension is the cause for the possibility of division. Therefore, just as the fact of extension entails that the atom must have an accident of location, so must the fact of extension entail that it is capable of further division because of the continuing presence of adhesion. The response of the *mutakallimūn*, as one would expect, is to show why accidents of location are unique so that they can never be removed from atoms. Ibn Mattawayh thus states:

> We reply: The atom's embrace of the accident of location is necessary (*wājib*) because it cannot exist without occupying space, and it cannot occupy space without being located in space, and this cannot be realized except by means of an accident of location. This is what necessitates the atom's embrace of the accident of location. This is not the case with adhesion because, were the atom to embrace adhesion [for the same reason] then it would be impossible for the atom to move in space while its adhesion remained the same, just as it is impossible for the atom to move while its accident of location remains the same. Since it is necessary for the accident of location to cease to exist [when the atom moves], it would also be necessary for adhesion to cease to exist. But we know that this is not true.[47]

On the face of it, this seems to be rather a weak argument. However, it too must be evaluated within a discrete minimal parts framework. An atom at rest has an accident of spatial location which is specific to its location. Now, when that atom moves, this specific accident must be destroyed and replaced by another accident of location. Similarly, if adhesion were like the accident of location, the same would apply to it. Therefore, if a body were to move, it would disintegrate because its accidents of adhesion, which were specific to the locations it was in, would be destroyed in the process of motion. But this is a weak point in Ibn Mattawayh's account for not only, as we shall see below, were the *mutakallimūn* forced to concede that a body disintegrates in the process of circular motion but also an anti-atomist could surely easily have countered such an argument.[48]

people that God combined together the parts of the world which, when He created them were separate. This is false because it is a claim without any evidence to support it. There is no difference between someone who says that God combined together the parts of the world which were previously separated and between someone who says that God separated the world from parts and that it was only one [of these] parts, because both are worthless claims without any evidence to support them, neither scriptural nor rational. Rather, the Qur'ān contains a text which refers to the subject at hand in which God says, 'When We wish to create something, We but say: Be! to it, and it is'" (*al-Fiṣal*, V:225).

47 Ibn Mattawayh, *Tadhkira*, 165.

48 See below, 178-180.

Having shown then that the accident of location has no logical connection to the presence of adhesion, the argument, in order to be complete, must also consider whether the other attributes of the atom, namely existence and the essential attribute of the atom have a logical connection to adhesion so that one can categorically deny that the existence of the atom is dependent on the accident of adhesion just as one denies that it is dependent on the accident of spatial location.

> As for the atom's dependence on [the accident of] adhesion in order to exist, this is absurd. The reason for this is that adhesion is dependent on the atom for its existence, so how can the atom be dependent on adhesion [for its existence]? This would entail that each one of them is dependent on the other in the same manner, and this is false.
>
> Even more far-fetched than this is to maintain that the atom's essential attribute is dependent on adhesion given the fact that the essential attribute is independent of any cause.
>
> It follows then, that if this is all sound, then there cannot be any kind of logical connection (*ta'alluq*) between the atom and adhesion which would make it impossible for the atom to be devoid of adhesion. Therefore what we have stated above has been substantiated.[49]

Even though Ibn Mattawayh does not attribute this argument for the divisibility of the atom on the basis of the composition of bodies by the accident of adhesion to any person, there is no doubt that it is, in its most basic form, to be attributed to Abū al-Hudhayl. To begin with, Ibn Mattawayh claims that Abū al-Hudhayl was the first person to affirm that adhesion is an accident which inheres in two substrates.[50] But even stronger evidence for attributing this argument to Abū al-Hudhayl is found in al-Ash'arī's report that:

> Abū al-Hudhayl believed that it is possible that God may separate a body and annihilate the combination (*ijtimā'*) in it so that it becomes atom[s]. The atom has neither length, nor breadth, nor depth, nor combination, nor separation.[51]

We may note here that Abū al-Hudhayl uses the term 'combination' (*ijtimā'*) in place of 'adhesion' (*ta'līf*) of the later *mutakallimūn*. Apart from this difference, Abū al-Hudhayl's view that combination is a feature of bodies and other aggregates of atoms, and that atoms do not have length, breadth, depth, combination, or separation, is consistent with a minimal parts interpretation of his doctrine which has been sketched in the previous chapter.

49 Ibn Mattawayh, *Tadhkira*, 166.

50 Ibid., 503.

51 al-Ash'arī, *Maqālāt*, 314.

The second argument for the indivisibility of the atom

There can be no doubt about the author of this second argument for the indivisibility of the atom for Ibn Mattawayh directly attributes it to Abū al-Hudhayl:

> One of the arguments by means of which we prove [the indivisibility of the atom] is the argument which Abū al-Hudhayl formulated against al-Naẓẓām. The principle here is that someone who traverses some distance which has a half, cannot traverse this half until he has first traversed half [of this half]. Since this half in turn has a half, then the same applies here. This being the case, if an ant were to creep over a sandal, it could never traverse the sandal because the parts of the sandal would be infinite. The ant cannot complete the traversal of a part of the sandal except by first traversing its half, and so on *ad infinitum*. The connection of one part of the sandal to another part, with regards to its traversal, leads to the fact that the ant can never commence the traversal. This is similar to someone whose entry into a door is connected to his previous entry into another door, so that he cannot enter any one of the doors. Al-Naẓẓām responded to this argument by the doctrine of the leap (*ṭafra*) and claimed that the ant traverses one part and leaps over another part.[52]

This is the classic argument for the existence of indivisible magnitudes which derives from Zeno's dichotomy paradox. Ibn Sīnā, recognizing this, tells us that the ancient atomists used the example of Achilles the runner and the tortoise, while the modern atomists (*muḥaddithūn*), namely the *mutakallimūn*, use the example of the ant traversing the sandal.[53] The use of Zeno's paradoxes as arguments for atomism is pointed out by Aristotle in his discussion of Democritus' argument for the existence of indivisibles. In this argument, Democritus had considered the through and through division of the body, and had concluded that if the absurd consequence that the ensuing parts of the body being through and through divided no longer have magnitude and must be like points was to be avoided, then indivisible magnitudes must exist. Aristotle suggests that such a through and through division can be conceived by first bisecting the body in half, and then each half in half, and so on.[54] Even though the division here applies to both halves and not a single half as in Zeno's Dichotomy paradox and in Abū al-Hudhayl's argument of the ant and the sandal, the two situations are otherwise identical.

[52] Ibn Mattawayh, *Tadhkira*, 169. See also al-Juwaynī, *Shāmil*, 144-146; al-Ījī, *Mawāqif*, VII:9-11.

[53] Ibn Sīnā, *al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 185-186. Furley discusses the connection between the Eleatics and the Atomists in his *Two Studies*, 79-103.

[54] This argument is discussed in detail in Sorabji, *Time, Creation, and the Continuum*, 336-341.

Ibn Mattawayh's statement of the argument itself is quite clear, but the atomist conclusion that the way out of this paradox is to posit the existence of indivisibles is implied, but not stated. Rather, the anti-atomist position of al-Naẓẓām that the motion must consist of leaps is mentioned in order to show the absurdity of denying this implied conclusion. The doctrine of leaps or *ṭafra*, which made al-Naẓẓām notorious, holds that it is possible to traverse a distance without going through all the parts which comprise it, but rather leaping over such parts.[55] Ibn Mattawayh then makes the point that Hishām al-Fuwaṭī (fl. first half of third/ninth century), who "also followed the doctrine of al-Naẓẓām regarding the atom" abandoned this doctrine when faced with the option of embracing the doctrine of leaps. Hishām strengthened the argument against the doctrine of leaps even further by stating that if this doctrine were true, then if the legs of the ant had been steeped in ink before the commencement of its motion, there would be a discontinuous track rather than a straight line.[56]

The anti-atomist and *kalām* critic Ibn al-Rāwandī (d. ca. 298/910) refused to accept both horns of this paradox, namely, that the ant's traversal can be accomplished because the sandal consists of indivisible parts, or because it leaps over some parts and traverses the others. He countered the argument by stating that the ant, like the sandal, also consists of infinite parts. Therefore its traversal of the sandal is possible. What is impossible is the traversal of a span consisting of infinite parts by an object consisting of finite parts. However, the traversal of a span consisting of infinite parts by an object consisting of infinite parts is valid. Ibn al-Rāwandī's alternative is akin to Aristotle's answer to Zeno's dichotomy paradox, for Aristotle distinguishes between infinite divisibility and infinite length. While Aristotle considers it appropriate to deny the traversal of an infinite length, he considers it possible to traverse a finite, but infinitely divisible length provided that time is likewise infinitely divisible.[57] Ibn Mattawayh ridicules Ibn al-Rāwandī's alternative:

> By this objection he certainly turns the argument against himself, because he had initially accepted that the impossibility derives from the span to be traversed, but now he has transfered the impossibility to both the span to be traversed as well as the traverser. That is to say, if the ant is infinite

[55] Ibid., 384-393; Josef Van Ess, *Theology and Science: The case of Abū Isḥāq al-Naẓẓām*, (Ann Arbor: Center for Near Eastern and North African Studies, University of Michigan, 1978), 6-9; see also below, 176-181.

[56] Ibn Mattawayh, *Tadhkira*, 169. I am grateful to Professor van Ess for identifying Hishām as Hishām al-Fuwāṭī on the basis of the parallel text in Ibn al-Murtaḍā's *Dāmigh al-awhām*, MS. British Museum Or. 3807, f. 19a.

[57] Sorabji, *Time, Creation, and the Continuum*, 322.

> [in its parts] then it cannot traverse by half of its body until it has traversed by half of this, and so on. Therefore the ant can never become the traverser nor the sandal the span traversed, and therefore the logical necessity is certain and the impossibility is strengthened.[58]

In a sense Ibn Mattawayh, if his representation of Ibn al-Rāwandī's objection is correct, has a valid point. For Ibn al-Rāwandī does not, like Aristotle, raise the question of the divisibility of time, but instead considers the infinite divisibility of the ant.

The Greek origin of this argument can be recognized in the pseudo-Aristotelean treatise *On Indivisible Lines*:

> According to Zeno's argument there must be a magnitude without parts, if it is impossible in a finite time to touch an infinite number of things one by one, and if it is necessary that anything that moves arrives at the half-way point first, and if there is a half-way point in everything that is not without parts.[59]

The *kalām* version of this argument, namely the argument of the ant and the sandal, which is by Abū al-Hudhayl, is strikingly similar to its Greek counterpart and suggests that Abū al-Hudhayl, or an earlier intermediary in the transmission of Greek atomism transformed the abstract argument which we find in *On Indivisible Lines* into the more concrete argument of the ant and the sandal. Moreover, the Greek argument correctly points out that the difficulty of traversal arises only when the time of traversal is finite, or when time is not infinitely divisible. It follows that al-Naẓẓām's acceptance of the consequence that a body consists of an infinite number of parts, but that its traversal in finite time is possible because some of its intervals are leaped, shows that he must have, like the atomist *mutakallimūn* who were his opponents, held a theory of discrete time or time atoms.

The third argument for the indivisibility of the atom

Ibn Mattawayh then discusses a third argument for the existence of indivisible atoms which he attributes to Abū 'Alī al-Jubbā'ī:

> One of the arguments by means of which we prove that division reaches a limit is the argument mentioned by Abū 'Alī. He said, "The void (*farāgh*) which comes upon the isolated atom encompasses it. Something which is in this situation must be finite, because, as we have shown, the production of the infinite is impossible."[60]

[58] Ibn Mattawayh, *Tadhkira*, 170.
[59] Pseudo-Aristotle, *On Indivisible Lines*, 968a18ff.
[60] Ibid.

This argument, even though it may be abbreviated in Ibn Mattawayh's account,[61] is a bad argument. For it denies the infinite divisibility of a body by asserting that that atom is indivisible because it is surrounded by a void. Without further information about how the presence or absence of the void inhibits or encourages the division of a body, we cannot consent to the premise that the the void somehow prevents the continued division of the atom. Perhaps, this argument derives from Democritus' argument that atoms are indivisible because of the absence of a void, for it is only the presence of a void which allows us to cut a body into its constituent parts.[62] However, as we have seen in the first argument for the indivisibility of the atom, in *kalām* atomism, the accident of adhesion plays the role of the void in the possibility of the separation of the parts of a body.

The fourth argument for the indivisibility of the atom

Ibn Mattawayh's fourth argument is also attributed to Abū 'Alī al-Jubbā'ī:

> He also said: Since smallness and largeness are a result of the scarcity or abundance of atoms, and since people hold that the mustard seed must be similar to a large mountain insofar as each one of them does not reach a limit but that further division is [always] possible, then they must both be equal with regards to their number [of parts], and they must both be equal in so far as each one of them has an infinite number [of parts]. However, an infinite cannot exceed an infinite[63] nor can it be larger than it. But, it is necessarily known that the mountain is greater and larger than a mustard seed. Thus their doctrine led them to reject something which is known necessarily.
>
> Abū 'Alī and others, forced them to accept the consequence that it would be possible from a single mustard seed to produce [parts] which would would cover the world [entirely], or to produce from it parts which, when placed one on top of the other would reach the clouds in the sky. But in both of these cases the opposite is known [to be true], for it has been established with regards to something which conceals another thing and is a cover to it, that it must be equal to the other thing in size and measure. Whoever rejects this is being absurd.[64]

[61] Ibn Mattawayh's commentator does not add any further information (*Sharḥ al-tadhkira*, 31r).
[62] See above, 154.
[63] Reading *wa mā lā nihāyata lahu lā yazīdu 'alā mā lā yatanāhī* for *wa mā lā nihāyata lahu lā yazidu 'alā mā yatanāhī* with MS Ambrosiana C104, 32r.
[64] Ibn Mattawayh, *Tadhkira*, 170-1; see also al-Juwaynī, *Shāmil*, 146; al-Ījī, *Mawāqif*, VII:20. Ibn Sīnā also mentions this argument: "They said that if a body were divisible without limit, then it would follow that the mustard seed could be divided into parts which would entirely cover the surface of the earth and they said that if a body were divisible without limit the mustard seed would, with respect to its parts, be equal to the parts of a large mountain" (*al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 186).

As Pines has shown, several variants to this argument can be found in *kalām* works.[65] Moreover, the general form of the argument, namely that larger objects must have more parts than smaller objects had already been made in the pseudo-Aristotelean work *On Indivisible Lines* (968a2-9), and also by, as Pines notes, Lucretius and Plutarch. Lucretius states:

> Besides, unless there is going to be a minimum, the smallest bodies will consist of infinitely many parts, since half of a half will always have a half and there will be nothing to halt the division. In that case, what is the difference between the universe and the smallest thing? None. For however utterly infinite the whole universe is, the smallest things will nevertheless consist equally of infinitely many parts. Since true reasoning protests against this and denies that the mind can believe it, you must give in and concede the existence of those things which consist of no parts and are of a minimum nature. Since these exist, you must admit that those things too [the atoms] are solid and everlasting.[66]

and Plutarch states:

> Yet how can it fail to be self-evident that man consists of more parts than man's finger and the world than man? This is understood by and appreciated by all, provided they have not become Stoics, but on becoming Stoics they say the opposite, and believe that man does not consist of more parts than his finger, nor the world than man. For division pulverizes bodies to infinity, and among infinities there is no more or less.[67]

It is clear that both of these citations are quite close to the general form of Ibn Mattawayh's fourth argument. The main difference is the *kalām* use of the example of the mountain and the mustard seed, which, since it is also found in the first century A.D. Indian author Kaṇāda, has led to speculation that the origins of *kalām*'s unextended atoms lie in Nyāya-Vaiśeṣika atomism.[68] But since, as we have shown above, the atoms of *kalām* are akin to Epicurean minimal parts and are to be understood in the context of a discrete geometry, this speculation can be laid to rest and only the use of the example of the mountain and mustard seed needs to be explained. It is interesting to note that Kaṇāda does not refer to 'a large mountain' but to Mount Meru and that in Ibn Mattawayh's commentator's version of this argument Abū 'Alī al-Jubbā'ī refers to Mount Danbāwand.[69] On the one hand, this

[65] Pines, *Beiträge*, 13, note 1.

[66] Lucretius, *De Rerum Natura*, I:215 ff. quoted as text 9C in Long & Sedley, *The Hellenistic Philosophers*, 40-41.

[67] Plutarch, *On Common Conceptions*, 1079a quoted as text 50C in Long & Sedley, *The Hellenistic Philosophers*, 38.

[68] Pines, *Beiträge*, 113-114.

[69] This is a reference to Mount Damāwand, which is the highest point in the Alburz mountains of Northern Persia, and the scene of the legendary history of many of the heroes of the *Shāhnāma* (M. Streck, "Damāwand" in *Encyclopaedia of Islam*, new ed., II:106-107).

reference strengthens the case for an Indian origin for this example, but on the other hand it is also reflects a possible Iranian intermediary or adaptation of the Indian argument, or even the not so interesting possibility that Ibn Mattawayh's commentator adapted this argument for his local readers.

This argument, like the first and second arguments for the divisibility of the atom must also be attributed to Abū al-Hudhayl. However, unlike the first and the second arguments, this argument does not depend on a discrete minimal parts atomism. Al-Ash'arī records that Abū al-Hudhayl believed that "it is possible to divide a mustard seed (*khardala*) into two parts, then four, then eight, until [the division reaches a point where] every part is indivisible."[70] Moreover, al-Naẓẓām's response to Abū al-Hudhayl on the question of the difference between the number of parts of a mustard seed and a mountain is preserved in al-Khayyāṭ's *al-Intiṣār*, namely that half of the mountain is larger than half of the mustard seed, and so on for every step of the division.[71] Ibn Mattawayh's attribution of this argument to Abū 'Alī al-Jubbā'ī is therefore incorrect.

The fifth argument for the indivisibility of the atom

Ibn Mattawayh's final argument would not have been very convincing to his anti-atomist opponents because it relies on the Basrian Mu'tazilī theory of the primary attributes of the atom, in particular, the doctrine that the atom has a specific location in space because of the inherence of a particular accident of spatial location (*kawn*). Ibn Mattawayh states:

> If the division [of the body] continues without end or limit, then the body must have an infinite number of atoms of location (*akwān*). Otherwise by the presence of a single accident of location it would be impossible for what is infinite [with respect to its number of parts] to move. This would entail the impossibility of our trying to move any body whatsoever, because of the ensuing need for the creation of an infinite number of accidents of location in it. If we were able to accomplish this, then there would be no difference in the motion of a light and a heavy body, and there would be no difference between the respective abilities of two agents [to move bodies].[72]

This argument can apply only to someone who assents to the framework of a discrete space as understood by the Basrian Mu'tazilī

[70] al-Ash'arī, *Maqālāt*, 314-315.

[71] al-Khayyāṭ, *al-Intiṣār*, 34.

[72] Ibn Mattawayh, *Tadhkira*, 171.

mutakallimūn. For, the location of an atom in space is attributed to the existence of an accident of spatial location. Its subsequent motion is therefore defined as the succession of an accident of spatial location which is the contrary of the previous accident of spatial location.[73] Now if the body were continually divisible, then it must, according to this theory of location, have an infinite number of accidents of location. But this entails that any attempt to move the body will require the creation of an infinite number of contrary accidents of location, and therefore its motion would be impossible. Moreover, since the speed of motion depends on how many atoms of a body are in motion and how many are at rest,[74] which in turn depends on the accidents of location of these atoms, it follows then that if the accidents of location of a body were infinite, there could be no differences in speed. Hence the motion of light and heavy bodies would be equivalent as would motion produced by stronger and weaker agents. Since, however, an opponent of atomism would not have given his assent to the premise that spatial location derives from the inherence of an accident in each part of a body, this argument does not have the force of the first, second, and fourth arguments for the indivisibility of the atom.

On the basis of this analysis of the Basrian Mu'tazilī's main arguments for the existence of atoms which are listed by Ibn Mattawayh, we may conclude that the major *kalām* arguments for atomism have their origins in the arguments of the Greek Atomists. But these arguments were adapted and transformed by the early *mutakallim* Abū al-Hudhayl for an atom which consists of one minimal part instead of an atom which consists of several minimal parts as in Epicurean atomism. Moreover, the arguments also reveal that the minimal parts atomism within the context of a discrete geometry was upheld by the early *mutakallimūn*. These arguments, therefore, provide additional evidence for the thesis that minimal parts atomism is not a product of the reformulation of the terms and premises of *kalām* atomism by Abū Hāshim and his followers. This is the reason why the arguments for the indivisibility of the atom which were formulated by the early *mutakallimūn* continued to be the arguments which were used by the later *mutakallimūn*.

[73] See above, 146-148.
[74] See above, Chapter Four, 138.

D. DIFFICULTIES RAISED BY ATOMISM

A discussion of the epistemological basis of atomism would not be complete without a discussion of how the Basrian Mu'tazilīs answer the difficulties (*shubah*) posed by atomism which are raised by their opponents. Ibn Mattawayh devotes an entire section to answering these difficulties. Such difficulties, he tells us, belong to three categories: conceptual difficulties (*'aqliyyāt*), difficulties regarding geometrical figures (*ashkāl*), and difficulties which are raised by al-Naẓẓām's doctrine of the leap.

Conceptual difficulties posed by atomism

The *first conceptual difficulty* which was raised by opponents of atomism regards the atomist doctrine of the possibility of the contact of one atom with six other atoms. This, the opponents argue, entails the conceptual divisibility of the atom, for each of the six sides (*jihāt*) of the atom is then distinct.[75]

The origins of this objection to atomism lie in Aristotle's first argument against atomism (*Physics*, 231a21-30). Aristotle asserted that it is impossible for a continuous magnitude to consist of indivisibles, for example for a line to consist of points. In order for indivisible magnitudes to form a continuous, magnitude their extremities must become one, but the extremities of an indivisible cannot become one because *an indivisible cannot have an extremity as distinct from any other part* (231a26). Epicurus, as we have seen above, answered this challenge by maintaining that an indivisible magnitude must have dimension, and therefore the indivisible in Aristotle's example of the line is not a point but a magnitude of the same dimension as the line itself.[76] However, this Epicurean formulation still leaves itself open to the objection that the indivisible cannot have an extremity nor any other distinguishable part because it is conceptually indivisible, which is precisely the difficulty under discussion here. But, such an objection is only valid in a continuous geometry and not in a discrete geometry.

The Basrian Mu'tazilī response to this difficulty divides along the line of the ancients and the moderns. The moderns, namely the fol-

[75] Ibn Mattawayh, *Tadhkira*, 187; A variant of this difficulty is raised by Ibn Sīnā, "If the sun illuminates a sheet of atoms, or if [some other] condition arises on one side, then it follows that the other side must have the same condition, or that we say that the sheet does not really have two sides and that the light which falls upon one side, and the side which does not face the sun is the same side. When one side is seen then so is the other since they are one. There is no this side and that side. Therefore a spectator on one side sees the sheet which is illuminated from the other side" (*al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 190). See also al-Ījī, *Mawāqif*, VII:20-22.
[76] See above, Chapter Four, 102.

lowers of Abū Hāshim al-Jubbā'ī, hold that the possibility of the atoms being in contact with six other atoms derives from the spatial extension of the atom, and as a result, an accident which does not occupy space can never be in contact with another accident. The spatial extension of the atom also entails that the atom has sides, even when no other atoms are in contact with it, because the attribute of spatial extension must always be present when the atom exists. This response therefore admits that the atom has sides, and that just as the extremities of a body are included within the body, or the number one is included in the number ten, the sides of the atom belong to the atom and cannot be separated from it and therefore be considered as somehow distinct from the atom itself.[77]

The ancients on the other hand, namely, Abū al-Hudhayl, Abū 'Alī al-Jubbā'ī, and Abū al-Qāsim al-Balkhī believed that the atom is in contact with another atom by its side, but, they held that the side of the atom was something other than the atom (*ghayru l-jawhari*), just as the extremity (*ṭarf*) of a body or the edge (*ḥadd*) of a body is something other than the body. "By something other than" (*ghayr*), Ibn Mattawayh tells us, "they meant the atoms which touch the atom, and in this manner, when the atom is isolated it has no sides."[78] This response then tries to meet the difficulty by denying that the atom in isolation has sides which can be conceptually distinguished from the atom. These sides can only exist when the atom is in contact with other atoms, and then the sides are these other atoms, so that our act of conceptually distinguishing the side of the atom is equivalent to distinguishing the atoms with which it is in contact, and this is legitimate.

The difference between the position of the ancients and moderns, then, revolves around the meaning of 'side'. Since side is an extremity, it must, according to the Epicurean formulation of extremity, have dimension. This means that the side must be a minimal part which in the *kalām* case is an atom. Therefore, the position which is consistent with a discrete minimal parts geometry denies the concept of side as an edge, because this is a concept of continuous geometry, but rather maintains that the side is an extremity which has dimension. As we have seen above, the ancients were strict adherents of the discrete minimal parts geometry, denying magnitude and shape to the atom, and hence also sides. The moderns, on the other hand, were not such consistent adherents of the discrete minimal parts geometry, and just as

[77] Ibn Mattawayh, *Tadhkira*, 188-189; al-Nīsābūrī, *Masā'il*, 59-60.

[78] Ibn Mattawayh, *Tadhkira*, 188-189; al-Nīsābūrī, *Masā'il*, 60. See Chapter Four, note 24 for al-Naẓẓām's reports on the various doctrines regarding the sides of the atom from his work *On the Atom*.

they upheld that the atom has size and shape, they also upheld that it has sides. Consequently, Ibn Mattawayh regards the difference between the ancients and the moderns to be one of the manner of expression (*'ibāra*), because the ancients also believed that the possibility of the contact of an atom with another atom derives from a characteristic property of the atom, which, in the doctrine of the moderns is its spatial occupation, namely, its spatial extension.

The *second conceptual difficulty* against the atomist doctrine is the difficulty raised by al-Naẓẓām who had argued that if the atom does not intrinsically have length, it cannot then have length when joined with another atom which also does not intrinsically have length. This difficulty, like the first difficulty, is valid only in a continuous geometry, for in a discrete geometry, linear dimension requires at least two minimal parts or atoms. Hence, Ibn Mattawayh answers:

> This difficulty has no foundation whatsoever because, the referent of 'length' is that which is constituted in a specific manner. It cannot then be denied that two atoms become lengthy by the joining of the one to the other by virtue of the inherence of the accident of adherence in them both, even though neither one of them has length in itself, for the inherence of the accident of adherence in one atom by itself is impossible.[79]

Ibn Mattawayh then gives examples of how two entities which do not have a certain property may combine together and then have this property in order to illustrate how two atoms which do not in themselves have length may combine to form a unit with length. Thus a letter of the alphabet which does not, by itself, convey any information may be joined to another letter and the two of them together may then form a word which conveys information. Similarly, a triangle may be joined to another triangle and they both may form a square etc..

The *third conceptual difficulty* concerns the power of God. If God is capable of unlimitedly enlarging bodies by combining them together, then He must also be capable of unlimitedly making them smaller by dividing them.[80]

The seriousness of this challenge to *kalām* atomism is very evident in the more detailed account by Ibn Ḥazm:

> We say to the atomists, "Does God have the power to divide each atom (*juz'*) and to divide every part of the parts of a body without limit or not?"
>
> If they reply, "He does not have power over this," then they have made their Lord powerless and they have become unbelievers. This is their doctrine, not an interpretation (*ta'wīl*), nor a consequence (*ilzām*) [of it]. However, they are afraid of some of the people of Islam and they

[79] Ibn Mattawayh, *Tadhkira*, 189.

[80] Ibid.

therefore disguise all of their errors in affirming the existence of the atom. If they were to state that God has power over this, then they would be true believers and would return to the truth which is our doctrine and the complete opposite of their doctrine.

We do not categorically oppose them regarding the parts of fine flour, namely that no created creature in this world has the ability to divide it into its parts. But we do oppose them in this matter [i.e. regarding the division of the atom], for, we believe that God has power over that over which we do not have power. But they believe that neither they nor God has power over this, but God transcends far beyond what the wrong-doers believe.

Their doctrine regarding the finitude of God's power over the division of parts is that God's creative [activity] reaches a magnitude beyond which He is unable to exceed and that at this point He remains powerless, but God transcends far beyond such a thought. Upon my life! Abū al-Hudhayl, the leader of those who affirm the atom, must have had an intense hankering for this doctrine, for he announced that whatever God had complete and absolute power over, if it were to actually transpire, God would not after this[81] have the power to put something at rest in motion, nor to bring to rest something in motion, nor accomplish anything whatsoever. Then he recognized his unbelief, so he said, "But this eventuality will never be realized."

He was asked, "What is the obstacle which prevents this eventuality from being realized or the limit which restrains it even though the action can occur? There is no doubt that with the passage of time this eventuality will be reached!"[82]

This difficulty illustrates the utter conceptual disparity between those who believe in a discrete geometry and those who believe in a continuous geometry. The question of whether God can divide the minimal part has no meaning in a discrete geometry because the very concept of the minimal part in this system is such that it cannot have any parts! As we shall see, this is precisely Ibn Mattawayh's response to this difficulty. But this answer cannot satisfy someone who sees this difficulty from the perspective of a continuous geometry, because to him, there can never be a minimal part. Therefore, God must have the power to continually divide any part of matter. Abū al-Hudhayl's attempt is therefore valiant, but doomed to fail because of the incommensurability of the two geometries.

Ibn Mattawayh's response, as one would expect, is to consider this difficulty to be frivolous, for it makes no sense within a discrete geometry. He thus states:

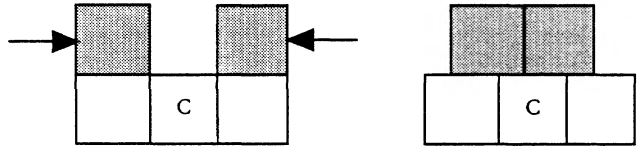
[81] Reading *ba'dahu* for *ba'da* (with the Beirut reprint edition of Ibn Ḥazm's *al-Fisal fī al-milal wa al-ahwā' wa al-niḥal*, (Beirut: Dār al-Fikr, 1980), V:95. All other references to this work are to the edition by M. Naṣr and 'A. 'Umayra, (Jedda,1982)).

[82] Ibn Ḥazm, V:226.

This is the epitome of a weak argument, because there can be no cause (*'illa*) which can bring these two things together. When the argument (*dalāla*) which shows that no magnitude smaller than the atom can exist has been made, it is not possible to attribute God with the power to diminish its size, because to have power over something impossible is impossible. The argument here is therefore similar to the possibility of increasing the accidents of the color black [in a body] even though it is impossible to divide the accident of the color black itself.[83]

The *fourth conceptual difficulty* is attributed to Ibn al-Rāwandī who states that since every number necessarily has a half, a third, a fourth, a sixth, etc., then so must a number of atoms, for example ten. Since this is not the case, then the atomist hypotheses must be false. This is a weak objection, and is so treated by Ibn Mattawayh who responds that this necessity does not apply to indivisibles like the atom. Similarly, the objection that a line constituted out of an odd number of atoms cannot be divided into two equal halves is not a serious objection.[84]

The *fifth conceptual difficulty* mentioned by Ibn Mattawayh examines the minimal parts of space. A line consisting of three atoms has two atoms on top of the end atoms of the line as in (a) below:



Now if two agents push the two top atoms towards each other, then each of the atoms would move until they come into contact over the middle of the atom C. Because the atoms are solid and cannot interpenetrate, they come to rest over the atom C in such a manner that C is conceptually divided into parts which are smaller in magnitude than the atom.[85]

We have already encountered this argument above in the discussion of the minimal parts of space, time, and motion in the context of whether an atom can be placed on the boundary of two atoms.[86] Ibn Mattawayh states that this difficulty does not pose a problem for those atomists who believe that it is possible for an atom to be placed on the boundary of two atoms, namely atomists who deny that space is discrete. On the other hand, those atomists who uphold a discrete mini-

[83] Ibn Mattawayh, *Tadhkira*, 189-190. Hence it is possible for God to increase the number of atoms in the world but it is impossible for Him to divide the atom.

[84] Ibid., 190-191; See also al-Juwaynī, *Shāmil*, 163.

[85] Ibn Mattawayh, *Tadhkira*, 191-192. See also al-Ījī, *Mawāqif*, VII:23-24.

[86] See above, Chapter Four, 128.

mal part conception of space must deny the possibility of the motion of one of the two atoms, because, if it were possible for an atom to be placed at the boundary of two atoms, this atom would have two contrary accidents of location.[87]

Of the five conceptual difficulties which are discussed by Ibn Mattawayh, the first regarding the side of the atom; the second regarding the formation of an aggregate having length from constituents which do not in themselves have length; and the third regarding the power of God over the continued division of a body; belong to the third/ninth century period of Abū al-Hudhayl and al-Naẓẓām. These difficulties and the solutions which were posed in response to them are consistent with a discrete minimal parts atomism. Moreover, in the case of the first two difficulties, a minimal parts atomism provides a much better interpretation of the difficulty as well as the solution, than does a theory of unextended atoms. We should also note that the fourth difficulty which is attributed to Ibn al-Rāwandī is probably one of several arguments he may have posed against *kalām* atomism.

Geometrical difficulties posed by atomism

Difficulties posed by geometrical figures (*ashkāl*) were also raised by the opponents of atomism. Ibn Sīnā, for one, states:

> The existence of indivisible atoms entails that there can be no circle, right-angled triangle, nor many other geometrical figures, for in the case of the circle, the outer perimeter will be greater than the inner perimeter with which it is in contact. But what is in contact must equal that with which it is in contact, and cannot be greater. As for the right-angled triangle, when two of its sides are both ten units long, its hypotenuse must equal the square root of two hundred. But this is impossible [in the atomist system] and cannot exist, for if it were possible, atoms would be divisible, but they are not divisible.[88]

Such geometrical difficulties constitute a major portion of Ibn Sīnā's refutation of atomism and are obviously the result of the differences between the discrete geometry of minimal parts atomism and continuous Euclidean geometry.

Ibn Mattawayh tells us that the *mutakallimūn* must either answer these geometrical difficulties or be forced to accept the rational arguments (*al-dalīl al-'aqlī*) of their opponents. However, he recognizes that there can be no direct answer because of the incommensurable geometries and therefore the utterly different premises on which the

[87] Ibn Mattawayh, *Tadhkira*, 192. I have discussed the role of the accident of location above, 145-147, 157.

[88] Ibn Sīnā, *al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 190.

objection and its intended target are formulated. He regards the situation here, then, to be "analogous to the ambiguous verses of the Qu'rān (*al-āyāt al-mutashābiha*) whose meaning is contrary to reason because we cannot deny what is established by rational arguments, but we must seek an interpretation (*ta'wīl*) which is in agreement with the text." Hence while accepting the logical soundness of the geometrical objections of his opponents, Ibn Mattawayh nevertheless reminds us that, "Much of what they adduce regarding these difficulties is built upon premises to which [we do] not [give our] assent,"[89] namely the premises of Euclidean geometry.

Ibn Mattawayh list seven geometrical difficulties. The *first geometrical difficulty* regards the geometrical property that the diagonal of a square is larger than its sides (we have already discussed this situation in another context).[90] The anti-atomist argues that in the square which has been depicted here, an equal number of atoms constitute both the side mnop as well as its diagonal dgjm. But this raises a problem for it is obvious that the diagonal appears longer than the side. The reason for this is, in the view of the atomists, is that the atoms which constitute the diagonal are in contact vertice to vertice (*bi-arkānihā*). However, the anti-atomist is quick to then raise the problem that this entails the existence of a magnitude smaller than the atom, namely, its vertice![91]

a	b	c	d
e	f	g	h
i	j	k	l
m	n	o	p

Ibn Mattawayh responds that in the view of the *mutakallimūn* the reason why the diagonal seems longer than the side is that it is not a straight line, but rather an oblique line (*'alā ḥaddi l-ta'rībī*), and it therefore contains interspersed gaps and fissures. As a result, it appears

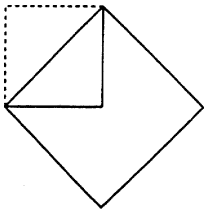
[89] Ibn Mattawayh, *Tadhkira*, 193.

[90] See above, Chapter Four, 129.

[91] Ibn Mattawayh, *Tadhkira*, 193; *Sharḥ al-tadhkira*, 34r. Ibn Sīnā also states this geometrical difficulty. But he first considers a right angle triangle whose sides are ten units long so that its hypotenuse is $\sqrt{200}$ units long. Since the hypotenuse cannot therefore be constituted out of an integer number of atoms such a triangle is either impossible or the atom must be divisible. In response to this difficulty, the atomists state that vision is mistaken (*al-baṣaru yukhṭi'u*) because the hypotenuse is not a straight line, but is serrated (*muḍarrasa*). Ibn Sīnā then describes the atomist construction of a square whose sides are four atoms long and the difficulty of the diagonal also being four atoms in length. He ridicules the notion that the diagonal seems larger because it is serrated and contains interspersed gaps and fissures, for the gaps and fissures can contain parts smaller than the atom and therefore the diagonal need not contain any gaps and fissures nor be serrated. It is clear that Ibn Sīnā cannot but conceive this geometrical problem within the Euclidean continuous geometry for he rejects the central premise of the minimal parts discrete geometry, namely, that an atom can only be in contact with six other atoms (*al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 190-193).

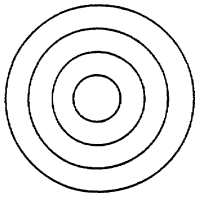
to be longer. If the diagonal were a straight line without gaps and fissures, then the diagonal would be the same length as the square.

But the anti-atomist comes back with a clever counter-example. If this square were turned around by fourty-five degrees, then half the diagonal would become the side and the side would become the diagonal. Hence, what had formerly been a straight line has now become oblique and what had been oblique has become a straight line. What then is the difference between this situation and the former one?[92]



Ibn Mattawayh responds that it is not impossible for the arrangement of the atoms which constitute the diagonal and the side to change with the rotational motion so that the side which is now the diagonal and which had previously been a straight line has now become an oblique line. As we shall see later in the discussion of difficulties raised by denying the doctrine of leaps, the *mutakallimūn* acknowledged that rotational motion raised difficulties for the adhesion between parts of bodies and that these parts changed position in the course of such motion.[93]

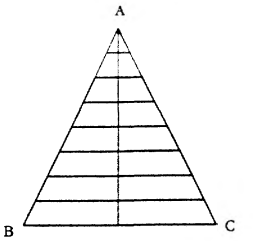
The *second geometrical difficulty* considers the property of the circle to contain all its inner circles which have the same center as it does.



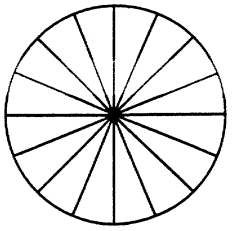
The process of forming these inner circles must reach the point when the circle is an atom which must also encompass the inner circles within it. This entails that magnitudes smaller than the atom must exist.

This difficulty can be brushed of very easily by simply stating that there is nothing for the atom to encompass, and therefore the premise of encompassing inner circles no longer applies.[94]

The *third geometrical difficulty* considers an isosceles triangle ABC which is bisected by a perpendicular to its base. The sides AB and AC of such a triangle are larger than the perpendicular and therefore the parts of the side must be greater than the parts of the perpendicular. It must be possible to construct equidistant lines which are parallel to the base BC which intersect the sides AB and AC and the perpendicular. But since the sides have more parts, the segment formed by the intersection of two of these lines with a side consists of more parts than in the segment formed by their intersection with the perpendicular. Therefore when the segment formed at the side consists of an atom, the segment at the perpendicular is smaller than this.

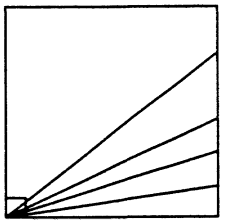


Ibn Mattawayh responds that in the view of the *mutakallimūn*, the sides of the triangle are not straight lines but are oblique and therefore serrated. A straight line, on the other hand, cannot be oblique, nor circular, nor an arc, for it can only be a lengthwise composite. This being the case, the sides of this triangle must have gaps, and therefore the segment at the sides and at the perpendicular must consist of the same number of atoms, as in the case of the diagonal of a square and its sides.[95]

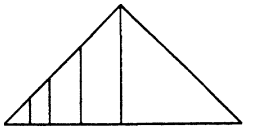


The *fifth geometrical difficulty* considers a circle, at the center of which is an atom. Since an infinite number of radii can be constructed from this center to the circumference, the atom must be divisible.

The *sixth geometrical difficulty* arises when a square has an atom at one of its corners. Since it is possible to construct many lines from this corner, the atom must be divisible.



The *seventh geometrical difficulty* regards a triangle which has been bisected into two by a perpendicular. The line after this perpendicular must be shorter and so on until at the extremity of the triangle we reach a line which is one atom long and the therefore the next line must be shorter than an atom.



Ibn Mattawayh does not respond individually to these last three geometrical difficulties, but consider the crux of the difficulties to be the atomist premise that an atom can at the most be in contact with six other atoms, namely its shape as a cube, which as we have seen above, derives from the minimal parts discrete geometry of the atomists. The difficulties which are raised by opponents of atomism are based on axioms of continuous Euclidean geometry, in which the indivisible part is a point which can be in contact

[92] Ibn Mattawayh, *Tadhkira*, 193-194. Cf. Pseudo-Aristotle, *On Indivisible Lines*, 970a11-14.

[93] See below, 178-180.

[94] Ibid. Al-Juwaynī discusses the more interesting question of whether the circle is possible at all since its circumference would be serrated (*Shāmil*, 163-165).

[95] Ibn Mattawayh, *Tadhkira*, 194-195.

with more than six other points.[96] Hence, these geometrical difficulties derive from the application of the premises of continuous geometry to a minimal parts discrete geometry and this is invalid.

Unlike the case regarding the conceptual difficulties he mentions, Ibn Mattawayh does not attribute these seven geometrical difficulties to any person and we cannot therefore ascertain when they were formulated. Perhaps this uncharacteristic lack of attribution indicates that these mathematical difficulties were not raised by persons who belong to the Islamic period. Since the pseudo-Aristotelean treatise *On Indivisible Lines* is largely devoted to the geometrical difficulties which arise as a result of indivisible magnitudes it is quite likely that the difficulties mentioned by Ibn Mattawayh (which are not found in this treatise) may have been raised during the Hellenistic period.

Difficulties posed by the doctrine of the leap

In the discussion of the second argument for the indivisibility of the atom, we have seen that al-Naẓẓām's answer to the paradox of the motion of the ant over the sandal was to postulate the doctrine of the leap (*ṭafra*), namely, that the ant does not traverse the entire length of the sandal, but leaps over some of its parts.[97] Ibn Mattawayh tells us that by leaps, al-Naẓẓām meant that "the body is at the second instant in the tenth location without having traversed through the intervening locations."[98] That is to say a body which is in some location can, at the next instant, move to another location without traversing the intervening locations by leaping from its previous location to its next location. Since al-Naẓẓām believed that the body consists of an infinite number of parts, he had to hold that the ant does not traverse over all the infinite parts, of the sandal and that it leaps over some parts and traverses the others. His adoption of this theory of leaping motion implies that al-Naẓẓām must further hold the doctrine of time atoms, that is to say that the ant has a finite number of instants in which to traverse the sandal, otherwise he could have adopted Aristotle's solution that since both the time of traversal and the interval to be traversed are infinitely divisible, the motion can take place, albeit Aristotle regards the divisibility to be potential and not actual.[99]

[96] Ibn Sīnā also recognizes that this is the crux of the disagreement (see above, note 91).

[97] See above, 160-162. Sorabji has suggested that al-Naẓẓām did not actually hold the theory of the leap but used it primarily against the atomism of his contemporaries (*Time, Creation, and the Continuum*, 387). Whether or not this was his actual intent, the atomists were forced to counter the theory of the leap and the challenges which al-Naẓẓām presented by the use of this theory.

[98] Ibn Mattawayh, *Tadhkira*, 197.

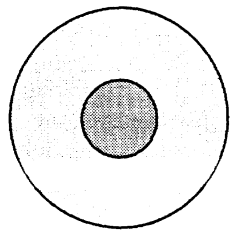
Ibn Mattawayh illustrates the general problem with the doctrine of the leap by an absurd consequence:

> If the doctrine of the leap were true, then it would be possible that someone who is in Basra at the present time will be in China at the next instant without traversing the [intervening] places, but rather by leaping and passing on [from the one place to the other] (*yaṭwā*).[100]

Ibn Mattawayh also lists other absurd consequences, for example this entails that we can dispense with our legs for we would not need to traverse the intervening space between our current and intended locations. Moreover, we would have the ability to see behind walls because the visual ray could leap from one side of the wall to another without going through the wall! Similarly, a prisoner could not be confined to a prison because he could leap to the outside, etc..[101]

But al-Naẓẓām also uses the theory of the leap to raises a number of serious difficulties which the atomists have to answer—difficulties, which are a consequence of the minimal parts discrete geometry and which he himself avoids by the doctrine of the leap. These are the difficulties which merit the serious attention of the atomists.[102]

The *first difficulty* is the difficulty of the millstone. Suppose the inner circle of a millstone, as depicted below, has a circumference of ten atoms and the outer circle a circumference of a hundred atoms. When the millstone rotates, the smaller inner circle must complete its rotation in the same time as the larger outer circle.



Al-Naẓẓām draws the conclusion that the inner circle of ten units must always traverse its distance while the outer circle of a hundred units must traverse some distances and leap over others, otherwise for every atom traversed by the inner circle, the outer circle must traverse ten atoms.[103]

[99] See above, 161; al-Juwaynī, *Shāmil*, 144.

[100] Ibn Mattawayh, *Tadhkira*, 197. See also al-Juwaynī, *Shāmil*, 145.

[101] Ibid., 197-198.

[102] I therefore only discuss the difficulties raised by use of the doctrine of the leap which were used to refute atomism here.

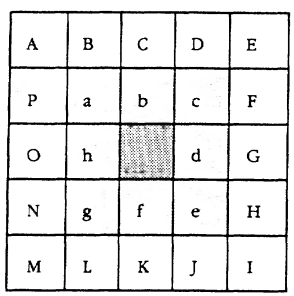
[103] Ibn Mattawayh, *Tadhkira*, 198-199; al-Juwaynī, *Shāmil*, 436; See also Sorabji, *Time, Creation, and the Continuum*, 387-390. Ibn Sīnā mentions this difficulty without attributing it to al-Naẓẓām, "The early outsiders [obviously a reference to the Muslim atomists who were non-Greeks—*awwalun ... min al-khārijīn*] who were like Epicurus constructed an example of the two circles, a circle close to the edge of a rotating millstone, and a circle close to the center. They mentioned that if an atom which was on the

Ibn Mattawayh's answer is to state that atoms on the outer circle move for nine time-atoms and then rest for a time-atom, while atoms on the inner circle move for one time-atom and rest for nine time-atoms.[104] The motion of the one circle is interspersed by a period of rest in which the other circle moves. This is the reason why the outer circle moves faster than the inner circle.

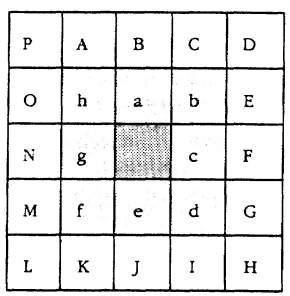
This answer raises a further difficulty which al-Naẓẓām was quick to exploit:

> The reason [for the differences in speed] which you have mentioned cannot stand because, when two bodies are contiguous and then one of them moves and the other remains at rest, then their separation must take place. This entails the scattering of the atoms of this millstone and its disintegration (*tafakkuk*).[105]

This can be illustrated in the diagram below where for the sake of simplicity, the millstone has been depicted as a square rather than a circle for the analysis must be undertaken from the perspective of discrete geometry:



(a) Beginning of motion



(b) After one time atom

circumference moved at the same speed as an atom at the center, then both must simultaneously traverse the same distance. It is impossible for the atom at the center to remain at rest because it is must be joined to another atom. They explained that the atom at the center moves but its leaps are smaller while the atom at the circumference moves with larger leaps so that it traverses a greater distance than the atom at the center.

Since the early outsiders who have mentioned the [theory] of the leap were horrified (*istashana'a*) but were compelled to accept this consequence, they refused to accept that a continuous motion could be faster than any other motion without the presence of interspersed rest [in this latter motion]. This requires that they must consider that the atom which lies at the center has more periods of rest than the atom at the circumference" (*al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 187).

[104] This must be incorrect, although it is found in both MS Ambrosiana C104, 36v, and *Sharḥ al-tadhkira*, 34v, for the inner circle will complete its motion in a hundred time atoms (of which ninety time atoms would have been times of rest) while the outer circle will, in the same period, have moved a distance of ninety atoms and have rested for ten time atoms, and therefore not have completed one revolution as the inner circle.

[105] Ibn Mattawayh, *Tadhkira*, 199; Ibn Sīnā, *al-Shifā' al-Ṭabī'iyyāt: al-Samā' al-Ṭabī'ī*, 188; al-Ījī, *Mawāqif*, VII:24-25.

Let us suppose that this figure which consists of an inner ring and outer ring rotates in a clockwise direction around the atom at the center. At the beginning of the motion, the corner atom A in the outer ring has no contact with atom h, atom B is in contact with the top side of atom a, atom C is in contact with the top side of atom b, atom D is in contact with the top side of atom c, and the corner atom E is in contact with the top right corner of atom c. After one time-atom has passed, each atom has moved one space. Now atom A is in contact with the top side of atom h, atom B is still in contact with the top side of atom a, atom C is in contact with the top side of atom b, and atom D is in no longer contact with the top side of atom c. Therefore some of the atoms no longer adhere to the same atoms, but have new partners and therefore the configuration of the parts of the body has been altered, or in al-Naẓẓām's words, the body has disintegrated in the course of the motion. The situation is even worse when, as in the case of the millstone, both rings move at the same *rotational* speed, for example when both rings complete a rotation in twenty-four time atoms. In this case each atom in the outer ring needs to move two positions for every position moved by an atom in the inner ring. In the formulation of the atomist *mutakallimūn*, this is equivalent to two moments of motion and a moment of rest for atoms in the outer ring, and two moments of rest and a moment of motion for atoms in the inner ring. It is interesting to note that this argument relies on a theory of discrete space (although the atoms themselves need not be extended), otherwise the distance travelled by the inner and outer atoms need not be the same and the difficulty does not arise. This is another indication that the early *mutakallimūn*, in particular Abū al-Hudhayl, who was the target of this argument by al-Naẓẓām, must have held a theory of discrete space.

The atomist response, as presented by Ibn Mattawayh, was to concede the separation of the atoms but to deny their scattering, because "these atoms are in one sense joined and in another sense separate." This formulation, which is attributed to Abū al-Qāsim al-Balkhī, draws an analogy with the rotational motion of mustard seeds in a salt-shaker, some of which are separate from others, while other seeds are joined to others. The mustard seeds do not scatter because the salt-shaker surrounds them and prevents their scattering. But, Ibn Mattawayh tells us, if the accidents of humidity and dryness which are present in the millstone were to be found among the mustard seeds, there would be no need for the salt-shaker to prevent their scattering, or in other words, the accidents of humidity and dryness in the millstone hold the rotating millstone together despite the disintegration of its internal structure as a result of the rotation. Other analogies of

restricted movement include the movement of the twigs of a tree, etc..[106]

In order to minimize the concession of the disintegration of the body, Ibn Mattawayh then tries to argue that even the doctrine of the leap entails the disintegration of the body but not its scattering. The reason for this is that, according to al-Naẓẓām, the difference between the atom in the inner circle of the millstone and the atom in its outer circle is that the outer atom leaps and reaches the tenth location at the second instant while the inner atom only reaches the second location at this time. The atoms must then separate and such a separation of the atom[107] is granted by the atomists. If the subsequent scattering of the body is not then entailed when the atom leaps, then how can it be entailed in the former case of the interspersed moments of motion and rest?[108]

This counter-argument is nonetheless defective. Because al-Naẓẓām is not an atomist, the leap can be as large or as small as necessary so that every part of the rotating millstone remains contiguous to the same part at the next instant. Hence the separation of the atom does not occur at all. Nonetheless, the atomist's reply reveals his difficulty in conceiving that the magnitude of the leap can vary in a continuous fashion, a difficulty, which is the consequence of his adherence to a doctrine of discrete space.

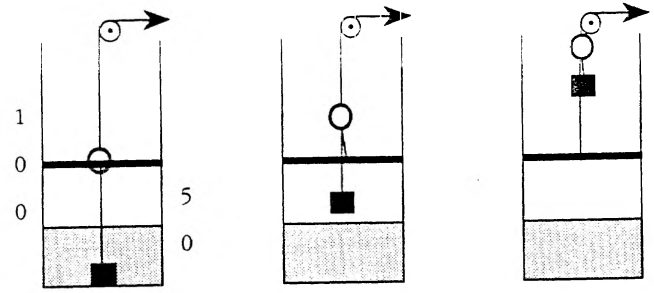
The *second difficulty* which the doctrine of the leap poses for atomism is al-Naẓẓām's example of the well and the bucket. A well which is 100 units deep has a beam at the depth of 50 units. One end of a rope which is 50 units long is attached to this beam. The other end of the rope is attached to a bucket at the bottom of the well. At the top of the well is a rope which is 50 units long and has a ring at its end through which the rope at the bottom of the well passes. When we pull out 50 units of the rope with the ring, the bucket which had been at the bottom of the well is now at its top having moved the entire length of the well, that is 100 units. Since we only pulled out 50 units of the rope with the ring, the bucket must traversed 50 units but leaped the remaining 50 units![109] Or, and this is the difficulty which the atomist who denies the leap must face, for every atom traversed by the bucket, the ring must traverse half an atom.

[106] Ibn Mattawayh, *Tadhkira*, 200.

[107] Reading *fa-qad tafakkaka mā balagha* for *fa-qad tafakkaka bi-'ablaghi* (?) with MS Ambrosiana C104, 37r.

[108] Ibn Mattawayh, *Tadhkira*, 200.

[109] Ibid., 202; van Ess, *Theology and Science*, 8-9; al-Ījī, *Mawāqif*, VII:27-28.



Ibn Mattawayh responds, "If the bucket leaps [50 units], then these spaces [which it has leaped] cannot have color or other accidents, and since this is not true, then his claim of leaping is false." As his commentator explains, what he means to say is that if the bucket were dipped in ink (in the manner of the ant over the sandal), it would trace a continuous path which would reveal that no leaps had taken place. This is an embarrassingly poor counter-argument on Ibn Mattawayh's part. Nor is his explication that both the ring and the bucket traverse 100 units, except that the ring traverses 50 units lengthwise and 50 units breadthwise in a to and fro motion any better.[110] Quite clearly the atomists were stumped by this difficulty and could not find a way to apply their doctrine of moments of motion and moments of rest.

The difficulties raised by the opponents of atomism which have been presented above mostly belong to the early period of *kalām* cosmology. Leaving aside the mathematical difficulties which are not attributed to any person and which may derive from Late Antiquity, three of the five conceptual difficulties and both of the difficulties arising as a result of the doctrine of the leap originate in the discussions of al-Naẓẓām with his uncle Abū al-Hudhayl. Many of these difficulties are best understood within the framework of a discrete minimal parts atomism. The only other difficulty which is attributed to a person is the fourth conceptual difficulty of Ibn al-Rāwandī. It would seem then that in the eyes of the later tradition, al-Naẓẓām and Ibn al-Rāwandī were anti-atomists who challenged the prevailing discrete minimal parts atomist doctrine which was held by most *mutakallimūn*.

[110] Ibn Mattawayh, *Tadhkira*, 202-203; *Sharḥ al-tadhkira*, 35r. Ibn Mattawayh also tries to answer another difficulty posed by al-Naẓẓām in the same manner. In this situation, a stick which is resting upon a wall is pulled by its bottom end on the ground in such a manner that the distance that the bottom end traverses is larger than the distance traversed by the top of the stick resting on the wall. Ibn Mattawayh claims that this too is a result of the top end of the stick traversing the same distance as the bottom end except that it traverses this distance both lengthwise and breadthwise.

CHAPTER SIX

HELLENISM AND KALĀM COSMOLOGY

We have, in the course of the examination of *kalām* physical theory in the previous chapters, encountered several specific instances of the influence of Hellenistic doctrines in general, as well as arguments in support of these doctrine in particular, on the physical theories of the *mutakallimūn*. In this final chapter, the influence of Hellenism on *kalām* physical theory will be considered from a wider perspective. In particular, the two distinct phases of the appropriation of Hellenistic doctrines into *kalām* physical theory, namely the appropriation of Hellenistic doctrines during the late second and early third/late eighth and early ninth centuries when *kalām* physical theory was in its nascent stage, and the appropriation of Hellenistic doctrines during the late third and early fourth/late ninth and early tenth centuries will be contrasted. The major difference between the two phases is that during the later phase, Hellenistic physical theories were accessible in Arabic through the translation of texts from Greek or Syriac into Arabic.

A. EARLY KALĀM AND THE PHYSICAL THEORIES OF THE DUALISTS AND NATURAL PHILOSOPHERS

In *kalām* accounts of physical theories in the late third/eighth century, the Dualists and the 'Natural Philosophers' (*aṣḥāb al-ṭabā'i'*) figure prominently. No doubt, in their polemic against the Dualist views of the former and the doctrine of the eternity of the world of the later, the early *mutakallimūn* were drawn to the examination of the cosmological doctrines of these two groups. These cosmological doctrines, perhaps in a distorted fashion, were then included in the reports of early *kalām* heresiographers, in particular the *Maqālāt*s of Abū 'Īsā al-Warrāq (d. 247/861) and Abū Ya'lā al-Mismā'ī (d. 278/891). While the works of these heresiographers have not been preserved, fragments from them which are included in later works reveal to us the early *kalām* perspective on the physical theories of their contemporaries or near-contemporaries from among the Dualists and 'Natural Philosophers'.

'Abd al-Jabbār quotes extensively from al-Warrāq's account of the Dualists and other early writers in volume five of the *Mughnī* which is devoted to a refutation of the doctrines of the Dualists, Magians, Christians, and Ṣabians. He has preserved the cosmological views of specific Dualists of the late second/eighth century which are reported by al-Mismā'ī:

> Al-Mismā'ī has related that Ibn Abī al-Awjā' held the doctrine of the Dualists, but he held the specific view that each of the two principles [of light and darkness] is divided into five senses. The sense which perceived colors is not the same as the sense which perceives tastes, while the sense which perceives tastes is not the same as the sense which perceives odors.
>
> He mentioned that ['Abd Allāh] ibn al-Muqaffa' held the specific view that light had only sought to regulate darkness and to mingle with it because this would lead to a more suitable outcome for light. He denied the absurd myths about the conflict between the two principles which were related by the Manicheans. He affirmed [the existence of] motions and that they are not the same as the entities [in motion]. He claimed that the motion of the two realms [of light and darkness] is natural and the motions of light are good while the motions of darkness are evil.
>
> He mentioned that Nu'mān the Dualist (he is the one who was put to death by al-Mahdī)[1] held the specific view which denied [the existence of] motions in the manner of the Dualists. He claimed that bodies are divisible into indivisible atoms (*al-juz' alladhī lā yatajazza'*), and that the atom is a long, broad, and deep body, either of the substance (*jawhar*) of light or of darkness.
>
> ...
>
> He related that Abū Shākir [al-Dayṣānī (d. 180/796)][2] held the views of Ibn Dayṣān. He affirmed [the existence of] motion claiming that it is an attribute of the body in motion, and that it is neither the body in motion nor is it something other than it. He denied that motion is either a thing or a not a thing. He believed that [the predicate] 'being other than' and the proposition that 'it is a thing' apply only to bodies, but that motion is not a body. Hishām ibn al-Ḥakam appropriated this theory of motions from him.
>
> He related that Ghassān al-Ruhāwī[3] held the views of the Manicheans but he claimed that motions are minute bodies (*ajrām liṭāf*) which inhere in the moving body. They are permanent entities which do not vanish.[4]

'Abd al-Jabbār also quotes al-Warrāq's more general account of the Manichean theories of matter and its attributes:

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[1] Monnot identifies him as Nu'mān ibn al-Mundhir on the basis of al-Jāḥiẓ, "Ḥujaj al-nubuwwa," in *Rasā'il al-Jāḥiẓ*, (Cairo,1933), 145 (Monnot, *Penseurs Musulmans et Religions Iraniennes: 'Abd al-Jabbār et ses Devanciers*, (Paris: J. Vrin, 1974), 68; van Ess, *Theologie und Gesellschaft*, I:442-443).

[2] van Ess, *Theologie und Gesellschaft*, I:437-439.

[3] Not much is known about him (Monnot, *Penseurs*, 65; van Ess, *Theologie und Gesellschaft*, I:442-443).

[4] 'Abd al-Jabbār, *Mughnī*, V:20-21.

> The *mutakallimūn* have related that they denied [the existence of] accidents. But al-Warrāq mentions in his book, and he [himself] was a Dualist, that they are divided into three groups. One group denies [the existence of] accidents, another affirms that they are real entities (*a'yān*) which belong to bodies, while a third claims that they are attributes which cannot be said to be the body nor something other than the body.[5]

The origins of two of the physical theories of early *kalām* can be recognized here. The first of these is the theory which denies the existence of accidents, that is, is the Stoic-inspired theory that only bodies constitute the world, which al-Warrāq attributes to a group of Dualists in general. In another place, al-Warrāq attributes a similar Stoic-inspired physical theory to the Natural Philosophers. In their view, all of the objects in the world, including secondary qualities like sounds and odors are the result of the mixture of the five elements of hot, cold, wet, dry, and pneuma (*rūḥ*).[6] As we have seen above, the view that there are no accidents and that only bodies constitute the world was held by Hishām ibn al-Ḥakam (d. 179/795?), al-Aṣamm (d. 200/815), and in a modified form by al-Naẓẓām (d. 220-230/835-845) for he held that motion is the only accident. Richard Sorabji has suggested that the Stoic doctrine of the corporeality of secondary qualities, on which this view is ultimately based, is nuanced and does not mean that these secondary qualities are themselves corporeal but rather that they are *dispositions* of bodies.[7] Perhaps it is this more nuanced view which is evident in the Abū Shākir al-Dayṣānī's position that motion is neither the body in motion nor other than it. Moreover, for our discussion here, it is also significant to note that Hishām ibn al-Ḥakam is said to have appropriated his theory of motion from Abū Shākir. Thus the proximate origins of this *kalām* physical theory are Dualist while its remote origins are Stoic.

The second Dualist theory which is recognizable in early *kalām* is the theory that accidents are real entities which inhere in bodies and therefore, that both accidents and bodies constitute the world.

[5] 'Abd al-Jabbār, *Mughni*, V:11. Al-Ash'arī also reports: "Abū 'Īsā al-Warrāq related that among the Dualists, some affirm that the accidents of motion, rest, and other actions are not bodies; some claim that they are attributes of bodies which are neither bodies nor something other than bodies; while others denied and refuted their existence claiming that there is neither motion, nor rest, nor action apart from the two principles [of light and darkness]' (*Maqālāt*, 349).

[6] M. McDermott, "Abū 'Īsā al-Warrāq on the *Dahriyya*," *Mēlanges de l'Universite Saint-Joseph*, 50(1984), 390. Al-Warrāq's account has been preserved in the *Mu'tamad fī uṣūl al-dīn* of the Mu'tazilī Rukn al-dīn Maḥmūd ibn Muḥammad ibn al-Malāḥimī (d. 536/1 141). The text of this work has been published by W. Madelung and M. McDermott (Beirut,1991), but I have not been able to obtain it. I have examined this report in further detail in my "Minimal Parts," 86-110.

[7] Sorabji, *Matter, Space, and Motion*, 89-93.

Al-Warrāq attributes this theory to another group of Dualists. In early *kalām*, this is the theory which was held by Abū al-Hudhayl and others. However, unlike the Dualists, the *mutakallimūn* in question were atomists. But atomism, as is clear in al-Mismā'ī's account was also known to the Dualists, and in particular held by Nu'mān, despite his otherwise Stoic-leaning view rejecting motions as accidents. Atomism was well-known to Dualism and had been combined in a eclectic manner with the Stoic position of the corporeality of secondary qualities by Bardaiṣān.[8] For our discussion of *kalām* physical theory, it is significant that Nu'mān, under the name Nu'mān the Manichean, is reported to have met and debated with Abū al-Hudhayl.[9]

What was the atomistic doctrine of Nu'mān? On this question, we unfortunately have no further information. But a doctrine of the composition of lines, surfaces, and bodies, which is very similar to the one which was held by the early atomist *mutakallimūn*, in particular Mu'ammar, is found unexpectedly in Muḥammad ibn al-Muqaffa''s (fl. 142/759) commentary on Aristotle's *Categories*.[10] Ibn al-Muqaffa' states:

> The constitutive element (*aṣl*) of a body (*juththa*) is a surface (*basīṭ*) and the constitutive element of a surface is a line (*khaṭṭ*). When a line is joined to another line then in addition to length, breath is produced in it and it is a surface. When a line is joined to a surface, then in addition to length and breadth, depth is produced in it and it is a body. All of these fall under the category of quantity because of the possibility of their measurement. As for the constitutive element of the line it is a point, for, when a point is joined to another point it becomes a line.[11]

This doctrine, which is unexpected as a Peripatetic account of the formation of these geometrical magnitudes, is remarkably similar to, and consistent with, what has, in the previous chapters, been termed the minimal parts discrete geometry and is indeed the first account of it in an Arabic text.[12] It is not unlikely that the doctrine which Ibn al-Muqaffa' states was held by some of his contemporaries, perhaps even Nu'mān. Possibly, through their acquaintance with the holders of such a doctrine, Abū al-Hudhayl and other early *kalām* atomists appropriated the minimal parts discrete geometry as well as the arguments which have been mentioned in Chapter Five which they used in

[8] H. Drijvers, *Bardaiṣan of Edessa*, (Gronigen: Van Gorcum, 1966), 137.

[9] van Ess, *Theologie und Gesellschaft*, I:443.

[10] Ibn al-Muqaffa', *al-Manṭiq li-ibn al-Muqaffa'*, ed. M.T. Dāneshpazhūh, (Teheran, 1978). Dāneshpazhūh maintains the traditional attribution of these logical commentaries to 'Abd Allāh ibn al-Muqaffa' (d. 139/756) despite the argument of Paul Kraus in his "Zu Ibn al-Muqaffa'," *Rivisita degli Studi Orientali*, 14(1933), 1-14 (see also van Ess, *Theologie und Gesellschaft*, II:27).

[11] Ibn al-Muqaffa', *al-Manṭiq*, 13.

[12] See above, Chapter Four, 95, 97-98.

support of atomism. It would seem then that the proximate origins of *kalām* atomism are Dualist while its remote origins are Epicurean.

The third early *kalām* physical theory which was held by Ḍirār ibn 'Amr (d. 220/815), Ḥafṣ al-Fard (fl. 195/810), and Ḥusayn al-Najjār (d. ca. 220-230/835-845) holds that accidents are the only constituents of the world and that bodies are bundles of properties. Richard Sorabji has shown that this doctrine has its roots in Greek Antiquity but that it played an important role in Neoplatonism and Christian theology.[13] Hence the proximate origins of this theory are probably Neoplatonic.

In his *On First Philosophy*, the third/ninth century *faylasūf* al-Kindī had proclaimed, "we ought not to be ashamed of appreciating the truth and of acquiring it wherever it comes from, even if it comes from races distant and nations different from us."[14] There can be no doubt that by this statement al-Kindī was appealing to his contemporaries to accept the works of Greek philosophers like Aristotle whose texts were being translated into Arabic in his lifetime. The translation of Greek philosophical and scientific texts represents one of the routes of the transmission of Hellenistic learning into Arabic and hence into Islamic civilization. The institutional framework and patronage within which these translations occurred as well as the titles of the texts translated gives us a very good idea of the manner and content of this kind of transmission of Hellenistic learning.

In the case of the physical theories of early *kalām*, we have an entirely different kind of transmission of Hellenistic learning. Here the transmission was not a translation of texts, but a transmission of ideas. Moreover, these ideas are not ideas from the Peripatetic and Neoplatonic textual tradition of Late Antiquity, but they are ideas which belong to Stoic and other Hellenistic traditions which had survived in an eclectic manner in the physical and cosmological doctrines of the Dualists and Natural Philosophers. Needless to say, the textual origins of these ideas were remote, or even obscure to the *mutakallimūn*, in large part because of the successful manner in which they had been naturalized by various intermediary intellectual and religious movements. While we can, from our vantage point, detect traces of Stoic or Epicurean doctrines in the fragments of the early *mutakallimūn*, we cannot ascribe them to the *mutakallimūn*'s familiarity with Stoic or Epicurean texts, for not only can we not presume that these texts had somehow survived to the second/eighth and later centuries, but to further entertain the notion that these texts were in a language which was accessible to the *mutakallimūn* is far-fetched

[13] Sorabji, *Matter, Space, and Motion*, 44-59.

[14] al-Kindī, *Fī al-falsafat al-'ūlā*, 103 translated in Ivry, *al-Kindi's Metaphysics*, 58.

indeed. Rather, the problem of the constituents of the world, the problem of the attributes of these constituents, the problem of the nature of life, and the problem of causality, which were the major topics of interest for *kalām* cosmology, were also problems which had engaged the Hellenized contemporaries or near-contemporaries of the early *mutakallimūn*. Moreover, these Hellenized contemporaries and near-contemporaries, who were members of Dualist sects or were Natural Philosophers had expressed different and sometimes opposing solutions to these problems. We can, to some degree, locate the origin of the early *mutakallimūn*'s theories of the constituents of the world and of their attributes in such solutions by their Dualist and Natural Philosopher contemporaries. We can be reasonably sure that in the course of their discussion and contact with these contemporaries, the *mutakallimūn* appropriated the theories of the constituents of the world and of their attributes with which they are associated.[15] Hence it is through such an oral transmission of an eclectic jumble of Hellenistic doctrines that the arguments, examples, and doctrines which are attributed to the early *mutakallimūn* were appropriated, moulded, and ultimately naturalized.

B. THE DEVELOPMENT OF KALĀM PHYSICAL THEORY TO THE FIFTH/ELEVENTH CENTURY

In the previous section we have seen the coexistence of three theories of matter and its attributes during the late second and early third/late eighth and early ninth centuries. At this early period, all three theories were theologically appropriate and there is no evidence to suggest that any one of these three theories was thought to be antithetical to basic Islamic beliefs. Moreover, there is abundant evidence of interaction and debate between the proponents of these three theories in surviving *kalām* texts. Al-Naẓẓām was a vehement and rigorous critic of both the atomistic theory as well as the bundle theory. In turn, al-Naẓẓām's theory was attacked by its opponents. In our examination of the arguments for and against atomism in the previous chapter, we have seen evidence of Greek arguments and positions. It is quite likely that Dualist atomists and anti-atomists were familiar with these arguments, perhaps, like Ibn Muqaffa', as a result of some familiarity with the

[15] In his article, "Greek Science in Islam" (*History of Science*, 25(1987), 223-243), Sabra has argued that the process of the transmission of science into Islam is best described as an act of appropriation rather than of reception, because it was an active, not passive, act. This is even truer in the case of the *mutakallimūn*'s appropriation of cosmological theories, for their transformation of the Hellenistic theories they had appropriated for their own purposes is clearly an active process.

works of Aristotle and his later commentators; or through an oral tradition which was cognizant of the work of the commentators of Aristotle; or finally through the Dayṣānite appropriation of an eclectic atomism which was also cognizant of anti-atomist arguments. This may explain the origins of *kalām* atomism in some measure, but it fails to shed any light on the transformation of atomism, that is, it is not clear to what degree the features of *kalām* atomism are a result of the *mutakallimūn*'s transformation of the atomism of their immediate pre-Islamic predecessors.

There can, however, be little doubt of the influence of the early translations of Aristotelian and other texts on the ongoing *kalām* discussion of cosmological doctrines. According to 'Abd al-Jabbār's biographical notice on al-Naẓẓām, al-Naẓẓām once discussed the subject of the ancient Greek philosophers with the wazīr Ja'far al-Barmakī (d. 187/803). Turning to Aristotle, al-Naẓẓām remarked:, "I have refuted his book." Jaf'ar asked, 'How could you when you have not considered it worthwhile to read his work?" To which al-Naẓẓām replied, "What would you prefer: that I recite it to you from the beginning to the end or from the end to the beginning?" Thereupon al-Naẓẓām proceeded to recite it part by part and then he refuted it amazing Ja'far.[16] At the very least this report indicates interest in, and awareness of, on the part of an anti-atomist like al-Naẓẓām, the Greek philosophical texts which were being translated into Arabic.

Possibly as a result of the arguments and counter-arguments by the proponents of the three cosmological theories of early *kalām*, the atomic theory became the predominant cosmological theory of the *mutakallimūn* by the middle of the third/ninth century. But this theory came under attack from three different quarters during the next few decades. To begin with, al-Kindī wrote a work which has not survived in which he attacked atomism, most likely from the Peripatetic point of view. Next, Ibn al-Rāwandī attacked several tenets of Mu'tazilī cosmology. Finally, Muḥammad ibn Zakarīyā al-Rāzī who was himself an atomist, countered the *mutakallim* al-Mismā'ī 's refutation of those who believe in the eternity of the world, and Abū al-Qāsim al-Balkhī's view on time in works which have not survived.[17] Moreover at about the same time, the Mu'tazilī view on God and His attributes, which had led them to posit that the Qur'ān was created, came under the attack of followers of Aḥmad ibn Ḥanbal and other traditionists.

16 'Abd al-Jabbār, *Faḍl al-i'tizāl*, 264-265.

17 Pines, *Beiträge*, 34, 79-80; Muḥammad Najmābādī, *Mu'allafāt va muṣannafāt-e Abū Bakr Muḥammad Zakarīyā Rāzī*, (Tehran,1339 A.H.), 193, 209, 212.

Some aspects of Ibn al-Rāwandī 's attack, insofar as they relate to atomism can be ascertained. We have seen that Ibn al-Rāwandī tried to solve the problem of the ant and the sandal by postulating that because the ant, like the sandal, consists of an infinite number of parts, its traversal over the sandal is possible. Moreover, one of the conceptual difficulties posed by opponents of atomism which are mentioned by Ibn Mattawayh is attributed to Ibn al-Rāwandī.[18] Furthermore, Ibn al-Rāwandī alleged that Abū al-Hudhayl held that there is a limit to God's Knowledge and Power beyond which His Power and Knowledge cannot extend, and that this is clear in Abū al-Hudhayl's doctrine that the pleasure of the inhabitants of Paradise will ultimately come to an end. The question of a limit to God's Power can also be raised regarding why God cannot divide the atom further, which as we have seen above, was taken up in Ibn Ḥazm's criticism of atomism.[19] Ibn al-Rāwandī also claimed that Abū al-Hudhayl had defended his view regarding the finitude of the pleasure of the inhabitants of Paradise, by stating that if it were possible for something to follow another thing without limit, then it should be possible for something to precede another thing without limit, and that this leads to the doctrine of the eternity of bodies.[20] This is a reference to the concept of potential infinity with respect to time. If the next moment of time can follow this moment of time, and so on to future infinity, then what is there to stop us from conceiving that this moment of time was preceded by a previous moment of time and so on to past infinity? Similarly, the concept of potential infinity, when applied to the division of the body maintains that since it is always possible to bisect the current part produced by the division of the body, the division can never come to an end.

One result of Ibn al-Rāwandī 's criticism seems to have been to shut out the potential infinite, and to therefore make atomism the only theologically sound doctrine of the constitution of matter. Ibn Mattawayh states:

> If someone asks: Does the doctrine of the division of bodies attack the doctrine of the creation of bodies in time so that someone who believes in their divisibility cannot accept their creation in time?
>
> We reply: The premises upon which the [doctrine of] creation of bodies is based do not require belief in atomism, so that anyone who accepts these premises can have knowledge of their creation in time without accepting any other premise. However, someone who believes in the unlimited division of bodies must hold the doctrine of the eternity of bodies

18 See above, Chapter Five, 170.

19 See above, Chapter Five, 168-170; al-Khayyāṭ, *Intiṣār*, 16.

20 al-Khayyāṭ, *Intiṣār*, 18.

> because of the fact that the existence of an infinite is impossible, so how can he then believe in their creation in time?[21]

The anti-atomist attacks of al-Kindī, al-Rāzī, and Ibn al-Rāwandī, are evidence of the increasing influence of the other mode of transmission of Hellenistic doctrines into the Arabo-Islamic milieu, namely the translation of Greek and Syriac texts into Arabic. There can be no doubt about the *mutakallimūn*'s increasing familiarity with these texts. This is evident in the arguments both in support of and against the void which, towards the end of the third/ninth century, were incorporated into the physical theory of *kalām*. It is possible that the question of the void was posed by al-Rāzī's embrace of the vacuum and the atomist *mutakallimūn*'s realization of the close relationship between the theory of vacuum and atomism in Greek Atomism.

The attacks on the physical theory of *kalām* by its anti-atomist critics in addition to the re-examination of the theory of attributes as a result of the controversy over the nature of the Qur'ān led Abū' Alī al-Jubbā'ī, Abū al-Qāsim al-Balkhī, and Abū Hāshim al-Jubbā'ī to restate the case for atomism. This restatement, which assumes its final form in the teaching of Abū Hāshim al-Jubbā'ī, uses the term *mutaḥayyiz* for the atom, and clearly enunciates that the atom has magnitude and occupies space, even though it does not have length, breadth, or depth, from the perspective of a minimal parts doctrine. But Abū Hāshim's reformulation had its own consequences, for even though he continued to hold the doctrine that matter consists of discrete minimal parts, he abandoned the corresponding doctrines that space and motion are also discrete. Having thus adopted a continuous conception of space, he could be consistent when stating that atoms have magnitude and shape. His successors, however, while they unanimously adopted the term *mutaḥayyiz* for the atom, and the premises that the atom has magnitude and shape, were divided regarding his rejection of discrete space. This division survived into the fifth/eleventh century, for Ibn Mattawayh, like his teacher 'Abd al-Jabbār continues to adhere to a discrete conception of space, while his contemporary and fellow student al-Nīsābūrī disavows discrete space in the manner of Abū Hāshim. Similarly the atomist paradigm, as reworked by Abū Hāshim was adopted by the rival Ash'arī and Baghdadī Mu'tazilī *mutakallimūn*, at least insofar as they also used the term *mutaḥayyiz* for the atom, and adopted the premises that the atom has magnitude and shape. But like their Basrian Mu'tazilī contemporaries, they were divided on whether to reject the doctrine of

[21] Ibn Mattawayh, *Tadhkira*, 169-171. See also Ibn al-Fūrak, *Mujarrad*, 202; al-Juwaynī, *Shāmil*, 148.

discrete space. It is this reworked atomist paradigm which is reflected in the newly rediscovered *kalām* texts, and has been the subject of Chapters Four and Five above.

We can therefore state that the major Hellenistic philosophical and cosmological systems: Peripateticism, Platonism, Neoplatonism, Stoicism, and Atomism, were all appropriated by various groups within the first three centuries of the birth of Islam. They were all naturalized to various degrees and incorporated into the intellectual thought of Islamic civilization. But surprisingly, Atomism, and in particular Epicurean atomism, which was shunned by the Christian Fathers because of its association with the Epicurean doctrine of hedonism, was most thoroughly assimilated into that most peculiarly Islamic discipline of *kalām*, albeit in a much transformed guise.

C. EPICUREAN ATOMISM AND KALĀM ATOMISM: A COMPARISON

On the basis of the above examination of previously unavailable *kalām* texts, Pines' hunch of a possible influence of Epicurean minimal parts on *kalām* atomism, can now be said to have been confirmed.[22] This examination, as we have seen, reveals that the atoms of early *kalām* are not unextended as Pines and others had proposed, in the sense of being points, but they are unextended and yet have magnitude in the context of a minimal parts discrete geometry. It follows then, that Wolfson's postulation of a pseudo-Democritean fragment in which unextended atoms had been discussed as the source for *kalām* atomism cannot be taken seriously.[23]

There are, however, major differences between Epicurean atomism and *kalām* atomism. A systematic comparison of the two kinds of atomism is useful in order to gain a more complete view of the relationship between these two kinds of atomism.

The Epicureans believe that the totality of things in the world consist of bodies and void or vacuum.[24] The Epicureans also have gods in their world, but it is not clear whether these gods are primarily human concepts or whether they have an independent existence. In any case, they have no role to play in the governance of the universe, that is to say, teleology has no role in the Epicurean universe.[25] The *mutakallimūn*, on the other hand, believe that the world consists of

[22] See above, Chapter Four, 100.
[23] Wolfson, *Philosophy of the Kalam*, 472-486.
[24] Epicurus, *Letter to Herodotus*, 39 quoted as text 5A in Long and Sedley, *The Hellenistic Philosophers*, I:27.
[25] Long and Sedley, *The Hellenistic Philosophers*, I:144-149, I:57-65.

bodies, accidents, void, and God. Their concept of Creator God is alien to the Epicurean concept of gods, and they certainly believe that God governs the universe. But apart from this theological difference, the atomist *mutakallimūn* separate themselves from every kind of Greek Atomism by their doctrine that the secondary qualities of atoms are accidents which inhere in these atoms.

Bodies in the Epicurean system are constituted out of atoms. This is also valid in *kalām* atomism. However, Epicurean atoms are in turn constituted out of minimal parts. But in the *kalām* system, atoms are themselves minimal parts.

In addition to minimal parts of matter, Epicurus also believes in the minimal parts of space and time, and in a maximum speed, which is the motion of one minimal part of space in a minimal part of time. This too is valid in *kalām* atomism.

Epicurean atoms are heterogeneous, that is to say, they have different shapes and sizes. However, their constituent minimal units have the same shape and size. *Kalām* denies that atoms have different shapes and sizes since atoms are minimal parts.

Epicurean atoms have the primary attributes of size, shape, motion, and weight. *Kalām* atoms have the primary attributes of size, which is a minimal unit, and shape, which is a cube, but they do not have the primary attribute of motion. Unlike Epicurean atoms, *kalām* atoms are not always in motion, for the motion of an atom is caused by the inherence of two different accidents of location. It follows then that the *mutakallimūn* do not hold the theory of the swerve. With respect to weight, the *mutakallimūn* were divided. Abū 'Alī al-Jubbā'ī and al-Ash'arī regarded it as a primary attribute of the atom, while the followers of Abū Hāshim and others did not.[26]

The Epicurean theory of secondary attributes is that they do not exist at the atomic level but at the phenomenal level and depend on the observer.[27] In *kalām* atomism, secondary attributes are the result of accidents which inhere in atoms and have a real, not phenomenal, existence.

Another significant element of Epicurean atomism is the view that atoms are eternal. Needless to say this view is not held by the *mutakallimūn*.

It follows then that the only aspects of Epicurean atomism which are found in *kalām* atomism are the minimal parts doctrines of matter, space, time, and motion.

[26] Ibn Mattawayh, *Tadhkira*, 183, 592; Ibn Fūrak, *Mujarrad*, 206.
[27] Long and Sedley, *The Hellenistic Philosophers*, 1:32-37, particularly 1:37.

D. EARLY KALĀM ATOMISM REVISITED

Even though the Epicurean doctrine of minimal parts of matter, space, time, and motion may be internally consistent, it poses, as we have seen, a variety of conceptual and geometrical problems when viewed from the perspective of a continuous theory of matter, space, time, and motion. But this is not all, for, it also poses a problem of the interpretation of terms which describe its particular concepts. The problem of interpretation arises because these are the very same terms which are used by the opponents of the minimal parts doctrine. Thus for example, a point which has no parts, is, in the context of a minimal parts doctrine, the smallest extended magnitude. From the perspective of the continuist side however, a point which has no parts is unextended, and needless to say, statements like, "points constitute bodies" by a believer in minimal parts make absolutely no sense whatsoever. The incommensurability between these two systems is in some respects similar to the incommensurability between Newtonian Physics and Quantum Physics, for here too, the language of the one refers to continuous entities and the language of the other refers to discontinuous entities, *but the discontinuity is seen only from the perspective of the continuous system and not within the discontinuous system itself in which the discontinuity is taken as an axiom.*

The problem of the different interpretations of terms like 'magnitude', 'length', 'breadth', 'depth' etc. within these two opposite conceptions is, I believe, the reason why the fragments of the early *mutakallimūn* have until now been understood to indicate belief in the doctrine of unextended atoms. The newly rediscovered texts of the fourth and fifth/tenth and eleventh centuries, however, very clearly show that most *mutakallimūn* of this period were adherents of a minimal parts doctrine of matter, and with a few notable exceptions, a minimal parts doctrine of space, time, and motion. Ironically, we are able to ascertain that they had held these theories only because they use such equivocal terms in an inconsistent manner, and to some degree adopt the usage of their opponents when describing their doctrines. We can thus make sense of their statements from the continuist perspective which we naturally adopt.

These later *mutakallimūn* probably recognized that their opponents were completely failing to see their perspective, and this may have been one reason for their adoption of the term *mutaḥayyiz*—'that which occupies space'—to denote the atom, just as it had denoted body. The point of the adoption of this term was to emphasize that the atom, which was a minimal part, was extended in the same manner as

the body. The adoption of this term was one of many seeming innovations of the later *mutakallimūn*, including their statements that "'the atom has magnitude" or that "it has shape." These *mutakallimūn*, however, recognized that their doctrine was the same as the doctrine of their predecessors and any difference between them was in large part a matter of the manner of expression (*'ibāra*). Indeed, the re-examination of the fragments of the early *mutakallimūn* in this book shows that the views expressed therein are consistent with a minimal parts interpretation of matter, time, space, and motion. But either because these earlier *mutakallimūn* were strict adherents of the minimal doctrines, or because they did not possess an adequate language which had a sufficiently developed a distinct set of terms in which they could express statements about these minimal parts, they made statements like "atoms have neither length nor breadth nor depth nor magnitude." In my view, these kinds of statements have been wrongly understood to show that the *mutakallimūn* held a theory of unextended atoms rather than the doctrine of minimal parts.

There is, as I have tried to show, a conceptual continuity in the atomism of the earlier and the later *mutakallimūn*, and discrepancies between their statements are a result of the fact that the later *mutakallimūn*, unlike their predecessors, did not follow the strict minimal parts definitions of concepts like 'magnitude' or 'shape' in their discourse. Rather, they used these terms in the manner of their opponents, namely, these terms had the same meaning for the later *mutakallimūn* as they did for their non-atomist contemporaries, which is the meaning that these terms have in a continuous geometry. The later *mutakallimūn* therefore abandoned the meaning which these terms held in a discrete geometry. It is not clear whether this was a good move. Perhaps the decline of the *kalām* atomism is to be attributed to the ensuing conceptual muddle which must have followed in later centuries. But from our perspective, this inconsistent usage allows us to determine that these later *mutakallimūn* subscribed to minimal parts theories and as a result to solve the riddle of the 'unextended' atoms of the early *mutakallimūn*.

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